Information Systems and Technology for Managers and Entrepreneurs

315 pages ● 17 Chapters ● 17 Quizzes ● 1 Online Final

Information Systems and Technology for Managers and Entrepreneurs
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This course covers information systems in all phases of business and functional areas as needed to analyze and solve business problems in the "real world." The practical and efficient use of computer technology, both software and hardware, is highlighted. Every type of business application is covered, as well as the importance of databases, networking, telecommunications, and wireless mobile technology. Other topics discussed include: popular accounting, tax finance, management, manufacturing, and marketing software. Software for Decision Support Systems (DSS), Executive Information Systems (EIS), Expert Systems (ES), and Artificial Intelligence (AI) as used for financial modeling, budgeting, strategic planning and control, forecasting, data analysis, and inventory planning is discussed, as well as optimization software.

Learning Objectives

Upon completion of this course, the student should be able to:
- Understand the information processing cycle.
- Evaluate Transaction Processing Systems (TPS).
- Distinguish among the various types of Management Reporting Systems (MRS).
- Understand and define DSS, OIS, and EIS.
- Develop an understanding of the uses of microcomputers.
- Evaluate network servers.
- List the key factors to be considered in selecting a laptop.
- Illustrate an operating system. (OS)
- Develop knowledge of programming language.
- Identify the seven main types of software.
- Define the concept of a database.
- Distinguish between digital signals versus analog signals.
- Explain the benefits associated with wide area network. (WAN)
- Differentiate between the functions of the Internet and Intranet.
- Identify some basic factors in selecting accounting software.

- Define and list the financial MIS subsystems and outputs.
- Give examples of the models of the manufacturing information systems.

This course includes:
- 17 Chapters
- 17 Review Quizzes following each chapter
- Answers and feedback to the review quizzes
- An online final exam

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PREFACE

The course covers information systems in all phases of business and in all functional areas to analyze and solve business problems in the "real world." The practical and efficient use of computer technology, both software and hardware, are highlighted. All types of business applications are covered. The importance of data bases, networking, and telecommunications are clearly presented. Popular accounting, tax, finance, management, manufacturing, and marketing software are explained for easy use. Software for decision support systems (DSS), Executive Information Systems (EIS), and Artificial Intelligence (AI) such as financial modeling, budgeting, strategic planning and control, forecasting, data analysis, inventory planning, and optimization software are covered with real-life examples. "What-if" analysis and the effects of changing assumptions are discussed.

The purpose of the course is to provide a wealth of current and essential information to managers in all types of organizations so they may make optimum decisions. It gives the businessperson all he or she needs to know in the computerized financial application and modeling environment. Emerging trends in information technology are anticipated and discussed. In other words, expected developments in computers are presented so as to properly plan ahead. The professional success of a business manager depends on keeping abreast to the latest thinking and applications in information technology. This surely gives a competitive edge.

The course is written for students of information systems and business professionals in a practical, reader-friendly manner including clear illustrations. We have simplified difficult computer terminology and usage. Important topics include management information systems (MIS), selection of the best software and hardware for particular applications, business application software (e.g., accounting, finance, management, tax, marketing, and manufacturing), data bases, telecommunications and on-line services (e.g., Internet, Prodigy, CompuServe, Dow Jones, Westlaw, AICPA), and computer security and auditing. The latest multimedia trends are covered. New developments in artificial intelligence and expert systems, decision support systems, and executive information systems are covered.

The audience for this course includes accountants, tax preparers, financial managers, general managers, marketing executives, production/operations managers, purchasing managers, personnel managers, business analysts, forecasters, budget analysts, chief financial officers (CFOs), chief executive officers (CEOs), chief operating officers (COOs), chief information officers (CIOs), project managers, consultants, systems analysts, and computer support staff. Businesspeople in large, medium, and small companies will benefit. Private and nonprofit entities will find the material of equal value.

In conclusion, the course shows clearly how computers can aid the business manager in efficiently performing his or her functions. His or her success depends on being up-to-date in the computer environment and having all information immediately available to make successful decisions.
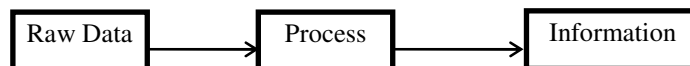
CHAPTER 1
THE WHAT AND WHY OF INFORMATION SYSTEMS (IS)
AND INFORMATION TECHNOLOGY (IT)

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Understand the information processing cycle.
2. Describe the latest computer hardware.
3. Give examples of computer software.
4. Evaluate Transaction Processing Systems (TPS).
5. Distinguish among the various types of Management Reporting Systems (MRS).
6. Implement Decision Support Systems (DSS).
7. Describe Office Information Systems (OIS).
8. Identify Executive Information Systems (EIS).
9. Interpret computer technologies used for business.
10. Manage your information resources.

An information system is a computerized system which processes data (facts) and produces information. This process is defined as an *information processing cycle (IPC)*. The information processing cycle consists of four operations: input, process, output and storage. The retrieval of raw data from the environment and delivering it to the computer is called input. After the computer receives data from the input device it will manipulate, refine and process the data to produce useful information for users. This step is called processing. After data has been refined and manipulated into useful information, the information is displayed to the end users and that is called output. Finally, the information needs to be saved for further usage. That is the storage step. All four processes make up the information processing cycle. The Input of the IPC is raw data. Raw data consists of raw facts while information is a collection of facts organized or processed in such a way that they have additional value for further usage.

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┌────────────┐        ┌────────────┐         ┌────────────────┐
│  Raw Data  │───────▶│  Process   │────────▶│  Information    │
└────────────┘        └────────────┘         └────────────────┘
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Information itself has value, and commerce often involves the exchange of information, rather than tangible goods. Information is valuable and useful because it can help decision makers. For example, investors are using information to make multi-million-dollar decisions; financial institutions employ information to transfer millions of dollars. Retailers use information to control inventory and process orders. Information technologies are consistently changing our society, our ways of doing business and our lives. To fully understand what an information system is and its concepts, the components of information systems should be first identified. A complete information system should contain the following elements:

COMPUTER HARDWARE

Computer hardware can be classified into five categories: personal computers, servers, minicomputers, mainframes and super computers.

Personal Computers

Personal computers are also called microcomputers. Each contains a microprocessor and is designed for individual or personal use. Classifications within this category include nonportable computers and portable computers. Microcomputers are more cost effective than mainframes for data entry and presentation. They are better suited to frequent screen updating and graphical user interfaces.

Desktop and tower computers: They are the most popular type of microcomputer and are designed to fit on the top of a desk. With the same options in the system, desk top models are the least expensive.

Workstations: Workstations are the most high-end personal computers. They are more powerful and expensive than any other personal computers. Very often, they are used to be the file servers in a network environment. Many engineers also use workstations to aid in product design and testing. Workstations are very good in calculations and graphics.

Laptop computers: They are the largest portable computers in this category. They weigh between eight and fifteen pounds and have a hard drive, CD-ROM drive and other equipment.

Notebook computers: They are a smaller version of laptop computers. They weigh between four and eight pounds. The functions available for notebooks are very similar to those in laptop computers but with a more compact design and smaller screen.

Subnotebook computers: They are even smaller than notebook computers. They weigh less than four pounds and carry less optional devices such as CD-ROM drives and regular hard drives.

Pen based computers: They are the smallest computers and use a pen-like device to enter data. This pen-like device can be used to write directly on the screen or can be used as a pointing device to make selections on the menu displayed on screen. The unique feature about pen based computers is the special software design to allow users to enter information by hand writing after several training sessions.

Servers

Server computers are designed to support a computer network that allows users to share files, applications, and hardware resources. A server computer is normally used to serve other computers in the network in terms of file storage and resources management, data communications, printing management, and other computer functions. The characteristics of a server computer follows:
- Communicate with other networks

- Enhance communication speed within the network
- High-end CPU power with a large capacity on the hard drive
- Some have parallel processing capabilities by employing more than one CPU.
- Large memory capacity

A server computer could be either a high-end microcomputer or a powerful microcomputer with minicomputer like functions.

Minicomputers
Minicomputers are more powerful than microcomputers in terms of multiple user environments. In other words, a minicomputer can be used by many users simultaneously. Many businesses and other organizations use minicomputers for their information processing requirements. The most powerful minicomputers are called supermini-computers.

Mainframe Computers
Mainframe computers are large computer systems that can handle hundreds of users, store large amounts of data, and process transactions at a high speed. Mainframe computers use a very sophisticated computer operating system to manage and control the whole system. Mainframes usually require a specialized environment including air conditioning and raised flooring that allows computer cables to be installed underneath. The price range for mainframes is from several hundred thousand to several million dollars.

The current trend in systems environment is to replace large mainframe computers with multiprocessor computer systems. Multiprocessor computer systems are more effective at handing high-volume, online transaction processing.

Supercomputers
Supercomputers are the most powerful category of computers. Typical applications are scientific calculations, engineering design, space exploration and other tasks requiring complicated processing. Supercomputers cost several million dollars.

COMPUTER SOFTWARE
Computer software is instructions called programs written in programming languages by programmers. Software consists of sequences of operations the computer will follow. Before a program can run or be executed, the program must be loaded into the main memory of the computer. After that, programs can be executed to perform certain functions based on how they are designed. For example, the word processing program allows users to enter their typing and edit the contents. A graphical design program is used to perform graphical designs. Most computer programs are written by people with special training. These people, called computer programmers, write the necessary instructions.

System Software
System software consists of programs that are used to control and operate the computer hardware. There are three components in system software: Operating

system, Utility programs, and Language processors. The operating system tells the computer how to perform functions such as how to load, store and execute programs, how to transfer data between input/output devices, and how to manage resources available (CPU time). To operate a computer, the operating system must be loaded in the main memory first. Other application software can then be loaded into the computer by the help of the operating system. Utility programs are designed to perform functions which are not available in application software such as formatting a diskette and creating a directory.

Application Software

Application software is programs to perform a specific user's task such as preparing a document, designing a financial worksheet and creating a useful database. When you think of the different ways that people use computers to improve the efficiency in their work place, they can be classified as application software. Most users do not write their own software programs (either system software or application software). They can buy ready to use software. These programs can be called software packages.

Data

Data is usually the input of a Management Information System (MIS). After data is processed by MIS, information will be generated. Users can then use information for decision making. Data is normally organized into files and files are organized into the database. Users can retrieve data as input of application software and produce information as output. If data is not accurate, the information produced will not be useful. Therefore, the garbage in, garbage out (GIGO) syndrome should be avoided.

Trained Personnel

People who operate MIS should be properly trained. MIS professionals and programmers are responsible for designing and programming MIS, while computer operators and users use them. With adequate training, users can achieve the desired functions designed by MIS professionals. An experienced user can also provide MIS professionals with valuable suggestions or be involved in MIS development.

Procedures

MIS procedures are designed for users to achieve certain functions. Well-designed procedures guarantee the quality and the security of information processing.

Information systems that are implemented on a computer can be classified into five different systems:
A. Transaction Processing Systems
B. Management Reporting Systems
C. Executive Information Systems/ Executive Support Systems
D. Decision Support Systems
E. Office Information Systems

The following sections will be used to describe the above systems.

WHEN TO USE TRANSACTION PROCESSING SYSTEMS (TPS)

Transaction processing systems are designed to process the day-to-day transactions of an organization so that many labor-intensive business transactions can be replaced by automated processes. These transactions have characteristics of large numbers and routine processes. Each process has a very simple data transaction, and TPS is expected to process each one in a very short period of time. Examples are super market grocery check out (billing systems) or bank transaction processes.

When computers were first used for processing business applications, TPS was the primary system implemented to replace the manual system in use. Typically, a successful TPS can improve transaction efficiency, customer service, and reduce transaction costs. The first TPS was a batch system. A TPS in batch processing implies that all transactions are collected first and at a later time, processed. Batch processing is the accumulation and grouping of transactions for processing on a delayed basis. The batch approach is suitable for applications that can be processed against the master file at intervals and involve large volumes of similar items, such as payroll, sales, inventory, and billing. The disadvantage of batch processing is that information cannot be updated immediately.

A TPS with on-line processing updates information when the transaction is entered. In a business where immediate update is required, an on-line TPS is necessary. An online processing system is in direct communication with the computer, giving it the capability to handle transactions as they are entered. An online system permits both immediate posting (updating) and inquiry of master files as transactions occur. In an online system, data are immediately available to users upon entry. On-line TPS requires higher fees for operation than batch TPS.

Today, most TPS use on-line processing to achieve better customer satisfaction and current information. An inquiry system requires the use of sophisticated hardware and software, including a database query language. Responses are in a prespecified format. End users receive responses concerning the results of transaction activities but are not allowed to make changes to the records retrieved.

WHEN TO USE MANAGEMENT REPORTING (INFORMATION) SYSTEMS (MRS)

After TPS was implemented, some organizations realized that the results produced by TPS are not suitable for higher level decision making and that the computer's capability to perform rapid calculations and logical functions could be used to produce meaningful information for management. As a result, MRS began to be developing so that managerial reports and summarized data could be produced. These reports helped managers perform their duties as well as provide middle management with statistical or summarized data for tactical level decision making.

In general, MRS is usually used with TPS. TPS processes daily transactions, updates inventory, and keeps customer information while MRS uses the data from TPS to produce daily total sales, inventory ordering lists, and customer lists with different

criteria. The output from MRS provides middle management with printed reports and inquiry capabilities to help maintain operations and management control of the enterprise. The concept of management reporting systems evolved as managers realized that computer processing could be used for more than just day-to-day transaction processing; it could also be used to produce meaningful information for management.

Frequently, an MRS is integrated with a TPS and the input source of MRS is usually the results of TPS. For example, a sales transaction can be processed by using a TPS to record the sales total and customer's information. A MRS can further process this data to generate reports on average sales daily or fast moving items.

WHEN TO USE DECISION SUPPORT SYSTEMS (DSS)

Decision Support Systems are designed to help managers reach a decision by summarizing or comparing data from different resources. They are suitable for semi-structured and unstructured problems. Decision support systems often include query languages, statistical analysis capabilities, spreadsheet, and graphics to help decision makers evaluate the decision. DSS are a type of MIS expressly developed to support the decision making process. DSS facilitate a dialogue between the user, who is considering alternative problem solutions, and the systems, with its built-in models and accessible database. A typical DSS process involves retrieving a model from the model base and allocating proper data from the database.

With a model, users can ask if-then questions by changing one or several variables as the input, the combination of data and model generates the recommendations from a DSS. The database is managed by a Data Base Management System (DBMS) while a model base is managed by a Model Base Management System (MBMS). Some DSS allow users to create models for better evaluation. For example, the vice president of marketing may want to know the net effect on company profit if the advertising budget decreases. TPS and MRS usually do not provide this type of information.

WHEN TO USE OFFICE INFORMATION SYSTEMS (OIS)

OIS is a system designed to support office tasks with information technology. Voice mail, multimedia systems, electronic mail, video conferencing, file transfer and even group decisions can be achieved by Office Information Systems. The final goal for OIS is to have an office environment where no paper is used (paperless environment).

WHEN TO USE EXECUTIVE INFORMATION SYSTEMS (EIS)

EIS is designed to generate information which is abstract enough to present the whole company operation in a simplified version to satisfy senior management. Characteristically, senior managers employ a great variety of informal sources of information, so that computerized information systems are able to provide only limited assistance. However, the CEO, senior and executive vice presidents, and the board of

directors also need to be able to track the performance of their company and of its various units, assess the business environment, and develop strategic directions for the company's future.

In particular, these executives need a great diversity of external information to compare their company's performance to that of its competition, and to investigate the general trends of the economies in the many countries where the company may be doing business. EIS is therefore, designed to address the information needs for senior management who may not be familiar working with computer systems. EIS also provides features that make them easier for executives to use. EIS provides a graphical user interface that can be mouse or touch screen oriented. EIS relies heavily on graphic presentation of both the menu options and data.

WHY DO YOU NEED MISs TO SOLVE YOUR BUSINESS PROBLEMS?

The business environment is changing on a daily basis. The competition is everywhere from cost cutting to marketing strategies. To maintain competitiveness, management must improve the efficiency of operation without sacrificing the quality of products and services. In order to achieve this task, making timely and correct decisions is the key to success. Since good decision makings require quality data and timely information, MIS is exactly designed to provide information on a timely basis. MIS also provides different types of information based on users' needs to improve effectiveness and efficiency.

WHAT ARE THE COMPUTER TECHNOLOGIES AVAILABLE FOR BUSINESS?

Information systems (S) are used in all business domains. For example, finance uses information to forecast revenues and maximize investment, make selections on stocks and even predict bankruptcies. Accounting uses information systems to record transactions, prepare financial statements, manage cash flow, or predict profit or loss. In marketing, information systems are used to develop new merchandise and services, customer segmentation, determine the locations for production and distribution facilities (so that the cost can be reduced and more customers will be attracted), formulate price strategies (so they can maximize total profits) and even develop the promotion policies (so that advertising will be more efficient). In manufacturing, information systems are used to process customer orders, develop production schedules, design new products, and test the quality of products.

In addition, network technologies allow users to share information and other resources. As a result, information retrieval can be more efficient and available. Current Internet technology provides businesses with a variety of external business information. Multimedia information transmissions (text, graphics, image and video) are also available on the Internet. With the impact of Internet, Intranet becomes another new technology popular to business. Intranet is a small version of Internet in one organization. It provides almost the same services as the Internet would do but with better security and privacy. Artificial Intelligence technologies are also applied to business functions. Neural networks have been used to predict the stock and bond

markets. Expert Systems are used to help managers with financial decisions. In the future, more intelligent agents will be used in the business environment to improve the quality of services and products.

HOW TO MANAGE YOUR INFORMATION RESOURCES?

Managing information resources can be a very complicated task due to rapid changes in this field. Generally speaking, there are two options available to managers:

1. In-House Operation
2. Outsourcing

In-house operation requires your own data processing facilities and personnel to operate. This approach allows users to receive MIS services faster and easier. However, it requires the company to use the equipment and employ MIS personnel to assure the facility is fully functional.

Outsourcing deals with subcontracting MIS tasks to professional MIS companies. With professional help, the task can be achieved more efficiently and effectively. However, the response time to acquire services might be a little longer and very often, the communication channels between subcontractor and users might not be well established. Different MISs are designed for different management functions. To understand which MIS will serve specific management needs, we categorize management into three levels (see Figure 1).

In addition, DSS and OIS are not specifically designed for any management level. They are good for all three levels of management.

FIGURE 1
MANAGEMENT TASK HIERARCHY
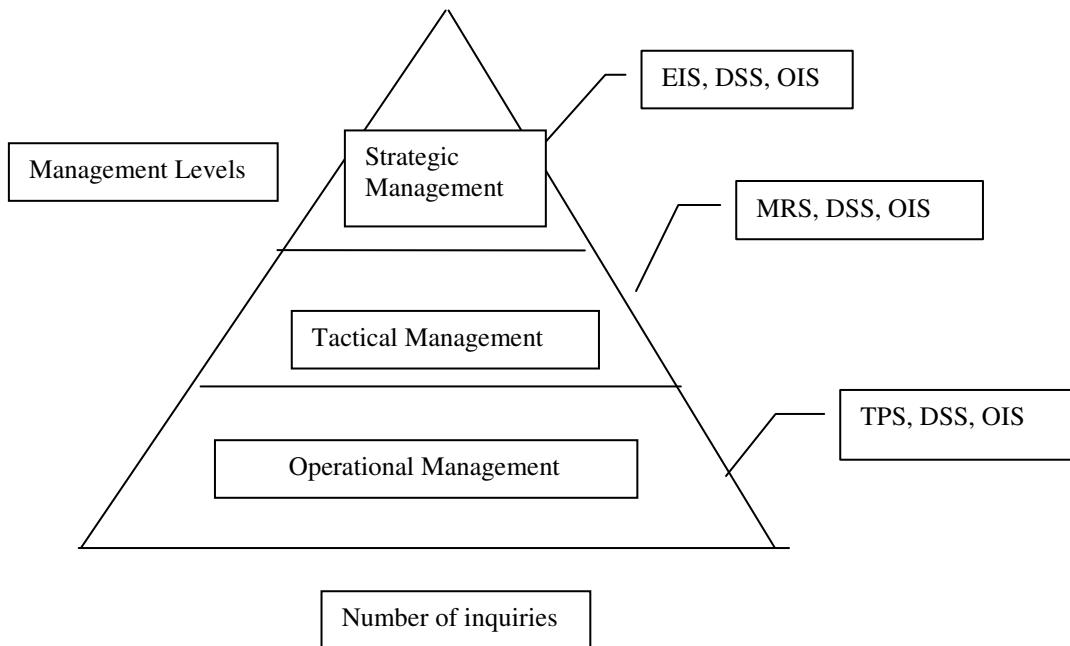
- First level:

Strategic management is the highest level of management. This level contains fewer decision makers but has much power over the whole organization. Therefore, EIS becomes the most appropriate IS available at this level.

- Second level:

Tactical management is the middle level of management. Managers in this level very often use MRS for summarized information and generate management reports for decision making.

- Third level:

Operational is the lowest level of management. Foreman and supervisors are in this level. TPS with large routine transaction processing capability is usually used for this management level.

WHAT IS THE ROLE OF THE INFORMATION SYSTEMS
IN THE DEVELOPMENT OF THE STRATEGIC PLAN?

Strategic planning is the process of selecting the organization's long-term objectives and of setting the strategies for achieving those objectives. This planning process is the responsibility of strategic management and is concerned with the overriding issues facing the organization, such as product lines and profitability. Given the international, competitive, and dynamic environment confronted by an organization, strategic planning is crucial to the survival of that organization.

The IS can play an important role in the development of the strategic plan and in monitoring ongoing operations to measure attainment of the plan. During the strategic planning process, data from the entity-wide database can be compared to data about the competition to determine an organization's relative strengths and weaknesses. For example, these data might include sales trends, gross margin on sales, age of capital assets, skills of existing personnel, debt/equity ratio, and so on. These data can be presented in reports from the existing information systems applications, such as sales/marketing, human resources management, fixed assets, finance and inventory, or via the models incorporated in the DSS and EIS. Note that data from the environment can also be incorporated into the DSS and EIS output. Strategic planners can combine the environmental data with those obtained internally to assess the organization's competitive position. The demand for such information has been a major driver in the move to enterprise resource planning (ERP) systems, which bring all of the organization's information together into a single entity-wide database and generally provide the associated tools for strategic analysis and decision support.

In addition to assisting in the planning phase, the IS can be used to follow up by reporting certain performance indicators that illustrate the status of processes and critical success factors. For example, the number of franchises along with the level of sales and number of customer complaints for each should indicate the status of an organization's franchise network. Other performance indicators might be the number of new products, the cost to manufacture the products, and their selling price. If the entity-wide database is developed in light of the strategic plan, many of the data for the performance indicators should be readily available.

In addition to an organizational strategic planning process, there must be a strategic planning process for the IS function. That process must be coordinated with the organization's strategic planning process to ensure that the organization's strategic plan is supported and that IT is used to the best advantage of the organization. For example, during the strategic planning process, organizations should seek to achieve strategic advantage over their competitors by utilizing available information technology. This is particularly observable as companies ponder how to deal with the rapidly evolving world of e-business.

SUMMARY

This chapter presented a broad introduction to concepts and technologies related to computers. After reading this chapter, you should have a basic understanding and concept of what a MIS is and how it processes data and the components of a MIS. Reading chapter 1 allows you to be able to understand topics as they are presented in more detail in the following chapters.

CHAPTER 1 QUIZ

1. Today organizations are using microcomputers for data presentation because microcomputer use, compared with mainframe use, is more
   - A. Controllable.
   - B. Conductive to data integrity.
   - C. Reliable.
   - D. Cost effective.

2. The current trend in systems environment is to replace large mainframe computers with multiprocessor computer systems. All of the following are reasons this trend is occurring except that multiprocessor computer systems
   - A. Are generally more flexible than mainframe computer systems.
   - B. Are most applicable in installations having a large number of small application programs.
   - C. Are more effective at handing high-volume, online transaction processing.
   - D. Applications are generally easier to program than mainframe applications.

3. Batch processing
   - A. Is not used by most businesses because it reduces the audit trail.
   - B. Processes individual transactions as they occur.
   - C. Allows users to inquire about groups of information contained in the system.
   - D. Accumulates transaction records into groups for processing against the master file.

4. Transaction processing systems frequently support the inquiry of online database users. Inquiry processing includes all of the following characteristics except that
   - A. Either batch or real-time processing may be used.
   - B. It is dependent on the use of telecommunication networks and database management query languages.
   - C. Responses are in a prespecified format display on the end user's terminal.
   - D. End users are allowed to make changes to the records retrieved.

5. The concept of timeliness of data availability is most relevant to online systems.
True / False

6. An interactive system environment is best characterized by
   - A. Data files with records arranged sequentially.
   - B. The processing of groups of data at regular intervals.
   - C. The processing of data immediately on input.
   - D. Sorting the transaction file before processing.

7. Which one of the following systems best characterizes a decision support system (DSS)?
- A. Interactive system.
- B. Transaction processing system (TPS).
- C. Database management system (DBMS).
- D. Spreadsheet system.

8. An information system that relies heavily on graphic presentation and designed to generate critical information to satisfy senior management is:
- A. OIS (Office reporting System)
- B. TPS (Transaction Processing System)
- C. MRS (management Reporting System)
- D. EIS (Executive Information System)

9. The highest level of management in the management task hierarchy is:
- A. Tactical management
- B. Operational management
- C. Strategic management
- D. Task management

CHAPTER 1 ANSWER KEY

1. (D) is correct. In cooperative processing, microcomputers are more cost effective than mainframes for data entry and presentation. They are better suited to frequent screen updating and graphical user interfaces.

(A) is incorrect. Microcomputer use is less controllable than mainframe use.

(B) is incorrect. The difficulty of control in a microcomputer environment threatens data integrity.

(C) is incorrect. Given their decades of refinement, mainframes are usually more reliable than microcomputers.

2. (C) is correct. Mainframes are the largest computers. They have very rapid processing ability and a massive amount of memory. Consequently, they are appropriate when great quantities of data must be processed.

(A) is incorrect. A multiprocessor system is more flexible than a mainframe. It consists of machines that may be networked in a variety of ways or treated stand-alone processors.

(B) is incorrect. Small applications may be processed more cheaply on smaller, less expensive machines.

(D) is incorrect. Programming tools available for smaller machines ordinarily simplify the programming process.

3. (D) is correct. Batch processing is the accumulation and grouping of transactions for processing on a delayed basis. The batch approach is suitable for applications that can be processed against the master file at intervals and involve large volumes of similar items, such as payroll, sales, inventory, and billing.

(A) is incorrect. Batch processing provides as much of an audit trial as any computerized operation.

(B) is incorrect. Individual transactions are grouped into batches, and the entire batch is processed together.

(C) is incorrect. Batch processing refers to the input of data, not inquiry.

4. (D) is correct. Inquiry processing in a database system can be the result of either batch or real-time processing. An inquiry system requires the use of sophisticated hardware and software, including a database query language. Responses are in a prespecified format. End users receive responses concerning the results of transaction activities but are not allowed to make changes to the records retrieved.

(A) is incorrect. Either batch or real-time processing may be used to query a database system.

(B) is incorrect. A query system is dependent on the use of telecommunication networks and database management query languages.

(C) is incorrect. Responses are in a prespecified format.

5. (T) is correct. An online processing system is in direct communication with the computer, giving it the capability to handle transactions as they are entered. An online system permits both immediate posting (updating) and inquiry of master files as transactions occur. In an online system, data are immediately available to users upon entry.

(F) is incorrect. Timeliness is not necessarily an element of any system unless it is online.

6. (C) is correct. In an interactive (inquiry) system, users employ interactive terminals to converse directly with the system. The system is characterized by online entry and processing, direct access, and timesharing.

(A) is incorrect. An interactive system requires direct-access files.

(B) is incorrect. An interactive system permits immediate, online processing of single transactions.

(D) is incorrect. The transaction file does not have to be sorted before processing.

7. (A) is correct. A DSS is used primarily for semistructured problems that require the decision maker to exercise judgment in controlling the process, but that allow for certain aspects of the problems to be preprogrammed. A DSS does not automate a decision but does provide a tool for the user to employ in applying his/her own insight and judgment. The system should be interactive to permit the user to explore the problem by using the computational capacities, models, and data resources of the system.

(B) is incorrect. A DSS does not process transactions. It supports decisions.

(C) is incorrect. A database management system is software used to create and maintain a database. It is more structured than a DSS.

(D) is incorrect. A DSS is not in the form of a spreadsheet system.

8. (D) is correct. EIS is designed to generate information which is abstract enough to present the whole company operation in a simplified version to satisfy senior management.

(A) is incorrect. OIS is a system designed to support office tasks with information technology.

(B) is incorrect. TPS is designed to process day-to-day transactions for an organization.

(C) is incorrect. MRS is used to process daily total sales, inventory ordering lists and customer lists and printed reports.

9.
(C) is correct. Strategic management is the highest level of management. This level contains fewer decision makers but has much power over the whole organization.

(A) is incorrect. Tactical management is a middle management task.

(B) is incorrect. Operational management is tasks for foremen and supervisors.

(D) is incorrect. Task management is designed for different management functions at all management levels.

CHAPTER 2
MODELS FOR DECISION MAKING

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Plan a model for management decision-making.
2. Implement a variety of systems.
3. Collect and evaluate information.
4. Understand output reports generated by MIS's.
5. Categorize and describe MIS and organizational Levels.
6. Illustrate the levels of management and types of decisions made.
7. Demonstrate the process used for modeling a real life system.
8. Explain and define the model base.

A management information system (MIS) comprises computer-based processing and/or manual procedures that provide useful, complete, and timely information. This information must support management decision making in a rapidly changing business environment. The MIS system must supply managers with information quickly, accurately, and completely.

Information systems are not new; only computerization of them is new. Before computers, information system techniques existed to supply information for functional purposes. What is the *Management Information System* (MIS)?

The scope and purpose of MIS is better understood if each part of the term is defined. See Figure 1.

FIGURE 1
THE MEANING OF A MANAGEMENT INFORMATION SYSTEM (MIS)

```
                          ┌──────────────┐
                          │     MIS      │
                          └──────┬───────┘
          ┌──────────────────────┼──────────────────────┐
   ┌──────────────┐       ┌──────────────┐       ┌──────────────┐
   │  Management  │       │ Information  │       │   Systems    │
   └──────────────┘       └──────────────┘       └──────────────┘
```
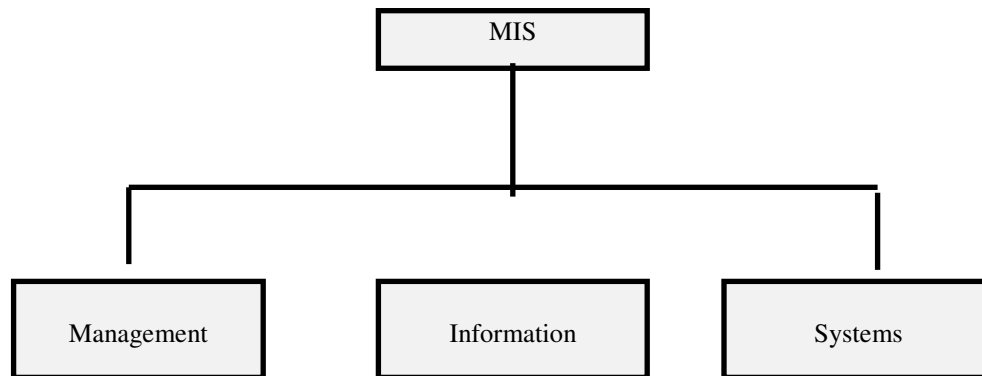
(1) Making decisions   (2) Information consists of: (3) Systems for integration
    regarding: orderly selected data   of all activities
       Planning   used for making   through exchange of
       Organizing   decisions   information
       Coordinating
       Controlling

MANAGEMENT

Management has been defined in a variety of ways, but for our purposes it comprises the processes or activities that describe what managers do in the operation of their organization: plan, organize, coordinate, and control operations. They *plan* by setting strategies and goals and selecting the best course of action to achieve the plan. They *organize* the tasks necessary for the operational plan, set these tasks up into homogeneous groups, and assign authority delegation. They *control* the performance of the work by setting performance standards and avoiding deviations from standard.

Because *decision-making is* such a fundamental prerequisite to each of the foregoing processes, the job of an MIS becomes that of facilitating decisions necessary for planning, organizing, and controlling the work and the functions of the business.
In general, the work that management performs can be classified as (a) planning, (b) organization and coordination, (c) controlling, and (d) decision-making.

Planning. The planning function of management involves the selection of long- and short-term objectives and the drawing up of strategic plans to achieve those objectives.

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For example, the vice president of marketing must consider numerous factors when planning short-term ad campaigns and promotional activities aimed at opening up new long-term markets.

Organizing and coordinating. In performing the organization and coordination function, management must decide how best to put together the firm's resources in order to carry out established plans. For example, top management must decide on the type and number of divisions and departments in the company and evaluate the effectiveness of the organizational structure. Furthermore, managers must identify the personnel needs of the company and select the personnel, as well as train staff.

Controlling. Controlling entails the implementation of a decision method and the use of feedback so that the firm's goals and specific strategic plans are optimally obtained. This includes supervising, guiding, and counseling employees necessary to keep them motivated and working productively toward the accomplishment of organization objectives.

Decision making. Decision making is the purposeful selection from a set of alternatives in light of a given objective. Each primary management function involves making decisions, and information is required to make sound decisions. Decisions may be classified as short-term or long-term. Depending upon the level of management, decisions can be operational, tactical, or strategic.

INFORMATION

Data must be distinguished from *information,* and this distinction is clear and important for our purposes. Data is facts and figures that are not currently being used in a decision process, and they usually take the form of historical records that are recorded and filed without immediate intent to retrieve for decision-making. An example would be one of the supporting documents, ledgers and so on, that comprise the source material for profit and loss statements. Such material would only be of historical interest to an external auditor.

Information consists of data that have been retrieved, processed, or otherwise used for informative or inference purposes, arguments, or as a basis for forecasting or decision-making. An example would be any one of the supporting documents mentioned above, but in this case the data could be used by an internal auditor, the management services department of an external auditor, or by internal management for profit planning and control, or for other decision-making purposes.

SYSTEMS

A *system* can be described simply as a set of elements joined together for a common objective. A subsystem is part of a larger system. All systems are parts of larger systems. For our purposes the organization is the system and the parts (divisions, departments, functions, units, etc.) are the subsystems. While we have achieved a very high degree of automation and joining together of subsystems in scientific, mechanical, and factory manufacturing operations, we have barely scratched the surface of applying systems principles for organizational or business systems. The concept of synergism has not generally been applied to business organizations, particularly as it applies to the integration of the subsystems through information

interchange. Marketing, production/operations, and finance are frequently on diverse paths and working at cross-purposes. The systems concept of MIS is therefore one of optimizing the output of the organization by connecting the operating subsystems through the medium of information exchange.

CLASSIFYING MANAGEMENT INFORMATION SYSTEMS IN TERMS OF THE TYPE OF OUTPUT PROVIDED

Another way of classifying MISs depends on the format of the output desired by the users of the management information system. Here three distinctions are made:

1. MISs that generate *reports:* These reports can be income statements, balance sheets, cash flow reports, accounts receivable statements, inventory status reports, production efficiency reports, or any report on the status of a situation of interest to the decision maker. The reports can be historical or refer to the current status of the situation.

2. MISs that answer "what-if" kinds of questions asked by management: These information systems take the information stored in the data base and reply to questions asked by management. These questions are in the form of "what would happen if this or that happened?" The information system thus uses its stored information, its comparison and calculation capabilities, and a set of programs especially written for this situation to provide management with the consequences of an action they are considering.

It works like this. The vice-president for human resources of an airline wonders what pilot recruiting levels would be necessary if the company changed its retirement age from 65 to 62 at the same time that the Civil Aeronautics Board (CAB) reduced the maximum number of hours a pilot can fly monthly from 80 to 75.

The vice-president uses a "what-if" information system approach to answer her question. The computer indicates that monthly recruiting levels would have to be increased from 110 to 185 pilots to meet these two conditions. She realizes that is not feasible and now "asks" the system the "what-if" question with the retirement age changed to 63. The reply is now 142 pilots a month recruited. She feels this is an attainable recruiting target. Some "what-if" systems print out entire financial statements reflecting the financial consequences of actions that are being contemplated. Figure 2 depicts a "what-if" scheme.

"What-if" management information systems combine models (to be discussed later), software enabling the decision maker to make various inputs to those models and receive the outputs, and report-generating capability. These are generally run on a real-time system which can be online and which can also run on a timesharing basis. In Figure 2 we have illustrated a "what-if" MIS.

3. MISs which support decision making (decision support systems): These advanced systems attempt to integrate the decision maker, the data base, and the

models being used. A decision support system (DSS) requires a very comprehensive data base together with the ability to manage that data base, to provide outputs to the decision maker, and to update whatever permanent models are stored in the system. It requires extensive hardware and software. Two features distinguish DSS from other information systems: (1) they actually make a recommended decision instead of merely supplying additional information to the decision maker, and (2) they "build in" the decision maker as an integral part of the system (the software accommodates the person as part of the decision process). Figure 3 illustrates a DSS management information system.

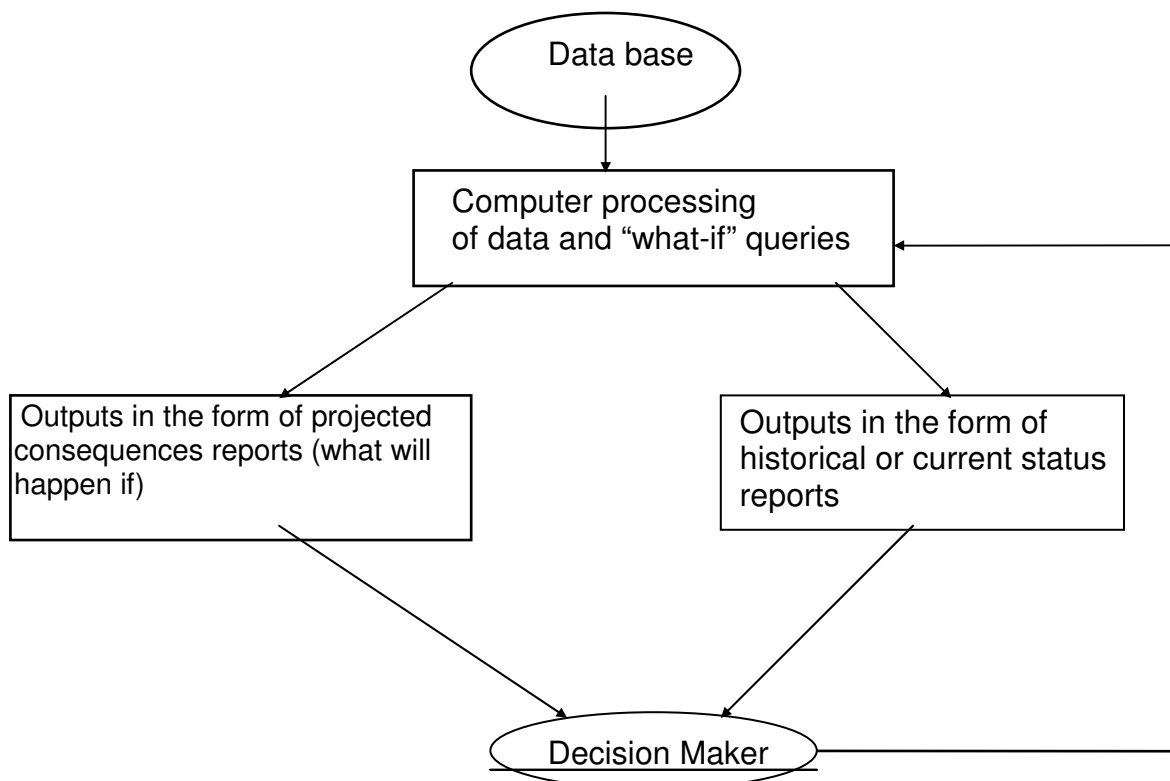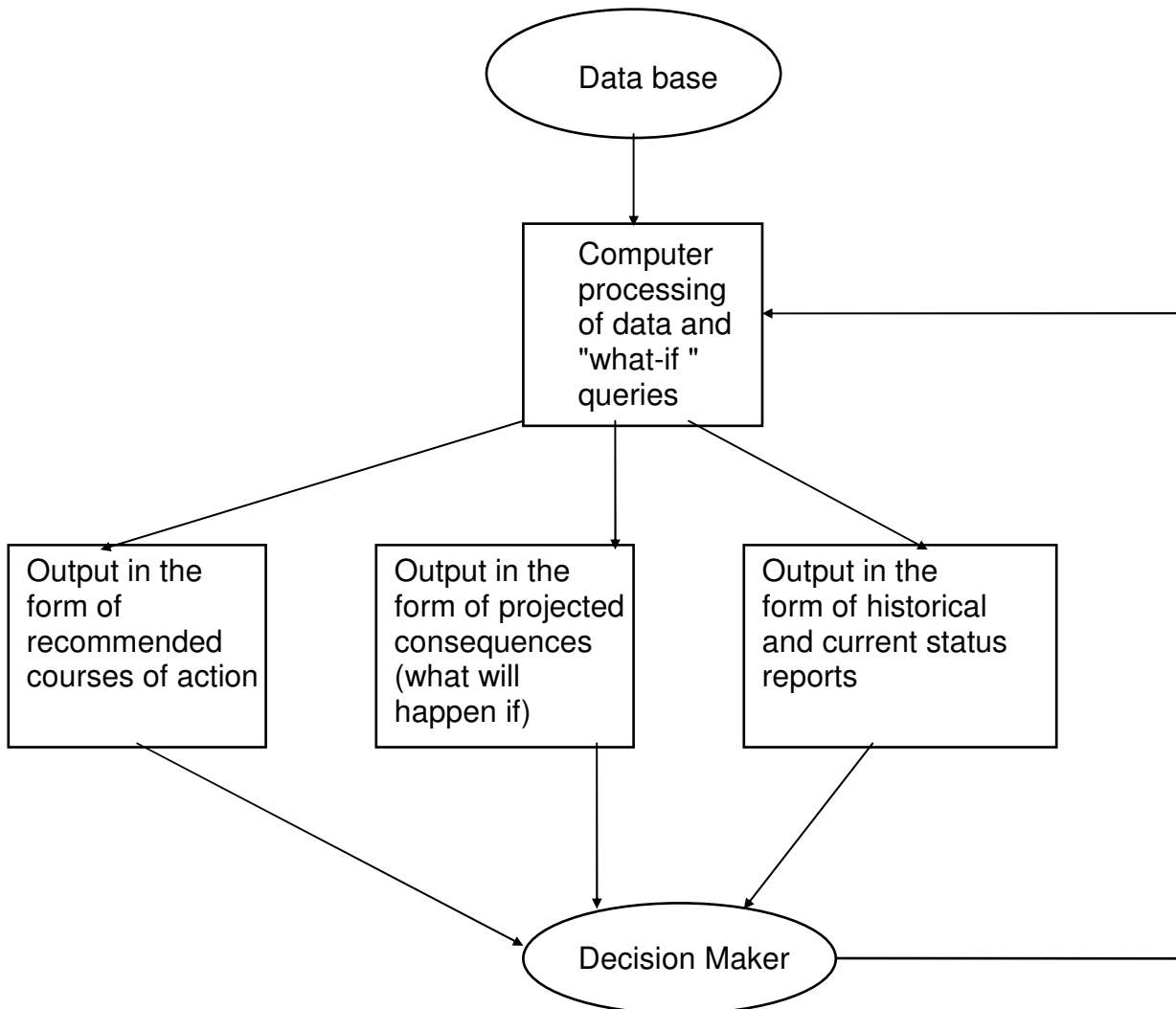**FIGURE 2**
"WHAT-IF" MIS

Data base

Computer processing
of data and "what-if" queries

Outputs in the form of projected consequences reports (what will happen if)

Outputs in the form of historical or current status reports

Decision Maker

FIGURE 3

DECISION MAKER'S "WHAT-IF" QUESTIONS

```
                    ┌─────────────┐
                    │  Data base  │
                    └──────┬──────┘
                           │
                           ▼
                   ┌──────────────┐
                   │ Computer     │◄──────────────┐
                   │ processing   │               │
                   │ of data and  │               │
                   │ "what-if "   │               │
                   │ queries      │               │
                   └──┬────┬───┬──┘               │
            ┌─────────┘    │   └─────────┐        │
            ▼              ▼             ▼         │
┌──────────────┐ ┌──────────────┐ ┌──────────────┐│
│ Output in the│ │ Output in the│ │ Output in the││
│ form of      │ │ form of      │ │ form of      ││
│ recommended  │ │ projected    │ │ historical   ││
│ courses of   │ │ consequences │ │ and current  ││
│ action       │ │ (what will   │ │ status       ││
│              │ │ happen if)   │ │ reports      ││
└──────┬───────┘ └──────┬───────┘ └──────┬───────┘│
       │                │                │        │
       └──────────┐     ▼      ┌─────────┘        │
                  ▼            ▼                   │
              ┌─────────────────────┐             │
              │   Decision Maker     │◄────────────┘
              └─────────────────────┘
```

AN MIS AND ORGANIZATIONAL LEVELS

An MIS should produce useful, accurate, and timely information to management on three levels: low-level (operational), middle (tactical), and top (strategic). Lower management make day-to-day operational decisions that affect a relatively narrow time frame and that involve details. These decisions are structured. Middle management is involved on more tactical decisions that cover a broader range of time and involve more experience. Middle managers use summary reports, exception reports, periodic reports, on-demand reports, and event-initiated reports to make semistructured decisions. Top management deals with decisions that are strategic and long-term in nature.

The primary objective of the MIS is to satisfy the needs at the various levels. Generally the information needs to be (1) more summarized and relevant to the specific

decisions that need to be made than the information normally produced in an organization and (2) available soon enough to be of value in the decision making process. The information flows up and down through the three levels of management and is made available in various types of reports.

LEVELS OF MANAGEMENT: WHAT KINDS OF DECISIONS ARE MADE?
Each level of management can be differentiated by the types of decisions made, the time frame considered in the decisions, and the types of report information needed to make decisions. (See Table 1).

TABLE 1
A COMPARISON OF THE MISs
AT THE OPERATIONAL, TACTICAL, AND STRATEGIC LEVELS

Characteristic	Operational	Tactical	Strategic
Frequency	Regular, repetitive	Mostly regular	Often ad hoc (as needed)
Dependability of results	Expected results	Some surprises may occur	Results often contain surprises
Time period Covered	Past	Comparative	Future
Level of data	Very detailed	Summaries of data	Summaries of data
Source of data	Internal	Internal and external	Internal and external
Nature of data	Highly structured	Some unstructured data (semistructured)	Highly unstructured
Accuracy	Highly accurate data	Some subjective data	Highly subjective data
Typical user	First-line supervisors	Middle managers	Top management
Level of decision	Task-oriented	Control and resource allocation oriented	Goal-oriented

LOWER MANAGEMENT

The largest level of management, lower (operational) management, deals mostly with decisions that cover a relatively narrow time frame. Lower management, also called supervisory management, actualizes the plans of middle management and controls daily operations—the day-to-day activities that keep the organization humming. Examples of a lower-level manager are the warehouse manager in charge of inventory restocking and the materials manager responsible for seeing that all necessary materials are on hand in manufacturing to meet production needs.

Most decisions at this level require easily defined information about current status and activities within the basic business functions—for example, the information needed to decide whether to restock inventory. This information is generally given in detail reports that contain specific information about routine activities. These reports are structured, so their form can usually be predetermined. Daily business operations data is readily available, and its processing can be easily computerized. Managers at this level typically make structured decisions. A structured decision is a predictable decision that can be made by following a well-defined set of predetermined, routine procedures. For example, a clothing store floor manager's decision to accept your credit card to pay for some new clothes is a structured decision based on several well-defined criteria:

1. Does the customer have satisfactory identification?
2. Is the card current or expired?
3. Is the card number 011 on the store's list of stolen or lost cards?
4. Is the amount of purchase under the cardholder's credit limit?

MIDDLE MANAGEMENT

The middle level of management deals with decisions that cover a somewhat broader range of time and involve more experience. Some common titles of middle managers are plant manager, division manager, sales manager, branch manager, and director of personnel.

The information that middle managers need involves review, summarization, and analysis of historical data to help plan and control operations and implement policy that has been formulated by upper management. This information is usually given to middle managers in two forms: (1) *summary reports*, which show totals and trends— for example, total sales by office, by product, by salesperson, and total overall sales—and (2) *exception reports*, which show out-of-the-ordinary data—for example, inventory reports that list only those items that number fewer than 10 in stock. These reports may be regularly scheduled (periodic reports), requested on a case-by-case basis (on-demand reports), or generated only when certain conditions exist (event-initiated reports).

Periodic reports are produced at predetermined times—daily, weekly, monthly, quarterly, or annually. These reports commonly include payroll reports, inventory status reports, sales reports, income statements, and balance sheets. On-demand reports are usually requested by a manager when information is needed for a particular problem. For example, if a customer wants to establish a large charge account, a manager might

request a special report on the customer's payment and order history. Event-initiated reports indicate a change in conditions that requires immediate attention, such as an out-of-stock report or a report on an equipment breakdown.

Managers at the middle level of management are often referred to as tactical decision makers who generally deal with semistructured decisions. A semistructured decision is a decision that includes some structured procedures and some procedures that do not follow a predetermined set of procedures. In most cases, a semistructured decision is complex, requiring detailed analysis and extensive computations. Examples of semistructured decisions include deciding how many units of a specific product should be kept in inventory, whether or not to purchase a larger computer system, from what source to purchase personal computers, and whether to purchase a multiuser minicomputer system. At least some of the information requirements at this level can be met through computer-based data processing.

TOP MANAGEMENT

The top level of management deals with decisions that are the broadest in scope and cover the widest time frame. Typical titles of managers at this level are chief executive officer (CEO), chief operating officer (COO), chief financial officer (CFO), treasurer, controller, chief information officer (CIO), executive vice president, and senior partner. Top managers include only a few powerful people which are in charge of the four basic functions of a business—marketing, accounting and finance, production, and research and development. Decisions made at this level are unpredictable, long-range, and related to the future, not just past and/or current activities. Therefore, they demand the most experience and judgment.

A company's MIS must be able to supply information to top management as needed in periodic reports, event-initiated reports, and on-demand reports. The information must show how all the company's operations and departments are related to and affected by one another. The major decisions made at this level tend to be directed toward (1) strategic planning—for example, how growth should be financed and which new markets should be tackled first; (2) allocation of resources, such as deciding whether to build or lease office space and whether to spend more money on advertising or the hiring of new staff members; and (3) policy formulation, such as determining the company's policy on hiring minorities and providing employee incentives. Managers at this level are often called strategic decision makers. Examples of unstructured decisions include deciding five-year goals for the company, evaluating future financial resources, and deciding how to react to the actions of competitors.

At the higher levels of management, much of the data required to make decisions comes from outside the organization (for example, financial information about other competitors).

Table 2 shows the decision areas that the three levels of management would deal with in (a) a consumer product business and (b) a bank

---

TABLE 2
THREE LEVELS OF MANAGERIAL LEVELS
AND INFORMATION NEEDS

(a) Consumer product business

Strategic Planning	Competitive Industry statistics
Tactical	Sales analysis by customer Reorder analysis of new products Sales analysis by product line Production planning
Operational	Bill of materials Manufacturing specifications Product specifications Order processing On-line order inquiry Finished goods inventory Accounts receivable General ledger

(b) Bank

Strategic Planning	Market forecast New product development Financial forecast
Tactical	Branch profitability Product profitability
Operational	Loan billing Accounting systems Policy issuance and maintenance

---

MODELING A REAL LIFE SYSTEM

Many MISs are model-based. The real world is complex, dynamic, and expensive to deal with. For this reason, we use models instead of real life systems. A model is an abstraction of a real life system that is used to simulate reality. Especially in the

computing environment we live in, managers and decision makers find use of models easy and less expensive to understand what is happening and to make better decisions.

There are many different types of models. They are:
1. Narrative
2. Physical
3. Graphical
4. Mathematical

NARRATIVE MODELS

A narrative model is either written or oral. The narrative represents a topic or subject. In an organization, reports, documents, and conversations concerning a system are all important narratives. Examples include the following: a salesperson verbally describing a product's competition to a sales manager, and a written report describing the function of a new piece of manufacturing equipment.
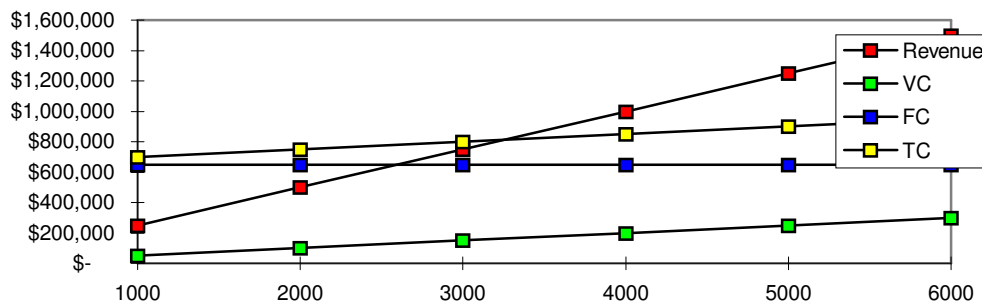
PHYSICAL MODELS

The fashion model is an example of physical models, as are dolls and model airplanes. Many physical models are computer designed or constructed. An aerospace engineer may develop a physical model of a shuttle to gain important information about how a large-scale shuttle might perform in space. A marketing department may develop a prototype of a new product.

GRAPHICAL MODELS

A graphical model is a pictorial representation of reality. Lines, charts, figures, diagrams, illustrations, and pictures are all types of graphical models. These are used often in developing computer programs. *Flowcharts* show how computer programs are to be developed. A graph that shows budget and financial projections and a break-even chart are good examples of graphic models. The break-even chart depicts the point at which sales revenues and costs are equal, as shown in Figure 4.

FIGURE 4
BREAK-EVEN CHART

MATHEMATICAL MODELS

A mathematical model is a quantitative representation of reality. These models are most popular for decision making in all areas of business. Any mathematical formula or equation is a model that can be used for simulation or "what-if" analysis purposes. Once properly constructed, management can experiment with them just as physical scientists do a controlled experiment in their laboratory. In a sense, mathematical models are the managers' laboratory. For example, the break-even formula used to compute the break-even point in Figure 4 is simply

$$X_{be} = \frac{FC}{(P - V)}$$

where X_{be} = break-even point, P = Price or average revenue per unit, V = Unit variable cost, and FC = Total fixed costs.

THE MODEL BASE

The purpose of the model base in a MIS is to give decision makers access to a variety of models and to assist them in the decision-making process. The model base can include *model management software (MMS)* that coordinates the use of models in a MIS. Depending on the needs of the decision maker, one or more of these models can be used.

FINANCIAL MODELS

Financial models provide cash flow, internal rate of return, and other investment analysis. Spreadsheet programs such as Excel are often used for this purpose. In addition, more sophisticated financial planning and modeling programs such as *Budget Express* can be employed. Some organizations develop customized financial models to handle the unique situations and problems faced by the organization. However, as spreadsheet packages continue to increase in power, the need for sophisticated financial modeling packages may decrease.

STATISTICAL MODELS

Statistical models can provide summary statistics, trend projections, hypothesis testing, and more. Many software packages, *including Statistical Packages for Social Scientists (SPSS), Statistical Analysis System (SAS),* and *MINITAB*, provide outstanding statistical analysis for organizations of all sizes. These statistical programs can calculate means, variances, correlation coefficients, regression analysis, do hypotheses testing, etc. Many packages also have graphics output capability.

The following illustrates the use of SPSS for Windows for regression analysis and the sample output.

EXAMPLE 1

 Cypress Consumer Products Corporation wishes to develop a forecasting model for its dryer sales by using multiple regression analysis. The marketing department prepared the following sample data.

Month	Sales of Washers (x_1)	Disposable Income (x_2)	Savings (x_3)	Sales of Dryers (y)
January	$45,000	$16,000	$71,000	$29,000
February	42,000	14,000	70,000	24,000
March	44,000	15,000	72,000	27,000
April	45,000	13,000	71,000	25,000
May	43,000	13,000	75,000	26,000
June	46,000	14,000	74,000	28,000
July	44,000	16,000	76,000	30,000
August	45,000	16,000	69,000	28,000
September	44,000	15,000	74,000	28,000
October	43,000	15,000	73,000	27,000

SPSS for Windows was employed to develop the regression model. Figure 5 presents the regression output results using three explanatory variables.

FIGURE 5
SPSS for MS WINDOWS

* * * *   M U L T I P L E   R E G R E S S I O N   * * * *

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable.. SALESDRY

Block Number 1. Method: Enter   SALESWAS INCOME   SAVINGS
Variable(s) Entered on Step Number

  1.. SAVINGS
  2.. SALESWAS
  3.. INCOME

Multiple R	.99167
R Square	.98340
Adjusted R Square	.97511
Standard Error	.28613

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	29.10878	9.70293
Residual	6	.49122	.08187

F =   118.51727   Signif F = .0000

------------------------ Variables in the Equation -------------------------

Variable	B	SE B	Beta	Tolerance	VIF	T
SALESWAS	.596972	.081124	.394097	.964339	1.037	7.359
INCOME	1.176838	.084074	.752425	.957217	1.045	13.998
SAVINGS	.405109	.042234	.507753	.987080	1.013	9.592
(Constant)	-45.796348	4.877651				-9.389

Durbin-Watson Test =   2.09377

OPTIMIZATION MODELS
    Optimization models refer to techniques for establishing complex sets of mathematical equations and inequalities that represent objectives and constraints. These models are "prescriptive" in that they try to provide the best possible solution to the problem at hand. They include mathematical programming such as linear programming (LP) and goal programming (GP) models.

Linear programming (LP) is a mathematical technique designed to determine an optimal decision (or an optimal plan) chosen from a large number of possible decisions. The optimal decision is the one that meets the specified objective of the company, subject to various restrictions or constraints. It concerns itself with the problem of allocating scarce resources among competing activities in an optimal manner. The optimal decision yields the highest profit, contribution margin (CM), or revenue, or the lowest cost. A linear programming model consists of two important ingredients:

1. *Objective function*. The company must define the specific objective to be achieved.
2. *Constraints.* Constraints are in the form of restrictions on availability of resources or meeting minimum requirements. As the name linear programming indicates, both the objective function and constraints must be in linear form.

A firm wishes to find an optimal product mix. The optimal mix would be the one that maximizes its total CM within the allowed budget and production capacity. Or the firm may want to determine a least cost combination of input materials while meeting production requirements, employing production capacities, and using available employees.

Applications of LP are numerous. They include:

1. Selecting least-cost mix of ingredients for manufactured products
2. Developing an optimal budget
3. Determining an optimal investment portfolio (or asset allocation)
4. Allocating an advertising budget to a variety of media.
5. Scheduling jobs to machines
6. Determining a least-cost shipping pattern
7. Scheduling flights
8. Gasoline blending
9. Optimal manpower allocation
10. Selecting the best warehouse location to minimize shipping costs.

FORMULATION OF LP
To formulate an LP problem, certain steps are followed. They are:
1. Define what is called *decision variables* that you are trying to solve for.
2. Express the objective function and constraints in terms of these decision variables. All the expressions must be in *linear* form.

In the following example, we will use this technique to find the optimal product mix.

EXAMPLE 2
The JKS Furniture Manufacturing Company produces two products: desk and table. Both products require time in two processing departments, Assembly Department and Finishing Department. Data on the two products are as follows:

Processing	Products Available		
	Desk	Table	Hours
Assembly	2	4	100 hours
Finishing	3	2	90
Contribution Margin Per Unit	$25	$40	

The company wants to find the most profitable mix of these two products.

Step 1: Define the decision variables as follows:

A = Number of units of desk to be produced
B = Number of units of table to be produced

Step 2: The objective function to maximize total contribution margin (CM) is expressed as:

Total CM = 25A + 40B

Then, formulate the constraints as inequalities:

2A + 4B ≤ 100 (Assembly constraint)
3A + 2B ≤ 90 (Finishing constraint)

In addition, implicit in any LP formulation are the constraints that restrict A and B to be nonnegative, i.e.,

A, B ≥ 0

Our LP model is:
Maximize: Total CM = 25A + 40B
Subject to: 2A + 4B ≤ 100
3A + 2B ≤ 90
A, B ≥ 0

USE OF COMPUTER LP SOFTWARE

We can use a computer LP software package such *as LINDO (Linear Interactive and Discrete Optimization)* and *What's Best!,* to quickly solve an LP problem.

Figure 6 shows a LINDO output by an LP program for our LP model set up in Example 2.

Note: The printout shows the following optimal solution:

A = 20 units
B = 15 units
CM = $1,100
Shadow prices are:
Assembly capacity = $8.75
Finishing capacity = $2.50

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FIGURE 6
COMPUTER PRINTOUT FOR LP

** INFORMATION ENTERED **

NUMBER OF CONSTRAINTS   2
NUMBER OF VARIABLES   2
NUMBER OF <=CONSTRAINTS 2
NUMBER OF =CONSTRAINTS 0
NUMBER OF >=CONSTRAINTS 0

MAXIMIZATION PROBLEM

  25 A   + 40 B

SUBJECT TO

  2 A   + 4 B   <= 100

  3 A   + 2 B   <= 90

** RESULTS **

		ORIGINAL	COEFF.
VARIABLE	VALUE	COEFF.	SENS.

Solution:
A=20

A	20	25	0	B=15
B	15	40	0	

CONSTRAINT	ORIGINAL	SLACK OR	SHADOW
NUMBER	RHS	SURPLUS	PRICE
1	100	0	8.75<--(shadow price of the assembly capacity)

OBJECTIVE FUNCTION VALUE : 1100 = CM

SENSITIVITY ANALYSIS

OBJECTIVE FUNCTION COEFFICIENTS

	LOWER	ORIGINAL	UPPER
VARIABLE	LIMIT	COEFFICIENT	LIMIT
A	20	25	60
B	16.67	40	50

RIGHT HAND SIDE

CONSTRAINT NUMBER	LOWER LIMIT	ORIGINAL VALUE	UPPER LIMIT
1	60	100	180
2	50	90	150

DECISION ANALYSIS MODELS

Decisions are made under certainty or under uncertainty. Decision making under certainty means that for each decision there is only one event and therefore only one outcome for each action. Decision making under uncertainty, which is more common in reality, involves several events for each action with its probability of occurrence. When decisions are made in a world of uncertainty, it is often helpful to make the computations of: (1) *expected value*, (2) *standard deviation*, and (3) *coefficient of variation.*

Standard Deviation

The standard deviation measures the tendency of data to be spread out. Cost analysts and managerial accountants can make important inferences from past data with this measure. The standard deviation, denoted with the Greek letter σ , read as *sigma*, is defined as follows:

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

where x is the mean (arithmetic average).

The standard deviation can be used to measure the variation of such items as the expected contribution margin (CM) or expected variable manufacturing costs. It can also be used to assess the risk associated with investment projects.

EXAMPLE 3

One and one-half years of quarterly returns are listed below for United Motors stock.

Time Period	x	$(x - \bar{x})$	$(x - \bar{x})^2$
1	10%	0	0
2	15	5	25
3	20	10	100
4	5	-5	25
5	-10	-20	400
6	20	10	100
	60		650

From the above table, note that

$$\bar{x} = 60 / 6 = 10\%$$

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{\frac{650}{6 - 1}} = \sqrt{130} = 11.40\%$$

The United Motors stock has returned on the average 10 percent over the last six quarters and the variability about its average return was 11.40%. The high standard deviation (11.40%) relative to the average return of 10% indicates that the stock is very risky.

Although statistics such as expected value and standard deviation are essential for choosing the best course of action under uncertainty, the decision problem can best be approached using what is called decision theory. Decision theory is a systematic approach to making decisions especially under uncertainty. Decision theory utilizes an organized approach such as a *decision matrix (*or *payoff table).*

Decision Matrix
A decision matrix is characterized by:

(1) the *row* representing a set of alternative courses of action available to the decision maker;
(2) the *column* representing the state of nature or conditions that are likely to occur and the decision maker has no control over; and
(3) the *entries* in the body of the table representing the outcome of the decision, known as payoffs which may be in the form of costs, revenues, profits or cash flows. By computing expected value of each action, we will be able to pick the best one.

EXAMPLE 4
Assume the following probability distribution of daily demand for a product:

Daily demand	0	1	2	3
Probability	.2	.3	.3	.2

Also assume that unit cost =$3, selling price=$5 (i.e., profit on sold unit = $2), and salvage value on unsold units =$2 (i.e., loss on unsold unit =$1). We can stock either 0, 1, 2, or 3 units. The question is:
How many units should be stocked each day? Assume that units from one day cannot be sold the next day. Then the payoff table can be constructed as follows:

<u>State of Nature</u>

Demand	0	1	2	3	Expected value
Stock (probability)	(.2)	(.3)	(.3)	(.2)	
0	$0	$0	$0	$0	$0
Actions 1	-1	2	2	2	1.40
2	- 2	1*	4	4	1.90**
3	-3	0	3	6	1.50

*Profit for (stock 2, demand 1) equals (no. of units sold)(profit per unit) - (no. of units unsold)(loss per unit) = (1)($5 - 3) - (1)($3 - 2)= $1

**Expected value for (stock 2) is: -2(.2) + 1(.3) + 4 (.3) + 4 (.2) =$1.90

The optimal stock action is the one with the highest expected monetary value i.e., stock 2 units.

Decision Tree

Decision tree is another approach used in discussions of decision making under uncertainty. It is a pictorial representation of a decision situation.

As in the case of the *decision matrix* approach discussed, it shows decision alternatives, states of nature, probabilities attached to the state of nature, and conditional benefits and losses. The decision tree approach is most useful in a sequential decision situation.

EXAMPLE 5

Assume XYZ Corporation wishes to introduce one of two products to the market this year. The probabilities and present values (PV) of projected cash inflows are given below:

Product	Initial investment	PV of cash inflows	Probabilities
A	$225,000		1.00
		$450,000	0.40
		200,000	0.50
		-100,000	0.10
B	80,000		1.00
		320,000	0.20
		100,000	0.60
		-150,000	0.20

• A decision tree analyzing the two products is given in Figure 7.

FIGURE 7
DECISION TREE

	Initial Investment (1)	Probability (2)	PV of Cash Inflows (3)	PV of Cash Inflows (2) X (3) = (4)
Product A	$225,000	0.40	$450,000	$180,000
		0.50	$200,000	100,000
		0.10	-$100,000	-10,000
			Expected PV of Cash Inflows	$270,000
Choice A or B				
Product B	$80,000	0.20	$320,000	$64,000
		0.60	$100,000	60,000
		0.20	-$150,000	-30,000
			Expected PV of Cash Inflows	$ 94,000

GRAPHICAL MODELS

Graphical modeling programs are software packages that assist decision makers in designing, developing, and using graphic displays of data and information. Numerous personal computer programs that can perform this type of analysis are available on the market. In addition, sophisticated graphic design and analysis such as computer-assisted design (CAD) is widely available.

PROJECT PLANNING AND MANAGEMENT MODELS

Project planning and management models are used to navigate and coordinate large projects, and to discover critical paths that could delay or jeopardize an entire project if they are not completed in a timely and cost-effective fashion. Some of these programs can determine the best way to speed up a project by effectively using additional resources, including cash, labor, and equipment. Project management allows decision makers to keep tight control over projects of all sizes and types.

Program Evaluation and Review Technique (PERT) is a useful management tool for planning, scheduling, costing, coordinating, and controlling complex projects such as

- Formulation of a master budget
- Construction of buildings
- Installation of computers
- Scheduling the closing of books
- Assembly of a machine
- Research and development activities

Questions to be answered by PERT include:

- When will the project be finished?
- What is the probability that the project will be completed by any given time?

SIMULATION MODELS

The primary use of a simulation model is to respond to "what if . . . ?" questions. These descriptive models can produce large amounts of detailed output because they work by mimicking many parts of the real-world system. One major weakness is that no automatic searching or optimizing is done by the model. (Any such features must be built on top of the simulation model and must be used as a submodel.) In such cases, the simulation may have to be performed many, many times while a search for the best decision parameters is under way. This can be quite expensive if the simulation is complex.

Two major issues in simulation modeling are how long a simulation run must proceed to achieve *steady state* (typical behavior) and how many different runs must be performed to achieve statistical significance. Inside most simulation models is a pseudo random number generator. This is a mathematical subroutine that produces numbers that appear to be random. These random numbers are manipulated further to represent parts of the model that are not deterministic. Examples might include the arrival of customers at a ticket counter or the time of failure of an electronic circuit component. These random number generators can be "seeded" with special input parameters to make them produce different streams of random values. Repeating runs with different seed values provides a set of outputs that has a statistical distribution to be analyzed.

Many commercial software packages are available that can be used to build simulation models. Some of these are general-purpose simulation languages that have general-but-powerful features, such as waiting lines and resource pools that ease the modeling task. At the other extreme are tailored simulation models (such as oil refinery models) that are already built but afford the user the ability to specify input parameters to describe the precise configuration under study. In between these extremes are simulation languages that are suited for a large class of models, such as networks, that are a formalism in which many problems can be represented.

EXAMPLE 6

During lunch hour, customers arrive at a fast-food restaurant at a rate of three per minute. They require 1.5 minutes to place an order and pay the bill before going to pick up the food. How many cash register stations are needed to ensure that the number of customers waiting in line does not exceed six and that this waiting time does not occur more than 30 percent of the time during the lunch hour rush?

A simulation language such as the SLAM II can be used to simulate the sequence of the operation in this problem. The language consists of symbols that can be composed on a computer terminal screen into a diagram like the one shown. The first circle represents customer arrivals. The second circle represents the queue, or waiting line. The last circle represents departures from the system.
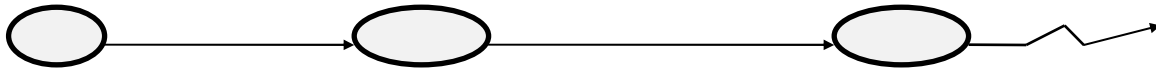
A random normal probability distribution was chosen to model the customer arrivals. The mean, or average, time between arrivals is set at 20 seconds, and the standard deviation is set to 5 seconds. The simulation model was run for 3,600 seconds for each experiment. The number of servers was changed between runs. The service time was represented by an exponential distribution with a mean of 90 seconds.

The simulation software generates random numbers using mathematical formulas and then computes when customers arrive, how long they require service, and so forth. A clock is simulated to keep track of what should happen next. These performance statistics are collected and reported.

Statistics describing the queue are produced automatically by the simulation software package. Table 3 below shows that five servers are needed to ensure that the queue will be no longer than six persons for 70 percent of the time. A thorough analysis would involve making more runs to confirm that the above statistics still hold true when different random numbers are used and longer periods of simulation are tried.

TABLE 3
PERCENT OF TIME THAT QUEUE LENGTH
IS NO MORE THAN

No. of Serve.	0	1	2	3	4	5	6	7
4	14	20	24	27	27	28	31	36
5	46	55	60	63	64	68	70	76

Table 3 would serve as a tool for establishing optimal staffing levels for a fast-food restaurant.

CHAPTER 2 QUIZ

1. An example where top management must decide on the type and number of divisions and departments in the company and evaluate the effectiveness of the organization structure is termed:
    A. Organizing and coordinating
    B. Planning
    C. Controlling
    D. Decision making

2. A MIS system that answers questions asked by management and uses its stored information to compare and calculate capabilities to provide the management with the consequences of an action they are considering is:
    A. MIS that answers "what-if" questions
    B. MIS that supports decision-making
    C. MIS that generates reports
    D. None of the above MIS systems

3. A MIS system that covers a time period in the past is:
    A. Tactical
    B. Operational
    C. Strategic
    D. All of the above

4. A model-based MIS where a salesperson verbally describes a product's completion to the sales manager or issues a written report describing the function of a new piece of manufacturing equipment is:
    A. Graphical
    B. Physical
    C. Narrative
    D. Mathematical

5. Linear programming (LP) is a mathematical technique designed to select an optimum decision chosen from a large number of possibilities. These applications can include all the following except:
    A. Computes expected values and standard deviations
    B. Develops and optimum budget
    C. Determines an optimum investment portfolio
    D. Schedules jobs to machines

CHAPTER 2 ANSWER KEY

1. (A) is correct. In performing the organization and coordination function, management must decide how best to put together the firm's resources in order to carry out established plans.

(B) is incorrect. Planning involves the selection of long-term and short-term objectives and strategies.

(C) is incorrect. Controlling entails the implementation of a decision to ensure goals and specific strategic plans are optimally obtained.

(D) is incorrect. Decision-making is the selection from a set of alternatives that are tactical or strategic management actions.

2. (A) is correct. These questions are in the form of "what would happen if this or that happened?"

(B) is incorrect. MIS that supports decision-making is an advanced system with built-in decision making hardware and software.

(C) is incorrect. MIS is a function that generates reports such as income statements, balance sheets, and cash flow reports.

(D) is incorrect. "What-if" MIS system uses its stored information, its comparison and calculation capabilities, and a set of programs especially written for this situation to provide management with the consequences of an action they are considering.

3. (B) is correct. Lower management make day-to-day operational decisions that affect a relatively narrow time frame and that involve details.

(A) is incorrect. Tactical is used to cover comparative time periods.

(C) is incorrect. Strategic covers future time periods.

(D) is incorrect. Only operational covers time periods of the past.

4. (C) is correct. A narrative model is either written or oral.

(A) is incorrect. A graphical model is a pictorial representation of lines, charts, figures and illustrations.

(B) is incorrect. A physical model is a computer design or proto-type of a product.

(D) is incorrect. Mathematical models are quantitative representations using formulas or equations to preset a model for simulation or "what-if" analysis.

5. (A) is correct. Expected values and standard deviations are used for risk analysis.

(B) is incorrect. Developing a budget is an application and not a mathematical technique.

(C) is incorrect. Determining an optimum investment portfolio is an application and not a mathematical technique.

(D) is incorrect. Scheduling jobs is an application and not a mathematical technique.

CHAPTER 3
SELECTING COMPUTER HARDWARE

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Develop an understanding of the uses of microcomputers.
2. Identify the need for large-system computing.
3. Evaluate network servers.
4. Define a computer system unit.
5. Select a microcomputer system unit.
6. Differentiate between CPUs and computing power.
7. Describe input technologies.
8. List and explain input devices.
9. Compare and contrast other types of output technologies.
10. Select output technologies to meet your needs.
11. Implement secondary storage system.
12. List key factors to be considered in selecting a laptop.

Generally speaking, computers can be classified into the following categories: Microcomputers, computers on the go, internet appliances, network servers, minicomputers, mainframe computers, and supercomputers.

MICROCOMPUTERS

Microcomputers are designed for a single user environment and small business applications. However, more and more business people are using microcomputers for both multi-user networks and business applications. For example, a business person can use a microcomputer to organize financial transactions, prepare the corporate tax return (Form 1120 or 1120S) or to update the inventory of several supermarkets on a network. Today's microcomputers can be so powerful that they provide solutions for most business applications.

A microcomputer uses a microprocessor as the central processing unit. In computer-speak, the term microprocessor is used interchangeably with CPU. It is frequently described as the brain of a computer because the microprocessor controls the central processing of data in personal computers (PCs), servers, workstations, and other devices.

Microprocessors can be very powerful despite its small size. Currently, there are two major microcomputer systems available on the market. They are the IBM compatible system and the Apple system. Both systems use different platforms (operating systems) to control the hardware. The IBM compatible system uses a Windows operating system developed by Microsoft. The Windows operating system

provides a graphical user interface (GUI) and a multitasking environment. The Windows operating system including Windows 98, Windows 2000, Windows XP dominate most of the microcomputer operating system market. Apple Macintosh uses a totally different operating system developed by Apple Computer. Newer Apple operating systems are able to run Window based applications. However, due to poor market strategy, the Apple system is loosing its market share. It is suggested that the business person use the IBM system because of greater compatibility, more program availability, and a more open platform.

Computers on The Go
In today's mobile society, computers are increasingly used outside the office. Notebook or handheld computers are used to record and retrieve data for people on the go.

Notebook computer (a *laptop*): A compact, light, personal computer powered by a rechargeable battery.

Personal digital assistant (PDA); A handheld computer that is small enough to fit in the palm of a hand. Typically a stylus (a penlike pointing and drawing device) is used to enter data through a touch screen, although some handhelds also have a small keyboard or can plug into a folding portable keyboard.

Tablet computer (tablet PC); A full power PC in the form of a thick writing tablet. It looks like a notebook computer without a keyboard, although it can be connected to a keyboard and a mouse.

Internet Appliances
An increasing number of handheld computers and other electronic devices are manufactured with a capability to link to the Internet. Collectively, such devices are called *internet appliances*. Many of the devices are equipped with circuitry and software that enables them to link to the Internet wirelessly.
- Personal Digital Assistants - (PDAs) are designed for convenient mobile communication and computing. PDAs use touch screens, pen-based handwriting recognition, or keyboards to help mobile workers send and receive e-mail, access the Web, and exchange information such as appointments, to-do lists, and sales contacts with their desktop PCs or Web servers.
- Set-top boxes and video-game consoles that connect to home TV sets. These devices enable you to surf the Web or send and receive e-mail and watch TV programs or play video games at the same time.
- Wireless PDAs and cellular and PCS phones and wired telephone-based appliances that can send and receive e-mail and access the Web.

LARGE-SYSTEM COMPUTING
Large-systems consist of mainframe computers, minicomputers and supercomputers. They are typically multi-user computer systems in which many users share the same computing resources at the same time (time sharing). The computing power of minicomputers or mainframe computers is usually more than microcomputers and so they are more expensive. Mainframe computers and supercomputers can be very expensive to purchase and maintain so that only large corporations can afford

them. The computing power of mainframe computers are usually shared by many users. That means the operating system of a mainframe computer allows many computer users to participate simultaneously. Mainframe computers are typically used for business applications where a large number of transactions are processed. They are fast in processing speed and have large storage capacity. Supercomputers have the most processing power of computers available. They are primarily designed for high speed computation, especially for scientific research or the defense industry, but their use is growing rapidly in business as supercomputer prices decrease.

Supercomputers are also very valuable for large model simulation and complex mathematical calculations. Weather forecasting agents use supercomputers to model the world's weather system in order to improve weather predictions in a very short period of time. The computer performance and speed required to achieve the above goal needs enormous speed and processing power. In order to increase the speed of supercomputers, some companies are linking together individual or serial processors into multiple processors or parallel processing systems.

NETWORK SERVERS
Network servers are used to manage and control computer networks. A network server needs to have larger storage capacity to store network programs and a high performance CPU to provide timely network functions. Computer networks can be localized or world wide scale. Therefore, computer servers can be designed to manage only several microcomputers in a local area network (LAN) or several hundred computers in a wide area network (WAN).

COMPUTER SYSTEM UNITS
The system unit has components such as System Board (Mother Board), Central Processing Unit (CPU), Main Memory (including Registers, Cache memory, RAM and ROM), System Clock, Power Supply, Expansion slots, Ports and Bus Lines.

System Board
The system board (or mother board) consists of a flat board that contains the CPU, memory chips and other devices. A chip has many tiny circuit boards etched on a small square of sandlike material called silicon. Chips are mounted on carrier packages, which then plug into sockets on the system board.

CPU
The central processing unit (CPU) is the center of all computer processing activities. It is here that all processing is controlled, all data are manipulated, and arithmetic/logic computations are performed.

The CPU takes data from the input device (such as the keyboard) and processes them to generate information so that output devices (such as the monitor) can display it. Inside the CPU, there are the Arithmetic/Logic Unit (ALU) and the Control Unit (CU). The Arithmetic/Logic Unit is used to perform the four basic arithmetic operations which are addition, subtraction, multiplication and division. Logic functions are used to compare values. They are >=, <=, =, <, >, and <>. All computer applications from typing

a document to supercomputer simulation are achieved through these simple operations. The control unit is responsible for managing the traffic of the CPU. It interprets and carries out computer operations contained in computer programs. It moves instructions from the memory to the registers in the control unit. The control unit executes only one instruction at a time and executes it so quickly that the control unit appears to do many different things simultaneously. The CPU capacity is often described in Word Sizes. A word is the number of bits (such as 16, 32, or 64) that can be processed at one time by the CPU. Therefore, the more bits of the Word Size the more powerful is the CPU.

Main Memory (Or Primary Storage)
The main memory consists of Registers, Cache memory, Random Access Memory (RAM) and Read Only Memory (ROM). Registers are located in the Control Unit and Arithmetic/Logic Unit of a CPU. Registers are special high-speed staging areas that hold data and instructions temporarily during processing. Since the registers are located inside the CPU, their contents can therefore be handled much faster than other main memory.

Cache Memory
Cache memory pronounced as "cash" is located between RAM and CPU for faster access. It is a special high speed memory area that the CPU can access quickly. Most frequently used routines are stored in the cache memory to improve performance.

RAM
Random-access memory (RAM) is the memory used to store temporary data or programs when the computer power is on. RAM, also known as internal primary storage, is so called because each memory location therein can be randomly accessed in the same amount of time.

ROM
ROM usually stores very essential information permanently. ROM consists of microinstructions hardwire into the computer. Data cannot be written on our erased from ROM. The operating system and the language translator (software that translates source programs into machine-readable instructions) are permanently stored in ROM to prohibit users from accidentally erasing or changing the system. Some microcomputers, however, have erasable, programmable ROM. This form of storage may be erased by an ultraviolet technique (but not by the microcomputer) after which new instructions may be entered.

System Clock
Part of the computer performance is determined by the speed of system clocks. The system clock controls how often the operation will take place within a computer. The system clock uses fixed vibrations from a quartz crystal to deliver a steady stream of digital pulses to the CPU. The faster the clock (measured by Mega Hertz), the faster the processing. For example, the most recent Intel Pentium IV chip runs at speeds up to 3.8 GHz. (For up-to-date information, visit **www.webopedia.com/quick_ref/processor.html**). In February, 2005, IBM and partners Sony and Toshiba unveiled what it describes as a "supercomputer on a chip" that aims to dramatically increase the computing power in video-game systems, TVs,

and other computer electronics. This chip is said to run at clock speeds greater than 4 GHz.

Note: Intel® Centrino™ mobile technology is Intel's new technology designed specifically for mobile computing with integrated wireless LAN capability and breakthrough mobile performance. It also enables extended battery life and sleek, easy-to-carry notebook PCs. With Intel Centrino mobile technology, three components work together to enable outstanding mobile performance, extended battery life and integrated wireless LAN capability in thinner and lighter notebooks. These components include the Intel® Pentium® M processor, the Intel® 855 Chipset Family and the Intel® PRO/Wireless 2100 network connection. AMD Athlon XP-M is a major competition.

Power Supply

A computer runs on direct current (DC) but the available electricity from a standard outlet is alternating current (AC). The power supply is a device that converts AC to DC to run the computer. Because the power supply can generate lots of heat, a fan in the computer is necessary to keep other devices from being too hot. In addition, electrical power drawn from a standard AC outlet can be quite uneven. For example, a sudden electrical surge can burn out the DC circuitry in your computer. Instead of plugging your computer directly into the wall electrical outlet, it is better to plug it into a power protection device. The two principle types are surge protectors and UPS units. The surge protector is a device that protects a computer from being damaged by a high voltage. A computer can be plugged into a surge protector which in turn is plugged into a standard electrical outlet.

Expansion Slots and Boards

Most microcomputers are expandable. Expandability refers to a computer's capability to add more functions such as more memory or a fax modem. In other words, when you buy a PC you can later add devices to enhance its computing power. Expansion slots are sockets on the motherboard into which you can plug expansion cards. Expansion cards (add-on boards) are circuit boards that provide more memory or control peripheral devices. The following are examples of expansion cards:

Controller cards: Control cards allow your PC to work with the computer's various peripheral devices such as a floppy drive or a hard drive.

Graphics cards: These cards allow you to adapt different kinds of color monitors for your computer such as super VGA cards.

Bus Lines

A bus line is an electrical pathway through which bits are transmitted between the CPU and other devices. There are different types of buses. The bus between the CPU and the expansion slots is called a local bus. The bus between RAM and the expansion slots is called an expansion bus. The old 8 bit bus can only transfer 8 bits at a time, while a 32 bit bus can transmit 32 bits at one time.

Ports

A port is a socket on the outside of the system unit which is connected to an expansion board on the inside of the system unit. A port allows you to plug in a cable to connect other devices such as a monitor, a keyboard, or a printer. In general, they are categorized into three types:

Parallel ports: a parallel port allows a line to be connected which allows many bits to be transmitted at one time. Since many bits can be transmitted, the transmission speed is higher. Printers, monitors and keyboards use parallel ports.

Serial ports: A serial [or RS-232] port, enables a line to be connected that will send one bit at a time. The serial port is usually used for data communication purposes.

USB: Short for Universal Serial Bus, an external bus standard that supports data transfer rates of 12 Mbps. A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards. USB also supports Plug-and-Play installation and hot plugging.
It is expected to completely replace serial and parallel ports.

HOW DO CPUs AFFECT YOUR COMPUTING POWER?

CPUs are the brain of a computer system. The CPU is measured by its processing capacity, speed in terms of MHz, Word size, and Million Instructions per Second (MIPS). Mega Hertz (million times per second) is the measurement for computer execution frequency. This frequency is controlled by the system clock. Word size is the number of bits the CPU can process at a time. The larger the word size the faster the computer can process data. MIPS is used to measure how many millions of instructions can be processed within a second. For microcomputers, CPU can be classified into two categories: Apple Mac System (developed by Motorola) and IBM compatible system (manufactured by Intel).

Table 1 illustrates the comparison of popular microcomputer CPUs.

TABLE 1
COMPARISON OF POPULAR MICROCOMPUTER CPUS

	Transistors	*CPU Speed*	*L2 Cache*	*Front-Side Bus Speed*
Celeron	7,500,000	1.06 GHz - 2 GHz	256 KB, full speed	133 MHz and 400 MHz
Pentium II	7,500,000	233 MHz - 450 MHz	512 KB, half speed	100 MHz
Pentium III	9,500,000	450 MHz - 1 GHz	256 KB, full speed	133 MHz
Pentium III Xeon	28,100,000	500 MHz - 1 GHz	256 KB - 2 MB, full speed	100 MHz
Pentium 4	55,000,000	1.4 GHz - 3.8 GHz	256 KB, full speed	800 MHz
K6-II	9,300,000	500 MHz - 550 MHz	N/A	100 MHz
K6-III	21,300,000	400 MHz - 450 MHz	256 KB, full speed	100 MHz
Athlon (K7)	22,000,000	850 MHz - 1.2 GHz	256 KB, full speed	200 MHz and 266 MHz
Athlon XP	37,500,000	1.67 GHz	384 KB, full speed	266 MHz
Duron	N/A	700-800 MHz	64 KB, full speed	200 MHz
PowerPC G3	6,500,000	233 MHz - 333 MHz	512 KB, 1 MB, half speed	100 MHz
PowerPC G4	10,500,000	400 MHz - 800 MHz	1 MB, half speed	100 MHz
Athlon 64	105,900,000	800 MHz	1 MB, half speed	1.6 GHz
G5	58,000,000	2.5GHz	512 KB	900MHz - 1.25GHz

INPUT TECHNOLOGIES

Input devices are used to collect data (information) from the environment. The data source could be a document, picture, speech, movie or even the temperature of a certain location. Most current input technologies are designed to capture data and send it to the computer system. The following are some of the input technologies available:

Keyboard

Keyboards are conventional input devices. Microcomputer keyboards have all the keys that typewriter keyboards have plus others unique to computers. People who always thought typing was an overrated skill will find themselves slightly behind in the Digital Age, since learning to use a keyboard is still probably the most important way of interacting with a computer. Users who have to use the hunt-and-peck method waste a lot of time. Fortunately, there are software programs available that can help you learn typing skills or improve your existing ones.

You are probably already familiar with a computer keyboard. As the use of computer keyboards has become widespread, so has the incidence of various hand and wrist injuries. Accordingly, keyboard manufacturers have been giving a lot of attention to ergonomics. Ergonomics is the study of the physical relationships between people and their work environment. Various attempts are being made to make keyboards more ergonomically sound in order to prevent injuries.

Mouse

A mouse is a device that is rolled about on a desktop and directs a pointer on the computer's display screen. The pointer may sometimes be, but is not necessarily the same as, the cursor. The mouse pointer is the symbol that indicates the position of the mouse on the display screen. It may be an arrow, a rectangle, or even a representation of a person's pointing finger. The pointer may change to the shape of an I -beam to indicate that it is a cursor and show the place where text may be entered. The mouse has a cable that is connected to the microcomputer's system unit by being plugged into a special port. The tail-like cable and the rounded "head" of the instrument are what suggested the name mouse. On the bottom side of the mouse is a ball (trackball) that translates the mouse movement into digital signals. On the top side are one, two, or three buttons. Depending on the software, these buttons are used for such functions as clicking, dropping, and dragging. Gently holding the mouse with one hand, you can move it in all directions on the desktop (or on a mouse pad, which may provide additional traction). This will produce a corresponding movement of the mouse pointer on the screen.

Trackball

Another form of pointing device, the trackball, is a variant of the mouse. A trackball is movable ball, on top of a stationary device, that is rotated with the fingers or palm of

the hand. In fact, the trackball looks like the mouse turned upside down. Instead of moving the mouse around on the desktop, you move the trackball with the tips of your fingers. Trackballs are especially suited to portable computers, which are often used in confined places, such as on airline tray tables. Trackballs may appear on the keyboard centered below the space bar, as on the Apple powerboat, or built into the right side of the screen. On some portables they are a separate device that is clipped to the side of the keyboard.

Bar Code Readers

Bar code readers are designed to read Universal Product Code (UPC) or similar bar codes. You can find this type of device in the supermarket or in the library when you check out a book.

Pen Based Input

This type of device uses hand writing as the input. A human's handwriting can be converted into typed letters for further processing. This technology makes the keyboard an optional device and reduces the computer size a great deal.

Image Scanner

This device allows users to store a picture as a computer file. Images can be modified by the computer software after they are digitized and saved as a computer file.

Voice Recognition Device

Users can use voice to issue a command and typing or mouse input can be optional. A training session may be required to let the computer understand and recognize your voice.

Video Capture

A video can be digitized as a computer file. This file can be further modified or edited for special effects.

Touch Screens

A touch screen is a video display screen that has been sensitized to receive input from the touch of a finger. Because touch screens are easy to use, they can convey information quickly. You'll find touch screens in automated teller machines, and tourist directories in airports. Touch screens are also available for personal computers, consisting of an overlay that mounts with adhesive to the front of a monitor.

Magnetic Ink Character Recognition (MICR)

MICR is used by banks to read the magnetic ink on checks and deposit slips. MICR is a form of data entry device.

WHAT INPUT DEVICES DO YOU NEED?

A keyboard and a mouse may be the most useful input devices to use most software. However, if you need to use multi media software or have a variety of information sources stored in different media, you might need devices such as image

scanners, the microphone for your voice input or digital camera. Digitized files require lots of disk space for storage. Before you upgrade your system with advanced input devices such as video and audio input, ample secondary storage devices will be needed.

OUTPUT TECHNOLOGIES

The types of output generated from the computer depend on the needs of users and the hardware software equipment. In general, output can be classified into two categories based on how output is displayed:

Hard copy: Printed output by printers or plotters.
Soft copy: displayed output by monitors or other devices.

Output can also be classified based on the way output is presented:

Text Format:

Text format is the original output when computers were first created. Text output can be numbers, alphabetic, and other symbols on the keyboard. It has a great limitation in terms of presenting charts and images. Today, very few computer systems use text format as the only output display.

Graphical Format:

Graphical format allows users to view output by the images it contains. By using a graphical format, computer user interfaces can be dramatically improved.

Video Format:

Video output is designed to display movies which have been digitized. This type of output provides a movie like image to the user. However, digitized movies require lots of capacity to store and transmit digital signals.

Audio Format:

Voice can also be digitized into computer files. This audio file can be stored or transferred just like a regular computer data file. With a sound card, speakers, and a microphone, users can use voice to communicate with the other party by voice.

The above output formats constitute multimedia which are going to be the major computer output in the future.

WHAT OUTPUT TECHNOLOGIES DO YOU NEED?

Depending on the task you would like to achieve, the output devices you need vary:

Regular Computer Users

A computer with a multimedia system can provide you with many ways of presenting information. This system should contain speakers, the video capture board, the digital camera, and a microphone. With the necessary software, the user is able to create a picture, a movie, or a voice message.

Retailers

A retailer requires inventory update and pricing display when merchandise is checked out. A bar code reader allows cashiers to scan the Universal Product Code (UPC) and retrieve current price as well as update the inventory.

Cartoon/Movie Makers:

To be able to modify videos or animation, special software for graphics is needed. This type of software allows users to create special effects and modify videos, as desired.

Information Help Center:

The information center is designed to provide users with a self guided information guide. For example, a supermarket usually has information centers with touch screen monitors that allow shoppers to touch the screen for menu selection and receive information.

Publishers

Desk top publishing software allows users to edit magazines, newspaper or other publication on a computer. This can dramatically improve the efficiency of publication.

Video Conferences

A meeting can be held without all participants attending the meeting physically. Users can use the video conferences technology to conduct a meeting through the network and still see other participants.

Architect

By using Computer Aided Design (CAD) software, users are able to generate architect drawing more efficiently. Some CAD software provides three dimensional capability which allows users to create a 3-D image design.

SECONDARY STORAGE

Compared with the primary storage devices, secondary storage is a type of storage device which is generally less expensive and slower in terms of data retrieval speed. Information on secondary storage devices is also permanent. We classify secondary storage devices into three categories: magnetic tape, magnetic disk, and optical disk.

Magnetic Tape:

Magnetic tape is thin plastic tape that has been coated with a substance that can be magnetized; data is represented by the magnetized or nonmagnetized spots. Magnetic tapes are the original secondary storage device of computer systems. Since the sequential access method is used, magnetic tape devices are slow in data retrieval but are the least expensive secondary device. For large storage and low performance requirements such as back up or duplicate storage, magnetic tapes are the ideal choice. The two principal forms of tape storage of interest to us are magnetic-tape units used with mainframes and minicomputers and cartridge tape units used on microcomputers.

Magnetic Disk:

There are two types of magnetic disk devices i.e. hard disk and floppy disk. They both are random access devices. Therefore, they are faster and more expensive.

Floppy Disk

A floppy disk is a device that holds, spin, and reads data from and writes data to a diskette. A diskette is inserted into a slot, called the drive gate or drive door, in front of the disk drive. On a diskette, data is recorded in rings called tracks. Each track is divided into eight or nine sectors. Sectors are invisible wedge-shaped sections used for storage reference purposes. Unformatted disks are manufactured without tracks and sectors in place. The operating system writes track and sectors on the diskette to make formatted disks. All diskettes are double sided, capable of storing data on both sides. A 3.5 high density disk can store 1.44 megabytes.

Hard Disk

A hard disk is a disk made out of metal and covered with a magnetic recording surface. Hard disk drives read and write in much the same way that diskette drives do. However, hard drives can handle thousands of times more data than diskettes. In addition, they are faster than floppy disk drives in terms of reading and writing data. Hard disks are one or more platters sealed inside a hard-disk drive that are built into the system unit and cannot be removed.

The operation speed and the capacity of a hard drive is much more than a floppy disk because a hard disk can store data 30 to 2000 times and spins several times faster than a diskette. For example, a 2.1 gigabyte hard disk will spin at 7800 revolutions per minute compared to 360 rpm for a diskette drive. The disadvantage of a hard drive is that the read/write head rides on a cushion of air about 0.000001 inch thick over the disk surface. A head crash happens when the surface of the read/write head or particles on its surface come into contact with the disk surface, causing the loss of some or all of the data on the disk.

Zip Drive

A high-capacity floppy disk drive developed by Iomega Corporation. Zip disks are slightly larger than conventional floppy disks, and about twice as thick. They can hold 100 or 250 MB of data. Because they're relatively inexpensive and durable, they have become a popular media for backing up hard disks and for transporting large files.

Optical Disk:

Optical disks are removable disks on which data is written and read through the use of laser beams. A single optical disk of the type called CD-ROM can hold up to 700 megabytes of data. This is equivalent to about 270000 pages of text.

CD-ROM

Compact Disk Read Only Memory (CD-ROM) is an optical-disk format that is used to prerecord text, graphics, and sound. Since CD-ROM is a read-only disk, CD-ROM can not be written or erased by the user.

CD-RW
Short for CD-ReWritable disk, CD-RW is a type of CD disk that enables you to write onto it in multiple sessions.

DVD-R, DVD-RW
DVD media can accommodate an astonishing 8.5 GB of data (dual layer).

USB KeyChain Hard Drives
Also called pen drives or flash drives, USB keychain hard drives is changing the way we store and transport data. The days of small and inconvenient media are gone. With capacities ranging from 16MB to 2GB.

Table 2 summarizes characteristics of storage media for business consideration

TABLE 2
CHARACTERISTICS OF STORAGE MEDIA

Medium	Storage Capacity	Transfer Rate	Cost (per 1 MB)
Magnetic Hard Disc	High	Fast	Moderate
Magnetic Tape	Moderate	Slow	Very Low
Optical Tape	Very High	Very Slow	Low
CD	High	Very slow	Low
DVD	Very High	Moderate	High
Flash Memory	High	Moderate	Very High

HOW TO SELECT LAPTOPS
Selecting a laptop computer is trickier than buying a desktop PC because laptops are more diverse and more personal. Here are some basics to consider.
1. Get Intel's latest Centrino-brand chip platform, code-named *Sonoma*, which is faster speeds.
2. Get at least 512 megabytes of memory. Don't worry much about processor speed.
3. Buy as much hard-drive capacity as you can afford.
4. Make sure your computer has multiple USB 2.0 ports, and slots for the memory cards used in cameras.
5. On Windows laptops, security is crucial. Make sure that you get the more secure SP2 version of Windows XP and that you immediately install anti-virus, anti-spam, anti-spyware, anti-popup and firewall software. If you plan to use your laptop in public wireless hot spots, take the time to enable its wireless security features.

Specifically, the following dimensions must be weighed.

Size and weight: There are several classes of laptops. At the light end are machines weighing just 2 pounds to 4 pounds. These models are designed for mobility and are meant to complement a desktop PC. They are very thin and have screens of 12 inches or less. In the middle are laptops weighing from 4 pounds to 7 pounds. These models can serve as desktop replacements but can also be toted on trips. They typically have 14-inch or 15-inch screens.

*Windows or Mac***:** Most laptop buyers will go for Windows machines and Apple's iBooks.

*Processor***:** If you want the best combination of power and battery life from your Windows laptop, get one that uses Intel's power-saving Pentium M processor. These chips are included in models bearing the Centrino label, offered by many manufacturers. But they are also available in some non-Centrino models that use different wireless chips. Don't pay extra for faster processor speeds. Even the slowest laptop processors can handily perform the most common computing tasks.

Battery life: Insist on a laptop that can run for at least three hours on its standard battery. Some models can do much better.

Screen and keyboard: Try to test laptops in stores to ensure you like their screens and keyboards. You don't need a huge screen if you can get one with high resolution.

Wireless Networking: Built-in Wi-Fi networking is a must. Buy a laptop with the newer "g" version. Wireless reception capabilities vary in laptops because of different antenna and case designs. If you plan to use your cell phone as a modem or to synchronize data with a cell phone or PDA, make sure your laptop has another type of wireless networking, called Bluetooth.

SUMMARY

No matter how complex a computer system is, it all consists of input, output, processing and secondary devices. New technologies make computer hardware and software so advanced that end-users can operate or program the computer without professional training. Computers are an essential part of our business life. The key to buying a computer is to understand what you want and need in the business and shop around for the best price. It may not be necessary to buy state of the art equipment to do your job effectively and efficiently.

CHAPTER 3 QUIZ

1. The main components of the central processing unit (CPU) of a computer are
      A. Semiconductors, online devices, and memory.
      B. Arithmetic-logic unit, control unit, and primary memory.
      C. Random-access memory, read-only memory, and auxiliary storage.
      D. Primary storage, input-output devices, and arithmetic-logic unit.

2. The location in the central processing unit (CPU) where data and programs are temporarily stored during processing is the
      A. Floppy disk drive.
      B. Magnetic tape drive.
      C. Random-access memory (RAM).
      D. Magnetic disk drive.

3. In a microcomputer system, the place where parts of the operating system program and language translator program are permanently stored is
      A. Read-only memory (ROM).
      B. Magnetic disk drive.
      C. Random-access memory (RAM).
      D. Magnetic tape drive.

4. All of the following are computer input devices except a(n)
      A. Plotter.
      B. Mouse.
      C. Magnetic ink character recognition device.
      D. Light pen.

5. A device used in supermarkets or libraries to read Universal Product Code (UPC) is a:
      A. Video Capture
      B. Voice recognition device
      C. Bar code reader
      D. Image scanner

6. Banks are required to process many transactions from paper documents (e.g., checks, deposit slips) during the course of an average business day. This requires a reliable, yet economical, form of input. The most common source automation device used by banks is
      A. Disk pack.
      B. Magnetic tape.
      C. Bar coding.
      D. Magnetic ink character recognition.

7. Output that can be classified as figures, alphabets and other keyboard symbols is described as a:
- A. Audio format
- B. Video format
- C. Text format
- D. Graphic format

8. A secondary storage device that is a disk made out of metal and covered with a magnetic recording surface is classified as:
- A. Magnetic tape
- B. Magnetic disk
- C. Optical disk
- D. CD-ROM

CHAPTER 3 ANSWER KEY

1. (B) is correct. All computers have a CPU that works in conjunction with peripheral devices. The CPU is the main element of a computer system. Its principal components are primarily storage, the arithmetic-logic unit, and the control unit.

(A) is incorrect. Online devices are peripheral units.

(C) is incorrect. Auxiliary storage is not a part of the CPU.

(D) is incorrect. Input-output devices are peripheral equipment.

2. (C) is correct. The CPU is the part of the computer system that manipulates numbers, symbols, and letters. Primary storage is the area in the CPU where programs and data are temporarily stored during processing. Internal primary storage is also known as random-access memory because each memory location therein can be randomly accessed in the same amount of time.

(A) is incorrect. A floppy disk drive is a random access storage medium for microcomputers that permits permanent storage of data.

(B) is incorrect. A magnetic tape drive is not for temporary storage.

(D) is incorrect. A magnetic disk drive is a secondary storage medium for permanent storage of data.

3. (A) is correct. ROM consists of microinstructions hardwire into the computer. Data cannot be written on our erased from ROM. The operating system and the language translator (software that translates source programs into machine-readable instructions) are permanently stored in ROM to prohibit users from accidentally erasing or changing the system. Some microcomputers, however, have erasable, programmable ROM. This form of storage may be erased by an ultraviolet technique (but not by the microcomputer) after which new instructions may be entered.

(B) is incorrect. Drives are not storage devices.

(C) is incorrect. RAM is erasable.

(D) is incorrect. Drives are not storage devices.

4. (A) is correct. An input, or data entry, device communicates information to a computer. Examples include bar code readers, magnetic ink character recognition devices, light pens, keyboards, touch screens, a computer mouse, digital scanners, and voice recognition devices. A plotter is an output device that draws graphs directly on paper.

(B) is incorrect. A mouse is an input device.

(C) is incorrect. A magnetic ink character recognition device is an input device.

(D) is incorrect. A light pen is an input device.

5. (C) is correct. Bar code reader is a device used in supermarkets or libraries to read Universal Product Code (UPC).

(A) is incorrect. Video capture digitizes the video as a computer file.

(B) is incorrect. A voice recognition device is activated by a voice command to type input.

(D) is incorrect. The image scanner allows the users to store pictures as a computer file.

6. (D) is correct. Magnetic ink character recognition (MICR) is used by banks to read the magnetic ink on checks and deposit slips. MICR is a form of data entry device.

(A) is incorrect. A disk pack is a storage device.

(B) is incorrect. Magnetic tape is a storage device, not a data entry device.

(C) is incorrect. Bar coding is a data entry technique often used by manufactures, wholesalers, and retailers but is rarely used by banks.

7. (C) is correct. Text Format is output that can be classified as figures, alphabets and other keyboard symbols.

(A) is incorrect. Audio format is a voice sound that is digitized into computer files.

(B) is incorrect. Video format is designed to display movies that have been digitized.

(D) is incorrect. Graphic format allows users to view output by the images it contains.

8. (B) is correct. Magnetic disk is a secondary storage device that is a disk made out of metal and covered with a magnetic recording surface.

(A) is incorrect. The magnetic tape is a thin plastic tape that has been coated with a substance that can be magnetized.

(C) is incorrect. An optical disk is a removable disk on which data is written and read through the use of laser beams.

(D) is incorrect. CD-ROM is a compact disk that can only be read and is used to pre-record text, graphics and sound.

CHAPTER 4
USING SYSTEMS SOFTWARE

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Illustrate an operating system (OS).
2. Utilize utility programs.
3. Describe the functions of programming language processors.
4. Discuss IBM compatible operating systems.
5. Recognize and list Macintosh operating systems.
6. Identify other operating systems.
7. Differentiate between single-user versus multi-user systems.
8. Describe distributed processing and cooperative processing.
9. Distinguish between systems versus multi-tasking systems.
10. Develop knowledge of programming language.

Software consists of computer programs, procedures, rules, and related documentation concerned with the operation of the computer system. System software is used to control the computer hardware so that all computer devices can interact with application software smoothly. System software creates a layer of insulation between the computer hardware and application software. System software can greatly help and simplify the design of application software. Generally speaking, system software consists of three components: Operating Systems, Utility Programs and Programming Language Processors (Language Translators).

THE OPERATING SYSTEM (OS)

The operating system (OS) consists of the master system of programs that manage the basic operations of the computer. These programs provide the control and use of hardware resources, including disk space, memory, CPU time allocation, and peripheral devices. They are also the interface between computer hardware and application programs so that end users can concentrate on their own tasks or applications rather than on the complexities of managing the computer. To be more specific, the operating system is used to control the hardware memory, schedule the execution of programs, and schedule input output traffic between the CPU and other devices.

A good Operating System can dramatically improve the effectiveness and the efficiency of program execution performance. Many different operating systems are available for computers. For example, Cray supercomputers use UNICOS and COS, IBM mainframes use MVS and VM, Data General minicomputers use AOS and DG, and DEC minicomputers use VAX/VMS. Windows 2000 and Windows XP are the latest versions of the IBM compatible operating system which have been widely used by most

IBM compatible microcomputers. Common features of Windows operating systems include support for the use of a mouse, icons, pull-down menus and the capability to open several applications at the same time.

Some operating systems are designed for a microcomputer single user environment and others are used for multiple users. The complexity of OS is much higher in multiple user OS due to the management of computer memory and CPU time shared by many users. Today, many computers use what is called an operating environment which provides end users with a user friendly interface to use. Some operating systems have a graphical user interface (GUI) that provides visual clues such as icons and objects to help the users. Each icon represents a folder, an application package, or a file. By clicking icons, users can open a folder or use an application package.

1. There are four versions of Windows 2000:

- Professional -- an operating system for business desktop and laptop systems. It is used to run software applications, connect to Internet and intranet sites, and access files, printers, and network resources.
- Server -- both a Web server and an office server. Windows 2000 Server lets users build Web applications and connect to the Internet.
- Advanced Server -- an operating system for line-of-business applications and e-commerce. It contains all the functionality of the standard version of Windows 2000 Server, plus additional features for applications that require higher levels of scalability and availability.
- Datacenter Server -- developed to work in high-traffic computer networks, it is designed for enterprises that need reliable high-end drivers and software. It supports up to 32-way SMP and up to 64 GB of physical memory.

Windows 2000 is sometimes abbreviated as W2K.

2. Windows XP is an operating system introduced in 2001 from Microsoft's Windows family of operating systems; the previous version of Windows being Windows Me. Microsoft called the release its most important product since Windows 95. Along with a redesigned look and feel to the user interface, the new operating system is built on the Windows 2000 kernel, giving the user a more stable and reliable environment than previous versions of Windows. Windows XP comes in two versions, Home and Professional. Where the Professional Edition focuses on reliability and security, the Home Edition includes extensive digital photography, digital music, digital video, home networking and communications features. The company has also focused on mobility for both editions, including plug and play features for connecting to wireless networks. The operating system also utilizes the 802.1x wireless security standard.

TABLE 1
POPULAR OPERATING SYSTEMS

Name	OS Developer	Runs on
OS390 (formerly MVS)	IBM	IBM mainframes
OS400	IBM	IBM AS/400 computers
MS-DOS	Microsoft	PCs
Windows 95, 98, Me, NT, 2000, XP	Microsoft	PCs
MacOS X	Apple Computer	Macintosh PCs
Solaris	SunSoft, Inc.	Sun computers
UNIX	AT&T (originally) and other software companies	Various versions for IBM, Macintosh, Sun, and other computers
Linux	Linus Torvalds and other software companies	PCs, mainly servers
NetWare	Novell	Usually network servers
PalmOS	Palm	Handheld computers (PDA)
Windows CE	Microsoft	Handheld computers (PDA)

Major functions provided by OS are the following:

Booting

Booting refers to the process of loading an operating system into a computer's main memory from the hard disk. This loading is accomplished by a program that is stored permanently in ROM.

Housekeeping Tasks

Housekeeping tasks provide end users with functions without starting application programs. One example is the Format command.

User Interface

This function allows users to communicate, or interact with the OS. Three types of user interfaces are common: Command, menu-driven, and graphical user interface (GUI). GUI is part of an operating system with which users may interact. It uses graphic icons to represent activities, programs, and files. The computer mouse is used to make selections. Windows is a graphical user interface shell initially developed by Microsoft to run in conjunction with DOS. Newer operating systems also have this feature. Thus, the so-called *windowing* is the characteristic that allows a computer to display more than one program on the screen at the same time. Each program has its own section of the screen, but only one program is active.

Managing Computer Resources
      Computer resources include the CPU, main memory, the printer, the monitor, and other peripheral devices. This activity manages and controls the resources available to the user so that each user's task can be accomplished.

Managing Files
      This function allows users to find, copy, erase and manipulate computer files from the hard disk and the floppy disk. For example, you can copy files from one disk to another, back up, or make a duplicate copy of a disk or erase a file from a disk.

Managing Tasks
      Operating systems are designed to run user tasks more efficiently. They can be classified into three types:

- Multitasking is the execution of two or more programs by one user concurrently on the same computer with one CPU.
- Multiprogramming is the execution of two or more programs on a multi-user operating system. The CPU time is shared by many users which are in the management of the OS.
- Multiprocessing uses multiple CPUs to perform work simultaneously. In other words, tasks can be decomposed into several subtasks and each subtask is assigned to a CPU for processing. Multiprocessing greatly increases system efficiency by executing multiple programs on the same computer at the same time. In systems with only one CPU, although multiple programs may be active simultaneously, program instructions can only be executed for one of these programs at a time.

UTILITY PROGRAMS
      The Utility Programs are used to help end users with a tool box to fine tune hardware components or modify system software functions. Utility programs are normally associated with the operating system. The utility programs for large computer systems (such as mainframe computers and super computers) are designed for professional system programmers to either modify or repair the system software. However, the utility programs for microcomputers are very often used by end users. They are user friendly and designed for end users to format a diskette, change the monitor's background pattern, or install computer hardware. Some vendors provide utility programs which can enhance the performance of the computer such as RAM disk, virtual memory, or check for viruses. Some of the principal utility programs are:

- *Data recovery:* A data recovery utility is used to undelete a file or information that has been accidentally deleted. By this function, users are able to undo the last delete operation that has taken place.
- *Screen Saver:* A screen saver prevents a monitor's display screen from being etched by an unchanging image (burn in).
- *Backup:* The backup utility allows users to make a back up, or duplicate copy, of the information on the hard disk.

- *Data compression:* Data compression removes redundant elements, gaps, and unnecessary data from a computer's storage space so less space is required to store or transmit data.
- *Virus protection:* A virus consists of hidden programming instructions that are buried within an applications or system program. They can reproduce themselves and cause damage to computer programs.

A query utility program could be used to access items in a database. A query language permits interactive searching of a database. Data may be read and reorganized but not altered.

PROGRAMMING LANGUAGE PROCESSORS

A Program Language Processor can be either a compiler or an interpreter. A compiler translates programming codes into machine code all at once so an executable file will be created for further execution. An interpreter translates a program line by line for each execution. Interpreters are usually used by business researchers or software developers who frequently modify their software and make lots of changes. It is easier to diagnose the programming errors line by line after the execution. An example is the BASIC interpreter.

A compiler has the advantage of being able to generate an executable file for later execution. This file called the object code is represented in binary code (machine code). The original program is called the source code. Users only need the object code to execute the program. Therefore, they do not have to compile the program every time when they need to run it. The drawback is that if there are any programming errors in the program, it is very hard for the program designers to tell what went wrong. Therefore, compilers are best used for programs that are fully developed and ready for the user.

MACINTOSH OPERATING SYSTEMS

While IBM system platforms traditionally use microprocessors made by Intel and use DOS or Windows in terms of OS, Apple computers typically use Motorola processors and a proprietary Apple Operating System such as "System 7." Macintosh had a very successful experience in designing graphical user interfaces in the 1980s. A multitasking environment was also available in the 1980s. However, at the time, IBM compatible computers only used DOS operating systems which have very poor user interfaces. However, this advantage was eliminated after Microsoft launched a Windows serial operating system which has a similar graphical user interface and multi-tasking environment.

Earlier versions of the Macintosh operating system, Mac OS for short, were called System x.x, where x.x were the version numbers. With the release of Mac OS 8, however, Apple dropped the System moniker. The newest version, Mac OS X Tiger, features breakthrough search technology known as *Spotlight*, outstanding graphics and media, unparalleled connectivity, an intuitive user interface and a virtual toolbox chock full of cleverly integrated features — all atop a rock-solid UNIX foundation — give you the most innovative, stable and compatible desktop operating system. *Note:* **Microsoft**'s

next-generation operating system for Windows, code-named *Longhorn*, is a Windows' answer to Mac OS X Tiger.

OTHER OPERATING SYSTEMS
Other operating systems such as UNIX are designed for mini computers or mainframe computers.

UNIX
UNIX is a powerful operating system developed by AT&T for mini-computers. At the time of UNIX development in the 1970s, AT & T was not permitted to market the operating system due to federal regulations that prohibited the company from competing in the computer marketplace. In 1980s, when AT&T was decomposed into many small companies, many federal regulations were removed. Since then, UNIX has increased in popularity. Today, UNIX is the leading portable OS. It can be used on many computer system types and performs from personal computers to mainframe systems, because it is compatible with different types of hardware. Users have to learn only one system.

LINUX ANDTHE OPEN SOURCE REVOLUTION
The great majority of business and individual software is proprietary, that is, software that is developed and sold for profit. The developer retains the rights to the software. In most cases you do not actually own the copies of applications that you "purchase;" you only purchase licenses to use those applications. In contrast to proprietary software, there are growing numbers of computer programs that have been developed by many unrelated programmers and not for
profit. The advantages of open source software over proprietary software are clear: the software has fewer bugs because thousands of independent programmers review the code, and it can offer more innovative features by incorporating ideas from a diverse set of experts from different countries and cultures who collaborate. However, the concept of open source is probably best known for its application in the development of Linux, a popular variant of UNIX.

Linus Torvalds developed it for his own use, but he has never claimed rights to the software. So far more than 200 programmers have contributed code to Linux. Linux has become the OS of choice of many Internet service providers to run their Internet servers. While many versions of Linux can be downloaded free of charge from the Web, most firms prefer to purchase a packaged version. Companies such as Red Hat, Ximian, SCO, and VA Software sell the software and promise technical support. Usually, contracts also include updates.

NETWARE
NetWare is a local-area network (LAN) operating system developed by Novell Corporation. NetWare is a software product that runs on a variety of different types of LANs, from Ethernets to IBM token-ring networks. It provides users and programmers with a consistent interface that is independent of the actual hardware used to transmit messages.

SINGLE USER VERSUS MULTI-USER SYSTEMS

Single user operating systems can allow only one user to work at a time. This kind of OS has a relatively simple design and usually has less graphic user interfaces. Most microcomputers have a single user OS. For example, DOS and Windows are good examples. A multi-user OS allows many users to share the same computer. It is normally a mini or a mainframe computer. A multi-user OS has a more complicated design since many users have to access the same resources at the same time. This will create tremendous traffic and management problems among different users. UNIX is a good multi-user system.

SINGLE TASKING SYSTEMS VERSUS MULTI-TASKING SYSTEMS

Single Tasking

Single tasking implies that only one job or task can be executed at one time. DOS is a typical example of a single tasking system since only one job can be executed. However, a multi-tasking system allows more than one job (task) to be executed at the same time. One example is you can work on your word processing program while your printer manager software is running the functions which control the printer. This is usually conducted by opening several windows. Microsoft Windows and Macintosh OS are good examples.

Multi-Tasking

The multi-tasking environment allows users to perform several computer tasks at one time. Each task occupies a window. By swapping between windows, users are able to use different packages as they wish.

Distributed Processing and Cooperative Processing

Distributed processing is characterized by a merger of computer and telecommunications technology. Distributed systems permit not only remote access to a computer but also the performance of local processing at local sites. The result is greater flexibility in systems design and the possibility of an optimal distribution of processing tasks. In distributed or cooperative systems, the responsibility for ensuring that adequate backups are taken is the responsibility of user management. The systems are under the control of users, not a central information processing department.

Cooperative processing is a system in which computers in a distributed processing network can share the use of application programs belonging to another end user. The system assigns different machines the functions they perform best in executing a transaction-based application program. For example, a microcomputer might be used to enter and validate data for the application, and a mainframe might handle file input and output. Cooperative processing implies a tighter coupling than previously existed between the microcomputers and the mainframe. The result may threaten the manager's perceived autonomy by increasing the control exercised by headquarters and therefore the accountability of local managers.

EVOLUTION OF PROGRAMMING LANGUAGES

Programming languages can be classified into five generations in terms of the history of development.

First Generation of Programming Language

Machine code is represented in binary representation. All numbers are represented by 1s and 0s since inside the computer, only 1 or 0 can be represented by circuits. To see how hard this is to understand, imagine if you have to read this

00010101001110111100111000001111101000001111

Machine languages also vary according to the make of the computer. This is another characteristic that makes for difficulty. However, machine codes are very efficient from a hardware point of view because no additional processing procedures are required.

Second Generation Programming Language

Assembly language is designed to simplify the coding process of machine codes. Instead of binary code, all addresses are coded in Hexadecimal system and all operators are represented in English abbreviation. For example

ADD 43(9, 2), B4(10, A)

is a piece of Assembly code which is still pretty obscure. Therefore, Assembly Language is also considered a low-level language. Both 1st and 2nd generation programming languages are "hardware dependent." That means programmers must know the hardware structure and configuration in order to write codes properly.

Third Generation Programming Language

Third generation languages are designed to let programmers develop codes without the knowledge of computer memory configuration. Examples are COBOL, PASCAL, FORTRAN and many popular languages. One drawback of a third generation language is that it could be too complicated to code. A good programmer usually requires a couple of years of training and experience.

BASIC

Short for Beginner's All-purpose Symbolic Instruction Code. BASIC is a popular microcomputer language. It is widely used on microcomputers and easy to learn. It is suited to both beginning and experienced programmers. It is also interactive-users and computers communicate with each other directly during the waiting and running of programs. Another version created by the Microsoft Corporation is Visual Basic, which has been hailed as a programming breakthrough. Visual BASIC makes it easier for novice programmers, as well as professionals, to develop customized applications for Windows. The new language is expected to become quite popular for corporate, in-house development.

PASCAL

Another language that is widely used on microcomputers and easy to learn is Pascal. It is named after Blaise Pascal, a seventeenth-century French mathematician. Pascal has become quite popular in computer science programs. One advantage is that it encourages programmers to follow structured coding procedures. It also works well for graphics.

C/C++

C is a general-purpose language that also works well with microcomputers. It is useful for writing operating systems, spreadsheet programs, database programs, and some scientific applications. Programs are portable; they can be run without change on a variety of computers. C++ is a version of C that incorporates object-oriented technologies. It is popular with some software developers and promises to increase programmer productivity. C ++ is sometimes referred to as "C with classes." As the name implies, C is its foundation. Classes provide a means of encapsulating the objects used by the program (which ordinarily represents the program's data) into a well organized, modular format that is easy to reuse and maintain. Through a process called inheritance, new objects can be derived from existing objects by adding new elements to the existing object design. C ++ was specifically designed with these features in mind.

COBOL

COBOL--- which stands for Common Business-Oriented Language---is one of the most frequently used programming languages in business. Though harder to learn than BASIC, its logic is easier for a person who is not a trained programmer to understand. Writing a COBOL program is sort of like writing the outline for a business research analysis. The program is divided into four divisions. The divisions in turn are divided into sections, which are divided into paragraphs, then into statements.

FORTRAN

Short for FORmula TRANslation, FORTRAN is a widely used scientific and mathematical language. It is very useful for processing complex formulas. Thus, many scientific and engineering programs have been written in this language.

Ada

Ada is named after Augusta Ada, the English Countess of Lovelace who is regarded as the first programmer. Ada was developed under the sponsorship of the U.S. Department of Defense. Originally designed for weapons systems, it has commercial uses as well. Because of its structured design, modules (sections) of a large program can be written, compiled, and tested separately--- before the entire program is put together.

FOURTH GENERATION

Fourth generation language is designed for people who need a simplified and powerful tool to conduct programming processes. Tens of third generation language codes can usually be compacted into several lines. However, this language requires a lots of hardware power to translate into machine code and perform the execution.

Query Languages

Query languages enable nonprogrammers to use certain easily understood commands to search and generate reports from a database.

Application Generators

An application generator contains a number of modules--- logically related program statements--- that have been preprogrammed to accomplish various tasks. An example would be a module that calculates overtime pay. The programmer can simply state which task is needed for a particular application. The application generator creates the program code by selecting the appropriate modules.

FIFTH GENERATION PROGRAMMING LANGUAGE (NATURAL LANGUAGE)

Natural languages are designed to give people a more human connection with computers. The language used to communicate is basically the language we use on a daily basis such as English, Chinese and French. This kind of language allows users to speak or type in human language command to execute the function. This language provides a computer novice with a handy tool.

Generation	Sample Statement
First	1000011101110011
Second	ADD 32(4, B), 8AB(5, 9)
Third	Counter: = 20
Fourth	Select name FROM Executive
Fifth	Update the inventory file by transaction file

WHAT ARE OBJECT ORIENTED LANGUAGES (OOL) AND COMPUTER-AIDED SOFTWARE ENGINEERING (CASE) TOOLS?

Object oriented languages have a different way to code. They allow the interaction of programming objects. This approach to programming is called object-oriented programming. In OOP, data, instructions, and other programming procedures are grouped together. The items in a group are called an object. The process of grouping items into an object is called encapsulation. Encapsulation means that functions or tasks are captured into each object, which keeps them safer from changes because access is protected. Objects often have properties of polymorphism and inheritance. Polymorphism allows the programmer to develop one routing that will operate or work with multiple objects. Inheritance means that objects in a group can take on or inherit characteristics of other objects in the same group or class of objects. This helps programmers select objects with certain characteristics for other

programming tasks or projects. Professional MIS programmers are consistently looking for ways to make the programming development process easier, faster, and more reliable. CASE tools provide some automation and assistance in program design, coding and testing. Some CASE tools can even convert your design into real codes.

SUMMARY

In the future, more powerful and easier-to-use versions will keep evolving. These new systems will be created with OOP which can create a series of interchangeable software objects or modules. By using OOP, new operating systems can be developed faster and more efficiently.

CHAPTER 4 QUIZ

1. All of the following are examples of computer software except a(n)
   A. Database management system.
   B. Telephone modern.
   C. Language translator.
   D. Word processing package.

2. System Software consists of:
   A. Operating systems
   B. Utility programs
   C. Programming language processor
   D. All of the above

3. Computers containing more than one central processing unit (CPU) are increasingly common. This feature enables a computer to execute multiple instructions from multiple programs simultaneously. This process is
   A. Time sharing.
   B. Multitasking.
   C. Multiprocessing.
   D. Batch processing.

4. A software tool infrequently used to select or access items in the database is most likely a(n)
   A. Report generator.
   B. Program generator.
   C. Application generator.
   D. Query utility program.

5. A characteristic of a microcomputer system that displays more than one program on the screen at eh same time, places each program in its own area of the screen, but permits only one program to be active is
   A. Windowing.
   B. Distributed processing.
   C. Context switching.
   D. File extension.

6. In traditional information systems, computer operators are generally responsible for backing up software and data files on a regular basis. In distributed or cooperative systems, ensuring that adequate backups are taken is the responsibility of
   A. User management.
   B. Systems programmers.
   C. Data entry clerks.
   D. Tape libraries.

7. A software tool used for ad hoc, online access to items in a database would most likely be a(n)
- A. Query utility program.
- B. Application generator.
- C. Report generator.
- D. Terminal emulation software.

8. An insurance company that has adopted cooperative processing is planning to implement new standard software in all its local offices. The new software has a fast response time, is very user friendly, and was developed with extensive user involvement. The new software captures, consolidates, edits, validates, and finally transfers standardized transaction data to the headquarters mainframe. Local managers, who were satisfied with existing locally written microcomputer applications, opposed the new approach because they anticipated
- A. Increased workloads.
- B. Centralized of all processing tasks.
- C. More accountability.
- D. Less computer equipment.

9. The system that permits the computers in a distributed processing network to share the use of another end user's application program is
- A. Electronic data interchange.
- B. Interactive processing.
- C. Executive support system.
- D. Cooperative processing.

10. Objective oriented programming is characterized by an emphasis on objects and the procedures performed upon them. Which of the following programming languages is most closely associated with object oriented programming?
- A. Basic.
- B. FORTRAN.
- C. C.
- D. C ++

CHAPTER 4 ANSWER KEY

1. (B) is correct. Software consists of computer programs, procedures, rules, and related documentation concerned with the operation of the computer system. A modern, however, is hardware used to convert digital signals from terminals and the CPU into analog signals for transmission along telephone lines.

(A) is incorrect. A DBMS is an example of computer software.

(C) is incorrect. A language translator is an example of computer software.

(D) is incorrect. A word processing package is an example of computer software.

2. (D) is correct. Operating systems, utility programs, and programming language processor are all part of System Software.

(A) is incorrect. Operating systems is part of System Software. It consists of the master system of programs that manage the basic operation of the computer.

(B) is incorrect. Utility programs are part of System Software. It is used to help end users with a tool box to fine tune hardware components and modify system software functions.

(C) is incorrect. Programming language processors is part of System Software. It compiles or interprets and translates codes into medium codes and translates the program line by line for each execution.

3. (C) is correct. Multiprocessing greatly increases system efficiency by executing multiple programs on the same computer at the same time. In systems with only one CPU, although multiple programs may be active simultaneously, program instructions can only be executed for one of these programs at a time.

(A) is incorrect. In time sharing, the CPU spends a fixed amount of time on each program.

(B) is incorrect. Multitasking is the process of having multiple programs active at a given time, although the CPU is executing instructions from only one program at a time.

(D) is incorrect. Batch processing entails execution of a list of instructions from beginning to end without interruption.

4. (D) is correct. Utility programs are service programs that perform certain standard tasks, such as sorting, merging, copying, and printing file dumps. A query utility program could be used to access items in a database. However, such programs would not be used in normal operational circumstances. A query language permits interactive searching of a database. Data may be read and reorganized but not altered.

(A) is incorrect. A report generator is frequently used. It generates reports based on special requirements by users, often in conjunction with query language.

(B) is incorrect. Program generators allow the user to create application programs based on requirements entered in a specific format. They differ from query languages because they permit data to be written or altered.

(C) is incorrect. An application generator is frequently used.

5. (A) is correct. A graphical user interface is part of an operating system with which users may interact. It uses graphic icons to represent activities, programs, and files. The computer mouse is used to make selections. Windows is a graphical user interface shell initially developed by Microsoft to run in conjunction with DOS. Newer operating systems also have this feature. Thus, windowing is the characteristic that allows a computer to display more than one program on the screen at the same time. Each program has its own section of the screen, but only one program is active.

(B) is incorrect. Distributed processing is a means of assigning computer processing to various segments of a business, with some aspects centralized and some decentralized.

(C) is incorrect. Context switching does not relate to the various segments on a computer screen.

(D) is incorrect. A file extension is a means of extending a logical collection of records.

6. (A) is correct. In distributed or cooperative systems, the responsibility for ensuring that adequate backups are taken is the responsibility of user management. The systems are under the control of users, not a central information processing department.

(B) is incorrect. Distributed environments have no systems programmers comparable to those at central sites for traditional systems.

(C) is incorrect. Distributed environments may not have data entry clerks. Users typically perform their own data entry.

(D) is incorrect. In distributed environments, there are no tape librarians.

7. (A) is correct. A query language is a fourth-generation language used to access information in files or databases. It is ordinarily used in interactive, online environments and is able to make requests that have not been standardized. A query utility program permits reading and reorganization of data but not its alteration.

(B) is incorrect. Application or program generations permit ultimate users to produce programs simply by specifying what needs to be accomplished.

(C) is incorrect. A report generator facilitates creation of customized reports in a variety of formats.

(D) is incorrect. Terminal emulation software permits a small computer to interface with a mainframe.

8. (C) is correct. Cooperative processing implies a tighter coupling than previously existed between the microcomputers and the mainframe. The result may threaten the manager's perceived autonomy by increasing the control exercised by headquarters and therefore the accountability of local managers.

(A) is incorrect. Given that only existing systems would be converted, the transaction volume would likely remain relatively constant.

(B) is incorrect. In a cooperative processing environment, different computers execute different parts of an application.

(D) is incorrect. Compared with mainframe-only processing, cooperative processing typically requires more computer equipment at distributed locations.

9. (D) is correct. Cooperative processing is a system in which computers in a distributed processing network can share the use of application programs belonging to another end user. The system assigns different machines the functions they perform best in executing a transaction-based application program. For example, a microcomputer might be used to enter and validate data for the application, and a mainframe might handle file input and output.

(A) is incorrect. EDI is the communication of electronic documents directly from a computer in one entity to a computer in another entity.

(B) is incorrect. Interactive processing does not allow for the use of another end user's application programs.

(C) is incorrect. An executive support system focuses on strategic objectives and gives immediate information about an organization's critical success factors.

10. (D) is correct. C ++ is sometimes referred to as "C with classes." As the name implies, C is its foundation. Classes provide a means of encapsulating the objects used by the program (which ordinarily represents the program's data) into a well organized, modular format that is easy to reuse and maintain. Through a process called inheritance, new objects can be derived from existing objects by adding new elements to the existing object design. C ++ was specifically designed with these features in mind.

(A) is incorrect. Basic traditionally emphasizes procedures rather than objects.

(B) is incorrect. FORTRAN is a programming language that traditionally emphasizes procedures.

(C) is incorrect. C traditionally stresses procedures rather than objects.

CHAPTER 5
USING APPLICATION SOFTWARE

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Identify the seven main types of software.
2. Facilitate the use of packaged, customized, or semi-customized software.
3. Describe presentation software.
4. Explain the uses of word-processing software.
5. Identify and illustrate the use of spreadsheet software.
6. Select database software.
7. Choose and appraise data communication software.
8. Utilize integrated software packages.

Before you decide to buy a piece of software, you should decide what functions are to be achieved. For example, if you just want to have a simple word processing system for your resume preparation, a simple word processing package would be enough. However, if you need to edit magazines for publication, professional desk top publication software would be required. If the computer functions are common, in general, packaged software should be easier to be found on the market. If, however, your requested function is rare or in a large scale so that no existing packaged software is available, you may have to develop your own software from scratch. This is called "customized software." In general, customized software is more time consuming and costs more money to develop, but it's more efficient in operation due to the special design of functions. You can buy packaged software from many computer software stores or through mail order or online. However, if you decide to design from scratch, you then have to choose a programming language to do the coding. This designing process is known as "System Analysis and Design" cycle.

Versions
 A version is a major upgrade in a software product. Versions are usually represented by numbers such as 1.0, 2.0, 3.0 and so forth. The higher the number, the more recent the version.

Release
 A release is a minor upgrade. The number indicates releases after the decimal point. For example, 3.1, 3.12, 3.121 and so on.

Yearly Version
 Microsoft uses "Windows 98" and "Windows 2000" for its new operating system since it was launched in 1995. Most software is upward compatible (forward compatible). That means the document created under an earlier version or release can be processed on a later version or release. Downward compatible means that the

document created under a later version can be run on older versions or releases. Software can be classified into four categories in terms of software copyright.

Proprietary Software

Proprietary software is the software whose rights are owned by an individual or business. Therefore, the ownership of the software is protected by the copyright. There are two types of licenses of the ownership.
- Single user licenses: Users can buy one copy of the software license and use this software in a single machine.
- Site Licenses: Users can buy multiple usage for an entity such as a campus or a company.

Public Domain Software

Public Domain software is software that is not protected by copyright law and may be duplicated by anyone. For example, a government developed program for the general public and a program donated by the original creator. Public domain software can normally be downloaded from the Internet or from the bulletin board of network service providers such as America on Line, CompuServe and etc.

Freeware

Freeware is software that is available free of charge through the Internet or computer users group. Sometimes software developers promote their product by giving away free software for trial. This trial can be thirty days or an unlimited time period. To create a standard for software on which people are apt to agree, the developers want to see how users respond, so they can make improvements in a later version. This is one of the reasons; there is no need to pay for it. The software distributed is free of charge but usually with limited functions. Freeware developers often retain all rights to their programs, so that technically you are not supposed to duplicate and distribute it. An example of freeware is Mosaic.

Shareware

Shareware is commercial software offered to users without initial charge. It is traditionally offered by less established software developers. Often it comes with some features disabled and can only be used without charge for a limited time. Users pay a fee to "register" it, in return for which they receive a license to use it with all features enabled.

Firmware

Firmware consists of software programs "hardwired" or permanently installed in the computer hardware. Firmware can be used to monitor internal conditions, e.g., by making signal counts (such as accesses to the computer) or taking "snapshots" of indicators. Thus, ROM (read-only-memory) is firmware.

SEVEN MAIN TYPES OF SOFTWARE AND HOW THEY OPERATE

There are seven major types of application software on the market. They are Presentation Software, Word Processing Software, Spreadsheet Software, Data Base

Software, Communication Software, Desktop publishing, Graphics and Personal Management software.

Presentation Software

Presentation software is designed to generate graphical presentation slides used to communicate or make a presentation of data to others. A good presentation software provides users with a graphical user interface and lots of utilities to make transparencies. Some presentation graphics packages provide artwork, drawing function and even multimedia utilities to make the presentation more attractive.

Word Processing Software

Word processing software allows users to create, edit, format, save and print a document such as letters, memos, reports, and manuscripts. Some word processing software also includes artwork, drawing functions, spreadsheet utilities and graphics. Others provide users with spelling checker, grammar checker and thesaurus functions.

Spreadsheets

A spreadsheet allows users to create tables and financial schedules with mathematical functions and by entering data in prepared tables; spreadsheets can calculate entered data and provide solutions. In the late 1970s, Daniel Bricklin was a student at the Harvard Business School. One day he was staring at columns of numbers on a blackboard when he got the idea for computerizing the spreadsheet. VisiCalc was the first product from his idea. Today, the principal spreadsheets are Microsoft Excel, Lotus 1-2-3, and Quattro Pro.

A spreadsheet contains many cells, each of which can be used to store a number (such as 34), a formula (such as =A4+B4) or a label (2002 Sales Report). A cell is where a row and a column intersect. For example, C4 is the address of the cell, where column C and row 4 intersect. A cell pointer indicates where data is to be entered. The cell pointer can be moved around like a cursor in a word processing program.

Since a cell contains numbers, labels and formulas, users can design a template with formulas and labels so that other users will type in collected data and receive the answer. Today's spreadsheets are more sophisticated. They very often have drawing facilities, artwork library, database interface and a very nice graphics generator. Therefore, spreadsheets will become the most popular small-business program.

Database Software:

Database software is a program that controls the structure of a database and access to the data. In other words, a database is any electronically stored collection of data in a computer system. These computer-based files are organized according to their common elements, so that data can be retrieved easily. The smallest element of data addressed in a file is a character. The following is a description of database elements.

File	A collection of related records
Record	A collection of related fields
Field	A unit of data consisting of one or more characters

A database management system (DBMS) is software that controls and manipulates the structure of a database. One advantage of a database management system (DBMS) is that the independence of the data from the application programs, which allows the programs to be developed for the user's specific needs without concern for data capture problems.

Major database software is MySQL, Oracle, Lotus Approach, Corel Paradox and Microsoft Access. Recently, newer DBMS has dramatically improved so not just data but images, voices and even motion pictures can be included. Principle features of database software are as follows:

1. Creating a database
   Users can create a database by creating files (or tables). Each table has several fields, which is type of attribute consisting of one or more characters. A field can have the attribute of text, data, number or even object. After the format of a table is created, users can input records into the database. A record is collection of related fields. An example is a person's name, address and phone number.

2. Select and display a database file or a report
   After a database (consisting of several files) is created, users can manipulate this database by issuing queries. The function of a query is to screen all records by defined criteria.

3. Update a database
   Users can also delete, add or change a record in a data file.

4. Calculate and format a database
   Some DBMS contain built-in mathematical formulas. This feature can be used to find the average number of a selected group. For example, to find the average age of all customers who live in California.

Major database manipulation languages are Structured Query Language (SQL) and Query By Examples (QBE). Generally speaking, SQL is more powerful than QBE. Most professional database administrators are required to know SQL. Generally speaking, database software is much better than the old file managers because it can access several files at one time (also is known as a flat-file management system).

Communication Software:
Computers are often networked so that information can be shared. In order to transfer information between different computers, communication software is required. Communication software allows computers to exchange data over private network such as Local Area Network or over public network such as Wide Area Network (WAN). When communication software exists in both sending and receiving units, computers are able to establish and relinquish electronic links, code and decode data transmissions, verify transmission errors, compress data streams for more efficient transmission, and manage the transmission of documents. Communications software provides functionality far beyond numeric computation, textual editing, and graphics. It provides access to a virtually unlimited amount of information from anywhere on earth.

Desktop Publishing
Desktop publishing involves using a microcomputer and peripherals to mix text and graphics to produce high quality printouts. Magazines or newspapers usually use the final product of desktop publishing. Typically text material and graphics can be generated by word processing and graphics packages and imported as text and graphics files. Optical scanners may be used to input text and graphics from printed material.

Personal Information Managers (PIMs) (Lotus Organizer and Microsoft Outlook)
The personal information manager is a popular software package for end user productivity and collaboration. They are used to help end users store, organize, and retrieve information about customers, clients, and prospects, or schedule and management appointments, meetings, and tasks. PIMs are being used for:
- Electronic calendar or list of appointments, meetings, or other things to do.
- Timetable for a project
- Display of key facts and financial data about customers, clients, and sales prospects
- Accessing the World Wide Web
- Providing e-mail capability.
- Internet and e-mail features to support team collaboration by sharing information with other networked PIM users.

PACKAGED, CUSTOMIZED, OR SEMI CUSTOMIZED SOFTWARE
There are three approaches to acquire software depending on the purpose of usage, the cost and the duration of development.

- Large software corporations (such as Microsoft), targeted for a large number of end users and for general purposes usually design packaged software. In other words, the software functions available are common and popular to the general public. This enables a large population to share the development cost and pay less prices for well designed software. However, they may not fit into every user's particular needs. Since software packages are developed to satisfy most end-users, the user interface and software documentation are very well prepared.

- Customized software requires intensive development efforts. It usually takes a longer time and costs more money to develop. Typically, only large corporations can afford the development cost. The major reason for customized software is the similar software is not available on the market or the user group is too small so that it would not be worthwhile for any software company to develop. Customized software requires more time and effort to develop a system that should be tailored to the customer's needs. In other words, the functions available in customized software are more flexible and powerful. Two system development methodologies are available: System analysis and design life cycle and Prototyping.

    - System analysis and design life cycle: the system development life cycle consists of seven steps:

1. Identify problems and opportunities
2. Analyze and document existing systems
3. Determine information requirements
4. Design technology and personal requirements
5. Develop, test and validate system
6. Implement system
7. Evaluation and maintain system

- Prototyping: this method involves building a working model and modifying it to fit our requirement. A working model (system) may only cover a subset of the whole system or only some functions among others. A complete system can then be built by including more functions or expand to other subsystems.

- Semi-customized software: The trade-off between customized software and packaged software is to have software, which provides a general structure. Customers can modify this software and customize the functions. For example, lots of database software provides a general database structure. Based on different individual needs, users can develop different applications for different environments.

WHERE TO GET SOFTWARE ASSISTANCE

There are several places you can receive software assistance.

1. Software vendor: Software producers usually provide buyers with telephone assistance. Users can call technology support department for help.

2. Software on-line help: most software programs come with the on-line help. On-line help contains functions or explanations that can be retrieved right from the program. Users can get immediate response from the help menu. One drawback for on-line help is that users may not be able to get answers they are looking for.

3. Network: in Internet (or other networks), there are many software users' bulletin boards. Many ideas and problems are posted on the bulletin board. Users can certainly exchange ideas or answers through the internet.

4. Professional consulting firms: Most software consulting firms provide software assistance by a fee. Services that are provided by consulting firms could be very expensive.

5. Software training facilities: Schools or training institutes give seminars or courses for different types of software.

6. Vendor's seminar: Most vendors provide seminars for new software released.

Users (or buyers) can attend these seminars for more information and help. Most seminars are free to users.

GUIDELINES IN PREPARING SPREADSHEET SOFTWARE

Spreadsheet software allows you to organize numeric data in a worksheet or table format called a spreadsheet. Within a spreadsheet, data is organized horizontally in rows and vertically in columns. The intersection where a row and column meet is called a cell. Cells are named by their location in the spreadsheet. Each cell may contain three types of data: Labels (text), values (numbers), and formulas. The text (label) identifies the data and documents the spreadsheet. The numbers are values, which can be calculated. The formulas perform calculations on the data in the spreadsheet and display the resulting value in the cell containing the formula.

DATABASE SOFTWARE

A database refers to a collection of data that is stored in files. Database software allows you to create a database and to retrieve, manipulate, and update the data that you store in it. In a manual system, data might be recorded on paper and stored in a filing cabinet. In a database on the computer, data will be stored in an electronic formation on an auxiliary storage device such as a disk. There are several terms you should be familiar with. A file is defined as a collection of related data that are organized in records. Each record contains a collection of related facts called fields. For example:

```
                        Student file
        Name            SS#                 Phone number
        ========================================
        Robert Jones 365-98-6509            909-675-9842
        Mary Smith   876-92-1425            818-837-2897
        Jim Lee      987-26-3833            909-824-2225
        John Doe     873-22-2998            818-827-9988
```

Student file contains four records and each record has three fields.

Database software can organize data in a certain way that allows users to retrieve, update, delete or create data in a very high speed. Users can therefore improve productivity by using database software

DATA COMMUNICATION SOFTWARE

Data communication software is used to transmit data from one computer to another. It gives users access to databases such as stock prices and airline schedules. There are two kinds of data communication software: network operating systems and network browsers. The network operating system is the software, which is used to manage the network communications. A network OS can be very powerful in order to manage several hundred workstations or even network servers in a wide area network. A network OS can also be designed to only handle a handful of PCs in a local area network. A network browser is used to access the network. Network users can access the network and retrieve information from the network through the network browser. For example, Novel and Windows NT are two popular local network OSs. Navigator and Internet Explorer are popular network browsers.

WHEN TO USE INTEGRATED SOFTWARE PACKAGES

Integrated software packages combine the features of several popular applications such as Word processing software, spreadsheet software, database software, presentation software and data communication software. Since different software is combined together as a single package, users do not have to pay the full price of each individual software package. In addition, the functions available for each different software package are more consistent than each individual software package. Three major integrated software packages are Microsoft Office, Lotus SmartSuite and Corel PerfectOffice. Microsoft Office or XP consists of programs that separately would cost perhaps over $1,000 but as a bundled package it costs only about $500.

SUMMARY

Application software is designed to accomplish users' tasks. The major efforts to improve the application software are to have good usability or good user interface. A better user interface indicates that the user can perform a user's task in a more efficient way so that productivity can be improved. In the future, the user interface of application software is going to be so natural that it takes no effort for users to communicate with a computer. One of the challenges of application software is file exchangeability. The information used for different applications may not be exchangeable. However, this has been dramatically improved after the 'open system' architecture has been emphasized. This enables end users to exchange information between different application software and communicate more effectively.

CHAPTER 5 QUIZ

1. Software offered to users on a "try before you buy" basis is called
   - A. Shareware.
   - B. Firmware.
   - C. Middleware.
   - D. Freeware.

2. Computer manufactures are now installing software programs permanently inside the computer as part of its main memory to provide protection from erasure or loss if there is interrupted electrical power. This concept is known as
   - A. File integrity.
   - B. Software control.
   - C. Firmware.
   - D. Random-access memory (RAM).

3. Software that is not protected by copyright law and may be duplicated by anyone is:
   - A. Proprietary software
   - B. Single user license software
   - C. Site users license software
   - D. Public domain software

4. Several places you can receive software assistance includes all except:
   - A. Software vendors
   - B. Proprietary software
   - C. Software online help
   - D. Network

5. Examples of the main types of software include all the following except:
   - A. Presentation software
   - B. Formula translation software
   - C. Word processing software
   - D. Spreadsheet software

6. Systems analysis and design life cycle consist of seven steps. The correct cycle order is:
   - A. Determine information requirements/design technical and personal requirements
   - B. Develop, test, validate/implement system
   - C. Identify problems and opportunities/analyze existing systems
   - D. Evaluate and maintain system

     - A. A/B/C/D
     - B. B/C/D/A
     - C. C/A/B/D
     - D. D/C//B/A

7. A cell in spreadsheet software contains labels (text) and formulas.
True / False

8. Microcomputer systems have enhanced use with systems software and applications software. Which one of the following statements concerning microcomputer systems is false?

      A. Database management systems are available for microcomputer systems.
      B. An operating system program is a critical software package for microcomputers.
      C. Electronic spreadsheet packages are types of applications software for microcomputers.
      D. Integrated packages are examples of operating systems for microcomputers.

CHAPTER 5 ANSWER KEY

1. (A) is correct. Shareware is commercial software offered to users without initial charge. It is traditionally offered by less established software developers. Often it comes with some features disabled and can only be used without charge for a limited time. Users pay a fee to "register" it, in return for which they receive a license to use it with all features enabled.

(B) is incorrect. Firmware is permanently wired into the hardware.

(C) is incorrect. Middleware oversees the interaction between disparate systems.

(D) is incorrect. Freeware is software that, although usually copyrighted, may be used without any licensing fee on a much less limited basis than shareware.

2. (C) is correct. Firmware consists of software programs "hardwired" or permanently installed in the computer hardware. Firmware can be used to monitor internal conditions, e.g., by making signal counts (such as accesses to the computer) or taking "snapshots" of indicators. Thus, ROM (read-only-memory) is firmware.

(A) is incorrect. File integrity is achieved by implementing controls that protect the completeness, accuracy, and physical security of files.

(B) is incorrect. Software control refers to library control of programs.

(D) is incorrect. RAM (as opposed to sequential-access memory) describes storage devices in which data locations can be directly accessed, thereby speeding data retrieval.

3. (D) is correct. Public domain software is software that is not protected by copyright law and may be duplicated by anyone.

(A) is incorrect. Proprietary software's rights are owned by individuals or businesses.

(B) is incorrect. Single user software is limited to users who buy one copy of the software license.

(C) is incorrect. Site users' license software is purchased for multiple users for an entity such as a company.

4. (B) is correct. Proprietary software is owned and protected by copy rights.

(A) is incorrect. Software vendors usually provide their buyers with telephone assistance.

(C) is incorrect. Software online contains function or explanations that can be retrieved from the program or help manual.

(D) is incorrect. Networks offer many software users bulletin boards used to exchange ideas and answers to problems.

5. (B) is correct. Formula translation software is not application software.

(A) is incorrect. Presentation software is designed to generate graphical presentation slides.

(C) is incorrect. Word processing software allows users to create, edit, format, and save and print documents.

(D) is incorrect. Spreadsheet software is used to create tables, financial schedules with mathematical functions.

6. (C) C/A/B/D is correct.

(A) is incorrect. A/B/C/D is steps three and four.

(B) is incorrect. B/C/D/A is steps five and six.

(D) is incorrect. D/C//B/A is step seven.

7. (F) is correct. A spreadsheet cell must have values (numbers).

(T) is incorrect. Spreadsheet software data is organized in rows and columns, where the row and column meet is a cell containing labels (text), values (numbers), and formulas.

8. (D) is correct. Integrated packages consist of tow or more applications programs rather than operating system programs. These software packages are increasingly available from vendors at prices less than the cost of internal development. However, they may require expensive modifications.

(A) is incorrect. Many database management systems are available for microcomputers.

(B) is incorrect. An operating system is critical since it is the software that controls the overall functioning of the computer. Operating systems are also commercially available.

(C) is incorrect. Electronic spreadsheet packages are types of business applications programs. An applications program is used to perform desired data processing tasks.

CHAPTER 6
DATA AND DATA MANAGEMENT

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Define the concept of database.
2. Prepare a database file (table).
3. Identity different types of file organization.
4. Demonstrate data models (relational, hierarchical and network).
5. List and explain the primary keys, secondary keys and foreign keys.
6. Construct a database design.
7. Explain and give examples of other features in a database management system.
8. Describe the role of the database administrator (DBA).
9. Select and review query languages.

A database is a system where data is organized in a certain way so that accurate and timely information can be retrieved. The information systems used to manage databases are called database management systems (DBMs). A database management system is software that allows managers to create, maintain, and report the data and file relationships. A file management system is software that allows users to manipulate one file at a time. Database management systems offer many advantages over file management systems as discussed below.

- *Reduced data redundancy*
Data redundancy means the same data field appears in different tables sometimes in different formats. For example, a customer's name, address and phone number can be stored in both the checking account file and the receivables account file. This would cause problems in terms of maintenance and update. It requires more time and money to maintain files with redundant records.

- *Improved data integrity*
   Data integrity means that data is accurate, consistent and up-to-date. If the same data is stored in different files, data updating may not cover all data elements in different files. Some reports will be produced with erroneous information. In a database, there are often conditions that constrain database records. For example, a sales order cannot exist unless the corresponding customer exists. This kind of constraint is an example of *referential integrity*.

- *Improved data security*
   Database management systems allow users to establish different levels of security over information in the database. This guarantees that data will be retrieved, or updated by authorized users. For example, the sales manager can only read employee payroll information, not modify it. A non-management employee probably

has no access privilege to the payroll data and can neither inquire nor modify the data.

- *Reduced Development Time*
  Since database management systems organize data in a better way, this enables the database administrator (DBA) to improve the efficiency and productivity of database development. For example, instead of creating a new file, the DBA can add new fields into existing files and still maintain data integrity.

WHAT IS A DATABASE FILE (TABLE)?

A database file is a collection of related records, which describe a subject by using a set of fields. Figure 1 shows a file with three records which are used to describe a student by using fields of "NAME," "GPA" and "MAJOR."

FIGURE 1
A TYPICAL DATA FILE

NAME	GPA	MAJOR
Robert Smith	3.2	IS
Mary Lee	3.5	ACCT
Jim Shaw	2.9	IS

Most organizations have many files which have numbers of records from hundreds to hundreds of thousands. Files that are stored on secondary storage devices can be organized in several different ways, and there are advantages and disadvantages to each of these types of file organizations.

TYPES OF FILE ORGANIZATION

Three types of file organization are used on secondary storage devices. They are Sequential, Indexed-sequential, and Direct file. Files stored on tape are processed as sequential files. Files on disk are usually direct or indexed-sequential files.

Sequential File

Sequential files can be stored on a sequential access device such as tapes or a random access device such as a disk. In a sequential file, records are arranged one after another, in a predetermined order. For example, an employee file can be organized by employee ID number. If this file is stored on a disk or tape, the employee record with the smallest ID number would be the first record in the file.

Indexed Sequential

An indexed-sequential-access (ISA) file allows both sequential and direct access to data records. Thus, files must be on a direct access storage device such as a disk. In indexed-sequential files, records are usually physically arranged on a storage medium by their primary key, just as they are with sequential files. The difference is that an index also exists for the file; it can be used to look up and directly access individual records. Files set up to allow this type of access are called ISAM (Indexed-sequential method)

files. Many Database Management Systems (DBMS) use ISAM files because of their relative flexibility and simplicity. These are often the best type of files for business applications that demand both batch updating and on line processing.

Direct file

A Direct file provides the fastest possible access to records. ISAM also provides users with direct access to individual records. Direct file is typically the best when access time is critical and when batch processing is not necessary. *Note:* Access time is the interval between the moment at which an instruction control unit initiates a call for data and the moment at which delivery of the data is completed. For example, direct access memory is faster than sequential access memory. A Direct file uses a formula to transfer the primary key to the location of each record. This formula is called a Hashing algorithm. Therefore, no index is needed to locate individual records. Many hashing algorithms have been developed. One popular procedure is to use prime numbers in the formula process. In general, the primary key value is divided by a prime number, which corresponds to the maximum number of storage locations allocated for the records of this file. The reminder obtained in this division is then used as the relative address of a record, but relative address can be translated into physical locations on the storage medium.

DATA MODELS (RELATIONAL, HIERARCHICAL AND NETWORK)

Relational databases

The relational database relates or connects data in different files through the use of a key field, or common data element. (See Figure 2). A flat file structure is used with a relational database model. In this arrangement, data elements are stored in different tables or files made up of rows and columns. In database terminology, tables are called "relations," rows are called "tuples" and columns are called "attributes." In a table, a row resembles a record—for example, a student's GPA record has a field of "student name," a field of "GPA," a field of "Address" and a field of "phone number." In this table, a student is described by a record or a combination of fields. The advantage of a relational database is that the manager does not have to be aware of any data structure or data pointer. Managers can easily add, update, delete or create records using simple logic. However, a disadvantage is that some search commands in a relational database require more time to process compared with other database models.

FIGURE 2
A RELATIONAL DATABASE

Student Table

Name	Major	GPA	Advisor

Advisor Table

Advisor	Phone	Address
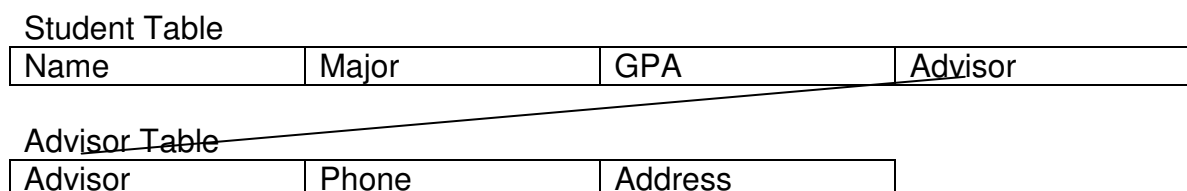
Hierarchical databases

In a hierarchical database, fields and records are arranged in a family tree, with lower-level records subordinate to higher-level records. (See figure 3). In a hierarchical database, a parent record may have more than one child, but a child always has only one parent. This is called a one-to-many relationship. To locate a particular record, you have to start at the top of the tree with a parent record and trace down the tree to the child. Hierarchical databases are the oldest of the four data models, and still used in some reservation systems. In addition, accessing records or updating records are very fast since the relationships have been predefined. The drawback of hierarchical data models is that the structure is quite rigid and adding new records to the database may require that the entire database be redefined.

Network databases

A network database (See Figure 4) is similar to a hierarchical database except that each child can have more than one parent record. In other words, a child record is referred to as a "member" and a parent record is referred to as an "owner." The advantage of the network database is its ability to establish relationships between different branches of data records and thus offer increased access capability for the manager. However, like the hierarchical database, the data record relationships must be predefined prior to the use of the database and must be redefined if records are added or updated.
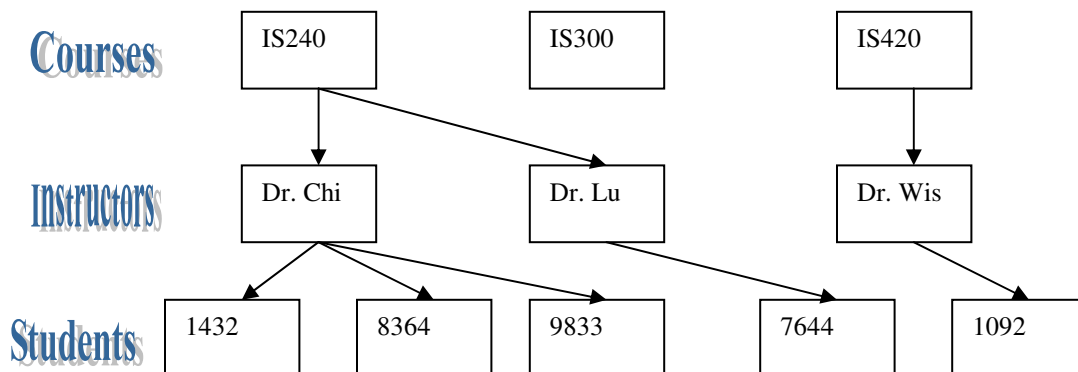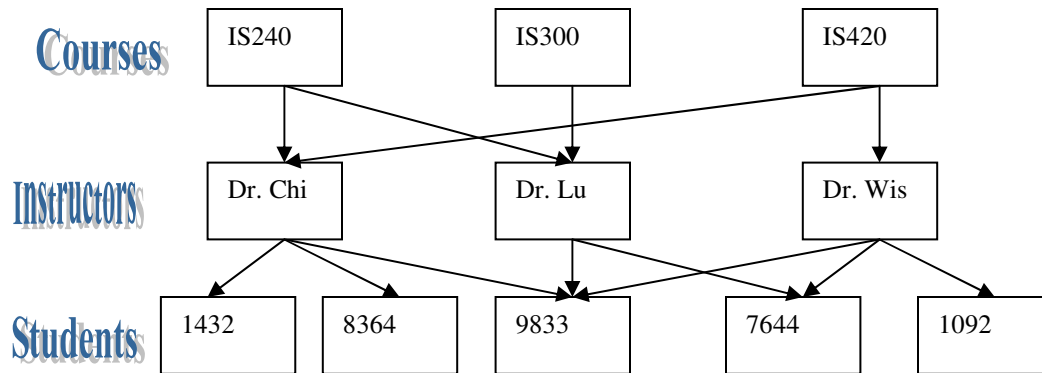
FIGURE 3

A HIERARCHICAL DATABASE

FIGURE 4

A NETWORK DATABASE

Object-Oriented Databases

An object-oriented database uses "objects" as elements within database files. An object consists of text, sound, images and instructions on the action to be taken on the data. For example, traditional data models such as Hierarchical, Network and Relational data models can contain only numeric and text data of an instructor. An object-oriented database might also contain the instructor's picture and video. Moreover, the object would store operations, called "methods" that perform actions on the data—for example how to calculate this person's pension fund based on his/her age and contributions.

PRIMARY KEYS, SECONDARY KEYS AND FOREIGN KEYS

In a database, data records are organized and identified by using the key field. A key field contains unique data used to identify a record so that it can be easily retrieved and processed. There are three types of key fields used for database management.

Primary Keys

The primary key can be a single field or a combination of several fields. It is the most important identifier to retrieve records. It is unique and can have only one in each table. For example, the social security number is a good primary key to identify each person while age may not be useful since many people may have the same age.

Secondary Keys

Secondary keys can be any field or the combination of several fields. A secondary key does not have to be unique and can have many of them in a table. For example, we can use major as a secondary key to allocate students majoring in Information Systems.

Note: A primary key, such as a customer number in an accounts receivable file, is the main code used to store and locate records within a file. However, records can be sorted, and temporary files created, using codes other than the primary keys. Secondary keys are used to sort records based on an attribute other than the primary key, for example, the credit limit or current balance for an accounts receivable file. An inverted file is the result of such a process. Moreover, a given data record can have more than one secondary key. However, secondary keys are not substitutes for primary keys.
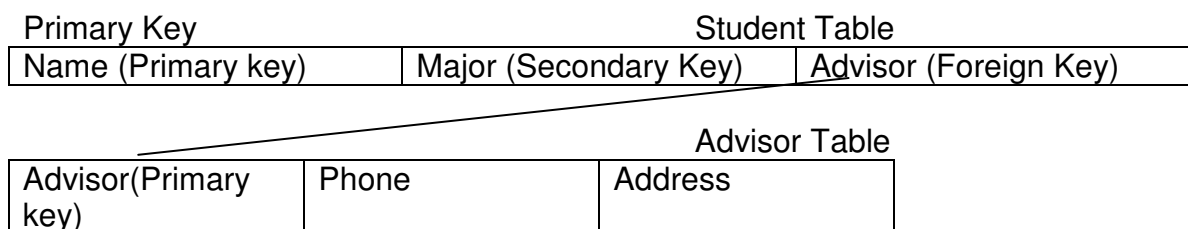
Foreign Keys

The foreign key is the field or a combination of several fields that can be used to relate two tables. A foreign key must be a primary key in one table. This primary key can thus be connected to another table. For example, a student table contains social security number, major and advisor's name. The advisor table has advisor's name, phone number and address. The "advisor's name" is the foreign key to connect the student table with the advisor table. (See Figure 5)

DATABASE DESIGN

Database design is an intuitive and artistic process. There is no strict algorithm for it. Typically, database design is an interactive process: during each iteration, the goal is to get closer to an acceptable design. Thus a design will be developed and then reviewed. Defects in the design will be identified, and the design will be redone. This process is repeated until the development team and users are satisfied with what is available. A well-designed database enables managers to perform efficient and useful tasks. In other words, a poorly designed database may cost lots of money and time without any significant contribution to a company's operation. Database design procedures are therefore very important and crucial to the success of a database system. Procedures for database design are listed below:

FIGURE 5
KEY FIELDS

Primary Key   Student Table

Name (Primary key)	Major (Secondary Key)	Advisor (Foreign Key)

Advisor Table

Advisor(Primary key)	Phone	Address

Current System Analysis and Survey

This process involves surveying and observing current manual data processes and potential benefits from computerized database systems. Usually, both decision-makers and process operators are interviewed to collect information of potential problems and opportunities. After the system analysis has been conducted, a feasibility report is prepared for evaluation. The recommendation of the feasibility report can be

either positive or negative. The main reason for a suggestion of infeasible is mainly because of financial or managerial problems.

Logical Database Design

A logical database design specifies the logical format of the database. The records to be maintained, their contents, and relationships among those records are specified. It is sometimes called the conceptual schema, or the logical schema. There is a technique called "normalization" developed for relational databases to improve the structure of files in a relational database. By using this method, data can be organized into the most efficient and logical file relationships. Normalization is the term for determining how groups of data items in a relational structure are arranged in records in a database. This process relies on "normal forms," that is, conceptual definitions of data records and specified design rules. Normalization is intended to prevent inconsistent updating of data items. It is a process of breaking down a complex data structure by creating smaller, more efficient relations, thereby minimizing or eliminating the repeating groups in each relation.

Physical Database Design

The logical schema is transformed into the particular data constructs that are available with the DBMS to be used. Whereas the logical design is DBMS-independent, the physical design is DBMS-dependent. Logical schema specifies general database design which can be implemented in any database management software, while physical schema is designed based on real database management software and cannot be transferred from one to another.

Implementation

After physical schema is designed, the database implementation will be conducted. This process involves lots of coding and programming. This process can be done with a DBMS such as ORACLE, FOXBase, Microsoft SQL Server, and a front end tool for user interface development such as Visual Basic or Power Builder.

Testing and Debugging

This process involves testing the system and making sure that it is ready to operate. In this stage, both program developers and end users should get involved in this process.

Training, Evaluation and Documentation

If both the end-user group and development team are satisfied with the system, the training session should proceed. The purpose of the training session is to teach managers how to use this new system and perform simple trouble shooting functions. The development team should also prepare system documentation for the managers for reference purposes.

OTHER FEATURES IN A DATABASE MANAGEMENT SYSTEM

Data Dictionary

A data dictionary/directory is an organized and shared collection of information about the objects and resources used by the IS organization to deliver or exchange information internally and externally. The data dictionary stores the data definitions or a description of the structure of data used in the database. This information could be stored in a dictionary-like document or on a text file. Managers can check the data dictionary and retrieve necessary information about the properties and nature of the database. Some data dictionaries also can monitor the data being entered into the database management system to conform to that definition, such as field name, field size, and type of data (text, numeric, date, logic and so on). The data dictionary also can help the database administrator (DBA) and other database designers with security concerns such as who has the right to access what kind of information.

Database Utilities

The database needs to have certain maintenance to insure that the data are properly organized. Database utility programs provide the DBA with functions that can fine tune the database functionality such as remove redundant or non-used records, assign priorities to different users, and monitor resource allocation. A good database utility program can improve the productivity and efficiency of a DBA.

Database Recovery

Situations such as systems failure, computer malfunctioning, disk head crash, programs having bugs, and so on will cause a database management system crash. Unfortunately, when systems fail, business does not stop. Customers continue to buy and pay, return merchandise, and obtain servicing. Therefore, system failures must be recovered as soon as possible. Furthermore, business demands that transactions that were in process when the failure occurred be recovered in such a way that their outputs are identical to what would have been produced. In other words, failure should be transparent in their effects on data. Recovering from a database system failure is getting more difficult due to the complexity of modern database management systems. It is impossible to simply fix the problem and resume program processing where it was interrupted. Even if no data is lost during a failure, the timing and scheduling of computer processing is too complex to be accurately recreated. Some techniques have been developed to recover a system failure:

- Recovery via reprocessing
- Recovery via rollback/rollforward
- Transaction logging
- Write-ahead log

The details of these techniques are beyond the scope of this course. Readers can check database books for more information.

THE DATABASE ADMINISTRATOR (DBA)

The DBA is the person who manages all activities related to the database. A qualified DBA should be able to understand the hardware configuration (such as the client server environment) and take advantage of existing hardware capability to improve the performance of the database management system. He/she should have expertise in terms of database engine (such as SQL) and front-end tools (such as Visual Basic and Power Builder) to create a good user interface. A DBA should be able to do limited trouble shooting in both the application area and system level since a database crash may involve both application and system software.

MAJOR FUNCTIONS OF A DATABASE ADMINISTRATOR
The responsibilities of a DBA are the following:

Database Design
The database administrator helps determine the design of the database including fields, tables, and key fields. Later he/she determines how resources are used on secondary-storage devices, how files and records may be added and deleted, and how losses may be detected and remedied.

System Backup and Recovery
Because loss of data or a crash in the database could vitally affect the organization, a database system must be able to recover if the system crashes. The DBA needs to make sure the system is regularly backed up and develop plans for recovering data should a failure occur.

End User Service and Coordination
A DBA should determine user access privileges and arrange resources allocation for different user groups. If different users conflict each other, the DBA should be able to coordinate to make sure an optimal arrangement is performed.

Database Security
The DBA can specify different access privileges for different users of a database management system to protect the database from unauthorized access and sabotage. For example, one kind of user is allowed to retrieve data, whereas another might have the right to update data and delete records.

Performance Monitoring
The database base system should maintain a certain standard of services for all users. The DBA monitors the system and uses different database tools to make sure that the system is set up to satisfy managers' performance requirements.

QUERY LANGUAGES
A query language is a simple English-like language that allows managers to specify what data they are looking for either on a printed report or on the screen.

Generally speaking, there are two types of query language: Structured Query Language and Query By Examples.

Structured Query Language
Structured Query Language (SQL) is the most widely used database query language. In 1985, the American National Standards Institute formed a committee to develop industry standards for SQL. Today, most database management systems support this standard. Figure 6 shows an example of the SQL statements.

FIGURE 6
STRUCTURED QUERY LANGUAGE

SELECT name, gpa
FROM student
WHERE gpa >=3.0
ORDER BY name

Query by Example
Query by Example (QBE) helps the manager construct a query by displaying a list of fields that are available in the files from which the query will be made.

Data Warehouses and Data Mining

Data Warehouse - A data warehouse stores data from current and previous years that has been extracted from the various operational and management databases of an organization. It becomes a central source of data, which has been screened, edited, standardized, and integrated so it can be used by managers and other end user professionals throughout an organization. Data warehouses may be subdivided into data marts, which hold specific subsets of data from the warehouse. The key software tools needed to construct and use a data warehouse would include:

- Data extraction software.
- User query and reporting software.
- Data transformation and loading software.

Data Mining - A major use of data warehouse databases is data mining. In data mining, the data in a data warehouse are processed to identify key factors and trends in historical patterns of business activity that can be used to help managers make decisions about strategic changes in business operations to gain competitive advantages in the marketplace. For example, many companies use data mining to;
- Perform "market-basket analysis" to identify new product bundles.
- Find root causes to quality or manufacturing problems.
- Prevent customer attrition and acquire new customers.
- Cross-sell to existing customers.
- Profile customers with more accuracy.

SUMMARY

Information is the most valuable asset in a company and the database management system is one of the most important MIS tools to manipulate the company's information. Understanding the way that data are organized and represented in database management systems becomes one of the most important concepts an executive should have in mind. By applying information technology properly including database management systems the manager can dramatically maximize productivity and reduce corporate costs and risks.

CHAPTER 6 QUIZ

1. One advantage of a database management system (DBMS) is
   A. The responsibility and control assumed by each organizational unit for its own data.
   B. The decrease in the cost of the data processing department as users become responsible for establishing their own data handling techniques.
   C. A decreased vulnerability because the database management system has numerous security controls to prevent disasters.
   D. The independence of the data from the application programs, which allows the programs to be developed for the user's specific needs without concern for data capture problems.

2. In a database, there are often conditions that constrain database records. For example, a sales order cannot exist unless the corresponding customer exists. This kind of constraint is an example of
   A. Normalization.
   B. Entity integrity.
   C. Internal schema.
   D. Referential integrity.

3. Access time in relation to computer processing is the amount of time it takes to
   A. Transmit data from a remote terminal to a central computer.
   B. Complete a transaction from initial input to output.
   C. Perform a computer instruction.
   D. Retrieve data from memory.

4. The indexed-sequential-access (ISA) method is an approach to file organization
   A. In which each data record has a pointer field containing the address of the next record in the list.
   B. In which an index of record pointers of some of the file attributes are maintained in a list.
   C. That uses an algorithm to convert a record key into a storage address to assist with later retrieval.

D. In which records are stored sequentially in a direct-access file and organized by a primary key stored in an index record.

5. A flat structure is used in database management systems (DBMS) when
   A. A complex network structure is employed.
   B. A network based structure is used and a complex database schema is developed.
   C. A simple network structure is employed.
   D. A relational database model is selected for use.

6. Coding in data processing assigns a unique identification number or key to each data record. Primary key is the main code used to store and locate records within a file. Secondary keys are used when the primary keys cannot be found.
True / False

7. All of the following are methods for distributing a relational database across multiple servers except
   A. Snapshot (making a copy of the database for distribution).
   B. Replication (creating and maintaining replica copies at multiple locations).
   C. Normalization (separating the database into logical tables for easier user processing).
   D. Fragmentation (separating the database into parts and distributing where they are needed).

8. In an overall description of a database, the names of data elements, their characteristics, and their relationship to each other are defined by using a
   A. Data definition language.
   B. Data control language.
   C. Data manipulation language.
   D. Data command interpreter language.

9. The database approach to systems and the resulting concept of database management systems have several unique characteristics not found in traditional systems, specifically file-oriented systems. The database administrator is the part of the software package that instructs the operating aspects of the program when data are retrieved.
True / False

10. The increased use of database processing systems makes managing data and information a major information service function. Because the databases of an organization are used for many different applications, they are coordinated and controlled by a database administrator. The functions of a database administrator are
   A. Data input preparation, database design, and database operations.
   B. Database design, database operation, and database security.

C. Database design, database operation, and equipment operations.
D. Database design, software support, and database security.

11. The function of a data dictionary is to
   A. Mark the boundary between two consecutive transactions.
   B. Organize and share information about objects and resources.
   C. Specify systems users.
   D. Specify privileges and security rules for objects and resources.

CHAPTER 6 ANSWER KEY

1. (D) is correct. A fundamental characteristic of database is that applications are independent of the database structure; when writing programs or designing applications to use the database, only the name of the desired item is necessary. Programs can be developed for problems. Reference can be made to the items using the data manipulation language, after which the DBMS takes physical or logical structure of the database can be completely altered without having to change any of the programs using the data items; only the schema requires alteration.

(A) is incorrect. Each organizational unit develops programs to make use of elements of a broad database.

(B) is incorrect. Data handling techniques are still the responsibility of the data processing department; it is the use of the data that is departmentalized.

(C) is incorrect. The DBMS is no safer than any other database system.

2. (D) is correct. The data in a database are subject to the constraint of referential integrity. Thus, if data are collected about something, e.g., a payment voucher, all reference conditions regarding the data must be met. Thus, for a voucher to exist, a vendor must also exist.

(A) is incorrect. Normalization is the practice of decomposing database relations to remove data field redundancies and thus reduce the likelihood of update anomalies.

(B) is incorrect. In a database, entity integrity means that each thing or relationship in the database is uniquely identified by a single key value.

(C) is incorrect. In a database, the internal schema describes the ways the data are physically organized on the disk.

3. (D) is correct. Access time is the interval between the moment at which an instruction control unit initiates a call for data and the moment at which delivery of the data is completed. For example, direct access memory is faster than sequential access memory.

(A) is incorrect. Access time refers to the speed of data retrieval, not data transmittal.

(B) is incorrect. Throughput time is the time to complete a transaction from initial input to output.

(C) is incorrect. Access time is much slower than the time required to execute an instruction.

4. (D) is correct. The indexed-sequential-access (ISA) is a system in which records are stored sequentially in a direct-access file and organized by a primary key stored in an index record. It does not use pointers. A pointer is a data element attached to a record that gives the address of the next logically related record. The virtue of an ISAM system is that is permits sequential processing of large numbers of records while providing for occasional direct access.

(A) is incorrect. A linked list is a file organization in which each data record has a pointer field containing the address of the next record in the list.

(B) is incorrect. An ISA system does not use pointers.

(C) is incorrect. In a direct file organization, a randomizing formula or hashing scheme (a transform algorithm) converts a record key into a storage address. This method permits direct access without an index.

5. (D) is correct. A flat file structure is used with a relational database model. A relational structure organizes data in conceptual tables. One relation (table or file) can be joined together or related to another without pointers or linked lists if each contains one or more of the same fields (also known as columns or attributes). The relational structure is expected to become the most popular structure because it is relatively easy to construct.

(A) is incorrect. A complex network structure requires something more intricate than a flat file structure.

(B) is incorrect. A network structure reduces redundancy by arranging data through development of many-to-many relationships; that is, each item may have multiple antecedent, as well as successive, relationships, which would preclude a flat file structure.

(C) is incorrect. A network structure reduces redundancy by arranging data through development of many-to-many relationships; that is, each item may have multiple antecedent, as well as successive, relationships, which would preclude a flat file structure.

6. (T) is correct. A primary key, such as a customer number in an accounts receivable file, is the main code used to store and locate records within a file. However, records can be sorted, and temporary files created, using codes other than the primary keys. Secondary keys are used to sort records based on an attribute other than the primary key, for example, the credit limit or current balance for an accounts receivable file. An inverted file is the result of such a process. Moreover, a given data record can have more than one secondary key. However, secondary keys are not substitutes for primary keys.

(F) is incorrect. A given data record can have more than one secondary key. However, secondary keys are not substitutes for primary keys.

7. (C) is correct. A distributed database is stored in two or more physical sites. The two basic methods of distributing a database are partitioning and replication. However, normalization is a process of database design, not distribution. Normalization is the term for determining how groups of data items in a relational structure are arranged in records in a database. This process relies on "normal forms," that is, conceptual definitions of data records and specified design rules. Normalization is intended to prevent inconsistent updating of data items. It is a process of breaking down a complex data structure by creating smaller, more efficient relations, thereby minimizing or eliminating the repeating groups in each relation.

(A) is incorrect. The snapshot technique makes duplicates to be stored at multiple locations.

(B) is incorrect. The replication technique makes duplicates to be stored at multiple locations. Changes are periodically copied and sent to each location. If a database is small, storing multiple copies may be cheaper than retrieving records from a central site.

(D) is incorrect. Fragmentation or partitioning stores specific records where they are most needed. For example, a financial institution may store a particular customer's data at the branch where (s)he usually transacts his/her business. If the customer executes a transaction at another branch, the pertinent data are retrieved via communications lines.

8. (A) is correct. The data definition language defines the database structure and content, especially the schema (the description of the entire database) and subschema (logical views of the database). The schema specifies characteristics such as the names of the data elements contained in the database and their relationship to each other. The subschema defines the logical data views required for applications. Thus, it limits the data elements and functions available to each application.

(B) is incorrect. The data control language specifies the privileges and security rules governing database users.

(C) is incorrect. Data manipulation language provides application programs with a means of interacting with the database to add, retrieve, modify, or delete data or relationships.

(D) is incorrect. Data command interpreter languages are symbolic character strings used to control the current state of database management system operations.

9. (F) is correct. The system is administered by a database administrator who is a person with overall responsibility for developing and maintaining the database.

(T) is incorrect. A database management system (DBMS) involves an integrated set of computer programs that create the database, maintain the elements, safeguard the data from loss or destruction, and make the data available to application programs and inquires. In a database system, the data and programs are maintained separately

except during processing. The DBMS constraints a description of the logical and physical structure of the database called the schema. The schema is the description of the structure of organization of the database using data description (definition) language. A primary goal of a DBMS is to minimize data redundancy, and user interface is enhanced through increased accessibility and flexibility.

10. (B) is correct. A database administrator (DBA) is the person who has overall responsibility for developing, designing, controlling, and maintaining the database. The DBA manages all database functions including design and maintenance of the schema that describes the structure of the database. The DBA also assigns user passwords and establishes other security measures. Control of changes in data items and in the programs that use the database is another responsibility of the DBA.

(A) is incorrect. The user is responsible for input preparation.

(C) is incorrect. The manager of the EDP department is responsible for equipment (hardware) operations.

(D) is incorrect. The systems programming group is responsible for software support.

11. (B) is correct. A data dictionary/directory is an organized and shared collection of information about the objects and resources used by the IS organization to deliver or exchange information internally and externally.

(A) is incorrect. The database management system log contains checkpoint records that mark the boundary between two consecutive transactions.

(C) is incorrect. Specification of system users is a function of the security features of a DBMS.

(D) is incorrect. The data control language specifies privileges and security rules for objects and resources.

CHAPTER 7
DATACOMMUNICATIONS AND WIRELESS NETWORKS

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Distinguish between digital signals versus analog signals.
2. Differentiate between digital data versus analog data.
3. Interprète digital transmission versus analog transmission.
4. Identify a variety of types of wired communication media.
5. Explain the process used by wireless communication media.
6. Operate modems and other devices.
7. Interpret the uses of local area network (LAN).
8. Explain the benefits associated with wide area network (WAN).
9. Discuss the construction of network topologies.
10. Understand the uses of the Internet.
11. Describe the need for the Intranet.
12. Review network software.
13. Utilize computer conferencing.
14. List and describe multimedia applications.

Data communication has become more and more important in business. The ability to instantly communicate information is changing the way people do business and interact with each other. New data communication technologies also allow voice, image, and even video to be transmitted through the network. Many business applications are available because of new data communication technologies. Examples are electronic mail, voice mail, teleconferencing, FAX, Electronic Data Interchange (EDI), online services, and others. As a matter of fact, more and more new services will become available through the network because of the Information Super Highway.

DIGITAL SIGNALS VERSUS ANALOG SIGNALS

Digital signals are individual voltage pulses that represent the bits which are grouped together to form characters. This type of signal is usually used inside the computer to transmit data between electronic components and close range devices. Digital signals have the characteristics of short-range transmission (at most several hundred feet) and are represented by on/off binary systems. Local Area Networks (LAN) usually use digital signals for transmission. This transmission is normally restricted in a certain area such as a room or a building. Analog signals are continuous electromagnetic waves. They are able to travel long distances, and most long distance transmissions are carried out by analog signals. For example, voice transmission

through the telephone lines and data transmission between computers use analog signals.

DIGITAL DATA VERSUS ANALOG DATA

Data can be defined as raw facts. To transfer data between devices, data must be represented in a certain format. There are generally two types of data representations. One is called digital data, the other is analog data. Digital data representation uses a binary system (i.e. 1 and 0) to represent anything. A number, a letter, an image or even a video can be represented in a binary system. Analog data representation uses continuous signals. Voice, pictures and video are normally represented in analog data representation. The videotape records video in analog signals and the cassette records audio signals in analog form. The same data or information can be represented by both digital and analog representations. For example, audiocassettes use analog representation to record voice, while compact disks have digital representation. In general, digital data representation is more accurate and durable for repetitive usage than analog data representation. However, digital data representations require more storage space for voice and video than analog representations.

DIGITAL TRANSMISSION VERSUS ANALOG TRANSMISSION

Digital transmission use either digital signals or analog signals to transmit information in digital format. That means all data or information must be converted into digital representation prior to transmission. For example, an image can be converted into a digital file and this digital file will be transmitted by analog signals, which carry this digital representation to the destination. Digital transmission uses repeaters instead of amplifiers for long distance transmission. It is considered the best way for information transmission. Analog transmission uses analog representation by analog signals. For example, a telephone conversation can be transmitted in analog representation and use analog transmission.

	Digital Representation	*Analog Representation*
Digital Transmission	Integrated Services Digital Network (ISDN)	Not Available
Analog Transmission	Using MODEM to transmit computer files	Traditional telephone calls

TYPES OF WIRED COMMUNICATION MEDIA

There are three types of wired transmission media

Twisted Pair Wire (TPW)

Most telephone lines consist of cables made up of hundreds of copper wires called twisted pair wire. TPW has been the standard transmission medium for years for

both voice and data. However, they are now being phased out by more technically advanced and reliable media (such as fiber optical cables). Twisted-pair wire consists of two or more strands of insulated copper wire, twisted around each other in pairs. They are then covered in another layer of plastic insulation. Since so much of the world is already served by twisted-pair wire, it will no doubt continue to be used for years, both for voice messages and for modern-transmitted computer data. However, it is relatively slow and does not protect well against electrical interference.

Coaxial Cable

Coaxial cable, commonly called "coax," consists of insulated copper wire wrapped in a solid or braided metal shield, then in an external cover. Coaxial cable has a larger bandwidth compared with TPW. Bandwidth is the capacity for the number of communications that can be transmitted at one time. A coaxial cable has about 80 times the transmission capacity of TPW. Coaxial cable is often used to link parts of a computer system in one building. In addition, coaxial cable is much better at resisting noise than twisted-pair wiring.

Fiber Optical Cable

A fiber-optic cable consists of hundreds of thin strands of glass that transmit not electricity but rather pulsating beams of light. These strands, each as thin as a human hair, can transmit billions of pulses per second, each "on" pulse representing one bit. When bundled together, fiber-optical strands in a cable 0.12-inch thick can support from a quarter to a half million-voice conversations at the same time. In other words, fiber optical cable has the largest bandwidth. In fiber optical cable, signals in the form of light waves are transmitted through tubes of glass. In general, FOC has 26000 times the transmission capacity of TPW. In addition, FOC has the following advantages over both TPW and CC. Such cables are immune to electronic interference, which makes them more secure. They are also lighter and less expensive than coaxial cable and are more reliable at transmitting data.


WIRELESS COMMUNICATION MEDIA

Major wireless transmission media are the Microwave system and the Satellite system. In addition, there are other systems such as the Global Positioning System, Pager, and mobile phone systems.

Microwave Systems

Microwaves are high frequency radio waves that travel in straight lines through the air. Because of the curve of the earth, they must be relayed through amplifiers or repeaters to regenerate signals. They can be installed on towers, high buildings and mountaintops. Satellites can be used as microwave relay stations (see Figure 1). Many of these rotate at a precise point and speed above the earth. This makes them appear stationary and that can transmit signals as a relay station in the sky. The drawback is that bad weather can affect the quality of transmission.

FIGURE 1
A MICROWAVE SYSTEM
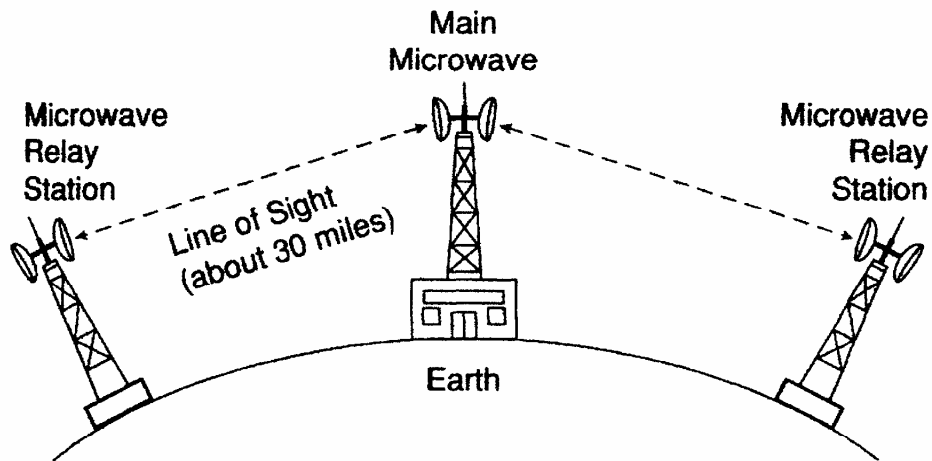
Satellite System

Satellite systems use a "sky station" to transmit signals between two locations on earth. Communication satellites are microwave relay stations in orbit around the earth. Typically the orbit is 22,300 miles above the earth. Since the satellite travels at the same speed as the earth, they appear to be stationary in space from the earth (see Figure 2). The power of a satellite is from solar. When the satellite receives signals from one station on earth, it will then transmit them to another station on earth. Each satellite contains many communication channels and receives both analog and digital signals from earth stations. Sometimes, it can take more than one satellite to deliver a message.

FIGURE 2
A SATELLITE SYSTEM
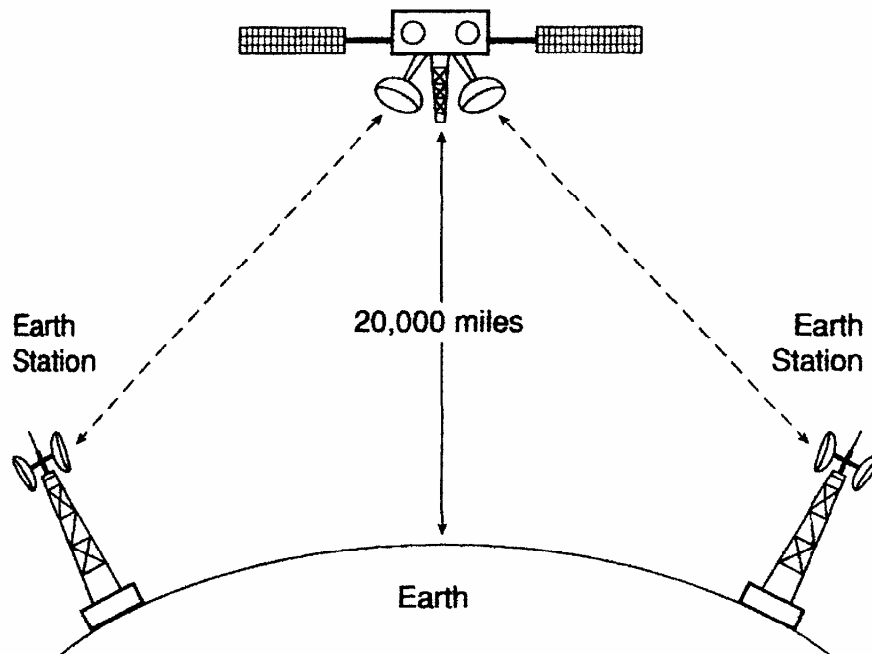
Global Positioning System (GPS)

The original design of GPS was for military purposes. The project cost about 10 billion dollars and consisted of 24 earth orbiting satellites that consistently transmit signals to identify earth locations. A GPS receiver can then pick up the signals from four satellites, calculate the signals, and generate the longitude, latitude and altitude with accuracy of a few feet. Although the system was designed for military usage, business applications have been implemented. Examples are tracking a delivery truck and a salesperson's automobile

Pagers and Cellular phones

Pagers or beepers are designed to receive another party's phone number so the owner of a pager can call back immediately. This is a one-way communication device and does not provide response to the calling party. Paging services include SkyTel, PageNet and EMBARC. Some pagers can transmit full-blown alphanumeric text and other data. Cellular phones are designed primarily for communicating by voice through a system of cells. Each cell is hexagonal in shape, usually 8 miles or less in diameter, and is served by a transmitter-receiving tower. Calls are directly transmitted to a mobile telephone switching office (MTSO) and then connected to the regular telephone network. If the caller is moving from one cell to another, the on going call will be

"handed off" to another MTSO. Newer technologies allow digital signals to be transmitted by cellular phones.

MODEMS AND OTHER DEVICES

Current communication networks use voice graded media. Digital signals, being voltage pulses do not travel a long distance. To send digital signals from the computer into the networks, a special device is needed to convert digital signals into analog signals so analog signals can carry the information of digital signals and travel a long distance. Modems are the device for this purpose. A modem can convert digital signals to analog signals when sending out signals and convert analog signals to digital signals when receiving signals. In other words, computer digital signals can be converted into analog signals and transmitted through current telephone networks.

LOCAL AREA NETWORK (LAN) AND ITS APPLICATIONS

A local area network (LAN) is a privately owned communications network that covers a limited geographic area such as a company computer laboratory, an executive's office, one building, or a group of buildings close together. A LAN is a local distributed computer system, often housed within a single building. Computers, communication devices, and other equipment are linked by cable. Special software facilitates efficient data communication among the hardware devices. Usually they are privately owned. The range is typically within a mile or so. The topologies of LANs are Star, Ring, Bus and Hybrid.

COMPONENTS OF A LAN

Microcomputer (Workstation)
A LAN consists of many workstations, each of which can be used as a server, a terminal, or a microcomputer. A server in a LAN stores network management software and performs management functions. There are different types of LAN servers depending on the major functions assigned in a client/server environment. A printer server provides printing services to other workstations, while a file server stores network and application software for the network.

Network Interface Card
A network interface card is the interface between the network and the computer. This card provides the communication protocol recognized by the network architecture. For example, an Ethernet card is used to connect a PC with the network in a BUS network.

Network Operating System:
A network operating system (NOS) is software that allows a user to manage the resources of a computer network. The NOS runs on the server computer in addition to the client operating systems, such as Windows or OS/2. The functions provided by NOS follow:

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- Administration: To add, delete or organize client users and perform maintenance tasks such as backup.
- File management: To store and transfer software to client computers.
- Printer Management: To prioritize printing jobs and direct reports to specific printers on the network.
- Network security: To control the access and usage of the network.

Types of LANS

- Peer-to-peer: All workstations on the network have the same priority and equal status. Workstations can exchange data or information through the network. A peer-to-peer network operates without a mainframe or server.
- Client Server: Server computers are used to provide certain functions for other client computers. Each server computer is dedicated to a specific function.

WIDE AREA NETWORK (WAN) AND ITS APPLICATIONS

Wide area networks are communication networks covering a large geographical area. A WAN uses telephone lines, microwaves, satellites, or a combination of communication channels to transmit signals. A WAN that is limited to the area surrounding a city is referred to as a metropolitan area network (MAN).

Integrated Services Digital Network (ISDN)
ISDN is an international standard for the digital transmission of both voice and data by digital transmission. Using ISDN lines, data can be transmitted over one or more separate channels at up to 2.2 billion bits per second if fiber optical cables are used.

NETWORK TOPOLOGIES

Generally speaking, three basic LAN topologies and a hybrid topology are recognized:

- *Star*: A star network is one in which all microcomputers and other communication devices are connected to a central server. Electrical messages are routed through the central node to their destinations. The central node monitors the flow of traffic.

- *Ring*: A ring network is a network in which all workstations are connected in a continuous loop. Ring network uses a broadcast topology. Messages pass from node to node in one direction. The computer scans the message from the proceeding node for an address that it recognizes. If the message contains the proper address, it is read. Otherwise, it is sent ahead to the next node.

- *Bus*: The bus topology is a linear channel with many nodes connected. There is no central server. Each node transmits messages to all other devices. If a node receives a message, which was not sent to this node, this message will be discarded. Otherwise it is read. Advantages of a bus are that it may be organized as a client/server or peer to peer network and it is easier to maintain than other networks. The bus topology is often called a broadcast topology since every message or set of data sent on the bus goes to every node.

- *Hybrid*: Hybrid networks are combinations of star, ring, and bus networks. For example, a bus network may connect with a ring topology, which communicates with another star network.

Selection of the proper topology configuration depends on three primary criteria: the distance between points, the amount of time permissible for transmissions, and the amount of data to be transmitted from one point to another.

INTERNET AND ECOMMERCE

The Internet is the largest and best-known wide area network in the world. Because of its tremendous size and number of users, most businesses have taken advantage of its powerful and convenient features for many business applications and opportunities. Often called "Electronic Commerce," business transactions can be made electronically. Consumers can browse the Internet virtual shopping mall and place orders for the company's merchandise. Investors can trade securities over the Internet. Telephone calls can also be connected via the Internet. Other services available on the Internet are:

- Electronic mail: E-mail can be sent anywhere in the world to users with an Internet address. Loss of confidentiality is a major risk of an e-mail system. Thus, inability to encrypt messages going between network gateways is a major security issue. A gateway is a means of connecting otherwise incompatible networks, nodes, or devices. It performs this function by converting one set of communication protocol to another. Accordingly, even if all systems are secured, an unsecured gateway can be a security exposure.
- File Transfer and Software downloads: The Internet can transfer different files all over the world. Software can also be downloaded from the Internet.
- Database Search: The Internet can also be used to access different databases.
- Discussion and News Group: Thousands of discussion topics can be discussed in the bulletin board of the Internet. Information can be shared within this business group.

The Internet is an international network connecting approximately 36,000 smaller networks that link computers: commercial institutions and businesses. There are about 100 million Internet users and the number is increasing exponentially. The reason the

Internet is getting more popular is its power and practicality. The potential and utilization of the Internet for business is unlimited.

Electronic Commerce

The term electronic commerce emerged only several years ago when business people started to understand the powerful tool of the Internet. The basic idea of electronic commerce is to let business people conduct business transactions over the Internet. For example, a corporate buyer can browse the Internet, look at the merchandise on the Internet and place an order. This transaction can be completed by sending a company's purchase order number to the vendor and receiving a confirmation number. The advantage of electronic commerce is that business transactions can be very efficient and fast through the Internet. Entrepreneurs can use the Internet as the market place rather than huge retail channels. However, there are some other issues needing to be researched such as how to police the transactions over the network, how to certify the accuracy of each transaction, and how to prevent any transaction fraud.

Internet Development Tools

To design an Internet application, proper tools are required. HyperText Markup Language (HTML) is designed to implement home page design. This language requires certain programming training. Recently, more Internet development tools have been developed. Microsoft FrontPage is a tool, which provides users with a graphical user interface (GUI) and a word processing type of user friendliness. Netscape Navigator 3.0 also provides an Internet development tool. In addition, JAVA by Sun Microcomputers provides sophisticated functions for Internet application development.

INTERNET2

Internet2 is a high-performance network that uses an entirely different infrastructure than the public Internet we know today. There are over 200 universities and scientific institutions and over 60 communications corporations in the Internet2 network. Internet2 is never intended to replace the Internet; rather its purpose is to build a road map that can be followed when the next stage of innovation to the current Internet takes place. Most institutions and commercial partners are connected via Abilene, a network backbone that will soon support throughput of 10 gigabits per second. In short, Internet2 is all about high-speed telecommunications and infinite bandwidth.

INTRANET

Intranets are internal corporate networks that use the infrastructure and standards of the Internet and the World Wide Web. In other words, they are small versions of the Internet, which are basically developed and used by corporations. Customers or employees can access the database or information in a company through web browsers to reduce operating costs. One of the greatest considerations of Intranets is security. That means unauthorized people can access a company's data through the Intranet. To prevent this from happening, security software called firewalls has been developed. It blocks unauthorized traffic from entering the Intranet. The objective of security software is to control access to information system resources, such as program libraries, data files, and proprietary software. Security software identifies and

authenticates users, controls access to information, and records and investigates security related events and data. *Note:* Encryption of data is a security procedure in which a program encodes data prior to transmission and another program decodes the data after transmission. Encoding is important when confidential data that can be electronically monitored are transmitted between geographically separated locations.

NETWORK SOFTWARE

Network System Software
Popular network system software for LANs are Novell's NetWare, Microsoft's Windows NT Server, and Apple's Apple Talk. Most network system software for WAN is custom made and usually requires mainframe computers to operate.

Network Application Software
Most application software for individual computers has a network version. To share the same software on the network, a site license is required.

COMPUTER CONFERENCING

Another application developed based on telecommunication technologies is the computer conference. They can be either voice communication through the network or voice plus video communications. This technology is also available on LAN, WAN and even on the Internet. The benefit of the computer conference is to reduce travel cost and improve efficiency.

MULTIMEDIA

Multimedia refers to technology that presents information in more than one medium, including text, graphics, animation, video, music, and voice.

Multimedia Components
To have a multimedia computer, which is able to deliver sound, video, image and voice, a sound card is required. The function of a sound card is to digitize voice or sound into a computer data file. This data file can then be transmitted and converted back to sound or voice. In addition, a video capture card is also needed in order to convert a video from a regular video device such as a VCR to a digital file. This file can be converted back to a regular video. A digital camera can be useful when a picture is taken and needs to be transferred into a digital file. Scanning a picture through a scanner can do this. Since Multimedia information (such as video) requires lots of storage space, a device called "CD-ROM" is necessary. CD-ROM stands for compact disk-read-only memory, which is an optical-disk format that is used to hold prerecorded text, graphics, and sound. Like music CD, CD-ROM is a read-only disk. Read-only means the disk cannot be written on or erased by the user. A CD-ROM drive allows users to receive

input information from a CD-ROM, which typically can store up to 700 megabytes of memory. At one time a CD-ROM drive was only a single-speed drive. Now double speed, triple speed or even 12X are available. Typically, a single speed CD-ROM drive can access data at the speed of 150 kilobytes per second. That is to say a 12 speed can deliver data at the speed of 150 kilobytes * 12 = 1.8 megabytes per second. Short for CD-ReWritable disk, CD-RW is a type of CD disk that enables you to write onto it in multiple sessions. DVD media (DVD-R and DVD-RW**)** and dual layer can accommodate an astonishing 9.4 GB of data.

MULTIMEDIA APPLICATIONS

Multimedia provides business people with a better way of communication. Managers can deliver a better presentation or lecture by including animation and voice. Productivity can therefore be improved by using multimedia. Some applications are discussed below.

Encyclopedias, Large Databases
A large database, which is not time sensitive, can be stored in a CD-ROM for later retrieval. For example, the encyclopedia and business article collections can be stored on a CD-ROM.

Training
A lecture can be given by interactive multimedia systems over the Internet. As a result, employees can go to virtual educational instruction on corporate business sites.

Presentations
There are presentation software designed to include animation, voice and pictures. By using these tools, presenters can more effectively deliver important messages than traditional presentations.

Animation
Corporate visual presenters use multimedia techniques to produce special effects to aid corporate employee learning. For business presentations, they may use lots of multimedia techniques in the business education process.

SUMMARY
Data communications will continue to affect business life. Businesses are no longer limited to local information. With the help of data communication technologies, business managers are able to access different information from any corner of the world. With communication technologies rapidly changing, today's businesses are challenged to find ways to adapt the technology to provide better products and services. In addition, new business opportunities are also created. For executives, the new technology offers increased access to worldwide information services and provides new opportunities for the business.

CHAPTER 7 QUIZ

1. New data communication technologies now available include all the following except:
    A. Electronic mail
    B. Voice mail
    C. Teletype
    D. Teleconferencing

2. Types of wire communication media that consists of hundreds of thin strands of glass that transmit pulsating beams of light is:
    A. Coaxial cable
    B. Twisted pair wire (TPW)
    C. Fiber Optical Cable
    D. Microwave Systems

3. A wireless system that uses a "sky Station" to transmit signals between two locations on earth is a:
    A. Microwave system
    B. Satellite system
    C. Global positioning system
    D. Pagers and beepers

4. A network in which all workstations are connected in a continuous loop and uses a broadcast topology is:
    A. Ring network topology
    B. Star network topology
    C. Bus network topology
    D. Hybrid network topology

5. A local are network (LAN) is best described as a(n)
    A. Computer system that connects computers of all sizes, workstations, terminals, and other devices within a limited proximity.
    B. System to allow computer users to meet and share ideas and information.
    C. Electronic library containing millions of items of data that can be reviewed, retrieved, and analyzed.

D. Method to offer specialized software, hardware, and data handling techniques that improve effectiveness and reduce costs.

6. If a system does not have a mainframe computer or a life server but does processing within a series of microcomputers, the network is a(n)

A. Offline processing system.
B. Expect system.
C. Direct access system.
D. Peer-to-peer-system.

7. The primary objective of security software is to
- A. Control access to information system resources.
- B. Restrict access to prevent installation of unauthorized utility software.
- C. Detect the presence of viruses.
- D. Monitor the separation of duties within applications.

CHAPTER 7 ANSWER KEY

1. (C) is correct. Teletype is an old communication method.

(A) is incorrect. Electronic mail (e-mail) is a new technology.

(B) is incorrect. Voice mail is a new communication technology.

(D) is incorrect. Teleconferencing is a new communication technology.

2. (C) is correct. A fiber-optic cable consists of hundreds of thin strands of glass that transmit not electricity but rather pulsating beams of light.

(A) is incorrect. Coaxial cable consists of insulated copper wire wrapped in solid or braided metal shielding.

(B) is incorrect. Twisted Pair Wire (TPW) is made up of hundreds of copper wires twisted in pairs and covered in plastic insulation.

(D) is incorrect. Microwave systems are wireless transmission using high frequency radio waves.

3. (B) is correct. Satellite systems use a "sky station" to transmit signals between two locations on earth. Communication satellites are microwave relay stations in orbit around the earth.

(A) is incorrect. Microwave systems use high frequency radio waves.

(C) is correct. Global positioning systems consist of 24 earth orbiting satellites that consistently transmit signals identifying earth locations.

(D) is incorrect. Pagers and beepers are designed to receive another party's phone number and is only a one-way communication device.

4. (A) is correct. A ring network is a network in which all workstations are connected in a continuous loop. Ring network uses a broadcast topology.

(B) is incorrect. In a Star network topology all of the computers and communication devices are connected to a central server.

(C) is incorrect. Bus network topology is a linear channel with many nodes connected and no central server.

(D) is incorrect. Hybrid network topologies are combinations of Star, Ring and Bus network topologies.

5. (A) is correct. A local are network (LAN) is a local distributed computer system, often housed within a single building. Computers, communication devices, and other equipment are linked by cable. Special software facilitates efficient data communication among the hardware devices.

(B) is incorrect. A LAN is more than a system to allow computer users to share information; it is an interconnection of a computer system.

(C) is incorrect. A LAN is not a library.

(D) is incorrect. A LAN does not require specialized hardware.

6. (D) is correct. A local area network is a user-controlled network that operates without the assistance of a common carrier. It can have several microcomputers attached to a host computer, can be linked as part of several LAN's that may or may not communicate with a host computer, or can be connected together but not connected to a host computer (stand alone). A peer-to-peer network operates without a mainframe or server.

(A) is incorrect. Offline processing occurs when devices are not directly connected to the computer.

(B) is incorrect. Expert systems are information systems that provide diagnostic and problem solving through the use of structured software and expert experience.

(C) is incorrect. Direct access refers to the method for storing and retrieving data with a database.

7. (A) is correct. The objective of security software is to control access to information system resources, such as program libraries, data files, and proprietary software. Security software identifies and authenticates users, controls access to information, and records and investigates security related events and data.

(B) is incorrect. Security software will control the use of utilities, not their installation.

(C) is incorrect. Antivirus software detects the presence of viruses.

(D) is incorrect. Security software may be a tool to establish, but does not monitor, separation of duties.

CHAPTER 8
NETWORK AND TELECOMMUNICATIONS

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Utilize online telecommunication.
2. Explain the process of going online.
3. Define and give examples of computer networks.
4. Explain the concept to define network topologies.
5. Illustrate electronic databases.
6. List commercial online services.
7. Utilize online business databases.

Telecommunication means using computers to communicate over a distance. To communicate properly, two computers must use the same standard transmission procedure (protocols). Telecommunication is a popular application of personal computers. The future trend is toward increased use of telecommunications. There are several types of online systems.

Commercial online services offer both general interest services that appeal to a wide variety of people, and specialized services that appeal to special interests such as stock market research or marketing research.

Electronic Bulletin Board Systems (BBSs*)* are often set up by special interest groups to provide the public with specialized services. They function as a centralized information source and message switching system for a particular interest group. Users review and leave messages for other users, and communicate with other users on the system at the same time. Many BBSs have nothing more than a single telephone input line and a large hard disk. It may be managed by only a single owner or "system operator."

Direct connection is another common use of telecommunication, in which you dial another computer directly. For example, you can connect directly to the computer of a customer or supplier. To connect, you only need the permission of the operator of the remote computer, and its modem number. You incur no charges, except perhaps for any long distance calling charges. With specialized software, it is possible for you to control from a remote location.

GOING ONLINE

To access any online service, you will need a user number and a password. You also will need a modem and communication software. Most service providers have their own communication software.

Modem

You will need a modem to connect your computer to a telephone line. Most modems also provide faxing capabilities. You can purchase either an internal or an external modem. There is no difference in performance between internal and external modems. Internal modems plug into expansion slots inside your computer; this means an internal modem will not occupy any extra space on your desk. Internal modems are also less expensive since they do not require an external case or a separate power supply. Disadvantages of internal modems are that they increase internal heat, do not show visible status lights, and can cause computer damage if the modem malfunctions or was not properly installed. One advantage of selecting an external modem is that you don't need to open the computer's case to install the modem, and it is portable. External modems also have lights that tell the user what the modem is doing, such as whether data is being sent or received. The external modem does not drain the system unit's power. It can also be transferred to upgrade equipment.

The most important consideration in selecting a modem is its speed or baud rate. You should select a modem with a minimum speed of 28,800 bits per second (bps). A high-speed modem is compatible with lower-speed modems. A 28,800 bps modem can communicate with a 14,400 bps or a 2,400 bps modem. Other considerations in selecting a modem are available software support, reliability (minimal errors), versatility, message buffering, call duration logging, error correction ability, and voice data switching.

An intelligent modem can perform many functions more complicated than to receive and transmit characters over the telephone lines. It allows for dialing, answering, or hanging up the phone on command, redialing last number called, and recalling a series of phone numbers. A "dumb" modem does not possess internal instructions for dialing or hanging up. It does not recognize if it is starting the call or answering it (a person usually has to put the modem switch manually to either "originate" or answer"). It has to be instructed as to the speed at which to operate.

Automatic features are available for different types of modems, including:

- Auto/Log On: Log-on information is provided automatically.
- Auto/Answer: Modem is able to get calls and data without the computer operator's intervention.
- Auto/Dial: Modem can automatically place a call.
- Auto/Redial: This feature keeps calling a number that is busy until the call goes through.

- Directory Dialing: This feature allows dialing from a directory of numbers that have been saved in a smart telecommunications software program.
- Number Chaining: Allows for responding to a busy signal by dialing other numbers.
- Line-Test: Modem tests the telephone line.
- Answer-back Strings: The modem responds to an incoming call by giving identification codes or messages.
- Self-Test: The modem verifies its own reliability.
- Software Disconnection: Capability of modem to hang up the phone.
- Dial Tone Connection: The modem listens for a dial tone, dials 9 to get an outside line, and then waits for a second dial tone.
- Line-Sound Monitoring.

Types of Telecommunications

There are several different ways you can use telecommunications; most people tend to use the following types of activities:

- *Electronic mail* (e-mail) is available on most systems and it allows you to send and receive messages in your mailbox. Your e-mail messages may be private or public. You can send a private message to another user that has an electronic mailbox. You can also send a public message that can be read by everyone on the system.

- *Real-time conferencing* takes you one step beyond e-mail. As soon as you type your message, the recipient is able to get the message immediately and can then respond. Real-time conferencing (also called "chatting") is similar to talking to someone on the telephone; however, instead of talking, you type your messages. Real-time conferencing offers at least two advantages over telephone conferencing. First, a large number of users can communicate simultaneously. Second, a written record can be kept of all statements. Problem situations may be solved more quickly.

- *File transfer* is frequently used in telecommunications. You can either download or upload files. Downloading involves copying files from an online system to your own computer. Uploading is the reverse process; that is, you send a copy of files from your computer to the online system. Most commercial online services and BBSs have software that can be downloaded. Some services also allow you to upload software. Generally, the software that is downloadable is either public domain or Shareware. You can try this software for free; however, if you continue to use shareware software, you are expected to pay a small registration fee. Note: A buffer is a temporary storage area holding information such as that downloaded from an online service.

- *Online research* is possible on almost any topic. There are specialized databases for stock market data, accounting and tax information, marketing data, management updates, production information, legal cases, computer information,

and a wide variety of other topics. There are also databases that provide indexes and abstracts of business and financial articles from thousands of publications.

- *Online transactions* are now becoming the norm in many industries. It is possible to do banking and order merchandise online. It is easy to check the cash balance, find out what checks have cleared, or contact your bank's service online. Everything from financial specifics to economic data is online. Businesses can place orders with suppliers and receive orders from customers.

COMPUTER NETWORKS

The productivity of organizations has increased tremendously due to the advent of computers. Due to the major advances in computer technology, this period of history has come to be called the "information age." Computer networks play a dominant role in transmitting information to users.

A computer network is simply a set of computers (or terminals) interconnected by transmission paths. These paths usually take the form of telephone lines; however, other media such as wireless and infrared transmission, radio waves, and satellite are possible. The network serves one purpose exchange of data between the computers and/or terminals.

The considerations in selecting a network medium are:

- Technical reliability
- Type of business involved
- The number of managers who will need to access or update data simultaneously
- Physical layout of existing equipment
- The frequency of updating
- Number of micros involved
- Compatibility
- Cost
- Geographic dispersion
- Type of network operating software available and support
- Availability of application software
- Expandability in adding additional workstations
- Restriction to PCs (or can cheaper terminals be used?)
- Ease of access in sharing equipment and data
- Need to access disparate equipment like other networks and mainframes
- Processing needs
- Speed
- Data storage ability
- Maintenance
- Noise
- Connectability mechanism

- Capability of network to conduct tasks without corrupting data moving through it
- Appearance
- Fire safety

Advantages of Networks

Computer networks provide several advantages. Most organizations are geographically dispersed, with offices located all over the world. Computers at each site need to transfer and exchange data, frequently on a daily basis and sometimes even in real-time. A network provides the means to exchange such data.

Even if the organization is not geographically dispersed and has only one office, networks can serve useful functions. Networks permit efficient sharing of resources. For example, if there is too much work at one site, the network allows the work to be transferred to another computer in the network. Such load sharing enhances productivity by allowing a more even utilization of an organization's resources.

Backup capability is an especially important feature of networks. For instance, if one computer fails, another computer in the network can take over the load. This might be critical in certain industries such as financial institutions.

Networks can be used to provide a very flexible work environment. An organization can allow its employees to connect to the network and work from home or "telecommute." A network makes it easier for employees to travel to remote locations and still have access to critical data such as sales for last week or research data from a project.

Data Flow

Data flows between computers in a network using one of three methods. *Simplex* transmission is in one direction only. An example of simplex transmission is radio or television transmission. Simplex transmission is rare in computer networks due to the one-way nature of data transmission. *Half-duplex* transmission is found in many systems. In a half-duplex system, information can flow in both directions. However, it is not possible for the information to flow in both directions simultaneously. In other words, once a query is transmitted from one device, it must wait for a response to come back. A *full-duplex* system can transmit information in both directions simultaneously; it does not have the intervening stop-and-wait aspect of half-duplex systems. For high throughput and fast response time, full-duplex transmission frequently is used in computer applications.

Data switching equipment is used to route data through the network to its final destinations. For instance, data switching equipment is used to route data around failed or busy devices or channels.

In designing the network, one must consider three factors. First, the user should get the best response time and throughput. Minimizing response time entails shortening delays between transmission and receipt of data; this is especially important for interactive

sessions between user applications. Throughput involves transmitting the maximum amount of data per unit of time.

Second, the data should be transmitted along the least-cost path within the network, as long as other factors such as reliability are not compromised. The least-cost path is generally the shortest channel between devices and involves the use of the fewest number of intermediate components. Furthermore, low-priority data can be transmitted over relatively inexpensive telephone lines, while high-priority data can be transmitted over expensive high-speed satellite channels.

Third, maximum reliability should be provided to assure proper receipt of all data traffic. Network reliability includes not only the ability to deliver error-free data, but also the ability to recover from errors or lost data in the network. The network's diagnostic system should be capable of locating problems with components and perhaps even isolating the component from the network.

NETWORK TOPOLOGIES

The network configuration or topology is the physical shape of the network in terms of the layout of linking stations. A node refers to a workstation. A bridge is a connection between two similar networks. Network protocols are software implementations providing support for network data transmission. A server is a microcomputer or a peripheral device performing tasks such as data storage functions within a local area network (LAN). Network servers are of several types. A dedicated server is a central computer used only to manage network traffic. A computer that is used simultaneously as a local workstation is called a nondedicated server. In general, dedicated servers provide faster network performance since they do not take requests from both local users and network stations. In addition, these machines are not susceptible to crashes caused by local users' errors. Dedicated servers are expensive and cannot be disconnected from the network and used as stand-alone computers. Nondedicated servers have a higher price performance ratio for companies that need occasional use of the server as a local workstation.

The most common types of network topologies are shown in Figure 1; they are as follows:

FIGURE 1

Hierarchical

The hierarchical topology (also called vertical or tree structure) is one of the most common networks. The hierarchical topology is attractive for several reasons. The software to control the network is simple and the topology provides a concentration point for control and error resolution. However, it also presents potential bottleneck and reliability problems. It is possible that network capabilities may be completely lost in the event of a failure at a higher level.
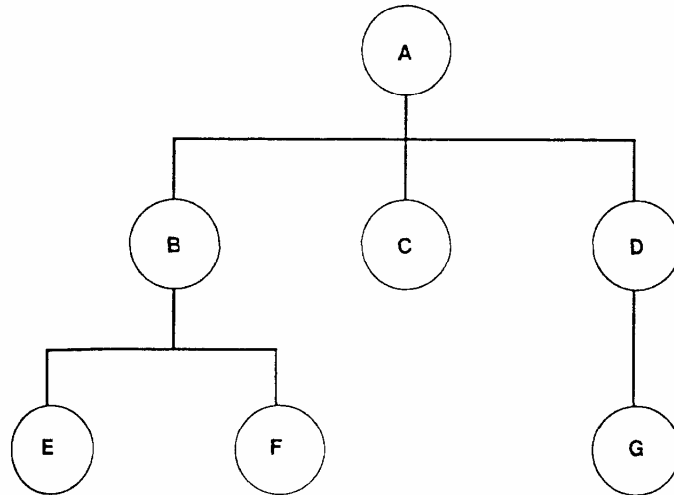
Horizontal

The horizontal topology (or bus topology) is popular in local area networks. Its advantages include simple traffic flow between devices. This topology permits all devices to receive every transmission; in other words, a single station broadcasts to multiple stations. The biggest disadvantage is that since all computers share a single channel, a failure in the communication channel results in the loss of the network. One way to get around this problem is through the use of redundant channels. Another disadvantage with this topology is that the absence of concentration points makes problem resolution difficult. Therefore, it is more difficult to isolate faults to any particular component. A bus network usually needs a minimum distance between taps to reduce noise. Identifying a problem requires the checking of each system element. A bus topology is suggested for shared databases but is not good for single-message switching. It employs minimum topology to fill a geographic area, while at the same time having complete connectivity.
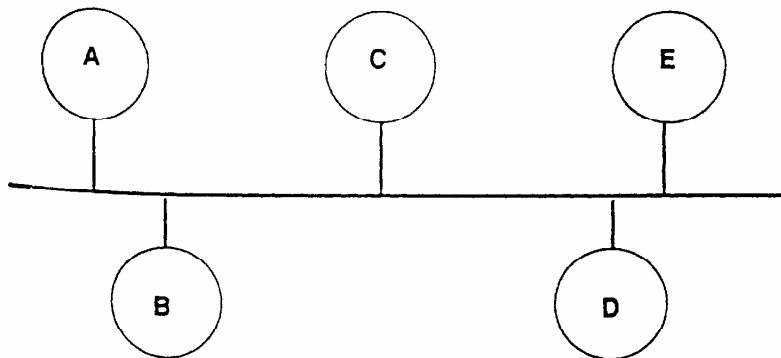
Star

The star topology is a very popular configuration and it is widely used for data communication systems. The software for star topology is not complex and controlling traffic is simple. All traffic emanates from the hub or the center of the star. In a way, the star configuration is similar to the hierarchical network; however, the star topology has more limited distributed processing capabilities. The hub is responsible for routing data traffic to other components. It is also responsible for isolating faults, which is a relatively simple matter in the star configuration. *Note:* Distributed processing is characterized by a merger of computer and telecommunications technology. Distributed systems permit not only remote access to a computer but also the performance of local processing at local sites. The result is greater flexibility in systems design and the possibility of an optimal distribution of processing tasks.

The star network, like the hierarchical network, is subject to potential bottleneck at the hub, which may cause serious reliability problems. One way to minimize this problem and enhance reliability is by establishing a redundant backup of the hub node. A star network is best when there is a need to enter and process data at many locations with day-end distribution to different remote users. Here, information for general use is sent to the host computer for subsequent processing. It is easy to identify errors in the system, since each communication must go through the central controller. While maintenance is easily conducted, if the central computer fails, the network stops. There is a high initial cost in setting up the system because each node requires hookup to the host computer in addition to the mainframe's cost. Expansion is easy, as all that is needed is to run a wire from the terminal to the host computer.
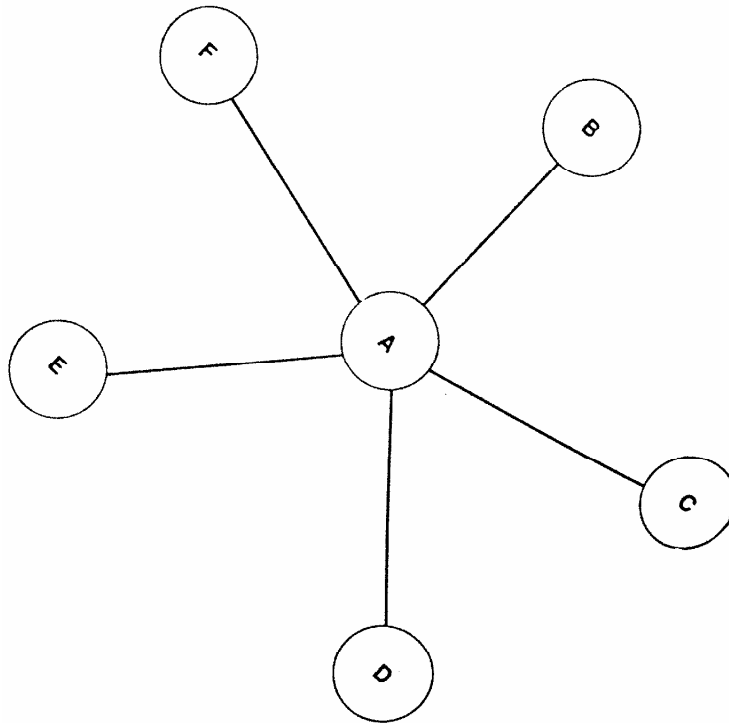
Ring

The ring topology is another popular approach to structuring a network. The data in a ring network flows in a circular direction, usually in one direction only. The data flows from one station to the next station; each station receives the data and then transmits it to the next station.

One main advantage of the ring network is that bottlenecks, such as those found in the hierarchical or star networks, are relatively uncommon. There is an organized structure. The primary disadvantage of the ring network is that a single channel ties all of the components in a network. The entire network can be lost if the channel between two nodes fails. Establishing a backup channel can usually alleviate this problem. Other ways to overcome this problem are using switches to automatically route the traffic around the failed node, or installing redundant cables.

A ring network is more reliable and less expensive when there is a minimum level of communication between micros. This type of network is best when there are several users at different locations who have to access updated data on a continual basis. Here, more than one data transmission can occur simultaneously. The system is kept current on an ongoing basis. The ring network permits managers within the firm to create and update shared databases. With a ring, there is greater likelihood of error incidence compared to a star because data are handled by numerous intervening parties. In light of this, the manager should recommend that data in a ring system make an entire circle before being removed from the network.
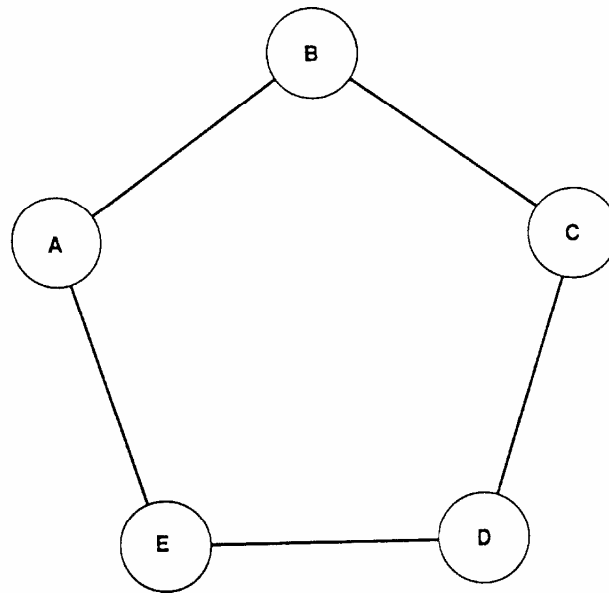
Mesh

The mesh topology provides a very reliable, though complex, network. Its structure makes it relatively immune to bottlenecks and other failures. The multiplicity of paths makes it relatively easy to route traffic around failed components or busy nodes.
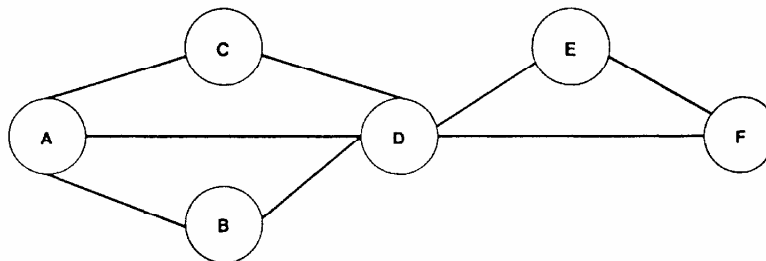
Wide Area Networks and Local Area Networks

Networks may be broadly classified as either wide area networks (WANs) or local area networks (LANs). The computers in a WAN may be anywhere from several miles to thousands of miles apart. In contrast, the computers in a LAN are usually closer together, such as in a building or a plant. Data switching equipment might be used in LANs, but not as frequently as it is in WANs.

The channels in WANs are usually provided by an interchange carrier, such as AT&T or MCI, for a monthly fee plus usage cost. These channels are usually slow and relatively error-prone. In contrast, the channels in a LAN are usually fast and relatively error free; the user organization usually owns these channels.

The major differences in WANs and LANs mean that their topologies usually take on different shapes. A WAN structure tends to be more irregular. Since an organization generally leases the lines at a considerable cost, an attempt is usually made to keep the lines fully utilized. To keep the lines fully utilized, data is often routed for a geographical area through one channel; hence, the irregular shape of the WAN network.

The LAN topology tends to be more structured. Since the channels in a LAN network are relatively inexpensive, the owners of a LAN are generally not concerned with the maximum utilization of channels. Furthermore, since LANs usually reside in a building or a plant, such networks tend to be inherently more structured and ordered. LANs are flexible, fast, and compatible, maximize equipment utilization, reduce processing cost, reduce errors, and provide ease of information flow. LANs use ordinary telephone lines, coaxial cables, fiber optics, and other devices like interfaces. Coaxial cables are one or more central wires surrounded by thick insulation Fiber optics result in good speed and capacity, but they are expensive. LAN performance depends on physical design, protocols supported, and transmission bandwidth. Bandwidth is the frequency range of a channel and reflects transmission speed along the network. Transmission speed is slowed down as more devices become part of the LAN.

Two or more LANs may be interconnected. Each node becomes a cluster of stations (subnetworks). The LANs communicate with each other.

Advantages of Interfacing Networks
- Total network costs are lower.
- There is flexibility in having individual subnetworks meet particular needs.
- More reliable and higher cost subnetworks can be used for critical activities and vice versa.
- If one LAN fails, the other LAN still functions.

Disadvantages of Interfacing Networks
- Complexity is greater.
- Some network functions may not be able to go across network boundaries.

Note: A peer-to-peer network operates without a mainframe or server.

ELECTRONIC DATABASES

There has been a tremendous growth in the online database industry throughout the world in terms of the number and type of databases, producers, and vendors. Never before has management had real time access to such a vast amount of information resources. Online business databases improve decision making and analysis, allow management to add value by creating new products and services through information exchange and processing, and improve the bottom line. Online databases are a resource to be converted to useful information for decision-making purposes. The real measure of the industry, however, is its actual use as measured by the number of online searches. Estimates produced by the major word oriented database vendors show that the number of online searches increased from fewer than one million in 1974 to over

hundred millions in 2005. These figures do not include financial transaction databases, such as databases for stocks, electronic ordering, etc. If they did, the total searches would be many times higher.

One way to classify databases is according to the presentation methodology. The methodologies include text, number, image (video), audio, electronic services, and software. The earliest public databases were text-based, and they still are the predominant type of database. Text-based databases are continuing to grow in number. The user performs searches using text phrases in order to find specific information. Text-based databases include bibliographic, directory, dictionary, full text, and others.

Numeric databases are used primarily for transactions and for obtaining statistical information. Multimedia audio and graphical databases are in the process of development and are gaining popularity. One application of a multimedia database is in the real estate industry where clients can be taken on a "virtual visit" of a particular property without leaving the office. Bulletin board services (BBSs) are another form of online database which have a wide variety of downloadable data.

Commercial online services, such as America Online and Microsoft Network have extensive access to various business database providers. Their primary function is to be a conduit for delivering databases developed by these providers. Commercial online services offer both general interest services that appeal to a wide variety of people, and specialized services that appeal to special interests such as stock market research or marketing research.

The World Wide Web (Web) portion of the Internet has a rapidly increasing series of online business databases. These databases use multimedia graphical and audio features with hypertext links to other data and resources. Users need a web browser to read a graphical Web database. Web online business databases are a valuable resource because they link to all other Internet resources including text files, Telnet (standard Internet protocol for remote terminal connection service), Usenet newsgroups (a collection of thousands of topically named newsgroups and members associated with them on the Internet), and other portions of the Internet as required.

Another form of a multimedia database is the development of a vast number of CD-ROM business databases which interrelate audio, video, and text and allow the user search and download capabilities.

Faxback services are becoming popular and are a major source of timely business information. They are easy to use and provide a wide variety of information by just using a fax machine or a fax modem.

Finally, there are many online U.S. government databases. These high-quality databases contain extremely useful information and are often free of charge.

COMMERCIAL ONLINE SERVICES

These services are steadily increasing in popularity, are designed to be user friendly, and normally have graphical user interface (GUI) software with access to the Internet including the Web. Pricing options vary widely, and each service should be consulted directly. America Online and MSN are two major services. Other services include:

- *Hoover's Online* (//www.hoovers.com/free/): This service provides comprehensive company, industry, and market intelligence that drive business growth. It has database of 12 million companies, with in-depth coverage of 40,000 of the world's top business enterprises.

- *LEXIS/NEXIS* (www.lexisnexis.com/): LexisNexis® provides authoritative legal, news, public records and business information; including tax and regulatory publications in online, print or CD-ROM formats.

U.S. GOVERNMENT'S STAT-USA ONLINE SERVICES
The U.S. government has moved aggressively to provide extensive online database access. The Economics and Statistics Administration of the U.S. Department of Commerce has created STAT-USA for providing U.S. government online databases. It has several databases on the Internet at www.stat-usa.gov. STAT-USA/Internet, a service of the U.S. Department of Commerce, is a single point of access to authoritative business, trade, and economic information from across the Federal Government.

- *Budget of the United States*: STAT-USA offers budget files free of charge in ASCII and in Adobe's Portable Document Format, and makes them searchable using Inquery. The Budget contains the budget message of the president, the president's budget proposals, analytical perspectives, and historical tables.

- *Bureau of Economic Analysis* (BEA) Economic Information: An authoritative online news release source for Survey of Current Business issues and for detailed data files from BEA's national, regional, and international economic accounts.

- *Bureau of Economic Analysis*, US. Department of Commerce: GDP press release (complete) with corporate profits, economic indicators summary text file; leading, coincident, and lagging indexes release (text and tables in text format); and personal income and outlays.

- *Bureau of the Census*, US. Department of Commerce: New construction, durable goods, shipments & orders, new home sales, housing starts, manufacturing & trade inventories and sales, advance retail sales, shipments, inventories & orders, and U.S. international trade in goods and services--formerly merchandise trade (complete release).

- *Bureau of Labor Statistics*, U.S. Department of Labor: The Employment Situation (complete release), Consumer Price Index (full release), Producer Price Index (text/tables), and Productivity and Cost Preliminary (complete release).

- *Daily Economic Press Releases*: State and local government bond rates, trade opportunities, 10:00 A.M. and 12:00 PM. daily foreign exchange rates, the daily treasury statement, treasury rate quotations, and yield curve points.

- *Economic Bulletin Board/Lite Edition*: The Economic Bulletin Board/Lite Edition is a comprehensive Internet source for government-sponsored economic releases and business leads. The EBB/LE offers a small subset of the files available on STAT-USA's modem-based Economic Bulletin Board (EBB) system, thus its title "Life Edition." Economic news and business leads are available the minute they are released on the EBB/LE as well as giving in-depth analyses of markets, products, and economic trends. The EBB/LE provides: searchable databases containing export promotion information; the Trade Opportunity Program (TOPS) and market research reports with daily updates and three months of archives; and the U.S. Department of Agriculture's Agricultural Trade Leads.

- *Federal Reserve Board* (FRB): Summary of commentary on current economic conditions by Federal Reserve District, industrial production & capacity utilization, FRB bank credit, FRB consumer credit report, FRB foreign exchange rates, FRB selected interest rates, FRB money stock data, and FRB aggregate reserves.

- *The Global Business Opportunities Service* (GLOBUS) GLOBUS is an international marketplace for U.S. businesses, providing billions of dollars in procurement opportunities from all over the world. Currently, GLOBUS contains the Commerce Business Daily, and Small Purchase Opportunities from the Defense Logistics Agency.
- *The Census Bureau's Merchandise Trade Export and Import Statistics*: These are available on a commodity level as well as a country level.

- *The Economic Bulletin Board* (EBB): This is the world's leading source of government-sponsored business data. Begun in 1985, it helped launch the era of electronic reporting and today is still the most-used bulletin board of its kind. On the EBB, late-breaking business developments are reported within thirty minutes after they are received from contributing federal agencies. In-depth analyses of markets, products, and economic trends are also provided The EBB has a vast collection of files. The list of available files alone is 471 pages. The EBB collects, collates, and publishes data from more than 35 federal agencies.

ONLINE BUSINESS DATABASES

The following online business databases are a selected listing of the numerous databases available.

Thomson Galetm (www.gale.com), a business of The Thomson Corporation, is a world leader in e-research and educational publishing for libraries, schools and businesses. Best known for its accurate and authoritative reference content as well as its intelligent organization of full-text magazine and newspaper articles, the company

creates and maintains more than 600 databases that are published online, in print and in microform. The Thomson Gale family of publishing imprints includes such noted reference brands as Macmillan Reference USA™, Charles Scribner's Sons®, Primary Source Microfilm™ and Scholarly Resources Inc.

CHAPTER 8 QUIZ

1. There are several types of online systems. An example of commercial online systems is:
      A. Customer supplier (direct connection)
      B. Bulletin board
      C. Specialized marketing research
      D. Direct connection

2. Downloading or uploading file from an online system is:
      A. Electronic mail
      B. File transfer
      C. Online research
      D. Online transactions

3. A company has a very large, widely dispersed internal audit department. Management wants to implement a computerized system to facilitate communications among auditors. The specifications require that auditors have the ability to place messages in a central electronic repository where all auditors can access them. The system should facilitate finding information on a particular topic. Which type of system would best meet these specifications?
      A. Electronic data interchange (EDI).
      B. Electronic bulletin board system (BBS).
      C. Fax/modem software.
      D. Private branch exchange (PBX).

4. A system that has several minicomputers connected for communication and data transmission purposes but also enables each computer to process its own data is known as a
      A. Distributed data processing network.
      B. Centralized network.
      C. Decentralized network.
      D. Multidrop network.

CHAPTER 8 ANSWER KEY

1. (C) Commercial online services offer both general interest services that appeal to a wide variety of people, and specialized services that appeal to special interests such as stock market research or marketing research.

(A) is incorrect. Customer supplier is a direct connection. Using traditional transportation delivery system.

(B) is incorrect. A bulletin board system is a special interest group managed usually by a single system operator.

(D) is incorrect. Direct connection uses direct dialing to connect to another computer.

2. (B) is correct. File transfer is frequently used in telecommunications. You can either download or upload files.

(A) is incorrect. Electronic mail allows you to sent and receive messages in your mailbox.

(C) is incorrect. Online research uses special databases for research on any topic using a variety of search engines.

(D) is incorrect. Online transactions include banking or ordering merchandise online.

3. (B) is correct. Electronic bulletin board systems (BBSs) function as a centralized information source and message switching system for a particular interest group. Users review and leave messages for other users, and communicate with other users on the system at the same time.

(A) is incorrect. EDI is for the electronic transmission of business information and electronic mail, but it does not offer central repositories that store messages for many parties to read.

(C) is incorrect. Although fax/modem software can store images of faxes received, it does not meet the criterion of ease of access to information on a particular topic.

(D) is incorrect. A PBX is a telecommunications system that routes calls to particular extensions within an organization.

4. (A) is correct. Distributed processing is characterized by a merger of computer and telecommunications technology. Distributed systems permit not only remote access to a computer but also the performance of local processing at local sites. The result is greater flexibility in systems design and the possibility of an optimal distribution of processing tasks.

(B) is incorrect. In a centralized network, processing occurs in one location.

(C) is incorrect. In a pure decentralized system, the nodes are not interconnected.

(D) is incorrect. A multidrop network provides links for each terminal to a single communications line connected to a central processing unit; only one terminal can send or receive messages at a time.

CHAPTER 9

INTERNET AND INTRANET

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Differentiate between the functions of Internet and Intranet.
2. Describe the Intranet explosion.
3. Discriminate between the processes of calendar-driven versus event-driven strategy.
4. List practical applications of the Internet and the Intranet.
5. Explain Hypertext Markup Language (HTML).
6. Understand the Common Gateway Interface (CGI).

The Internet is made up of a series of networks that include gateways to allow personal computers to connect to mainframe computers. The Internet facilitates information transfer between computers. Gateways are hardware or software products that allow translation between two different protocol families. For example, a gateway can be used to exchange messages between different e-mail systems. The graphics-rich environment of the World Wide Web (WWW) has been largely responsible for bringing the Internet out of the static realm of e-mail and text-only documents. The WWW continues to grow faster than any other segment of the Internet. Businesses, schools, government, and nonprofit organizations (in addition to millions of individuals) are flocking to the Internet to promote themselves and their products to an audience spanning the entire planet. Accordingly, given the vast scope of the Internet, the most difficult aspect of its use is locating the best information sources. One solution has been the development of programs called browsers for accessing the WWW. *Note:* Companies that wish to maintain adequate security must use firewalls to protect data from being accessed by unauthorized users. A network firewall is a device that separates a network segment from the rest of the network. This machine maintains a connection between the networks but does not pass network traffic.

Intranet utilization in corporate America is rapidly growing. Because Intranets use Internet technology, there is ready access to external data. In effect, Intranets are internal Web sites. An Intranet is an important tool to use in business and is developed and used by the company itself. An Intranet is easy to install and flexible (what is developed for one platform may be used for others).

Corporate managers must have knowledge of Intranet structure and organization because it relates to accounting, tax, audit, control, and security issues. Managers, customers, employees, stockholders, potential investors, creditors, loan officers, government agent representatives (SEC, IRS), and other interested parties can access

the database or information in a company through Web browsers (interfaces) such as Netscape Navigator and Microsoft's Internet Explorer. Management may set up an Intranet to improve operating efficiencies and productivity and to reduce operating costs (e.g., distribution expenses), time, and errors. Of course, keeping information on the Intranet current takes time and resources. Proper controls must be established to guard against unauthorized access of the company's data through the Internet. One security device is the use of firewalls (barriers) to protect the company's Intranet by unauthorized access, and to prevent misuse of the Intranet by outsiders who might otherwise be able to alter accounting and financial information, steal property, obtain confidential data, or commit other inappropriate or fraudulent acts. Further, add-on security tools are available to restrict users by preventing them from performing certain acts, or from viewing certain "restricted" information.

In an Intranet, one protocol connects all users to the Web server run on standard protocols supported by any computer.

INTRANET EXPLOSION

Information System (IS) and functional department managers quickly saw the power of this new communications medium as a resource to be leveraged on the corporate network as well. Forrester Research did a study finding that two-thirds of large companies already had or are contemplating some use of Intranet business applications. Surveyed companies identified the Intranet as a powerful tool to make information more readily available within and outside the company.

With businesses under significant pressure to empower employees and to better leverage internal information resources, Intranets furnish a very effective communications platform, one that is both timely and extensive. A basic Intranet can be set up in days and can eventually act as an "information hub" for the whole company, its remote offices, partners, suppliers, customers, investors, creditors, consultants, regulatory agencies, and other interested parties.

Intranets provide the following features:

- Easy navigation (internal home page provides links to information)
- Can integrate distributed computing strategy (localized web servers residing near the content author)
- Rapid prototyping (can be measured in days or even hours in some cases)
- Accessible via most computing platforms
- Scaleable (start small, build as requirements dictate)
- Extensible to many media types (video, audio, interactive applications)
- Can be tied in to "legacy" information sources (databases, existing word processing documents, groupware databases)

The benefits to these features are many, including:

- An Intranet is inexpensive to start, requires minimal investment in dollars or infrastructure.
- Open platform architecture means large (and increasing) numbers of add-on applications.
- A distributed computing strategy uses computing resources more effectively.
- An Intranet is much timelier and less expensive than traditional information (paper) delivery.

CALENDAR-DRIVEN VERSUS EVENT-DRIVEN STRATEGY

One of the key drivers in the Intranet adoption curve is they allow businesses to evolve from a "calendar" or "schedule" based publishing strategy, to one of an "event-driven" or "needs-based" publishing strategy. In the past, businesses published an employee handbook once a year, whether or not policies changed to coincide with that publication date. Traditionally, even though these handbooks may have been outdated as soon as they arrived on the users' desks (and were promptly misplaced), they would not be updated until next year.

With an Intranet publishing strategy, information can be updated instantly. If the company adds a new mutual fund to the 401K program, content on the benefits page can be immediately updated to incorporate that change, and the company internal home page can have a brief announcement about the change. Then when employees refer to the 401K program, they have the new information at their fingertips. Content can be changed or updated to reflect new rules at any time.

INTRANETS REDUCE COST, TIME TO MARKET

Intranets dramatically reduce the costs (and time) of content development, duplication, distribution, and usage. The traditional publication model includes a multistep process including creation of content, migration of content to desktop publishing environment, production of draft, revision, final draft production, duplication, and distribution.

The Intranet publishing model includes a much shorter process, skipping many of the steps involved in the traditional publication model. In the Intranet model, revision becomes part of the updating process while the original content is available to end users, thus dramatically reducing the time it takes for the information to become available to the user. As the information is centrally stored and always presumed to be current, the company will not have to retrieve "old" information from employees, thus saving updating expenses.

This new publishing model significantly reduces both costs and the time frame. Assuming that the corporate Local Area Network (LAN) environment can support Intranet activities (and most can), the Information Technology (IT) infrastructure is already in place. Further, most popular Intranet web servers can run on platforms widely found in most companies (Intel 80486 or Pentium class computers, Apple Macintosh, Novell NetWare, etc.), so that little if any additional infrastructure is required.

Organizations estimate that the traditional model may entail physical duplication and distribution costs of as high as $15 per employee, costs separate from the content

development or testing phases. An organization with 10,000 employees may find potential cost savings of moving to an Intranet policy for a single application alone--the employee policies and benefits manual--of $150,000. This cost savings does not even consider the additional value in an Intranet solution which makes information more easily available to staff, thus improving their productivity and morale.

PRACTICAL APPLICATIONS

The uses of Intranets (internal Webs) by companies are unlimited, including:

- Furnishing outside CPAs with accounting, audit, and tax information.
- Gathering information by performing online searches using web browsers and search engines. Providing marketing and sales information to current and prospective customers or clients.
- Providing information to salespersons in the field and managers at different branches (e.g., sales and profit reports, product tracking, transaction analysis).
- Furnishing resource needs and reports to suppliers.
- Communicating corporate information to employees, such as company policies and forms, operating instructions, job descriptions, time sheets, human resource data and documents, business plans, newsletters, marketing manuals, phone directories, schedules, and performance reports.
- Assisting in employee training, development, and technical support.
- Transferring information to government agencies (e.g., Department of Commerce, SEC, and IRS).
- Furnishing current and prospective investors with profitability, growth, and market value statistics.
- Providing lenders and creditors with useful liquidity and solvency data.
- Providing project, proposal, and scheduling data to participating companies in joint ventures.
- Providing press releases and product/service announcements.
- Giving legal information to outside attorneys involved in litigation matters.
- Providing trade associations with input for their surveys.
- Accessing and searching databases and rearranging information.
- Furnishing information to outside consultants (e.g., investment management advisors, pension planners).
- Providing insurance companies with information to draft or modify insurance coverage.
- Allowing for collaborative workgroups such as letting users access various drafts of a specific project document interactively and add annotations and comments. For example, Ford's Intranet links design engineers in the U.S., Europe, and Asia
- Furnishing economic statistics about the company to economic advisors.
- Facilitating database queries and document requests.
- Providing spreadsheets, database reports, tables, checklists, and graphs to interested parties.
- Displaying e-mail.

Site maps (e.g., Table of Contents) should be included so users may easily navigate from each note (element) and are visible through frames or panels.

An Intranet requires Web application development for its internal network such as appropriate Web servers. For quick response time, there should be a direct connection to the server. Web browsers may be used to achieve cross-platform viewing and applications for a wide variety of desktops used within the company. The use of Web technology (e.g., Web servers) allows each desktop having a Web browser to access corporate information over the existing network. Therefore, employees in different divisions of the company located in different geographic areas (e.g., buildings) can access and use centralized and/or scattered information (cross section).

There are many client/server applications within and among companies such as cross-platform applications. The major element in an Intranet is the Web server software which runs on a central computer and serves as a clearinghouse for all information. Web servers for the Intranet are available from many vendors including:

- IBM (800-426-2255). Internet Connection Server for MVS.
- Microsoft (800-426-9400). Internet Information Server (comes with Microsoft's NT Server).
- Netscape (415-528-2555). Fast Track and Commerce Server for Windows NT.

The advantages of the Microsoft's Windows NT Server are higher security and easier capability to upgrade to more powerful hardware at a later date as application needs increase.

HYPERTEXT MARKUP LANGUAGE (HTML)

The authors recommend the use of a Hypertext Markup Language (HTML) in developing Intranets because it is an easier Graphical User Interface (GUI) to program than windows environments such as Motif or Microsoft Windows. HTML is a good integrating tool for database applications and information systems. It facilitates the use of hyper links and search engines enabling the easy sharing of identical information among different responsibility segments of the company. Intranet data usually goes from back-end sources (e.g., mainframe host) to the Web server to users (e.g., customers) in HTML format.

COMMON GATEWAY INTERFACE (CGI)

The majority of Web applications run through a mechanism in the Web server referred to as the common gateway interface (CGI). CGI is used to connect users to databases. Most CGI programs are written in TCL or Pert (a scripting language). However, due to the fact that these languages involve printing a source code of the Web server, there is an unsecured situation from a control and security standpoint. Other deficiencies are relative slowness in applications, nonexistence or inadequate debuggers, and maintenance problems. The authors suggest considering other languages for the CGI such as C or C++.

The following for CGI business applications is recommended:

1. In developing Web applications for INTRANETS, code management tools are needed to enable different participants in a corporate project or activity to communicate and work together. You must also use tools for database design, modeling, and debugging. In this connection, the following Web sites, among others, provide helpful information to corporate managers:

a. Basic HTTP
(http://www.w3.org/TR/REC-html40/types.html)

b. HTML Browser List
(http://www.w3.org/MarkUp/)

c. Web Server Comparison Chart
(http://www.orphanage.com/products/compare.html)

d. HTML Specs from the WWW Consortium
(http://www.w3.org/hypertext/www/markup/markup.html)
or (http://www.macronimous.com/resources/web_servers_demystifyed.asp)

e. Introduction to CGI
(http://hoohoo.ncsa.uiuc.edu/cgi/overview.html)

2. Do not commit to a particular server or browser because new technological developments require flexibility on your part. Therefore, you should set up your system so that it may accommodate many servers and browsers.

3. Make sure your HTML user interface is separate from the database and application logic.

SETTING UP AN INTRANET
Intranet applications are scaleable--they can start small and grow. This feature allows many businesses to "try out" an Intranet pilot--to publish a limited amount of content on a single platform, and evaluate the results. If the pilot looks promising, additional content can be migrated to the Intranet server.

PROPOSED CONTENT
Companies must ascertain if data should be made available via a web server, via e-mail, or by some other means. If the data is of general import, such as company travel guidelines or mileage reimbursement, it can be posted on a web server so that when employees and travel agents, among others, require this information, they click on Travel Guidelines from the human resources page, and obtain the most current information.

Many businesses find building web interfaces to "legacy information" as a key application. With tools such as Purveyor's Data Wizard, HTML Transit, and WebDBC, end users can build simple point and click access to this legacy information without any programming, making it available to nontechnical users through their web browser. Key database applications include: customer records, product information, inventory,

technical problem tracking, call reports, etc. In addition, individuals can quickly set up seminar or training registration forms for short-term usage, loading the registrants' information into an easily manipulated database.

Conversely, interoffice e-mail may be more appropriate for "interrupt-driven" time sensitive information, especially for a focused group of recipients." Our most important customer is coming in March 2, so please attend the briefing at 9 A.M." In this case, the web server can be used as an extended information resource: "Before the meeting, check the internal web server link for Current Customers for updated information concerning this account."

ENHANCEMENTS

Intranets can provide efficient access to other external information resources including group access to mailing lists, threaded discussion groups, and stock/bond quotes. In this way, the oft-accessed information can be aggregated at the firewall and efficiently dispersed within the company, thus reducing external bandwidth and connectivity requirements.

Multithreaded discussion group software, or conferencing applications, can run on the same platform as the Intranet application, providing further chances to discuss company issues and the content that resides on the server.

INTRANETS COMPARED TO GROUPWARE

Intranets and groupware are not mutually exclusive. Many companies find that groupware (work flow, collaborative computing, etc.) is appropriate for certain focused applications, while Intranets are suitable for migrating existing content to online delivery. Others find a powerful combination in groupware and a web server (Lotus InterNotes engine for publishing Notes databases on the web, for example).

Ultimately, each application strategy has its merits. Beyond this, Intranet applications and web servers make an excellent foundation for web-based groupware, allowing businesses to employ a web-centric Intranet system strategy and leverage the nearly ubiquitous web browser and the powerful navigational aids provided by HTML.

SUMMARY

The application of Internet technologies in an Intranet environment can dramatically increase the flow and value of organizational information. The corporate manager can gain quick and timely access to a much wider variety of existing information residing in a variety of original forms and sources, including word processing files, databases, spreadsheets, Lotus Notes, and other resources. In addition, traditional paper-based information distribution can be displaced by Intranet applications, lowering costs and increasing the timeliness of information flow.

Intranet applications can start as small "pilots" and scale upward over time, gradually providing or facilitating access to an increasing breadth of information, thus

improving both employee productivity and satisfaction, and eventually bolstering the company's competitive position.

An "Extranet" is an extended Intranet creating virtual private networks (VPNs) between companies, business partners, and clients. VPNs is a secure network that uses the Internet as its main backbone network to connect the intranets of a company's different locations, or to establish extranet links between a company and its customers, suppliers, and other business partners

CHAPTER 9 QUIZ

1. The benefits of Intranet features can include all the following except:
   A. Inexpensive to start up
   B. Open platform architecture (handles a large number of add-on applications
   C. Permits file transfer from a remote server to the users computer
   D. Uses computing resources effectively

2. The Internet is made up of a series of networks that include
   A. Gateways to allow personal computers to connect to mainframe computers.
   B. Bridges to direct messages through the optimum data path.
   C. Repeaters to physically connect separate local area networks (LANs).
   D. Routers to strengthen data signals between distant computers.

3. Regarding the Internet as a commercially viable network, organizations must use firewalls if they wish to maintain security over internal data.
True / False

4. The most difficult aspect of using Internet resources is
   A. Making a physical connection.
   B. Locating the best information source.
   C. Obtaining the equipment required.
   D. Getting authorization for access.

5. An Internet firewall is designed to provide adequate protection against which of the following?
   A. A computer virus.
   B. Unauthenticated logins from outside users.
   C. Insider leaking of confidential information.
   D. A Trojan horse application.

CHAPTER 9 ANSWER KEY

1. (C) is correct. The benefits of Intranet features include:
- An Intranet is inexpensive to start, requires minimal investment in dollars or infrastructure.
- Open platform architecture means large (and increasing) numbers of add-on applications.
- A distributed computing strategy uses computing resources more effectively.

(A) is incorrect. "Inexpensive to start up" is an intranet feature.

(B) is incorrect. Intranet is an open platform.

(D) is incorrect. Using computing resources effectively is an Intranet feature.

2. (A) is correct. The Internet facilitates information transfer between computers. Gateways are hardware or software products that allow translation between two different protocol families. For example, a gateway can be used to exchange messages between different e-mail systems.

(B) is incorrect. Routers are used to determine the best path for data.

(C) is incorrect. Bridges connect LANs.

(D) is incorrect. Repeaters strengthen signals.

3. (T) is correct. Companies that wish to maintain adequate security must use firewalls to protect data from being accessed by unauthorized users. A network firewall is a device that separates a network segment from the rest of the network. This machine maintains a connection between the networks but does not pass network traffic.

(F) is incorrect. Anyone can establish a home page on the Internet The lack of security is a major problem with the Internet.

4. (B) is correct. The Internet is a series of networks throughout the world that facilitates information transfer between computers. Gateways allow mainframe computers to interface with personal computers. The graphics-rich environment of the World Wide Web (WWW) has been largely responsible for bringing the Internet out of the static realm of e-mail and text-only documents. The WWW continues to grow faster than any other segment of the Internet. Businesses, schools, government, and nonprofit organizations (in addition to millions of individuals) are flocking to the Internet to promote themselves and their products to an audience spanning the entire planet. Accordingly, given the vast scope of the Internet, the most difficult aspect of its use is locating the best information sources. One solution has been the development of programs called browsers for accessing the WWW.

(A) is incorrect. There is no limitation on the number of access ports.

(C) is incorrect. The only requirements for accessing Internet resources are a computer, a modem, a telephone line, and basic communications software.

(D) is incorrect. Organizations routinely provide Internet access to their employees, and individuals can obtain access through individual subscriptions to commercial Internet service providers.

5. (B). is correct. A firewall is a device that separates two networks and prevents passage of specific types of network traffic while maintaining a connection between the networks. Generally, and Internet firewall is designed to protect a system form unauthenticated logins from outside users. However, it may provide several other features as well.

(A) is incorrect. A firewall cannot adequately protect a system against computer viruses.

(C) is incorrect. Industrial spies need not leak information through the firewall. A telephone or floppy disk is a much more common means of sharing confidential information.

(D) is incorrect. A firewall cannot adequately protect against a Trojan horse (a program, such as game, that appears friendly but that actually contains applications destructive to the computer system) or any other program that can be executed in the system by an internal user.

CHAPTER 10
ACCOUNTING INFORMATION SYSTEMS AND PACKAGES

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Identify some basic factors in selecting accounting software.
2. Understand the benefits of Windows Interface.
3. Explain modular features of accounting software.
4. List popular write-up software.
5. Describe tax preparation software.
6. Give examples of audit software.
7. Explain major applications of spreadsheets.
8. List major Activity-Based Costing (ABC) software.

This chapter discusses accounting information systems and a variety of software applications of particular interest to accountants. The discussion includes the major players in the area, and some important features to look for when considering a particular type of software.

ACCOUNTING INFORMATION SYSTEMS

An accounting information system (AIS) is a subsystem of an MIS and processes financial and transactional data relevant to managerial decisions as well as financial accounting. AISs are the oldest and most widely used information systems in business.

Computer-based accounting information systems:
- Record and report the flow of funds through an organization on a historical basis and produce important financial statements such as balance sheets and income statements
- Produce forecasts of future conditions such as projected financial statements and financial budgets
- Operational accounting systems focus on transaction processing systems. They emphasize legal and historical record-keeping and the production of accurate financial statements.
- Typically, operational accounting systems include:
  1. Order Processing: Captures and processes customer orders and produces data for inventory control and accounts receivable.
  2. Inventory control: Processes data reflecting changes in inventory and provides shipping and reorder information.
  3. Accounts receivable: Records amounts owed by customers and produces customer invoices, monthly customer statements, and credit management reports.

4. Accounts payable: Records purchases from, amounts owed to, and payments to suppliers, and produces cash management reports.
5. Accounts payroll: Record employee work and compensation data and produces pay checks and other payroll documents and reports.
6. General ledger systems: Consolidates data from other accounting systems and produces the periodic financial statements and reports of the business.
- Management accounting systems focus on the planning and control of business operations. They emphasize:
  1. Cost accounting reports
  2. Development of financial budgets and projected financial statements
  3. Analytical reports comparing actual to forecasted performance

Figure 1 illustrates the interrelationships of several important accounting information systems. Many accounting software packages are available for these applications.

FIGURE 1
ACCOUNTING INFORMATION SYSTEMS
FOR TRANSACTION PROCESSING AND FINANCIAL REPORITNG
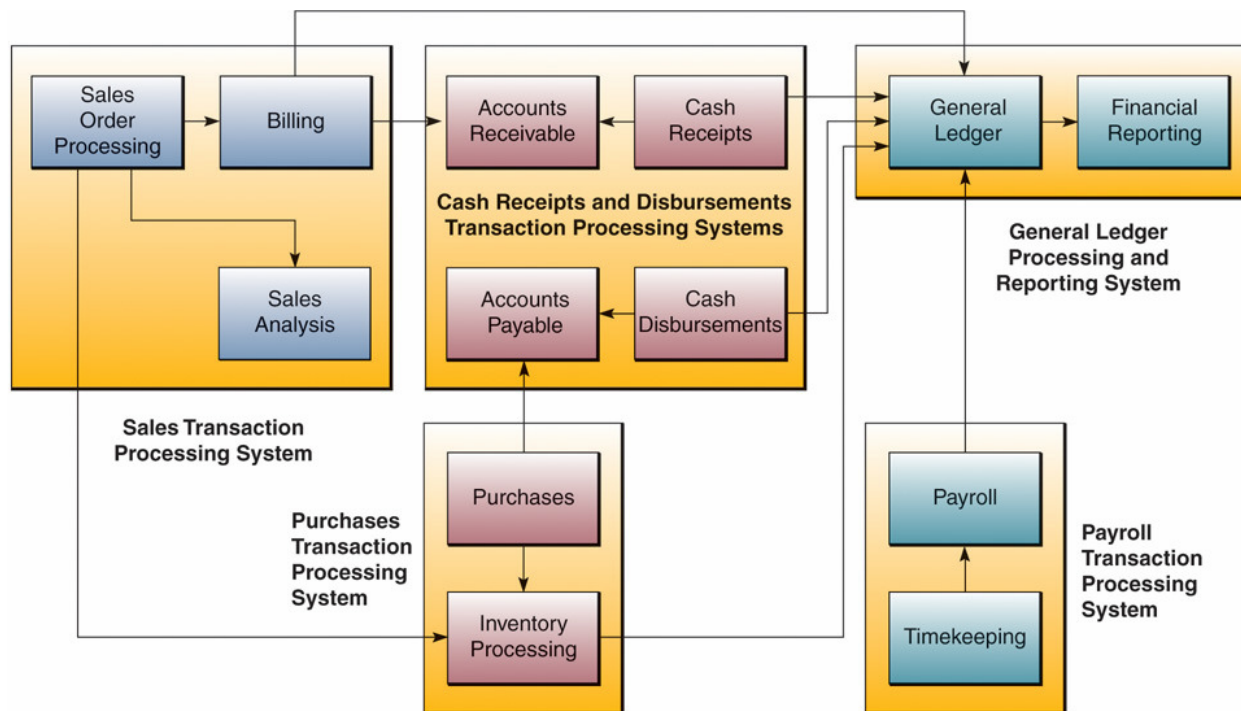
ONLINE ACCOUNTING SYSTEMS

Accounting information systems are being affected by Internet and client/server technologies. Using the Internet, intranets, extranets, and other network changes how accounting information systems monitor and track business activity. The online, interactive nature of such networks calls for new forms of transaction documents, procedures, and controls. Many companies are using or developing network links to their trading partners through the use of the Internet or other networks for applications such as order processing inventory control, accounts receivable, and accounts payable.

ACCOUNTING SOFTWARE

There are many factors that must be weighed when selecting a computer software package. Besides determining the software features currently needed and required in the future, the buyer must have a thorough understanding of the firm's existing system, and whether proposed software will integrate with all areas of that system and business.

Some of the basic considerations include: features and capabilities, compatibility and integration, ease of customization, ease of use, written documentation and technical support, price, and vendor's reputation and stability.

The fundamental task of accounting software is to automate the routine chore of entering and posting accounting transactions. This information is organized in an electronic format so as to produce financial statements and can be accessed immediately to assist in the management of the firm.

An accounting software package consists of a series of highly integrated modules. Each module corresponds to a specific accounting function (e.g., payroll, accounts receivable, and accounts payable). In an integrated system, after the details of the transaction are entered in one of the modules, the chart of accounts from the general ledger is "read." The transaction is then automatically posted to the accounts in the general ledger. For example, when a sale on account is entered in the accounts receivable module, a debit is automatically made to the accounts receivable account in the general ledger and an offsetting credit made to the general ledger sales account.

Module Descriptions

The basic module typically required by a firm and often integrated in an accounting software package include the following: general ledger, accounts receivable and invoicing, accounts payable and purchase order processing, inventory, payroll, job costing, and fixed assets.

General Ledger

The general ledger is the heart of the accounting system. It contains the chart of accounts of the business. A general ledger module should contain a sample chart of

accounts which can be customized to a particular business. In addition, it should contain predefined reports that support budget data and prior year comparisons which can be tailored to a firm's specific needs. Other essential features include the capability to generate automatic reversing and recurring journal entries, having at least 13 periods open at one time, and the ability to make prior period adjustments or post entries to another year without closing the current year.

Accounts Receivable and Invoicing
The accounts receivable and invoicing functions are often combined in the same module. This module allows you to enter sales data and permits extensive sales analysis. It provides customer receivables management by tracking customers' balances, generates invoices and/or monthly statements, as well as aging reports. It should allow for setting up credit limits for each customer, provide for flexible billing options, and the ability to apply partial payments to specific invoices or to the oldest balance. For faster processing, online inquiry should show the complete customer record at a glance including balances and unpaid invoices, and allow you to make changes "on the fly."

Accounts Payable and Purchase Order Processing
Accounts payable and purchase order processing also can be combined in a single module. The module tracks obligations to vendors and determines a best payments schedule, prints checks, and provides for the distribution to accounts. It should allow for enhanced management of order processing by tracking orders from the start to the receipt of goods. It should be able to detect supply problems and thus permit early planning for alternate sources. To analyze vendor performance, it must track the complete purchase and delivery history of vendors and allow for easy access to this information.

Inventory
This module automatically tracks inventory as purchases or sales are made, and maintains cost and price data for each inventory item. In an integrated system, the Inventory main file, which stores the product's number, is checked when a sales invoice is created in the accounts receivable module. If sufficient inventory is on hand, the amount of the sale is reduced from the balance. Likewise when inventory is purchased, the inventory quantity is automatically increased. The module should help improve inventory management by alerting the user when to reorder, identifying slow moving items and analyzing performance by item and category.

Payroll
The payroll module maintains default information for each employee (e.g., rate of pay and income tax withholding information). The module calculates the wages to be paid, prints checks, and keeps track of deductions, sick and vacation days, and other such information. It maintains information for government reporting (e.g., 941, W-2, unemployment, and state tax forms). For cost control, it should be able to provide for expense distribution or integrate with a costing module.

Job Costing
A job costing module allows you to track and report on the costs, income, and profitability of individual jobs or projects. This is done by assigning a job ID number to purchases, sales, and employee hours. A job cost module should provide for an accurate audit trail, detailed income, expenses and committed costs, as well as the tracking of other user-defined categories. For example, Maxwell Business Systems' JAMIS is a job costing accounting package that tracks costs by project, contract, or organization over multiple years.

Fixed Assets
Fixed assets usually represent a significant investment by a firm, thus, it is essential to keep track of them, but extremely tedious to do so. Tracking fixed assets and the repetitive calculation of depreciation is well suited for the computer. Most accounting software packages include one fixed asset module or capabilities to control fixed assets. It is also possible to purchase dedicated stand-alone fixed asset packages.

Fixed asset software can handle large amounts of data and a variety of depreciation methods for financial accounting and tax purposes. It should be able to maintain detailed information about each asset, including a description of the asset, its location, date placed in service, and estimated useful life. It also should be able to track additions and disposal, as well as basis adjustments. An example of a fixed asset package is Decision Support Technology's BASSETS Fixed Asset System.

Before purchasing an accounting package, check if it has a fixed asset module, or capabilities sufficient for your needs. If not, ask if the vendor produces a stand-alone version, or would recommend a third party vendor. Before purchasing a stand-alone fixed asset software package, make sure that it allows for easy sharing of information with your general ledger, tax packages, and other data repositories.

CHECKLIST FOR SELECTING ACCOUNTING SOFTWARE
When you make calls to vendors or perhaps meet with the most promising ones, here is a checklist of questions and key features you want to address.
Does the package offer:
- ❑ Ability to drill down from summary general ledger data to individual transactions?
- ❑ Ability to import and export data to and from spreadsheets and word processing programs?
- ❑ Ability to generate custom reports?
- ❑ Fast posting of large batches of transactions?
- ❑ Strong security?
- ❑ Adequate technical support?
- ❑ Retention of historical data and ability to compare current results to past results?
- ❑ Ability to match direct expenses with specific clients and projects?
- ❑ Ability to allocate indirect costs to individual projects?
- ❑ Ability to integrate customer management and e-commerce functions?
- ❑ Preparation of 941s, W-2s, 1099s, and 940s?
- ❑ Ability to flow data from the program into your tax software?
- ❑ Ability to add more users at a later date with minimal cost increases?

Also, below is a "wish list" of functions the package should include. Here are some possibilities:

- ❑ Offers ease of use, especially the ability to directly query the data and perform ad hoc reporting.
- ❑ Enables fast and easy user training.
- ❑ Requires a minimum of effort from the IT staff to keep it running at optimum efficiency.
- ❑ Provides all-in-one accounts payable/receivable and general ledger functions.
- ❑ Includes import and export features and a report writer.
- ❑ Offers access to live people for technical support.
- ❑ Requires a minimum of process modifications.

Note: For more in-depth analysis of various accounting packages, you may want to consult these professional organizations and manuals, some of which offer advice on purchasing software. They include:

- Institute of Management Accountants (http://www.imanet.org)
- Family Firm Institute (http://www.ffi.org/)
- National Society of Accountants (http://www.nsa.org)
- The American Institute of Certified Public Accountants (http://www.aicpa.org/)
- Accounting Technology (http://www.electronicaccountant.com), a great site for industry news, special reports, and product reviews.
- CPA Software News (http://www.softwarenews.net
- CPA Technology Report (http://cpatech.hbpp.com)
- SoftWorld's Accounting and Finance Expo (http://www.softworld.com). These frequent trade shows are the best place for buyers to get hands-on demos of the latest accounting and finance products, both in North America and Europe.

MARKET LEADERS
There are a number of accounting software products. They conveniently can be categorized as (a) low-end, (b) mid-level, and (c) high-end packages.

TechRepublic (http://techrepublic.com.com/) provides a list of these packages.

High-End
High-end applications serve both midsize, regional companies and large, multinational corporations. They're flexible, easy to implement, and can be modified to meet the users' needs. Although this category of software isn't inexpensive, high-end packages aren't in the same league as AS/400 or ERP installations and therefore won't enter that $100,000 range.

AccountMate Software—Visual AccountMate
(http://www.accountmate.com/EN/products/)
Client/server software available to almost any size business.

ACCPAC International—ACCPAC for Windows Corporate Series
(http://www.accpac.com/products/finance/accwin/cs/default.asp)

Multi-tier business management system, multi-currency and multilingual support, e-business and sales force automation capabilities, customization options.

Damgaard—Axapta (http://www.damgaard.com/)
Internet-enabled, object-oriented, single code base for all countries, and a three-tier client/server environment.

Epicor—Platinum for Windows and Platinum ERA
(http://www.epicor.com/solutions/accounting.asp)
Integration between front office and back office applications, customization options.

Great Plains Software—Great Plains Accounting
(http://www.greatplains.com/accounting/)
Twenty modules and tools for automating labor-intensive processes.

Infinium—Infinium Financial Management (http://www.infinium.com/html/fm.html)
Freestyle reporting capabilities; multinational, multi-currency processing of payments, invoices, and receivables; Web-enabled accounts receivable function.

Macola Software—Progression Series
(http://www.macola.com/macola/product/solutions/default.asp)
Allows multiple budgets and prior year's data to be maintained.

Navision Software U.S.—Navision Financials (http://www.navision.com/)
Integrated development environment; provides customization tools for customer-specific solutions.

Peachtree Software—Peachtree 2000 (http://www.peachtree.com/peachtree2000/)
Designed for small to medium-size businesses; features multi-user capabilities.

Sage Software—Acuity Financials (http://www.us.sage.com/acuity/)
Designed for larger businesses or company divisions (100 to 1,000 employees; integrates Microsoft Office and BackOffice suites.

Solomon Software—Solomon IV
(http://www.solomon.com/product/series/series_fin.htm)
Full suite of financial management tools, including accounts payable/receivable, cash manager, and general ledger.

Tecsys—ControlSeries Project Financial Management (http://www.tecsys.com/)
Client/server, activity-based management software package.

Mid-Level
Buyers of mid-range programs are tough to define by revenue, but they usually include four or five accounting users and have needs that are technically sophisticated. These buyers generally require more robust, multi-user features and management reporting while still retaining tools that are required for a small business. Essential features of a package include client/server architectures, custom report design, and Internet/intranet-enabled functions.

AccountMate Software—Visual AccountMate
(http://www.accountmate.com/EN/products/)

Client/server software available to almost any size business.

CheckMark Software—MultiLedger (http://www.checkmark.com/ML_Win.html) Integrated, cross-platform accounting program combining general ledger, accounts receivable/payable, and inventory.

Cyma Systems—Cyma IV Accounting for Windows (http://www.cyma.com/products/fms.asp) Full suite of accounting modules, including system manager, general ledger, accounts receivable/payable, and payroll; available in workstation, peer-to-peer, and client/server configurations.

PC Accountant—ProBooks (http://www.pcaccountant.com/). Features integrated, point-and-click accounting.

Sage Software—BusinessWorks (http://www.us.sage.com/businessworks/). Features 10 fully integrated modules; can support up to 48 concurrent users.

SBT Accounting Systems—VisionPoint (http://www.sbt.com/products/vp.html). Designed for small to midsize enterprises; based on open architecture.
Syspro Impact Software—Impact Encore (http://www.syspro.com/). Features a relational database; integrates with other desktop productivity tools such as Microsoft Word, Outlook, and Excel.

Windsoft International—Bottomline Accounting (http://www.windsoft.com/index2.htm) Designed for small and midsize companies that want to automate accounting data.

Low-End
Products in the low-end category are not short on capabilities or features. Rather, they are made for sole proprietorships, partnerships, and corporations that are closely held with only a few employees. These users need a package that will help them balance checkbooks, prepare payroll reports and deposits, and keep track of bills and customer invoices. They want features including single points of entry for data, on-the-fly updating, tight integration with the Internet, sophisticated customized reporting, built-in job costing, and electronic payroll and bill paying services.

Aatrix Software—Mac P&L Accounting (http://www.aatrix.com/1.800.426.0854/macpandl/index.html). Full suite of applications at low cost, including general ledger, payroll, and inventory management.

ACCPAC International—Simply Accounting (http://www.accpac.com/products/finance/simply/default.asp). Entry-level package for the small office/home office user.

Intuit—QuickBooks (http://www.intuit.com/products_services/small_business.shtml). Features include time tracking, job costing, and estimations; integrated with Microsoft Excel, Word, Outlook, and Symantec ACT!

MYOB—Accounting Plus (http://www.myob.com/us/products/plus/index.htm). Features more than 100 accounting and financial management reports; supports multiple-currency accounting.

Peachtree Complete—One-Write Plus (http://www.onewrite.com/). Designed for small businesses converting from manual accounting systems.

SBT Accounting System—VisionPoint (http://www.sbt.com/products/vp.html). Designed for small to midsize enterprises; based on open architecture.

WRITE-UP SOFTWARE

With the development of easy-to-use and inexpensive accounting software, many companies who previously relied on CPAs to keep their books are doing it themselves. CPA firms can counter this trend with dedicated write-up software, which is easy-to-use and provides more features so as to add value to their write-up services.

Write-up software should allow you to do more than just record transactions. One of the biggest features to look for is the ability to easily create an array of printouts and reports that a client might need. This includes being able to link and transfer data from other software packages and applications.

Another important feature is the ability to customize the input screen, so that it is consistent with the layout of the client's source documents, thereby reducing unneeded keystrokes. Easy setup is another means to reduce the cost of write-up service. The package should contain sample company data, and the ability to copy common information and make changes to default information included in the setup "on the fly."

TAX PREPARATION SOFTWARE

Computer technology has had a significant impact on the way tax returns are prepared. Computerized tax return preparation lets the user prepare a return quickly and accurately, and allows the user to quickly analyze different tax planning strategies. Some software packages have built-in tools for tax research and permit for the electronic filing of tax returns. This software also lets the user easily do "what if" planning and then quickly makes all the necessary changes. Furthermore, data can be imported directly from accounting packages or electronic spreadsheets into tax preparation software.

While tax preparation software can help with tax planning, one should consider a dedicated tax research package for serious tax research. Most Compact Disk (CD)-based tax services can effectively replace the printed version of tax services. A major advantage of using CD-based tax services is having the ability to do electronic key-word searches. This can greatly facilitate the tax research process, and make it much more efficient. In addition, it is easier to maintain and store all this information on a CD, thereby saving a good deal of library storage space.

AUDIT SOFTWARE

Audit software is used by accountants to perform audits efficiently and effectively. Software audit tools include automated work papers, data extraction software, and trial balance software.

Products such as APG (Audit Program Generator) by the American Institute of Certified Public Accountants (AICPA) and the optional add-on modules allow you to prepare customized audit programs. It eliminates the photocopying, cutting, and pasting usually required when creating the audit program and guides users through the engagement.

Data extraction software, such as IDEA (Interactive Data Extraction and Analysis), also by the AICPA, allows auditors to access clients' files for audit testing. The auditor can either access the client's live data or obtain a copy of the company's data files on tape or disk. Data extraction software allows the auditor to audit "through the computer." The auditor can, for example, select a sample of accounts receivables for confirmations, or perform analytical reviews and do ratio analysis. Transactions may be compared to predetermined criteria. Linton Shafer's Audit Sampling Software packages select random numbers and dates. It handles multiple ranges and evaluates results. It performs compliance and substantive testing.

Trial Balance software, such as the AICPA's ATB (Accountant's Trial Balance), helps the auditor organize client's general ledger balances into a working trial balance. The auditor can then perform adjustments and update account balances. The calculation of financial ratios is extremely simple with trial balance software. This type of software aids in the preparation of financial statements. While trial balance software is designed primarily for audits, it can be used instead of write-up software for compilation and review services.

SPREADSHEETS

More than any other product, the electronic spreadsheet has done more to make the capabilities of microcomputers evident to the business community. An electronic spreadsheet allows the user to work with data in a huge number of rows and columns. The user works with this data in a columnar spreadsheet, a format familiar to accountants. A big advantage of the spreadsheet is that it eliminates the need to perform manual calculations and can perform powerful computer-aided operations.

The spreadsheet has become a valuable tool in business planning, since it permits the user to perform "what if" scenarios. Inputs can be continuously changed, and the results will automatically be recalculated throughout the spreadsheet. Thus, the effect of alternative decisions is easily determined and planning greatly facilitated. The use of templates is another important feature of spreadsheets. Templates provide the format and contain the formulas which are used to repeatedly solve various business applications. Since one doesn't have to be a programmer to construct a template, all firms could now more easily use the vast power of the computer to help make better decisions in the management of a firm. Major spreadsheet packages are Excel, Lotus 1-2-3, and Quattro Pro.

ACTIVITY-BASED COSTING (**ABC) SOFTWARE**

An Activity-Based Costing (ABC) system accumulates costs on the basis of production or service activities at a firm. Basically it assigns costs by activity and links them to specific products. It is argued that the resulting cost data is much more realistic and precise as compared to the data obtained from a traditional costing system. Aided by computer software designed for ABC, the management accountant can more easily and accurately accumulate cost information and perform "what-if" testing. With this data, management is in a better position to evaluate and make decisions regarding its operations and products. There is a good deal of software that the management accountant can use to aid in accumulating cost data. Some software is actually spreadsheet applications; others are modules of mainframe packages.

EXTENSIBLE BUSINESS REPORTING LANGUAGE (XBRL)

There exist too many data formats on the Internet preventing users from analyzing financial information without many labor intensive conversions. Excessive time is devoted to extracting useful information from available accounting and financial data. Further, time is wasted re-keying the same information into a spreadsheet. For example, data in the Securities and Exchange Commission's (SEC) database referred to as Electronic Data Gathering, Analysis, and Retrieval System (EDGAR) cannot be imported directly into spreadsheets. EDGAR performs automated collection, validation, indexing, acceptance, and forwarding of submissions by companies and others who are required by law to file forms with the SEC. The comparison of numbers and ratios requires significant effort and very time consuming re-keying.

Extensible Business Reporting Language (XBRL) makes available financial information in an "easy to use" format on the Internet. Formerly code named XFRML, a freely available electronic language for financial reporting, it is an XML-based framework that provides the financial community a standards-based method to prepare, publish in a variety of formats, reliably extract and automatically exchange financial statements of publicly held companies and the information they contain. XBRL is not about establishing new accounting standards but enhancing the usability of the ones that we have through the digital language of business. XBRL will not require additional disclosure from companies to outside audiences. This new language allows the financial community to communicate in a universal language.

How Companies Create XBRL Statements

Accounting software vendors will put XBRL tags in their accounting systems to allow users to cross-reference their accounts to this framework enabling a more efficient reporting process and a more meaningful experience for the users of financial information. Some of the most popular accounting software companies have al ready announced their plans to provide XBRL output in the financial statements. The list includes SAP, Oracle, Great Plains, and ACCPAC. There are more than 50 companies in the U.S. and about 150 companies globally involved in the development and adoption of XBRL. On March 5, 2002, Microsoft became the first major corporation to publish its financial statements on the Internet using the XBRL framework.

Applications of XBRL

There are many accounting, financial, and business applications of XBRL including:

1. Automating business reporting.
2. Financial statement preparation and analysis. For example, XBRL financial statements on a company's web site can go directly into Microsoft Excel so re-keying is not required.
3. Auditing of financial statements.
4. Managing and distributing accounting data.
5. Consolidating and reporting data to regulatory bodies.
6. Collecting and updating financial data on borrowers such as by accessing the borrower's Web page.
7. Assessing credit risk.
8. Integrating investment information.
9. Communicating financial performance to users of financial statements.
10. Internal management reporting such as cost control and analysis.

There are several very useful XBRL products for accountants such as PricewaterhouseCooper's **Edgar Scan** that is an interface to SEC EDGAR Filings. **Edgar Scan** takes filings from the SEC's servers and breaks them down automatically to find key financial tables and standardizes financials to a common format for all companies. Using hyperlinks, users of financial reports can access specific sections of the filing including the financial statements, footnotes, extracted financial information, and relevant financial ratios. Tables of financial information and comparisons can be downloaded as Excel charts. **Edgar Scan's** XBRL Query Service converts extracted SEC filing information into XBRL instances. This HTTP service makes available XBRL data for in excess of 500 of the largest U.S. businesses. Financial statement preparers and users can request the XBRL data on these companies or other information about this product from PricewaterhouseCoopers at http://edgarscan.pwcglobal.com/XBRL or e-mail edgar@uspwcglobal.com.

XBRL Enabled Applications include the following:

- Federal Deposit Insurance Corporation (FDIC)'s new **Call Report System** (launching in the second quarter of 2004) is XBRL-based. The FDIC believes this system will result in better information quality, more flexibility, and improved timeliness. When this system is launched it will result in about ten thousand U.S. banks submitting quarterly financial information in XBRL.
- One Source Information Services (www.onesource.com) is the first provider to deliver a fully NET-enabled Web Service for XBRL information on U.S. companies.
- The Tokyo Stock Exchange accepts company financial summary filings in XBRL.

XBRL vendors include Decision Soft (http://xbrl.decisionsoft.com), Semansys Technologies (www.semansys.com), Universal Business' Matrix (http://www.ubmatrix.com), Navision (www.navision.com), Hyperion Solutions (www.hyperion.com), Corel (www.corel.com), oracle (www.oracle.com), SAP (www.sap.com), CaseWare International (www.caseware.com), People Soft (www.peoplesoft.com), SYSPRO (www.syspro.com), Creative Solutions (www.creativesolutions.com), ACCPAC (www.accpac.com), and XBI Software

(www.xbisoftware.com).

VALUE CHAIN MANAGEMENT SOFTWARE

Firms employ a wide variety of software systems to process information and improve the operation of the value chain. They are Enterprise Resource Planning (ERP) systems, Supply Chain Management (SCM) systems, and Customer Relationship Management systems (CRM).

Enterprise Resource Planning (ERP) Systems. Enterprise Resource Planning (ERP) systems grew out of material requirements planning (MRP) systems which have been used for more than 20 years. MRP systems computerized inventory control and production planning. Key features included an ability to prepare a master production schedule, a bill of materials, and generate purchase orders. ERP systems update MRP systems with better integration, relational databases, and graphical user interfaces. Features now encompass supporting accounting and finance, human resources, and various e-commerce applications including SCM and CRM which are explained next.

ERP selection criteria checklist

Are you faced with the challenge of selecting an ERP application? It's a time-consuming process for IT/IS managers to assess application vendors, then compare what they are offering to what the organization needs. So we've designed this checklist to expedite the process and to help ensure that you touch all the bases as your investigate each vendor.

Database and network
- How many user licenses are required?
- Is the ERP designed to work with different RDBMS (relational database management systems), such as Oracle, Sybase, and Informix?
- Does the vendor have any built-in programs to handle integration?
- How will the data warehousing aspects be addressed?
- What is the maximum time it takes for uploading the remote data?
- What is the minimum time it takes for uploading the remote data?
- Does the software support distributed data processing?
- Does the software support a parallel processing option?
- Has the vendor had any problems in the past regarding concurrency?
- Does the software have an audit trail on key transactions?
- How many security layers have been incorporated into the software?
- What kind of networking protocols does the software support?
- Does the software support LONG and BLOB data types, etc.?

- What is the largest database the vendor has handled so far for the modules you're interested in?
- What is the smallest database size handled by the vendor so far for the modules you're interested in?

Implementation
- Has the vendor implemented sites in this region?
- Has the vendor implemented ERP in your industry segment?
- Has the vendor implemented the same modules that your organization needs?
- Will there be immediate delivery of the product?
- Does the vendor have a specific implementation plan?
- How long did it take for the vendor to implement the same modules elsewhere?
- How many years of experience does the vendor have with implementation?
- Does the vendor have good project plan initiatives?
- Does the vendor have a good implementation team with the required skills?
- Does the vendor have the Certification of Excellence given by other customers?
- What is the minimum implementation time for the modules you've chosen?
- What is the maximum implementation time for the modules you've chosen?

Business processes
- Does the vendor promise any reduction in lead times of those business processes in which you have some interest?
- What is the minimum processing time for MRP (material requirement planning)?
- What is the maximum processing time for MRP?
- What is the minimum processing time for MPS (master production schedule)?
- What is the maximum processing time for MPS?
- Does the software optimize the business processes after implementation?
- Does the software use a built-in business process modeler?

Hardware and software
- What kind of hardware support does the vendor offer?
- How many years of experience does the vendor have with the hardware/software that will be used for your project?
- Who are the alliance partners for the hardware support?
- What is the upgrade support for the software?
- Does the software have any interface to support the latest technology?
- How is the vendor maintaining the documentation for the software?
- Is the software Web-enabled?
- Will the software be implemented in modules?
- Will the software be purchased in modules?
- Will the software accounting adhere to international standards and adhere to each country's standards?
- How many operating systems does the software support?
- Does the software allow posting of transaction both in batch mode and online?
- Does the software support multilingual operation?

Support
- What support will the vendor provide after implementation?
- If the vendor is out-of-country, how is support provided?
- How much time will the vendor devote to ERP training for end users?
- Describe the UI (user interface)/GUI (graphical user interface) package support and how each will give end users ease of operation.
- Did the vendor complete any customization at any previously implemented sites? (Describe by percentage and the modules.)
- How will the vendor complete the reports' customization?
- Does the software have any built-in programs to handle data conversions?
- Is the front-end application developed using proprietary software?
- Is the customization cost included in the ERP cost?
- Can the vendor give approval for accessing other customers' data?
- Does the vendor have any test data built into the software for proper training?
- If any bugs are found in the software during or after implementation, what is the replacement support?
- Is the vendor ready to work with third-party tools and software?

Supply Chain Management (SCM) Systems. Supply chain management (SCM) is the organization of activities between a company and its suppliers in an effort to provide for the profitable development, production, and delivery of goods to customers. By sharing information, production lead times and inventory holding costs have been reduced, while on-time deliveries to customers have been improved. SCM software systems support the planning of the best way to fill orders and help tracking of products and components among companies in the supply chain.
Wal-Mart and Procter & Gamble (P&G) are two companies that have become well known for their cooperation in the use of SCM. When P&G products are scanned at a Wal-Mart store, P&G receives information on the sale via satellite and, thus, knows when to make more product and the specific Wal-Mart stores to which the product should be shipped. Related cost savings are passed on, at least in part, to Wal-Mart customers.

Customer Relationship Management Systems (CRM). Customer Relationship Management (CRM) Systems automates customer service and support. They also provide for customer data analysis and support e-commerce storefronts. While CRM is constantly evolving, it's already led to some remarkable changes in the way companies interact with customers. For example, Federal Express allows customers to track their packages on the Web. This service is becoming commonplace, but it didn't exist 10 years ago. Amazon.com uses CRM technology to make suggestions to customers based on their personal purchase histories. The ultimate development of CRM remains to be seen but undoubtedly mobile communication will playa significant role. Many companies are already experimenting with systems to send messages to cell phone

users offering them special discounts and buying opportunities.

CRM systems are designed to manage all the data related to customers, such as marketing, field service and contact management data. Over the course of the past year, CRM has become the primary focus on IS managers and CIOs responsible for prioritizing new systems acquisitions. CRM has also become the focus of ERP vendors who realize the need to tap into this growing market and to integrate CRM data with the other data already residing within the ERP system's database.

The concept behind CRM is that better customer service means happier customers and greater sales—particularly repeat sales. Part of the service concept is field-service support and contact management. Contact management facilitates the recording and storing of information related to each contact a salesperson has with a client and the context of the conversation or meeting. Additionally, each time the client makes contact regarding queries or service help, this information is also recorded. The result is that a salesperson can review all the historical information before calling on a customer and be better prepared to provide that customer with targeted products and services. These systems also support the recording information about the customer contact such as spouse's name, children, hobbies, etc., that help facilitate the salesperson in making quality contact with the customer.

At the same time, the software supports the organizing and retrieving of information on historical sales activities and promotions planning. This facilitates the matching of sales promotions with customers' buying trends. This is a particularly crucial area for integration with any existing ERP system because much of the information necessary to support sales analyses comes from data captured during the recording of sales event data in the ERP system.

A third area that is prevalent in CRMs is support for customer service— particularly for phone operators handling customer support call-in centers. For many organizations, phone operators who have not had previous contact with the customer handle the bulk of customer service activities. The CRM quickly provides the phone operator with the information on the customer's history and usually links the operator with a database of solutions for various problems that a customer may be inquiring about. These solutions may simply be warranty or contract information, or at a more complex level, solutions to operations or maintenance problems on machinery or equipment. All this information can be efficiently stored for quick retrieval by the system's user.

Note: In today's mobile environment, phones, PDAs, and other devices will be connected by a variety of wireless technologies and will become mandatory for corporate communications with customers and employees. Mobile applications provide opportunities in the ability to interact with customers in new ways, new places, and at new times. Adding mobility and immediacy to an application can be powerful: It offers the potential for new products and services, business process improvements, cost savings, and improved response times.

COMPLIANCE SOFTWARE

On July 2002, the U.S. Congress passes the **Sarbanes-Oxley Act**, the most significant change to U.S. business regulations in 70 years. The Act creates tough new penalties for corporate fraud, prevents accounting firms from offering consulting services to audit clients and places restrictions on financial analysts. Section 404 (Management Assessment of Internal Controls**)** requires each annual report of an issuer to contain an "internal control report," which shall:

    (1) State the responsibility of management for establishing and maintaining an adequate internal control structure and procedures for financial reporting; and

    (2) Contain an assessment, as of the end of the issuer's fiscal year, of the effectiveness of the internal control structure and procedures of the issuer for financial reporting.

Six Technologies That Can Assist with Compliance

        Much of compliance is a matter of putting rules in place and ensuring that they are followed. Technology can provide the solutions to the corporate governance and compliance problem. It includes computer software for: business intelligence, business process management, document management, e-mail management, financial and accounting software, and enterprise resource planning (ERP).

Business intelligence Regulatory requirements for "real-time" disclosure of factors that affect financial performance mean that executives need access to timely, relevant data from all areas of the business. By drilling down into financial and company data and providing sophisticated reporting and analysis tools, business intelligence software can help ensure the accessibility of information.

Business process management (BPM) Businesses have traditionally been built around functional "silos," making it difficult to share information and obtain a consistent, enterprise-wide view. By extracting businesses processes from the underlying application code into an independent management layer, BPM software can help improve visibility.

Document management New corporate governance standards mean that companies need an efficient system for storing and retrieving important records and documents. Software packages that maintain audit trails of documents and set controls over how, where and for how long files are stored can help companies meet these obligations.

E-mail management As the volume of e-mail continues to soar, the logistics of storing essential e-mails and being able to retrieve them quickly become increasingly complex. And with new regulatory requirements around internal controls and disclosure obligations, the need for comprehensive e-mail management software becomes ever-more compelling.

Financial and accounting software To help comply with new standards such as Sarbanes-Oxley, many vendors are giving their traditional financing and accounting software a boost with additional modules that help with risk management, more

accurate budgeting and forecasting, financial analysis and the establishment of internal financial controls.

Enterprise resource planning (ERP) ERP software can give organizations a consistent financial view across all divisions, thereby helping to maintain the accuracy of financial information. Many ERP providers are adding modules to their software to assist with compliance with Sarbanes-Oxley and other corporate governance standards. *Note:* Appendix A provides a guide to compliance software.

Note:
- Online advisors are very helpful sources of information, such as The CPA Software Review web site (www.cpasoftwarenews.com) and Accounting Software Advisor (www.accountingsoftwareadvisor.com) for reviews of various accounting-related software.
- Software vendors come and go. Software titles, vendor names, and telephone numbers are subject to change. Always check for up-to-date information using search engines such as MSN Search and Google.

CHAPTER 10 QUIZ

1. How is an accounting information system (AIS) distinguished from a management information system (MIS)?
    A. An AIS deals with financial information; an MIS handles all other information.
    B. An AIS may be either manual or computer-based; an MIS is computer-based.
    C. An AIS is a subsystem within an MIS.
    D. An AIS is control-oriented; an MIS is used exclusively for planning.

2. An accounting information system (AIS) must include certain source documents in order to control purchasing and accounts payable. For a manufacturing organization, the best set of documents should include
    A. Purchase requisitions, purchase orders, inventory reports of goods needed, and vendor invoices.
    B. Purchase orders, receiving reports, and inventory reports of goods needed.
    C. Purchase orders, receiving reports, and vendor invoices.
    D. Purchase requisitions, purchase orders, receiving reports, and vendor invoices.

3. The deciding factor in selecting accounting software should never be:
    A. The price of the software
    B. Implementation costs
    C. Training costs
    D. Ongoing maintenance and support costs

4. The heart of the software accounting system that contains the Chart of Accounts of a business is:
    A. Accounts receivable
    B. Invoicing
    C. General ledger
    D. Accounts payable

5. An accounting software module that maintains default information for each employee (rate of pay, in come tax withheld, etc) is the:
    A. Inventory module
    B. Job costing module
    C. Fixed assets module
    D. Payroll module

6. An example of a market leader low-end accounting software product is:
    A. Pro Series
    B. QuickBooks
    C. Tax Relief
    D. Veri-Tax

7. The major players in the spreadsheet field include all the following except:
   A. Lotus 1-2-3
   B. Excel
   C. Peachtree
   D. Quattro Pro

CHAPTER 10 ANSWER KEY

1. (C) is correct. An information system transforms raw data into knowledge useful for decision making. An MIS provides information for management decisions. An AIS is a subsystem of an MIS and processes financial and transactional data relevant to managerial decisions as well as financial accounting.

(A) is incorrect. An MIS provides financial information; an AIS is a subsystem within an MIS that is not limited to financial information.

(B) is incorrect. An AIS is a subsystem within an MIS which is an integrated user-machine system that includes computer hardware and software.

(D) is incorrect. Both types of systems are used to provide a wide range of information to management.

2. (D) is correct. An AIS is a subsystem of a management information system that processes financial and transactional data relevant to managerial and financial accounting. The AIS supports operations by collecting and sorting data about an organization's transactions. An AIS is concerned not only with external parties but also with the internal activities needed for management decision making at all levels. An AIS is best suited to solve problems when reporting requirements are well defined. A manufacturer has well-defined reporting needs for routine information about purchasing and payables. Purchase requisitions document user department needs, and purchase orders provide evidence that purchase transactions were appropriately authorized. A formal receiving procedure segregates the purchasing and receiving functions and establishes the quantity, quality, and timeliness of goods received. Vendor invoices establish the liability for payment and should be compared with the foregoing documents.

(A) is incorrect. Receiving reports should be included.

(B) is incorrect. Requisitions and vendor invoices should be included.

(C) is incorrect. Purchase requisitions should be included.

3. (A) is correct. The price of the software should never be the deciding factor in selecting accounting software.

(B) is incorrect. Implementation costs can be significantly higher than the cost of the software.

(C) is incorrect. Training costs can be significantly higher than the cost of the software.

(D) is incorrect. Ongoing maintenance and support costs can be significantly higher than the cost of the software.

4. (C) is correct. General ledger relies on the Chart of Accounts.

(A) is incorrect. Accounts receivable functions allow you to enter sales data and permits extensive sales analysis.

(B) is incorrect. Invoicing provides customer tracking, and generates monthly statements and aging reports.

(D) is incorrect. Accounts payable tracks obligations to vendors and determines a best payment schedule, prints checks and provides for distribution to each account.

5. (D) is correct. Payroll module maintains default information for each employee (rate of pay, in come tax withheld, etc).

(A) is incorrect. The inventory module automatically tracks purchases, sales and maintains price data and keeps an updated inventory file.

(B) is incorrect. The job costing module allows you to track and report on the costs, income, and profitability of individual jobs or projects.

(C) is incorrect. The fixed assets module keeps track of significant investments made by a firm and computes depreciation of assets.

6. (B) is correct. QuickBooks is low-end accounting software.

(A) is incorrect. Pro Series is not accounting software.

(C) is incorrect. Tax Relief is specialized Tax software.

(D) is incorrect. Veri-Tax is specialized tax software, not accounting software.

7. (C) is correct. Peachtree is popular accounting software.

(A) is incorrect. Lotus 1-2-3 is one of three major electronic spreadsheet software.

(B) is incorrect. Excel is a leading electronic spreadsheet.

(D) is incorrect. Quattro Pro is a electronic spreadsheet.

CHAPTER 11
FINANCIAL MANAGEMENT INFORMATION SYSTEMS AND PACKAGES

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Define and list the financial MIS subsystems and outputs.
2. Propose and develop a financial forecast.
3. Analyze profit/loss and cost systems.
4. Define financial intelligence.
5. Utilize funds management.
6. Implement a process of financial budgeting, planning, and control.
7. Forecast external financing needs using the percent-of-sales method.
8. Understand financial modeling languages.
9. Conduct financial analysis with spreadsheets.
10. Demonstrate financial ratio analysis.
11. Optimize profits.
12. Choose and utilize one of the depreciation methods.
13. Develop a procedure for planning and forecasting.
14. Evaluate short-term decisions.
15. Assess long-term asset decisions.
16. Implement long-term financing decisions.
17. List and demonstrate other financial management software.
18. Utilize popular budgeting and planning software.

Finance has been an important functional area for virtually all types of organizations. The finance area monitors cash flow and profitability. Well-conceived financial information systems are capable of providing financial managers with timely information, which is vital to success in today's competitive global economy. History has witnessed the results of poor financial decisions. Banks and savings institutions have gone into bankruptcy because of bad decisions and unfavorable economic conditions. Companies with too much debt and leverage have also gone bankrupt. On the contrary, good financial decisions have resulted in growing and prosperous organizations.

  A financial management information system provides financial information to all financial managers within an organization. Specifically, the financial MIS assists the financial manager in performing his/her responsibilities which include the following:

- *Financial analysis and planning* - analyzing historical and current financial activity and determining the proper amount of funds to employ in the firm; that is, designating the size of the firm and its rate of growth.

- *Investment decisions* - allocating funds to specific assets (things owned). The financial manager makes decisions regarding the mix and type of assets acquired, as well as modification or replacement of assets.

- *Financing and capital structure decisions* - projecting future financial needs and raising funds on favorable terms; that is, determining the nature of the company's liabilities (obligations). For instance, should funds be obtained from short-term or long-term sources?

- *Management of financial resources* -monitoring and controlling the use of funds over time and managing cash, receivables, and inventory to accomplish higher returns without undue risk.

Figure 1 shows the inputs, function-specific subsystems, and outputs of a financial MIS.

INPUTS TO THE FINANCIAL MANAGEMENT INFORMATION SYSTEM

Decisions supported by the financial MIS require diverse information needs. The sources, both internal and external, are briefly discussed below.

1. *Corporate strategic goals and policies.* The strategic plan covers major financial goals and targets. Earnings growth, and loan ratios, and expected returns are some of the measures that can be incorporated in the strategic plan. The plan often projects financial needs three to five years down the road. More specific information needs, such as expected financing needs, the return on investment (ROI) for various projects, and desired debt-to-equity ratios, evolve directly from the strategic plan.

FIGURE 1
OVERVIEW OF A FINANCIAL MIS

Inputs	Subsystems	Outputs
Strategic goals	Financial forecasting	Financial forecasts
Transaction processing system	Financial data from departments (profit/loss and costing)	Funds management
Internal accounting		Financial budget planning, and control
External sources	Financial intelligence	
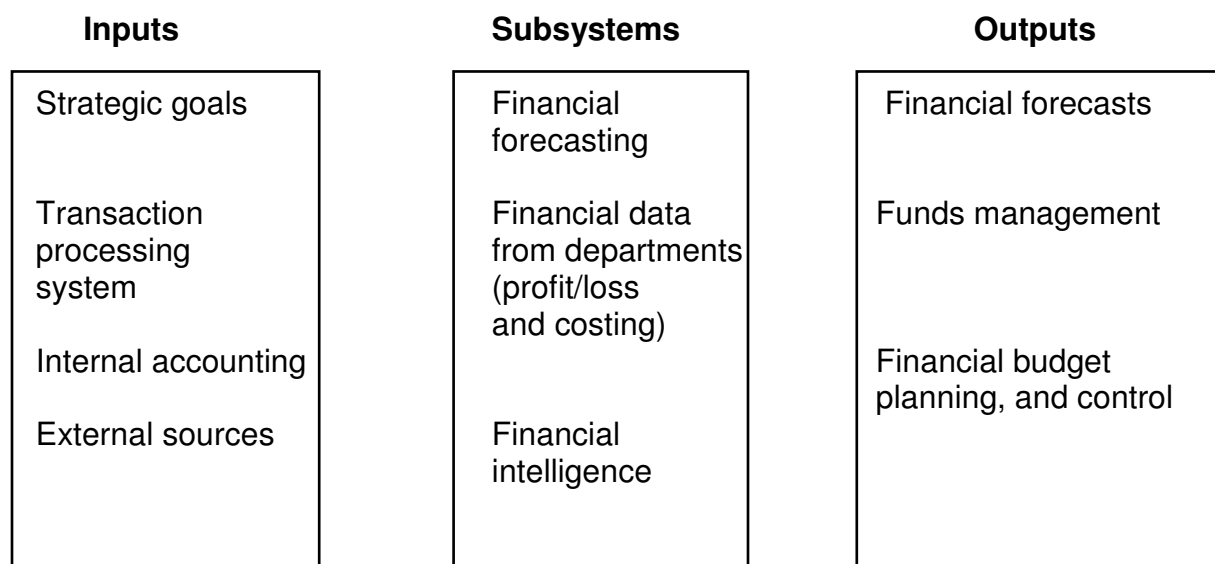
2. *The transaction processing system.* Important financial information is captured by a number of internal accounting systems. One is the *order entry system*, which enters the orders into the accounting system. Another is the *billing system*, which sends bills or invoices to customers. A third is the *accounts receivable system*, which collects the funds. Other key financial information also is collected from almost every transaction processing application- payroll, inventory control, accounts payable, and general ledger. Many financial reports are based on payroll costs, the investment in inventory, total sales over time, the amount of money paid to suppliers, the total amount owed to the company from customers, and detailed accounting data.

3. *External sources.* Information from and about the competition can be critical to financial decision making. Annual reports and financial statements from competitors and general news items and reports can be incorporated into MIS reports to provide units of measure or as a basis of comparison. Government agencies also provide important economic and financial information. Inflation, consumer price indexes, new housing starts, and leading economic indicators can help a company plan for future economic conditions. In addition, important tax laws and financial reporting requirements can also be reflected in the financial MIS.

FINANCIAL MIS SUBSYSTEMS AND OUTPUTS

Financial decisions are typically based on information generated from the accounting system. Depending on the organization and its needs, the financial MIS can include both internal and external systems that assist in acquiring, using, and controlling cash, funds, and other financial resources. The financial subsystems, discussed below, include financial forecasting, profit/loss and costing, and financial intelligence systems. Each subsystem interacts with the transaction processing system in a specialized, functionally oriented way, and has informational outputs that assist financial managers in making better decisions. The outputs are financial forecasts, management of funds reports, financial budgets and performance reports such as variance analysis used for control purposes.

FINANCIAL FORECASTING

Financial forecasting, the process of making predictions on the future growth of products or the organization as a whole, is based on projected business activity. For example, expected sales of goods and services can be converted into expected revenues and costs. The sales price per unit and production cost factors can be multiplied by the number of units expected to be sold in order to arrive at a forecasted value for revenues and costs. Fixed costs, such as insurance, rent, and office overhead, are estimated and used to determine expected net profits on a monthly, quarterly, or yearly basis. These estimates are then incorporated into the financial MIS. The financial forecasting subsystem relies on input from another functional subsystem (namely, the marketing forecasting system) to determine projected revenues.

Having an estimate of future cash flows can be one of the first steps for sound financial management. Financial managers and executives use this valuable information

to project future cash needs. For instance, an organization's managers will know in advance that in some months, additional cash might be required, while in other months excess cash will have to be invested. Improperly managed cash flow is one of the major causes of business failure and bankruptcy. Financial forecasting can help financial executives avoid cash-flow problems by predicting cash-flow needs.

PROFIT/LOSS AND COST SYSTEMS

Two specialized financial functional systems are profit/loss and cost systems. Revenue and expense data for various departments is captured by the transaction processing system (TPS) and becomes a primary internal source of financial information. Many departments within an organization are profit centers, which means they track total expenses, revenues, and net profits. An investment division of a large insurance or credit card company is an example of a profit center. Other departments may be revenue centers, which are divisions within the company that primarily track sales or revenues, such as a marketing or sales department. Still other departments may be cost centers, which are divisions within a company that do not directly generate revenue, such as manufacturing or research and development. These units incur costs with little or no revenues. Data on profit, revenue, and cost centers is gathered (mostly through the TPS but sometimes through other channels as well), summarized, and reported by the financial MIS.

FINANCIAL INTELLIGENCE

Financial intelligence is responsible for gathering data and information from stockholders, the financial community, and the government. Since the financial function controls the money flow through the firm, information is needed to expedite this flow. The day-to-day flow of money from customers and to vendors is controlled by the internal accounting subsystem. The financial intelligence subsystem is concerned with flows other than those involved in daily operations. This system seeks to identify the best sources of additional capital and the best investments of surplus funds.

Most of the information flows from the firm to the stockholders in the form of annual and quarterly reports. Stockholders have an opportunity to communicate information (complaints, suggestions, ideas, etc.) to the firm through the stockholder relations department. Also, once a year an annual stockholders meeting is held where stockholders can learn firsthand what the firm is doing. Very often, stockholders use these meetings as an opportunity to communicate directly with top management. Information gathered informally from stockholders is seldom entered into the computerized system, but it is disseminated by verbal communication and written memo to key executives in the firm.

The relationship between the firm and the financial community also receives attention from financial management. There should be a balanced flow of money through the firm, but this equilibrium is not always achieved. At times additional funds are needed or investments of surplus funds are desired. It is the responsibility of the financial intelligence subsystem to compile information on sources of funds and investment opportunities. An important indirect environmental effect influences this money flow through the firm. The federal government controls the money market of the

country through the Federal Reserve System. There are various means of releasing the controls to expedite the money flow and of tightening the controls to reduce the flow.

The firm therefore must gather information from both financial institutions and the Federal Reserve System. This information permits the firm to remain current on national monetary policies and trends and possibly to anticipate future changes. A variety of publications can be used for this purpose. They are prepared by both the financial institutions and the government. Two examples are the *Monthly Economic Letter* prepared by the City Bank of New York and the *Federal Reserve Bulletin* prepared by the Federal Reserve System.

In addition to the need to acquire funds, the firm frequently must invest surplus funds on either a short- or long-term basis. These funds can be invested in a number of different ways—in United States Treasury securities, commercial paper, or certificates of deposit (CDs). Since the terms and rates of return for some of these vary over time, it is necessary to monitor these investment opportunities continually so that the optimum ones can be used when needed.

Gathering information from the financial environment is the responsibility of the financial intelligence subsystem. As with the other two functional intelligence subsystems, the information is usually handled outside the computer system. This subsystem is one area where computer use could improve.

Two major financial dailies are worth mentioning as a great source of financial intelligence: the *Wall Street Journal (WSJ)* and *Investor's Business Daily (IBD)*. The WSJ contains news of happenings throughout the business community. It provides especially informative descriptions of the economic environment in which businesses operate. Simply by reading a periodical, such as the *WSJ,* you can keep up with many of the important environmental influences that shape a manager's decision strategy.

Each day the front page contains a "What's News" section in columns 2 and 3. The "Business and Finance" column offers a distillation of the day's major corporate, industrial, and economic news. The "World-Wide" column captures the day's domestic and international news developments. "Special Reports" appears in column 5 each day. On Monday, "The Outlook" provides an economic overview, analyzing the economy from every conceivable angle. On Tuesday, the "Labor Letter" addresses work news of all kinds—government policy, management, unions, labor relations, and personnel. Wednesday brings the "Tax Report," which alerts readers to new tax trends. The "Business Bulletin" appears each Thursday and tries to spot emerging trends. The idea is to make information available while managers can still act on it. Finally, every Friday brings the "Washington Wire," providing an interpretation of government policy and its possible impacts on business.

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Coverage of a wide variety of personal finance topics including investment ideas, and (6) Today's News Digest - 35 to 40 brief but important news items of the day.

FUNDS MANAGEMENT

Funds management is another critical function of the financial MIS. Companies that do not manage and use funds effectively produce lower profits or face possible bankruptcy. Outputs from the funds management subsystem, when combined with other aspects of the financial MIS, can locate serious cash-flow problems and help the company increase returns. Internal uses of funds include additional inventory, new plants and equipment, the acquisition of other companies, new computer systems, marketing and advertising, raw materials, and investments in new products. External uses of funds are typically investment related. On occasion, a company might have excess cash from sales that is placed into an external investment. Current profitability is only one important factor in predicting corporate success; current and future cash flows are also essential. In fact, it is possible for a profitable company to have a cash crisis; for example, a company with significant credit sales but a very long collection period may show a profit without actually having the cash from those sales.

Financial managers are responsible for planning how and when cash will be used and obtained. When planned expenditures require more cash than planned activities are likely to produce, financial managers must decide what to do. They may decide to obtain debt or equity funds or to dispose of some fixed assets or a whole business segment. Alternatively, they may decide to cut back on planned activities by modifying operational plans, such as ending a special advertising campaign or delaying new acquisitions, or to revise planned payments to financing sources, such as bondholders or stockholders. Whatever is decided, the financial manager's goal is to balance the cash available and the needs for cash over both the short and the long term.

Evaluating the statement of cash flows is essential if you are to appraise accurately an entity's cash flows from operating, investing, and financing activities and its liquidity and solvency positions. Inadequacy in cash flow has possible serious implications, including declining profitability, greater financial risk, and even possible bankruptcy.

Financial management also involves decisions relating to source of financing for, and use of financial resources within, an organization. Virtually all activities and decisions within an organization are reflected in financial information. One useful application of a real-time system to financial information involves inquiry processing. An on-line financial information system enables immediate response to inquiries concerning comparisons of current expenditure with budgeted expenditure, up-to-date calculations of profit center contribution, or information required for audit investigation.

The fund management subsystem can prepare a report showing cash flow for the next twelve-month period. The report can be printed by a mathematical model that uses the sales forecast plus expense projections as the basis for the calculation.

Another application of real-time systems to financial management which has great potential is the area of computer models for financial planning, which is discussed later.

FINANCIAL BUDGETING, PLANNING, AND CONTROL

More and more companies are developing computer-based models for financial planning and budgeting, using powerful, yet easy-to-use, financial modeling languages such as *Up Your Cash Flow* is illustrated later in the chapter. The models help not only build a budget for profit planning but answer a variety of "what-if" scenarios. The resultant calculations provide a basis for choice among alternatives under conditions of uncertainty. Furthermore, budget modeling can also be accomplished using spreadsheet programs such as Microsoft's *Excel*.

In this section we will illustrate the use of spreadsheet software such as *Excel* and stand-alone packages such as *Up Your Cash Flow* to develop a budget model. For illustrative purposes, we will present

(1) three examples of projecting an income statement
(2) forecasting financial distress with Z score
(3) forecasting external financing needs-the percent-of-sales method

EXAMPLE 1
　　Given:
　　　　Sales for 1st month = $60,000
　　　　Cost of sales = 42% of sales, all variable
　　　　Operating expenses = $10,000 fixed plus 5% of sales
　　　　Taxes = 30% of net income
　　　　Sales increase by 5% each month
　　(a) Based on this information, Figure 2 presents a spreadsheet for the contribution income　　statement for the next 12 months and in total.
　　(b) Figure 3 shows the same in assuming that sales increase by 10% and operating　　expenses= $10,000 plus 10% of sales. This is an example of "what-if" scenarios.

Figure 2

Projected Income Statement

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	PERCENT
Sales	$60,000	$63,000	$66,150	$69,458	$72,930	$76,577	$80,406	$84,426	$88,647	$93,080	$97,734	$102,620	$955,028	100%
Less: VC Cost of sales	$25,200	$26,460	$27,783	$29,172	$30,631	$32,162	$33,770	$35,459	$37,232	$39,093	$41,048	$43,101	$401,112	42%
Operating ex.	$3,000	$3,150	$3,308	$3,473	$3,647	$3,829	$4,020	$4,221	$4,432	$4,654	$4,887	$5,131	$47,751	5%
CM	$31,800	$33,390	$35,060	$36,812	$38,653	$40,586	$42,615	$44,746	$46,983	$49,332	$51,799	$54,389	$506,165	53%
Less: FC Op. expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$120,000	13%
Net income	$21,800	$23,390	$25,060	$26,812	$28,653	$30,586	$32,615	$34,746	$36,983	$39,332	$41,799	$44,389	$386,165	40%
Less: Tax	$6,540	$7,017	$7,518	$8,044	$8,596	$9,176	$9,785	$10,424	$11,095	$11,800	$12,540	$13,317	$115,849	12%
NI after tax	$15,260	$16,373	$17,542	$18,769	$20,057	$21,410	$22,831	$24,322	$25,888	$27,533	$29,259	$31,072	$270,315	28%

Figure 3

Projecting Income Statement

	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	PERCENT
Sales	$60,000	$66,000	$72,600	$79,860	$87,846	$96,631	$106,294	$116,923	$128,615	$141,477	$155,625	$171,187	$1,283,057	134%
Less: VC Cost of sales	$25,200	$27,720	$30,492	$33,541	$36,895	$40,585	$44,643	$49,108	$54,018	$59,420	$65,362	$71,899	$538,884	56%
Operating ex.	$6,000	$6,600	$7,260	$7,986	$8,785	$9,663	$10,629	$11,692	$12,862	$14,148	$15,562	$17,119	$64,153	7%
CM	$28,800	$31,680	$34,848	$38,333	$42,166	$46,383	$51,021	$56,123	$61,735	$67,909	$74,700	$82,170	$615,867	64%
Less: FC Op. expenses	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$120,000	13%
Net income	$18,800	$21,680	$24,848	$28,333	$32,166	$36,383	$41,021	$46,123	$51,735	$57,909	$64,700	$72,170	$495,867	52%
Less: Tax	$5,640	$6,504	$7,454	$8,500	$9,650	$10,915	$12,306	$13,837	$15,521	$17,373	$19,410	$21,651	$148,760	16%
NI after tax	$13,160	$15,176	$17,394	$19,833	$22,516	$25,468	$28,715	$32,286	$36,215	$40,536	$45,290	$50,519	$347,107	36%

EXAMPLE 2

Delta Gamma Company wishes to prepare a three-year projection of net income using the following information:

1. 2005 base year amounts are as follows:

Sales revenues	$4,500,000
Cost of sales	2,900,000
Selling and administrative expenses	800,000
Net income before taxes	800,000

2. Use the following assumptions:

• Sales revenues increase by 6% in 2006, 7% in 2007, and 8% in 2008.

• Cost of sales increase by 5% each year.

• Selling and administrative expenses increase only 1% in 2006and will remain at the 2006   level thereafter.

• The income tax rate = 46%

Figure 4 presents a spreadsheet for the income statement for the next three years.

Figure 4

Delta Gamma Company

Three-Year Income Projections (2005-2008)

	2005	2006	2007	2008
	-	-	-	-
Sales	$4,500,000	$4,770,000	$5,103,900	$5,512,212
Cost of sales	$2,900,000	$3,045,000	$3,197,250	$3,357,113
Gross margin	$1,600,000	$1,725,000	$1,906,650	$2,155,100
Selling & adm. exp.	$800,000	$808,000	$808,000	$808,000
Earnings before tax	$800,000	$917,000	$1,098,650	$1,347,100
Tax	$368,000	$421,820	$505,379	$619,666
Earnings after tax	$432,000	$495,180	$593,271	$727,434

EXAMPLE 3

Based on specific assumptions (see Figure 5), develop a budget using *Up Your Cash Flow* (Figure 6).

FIGURE 5

Category   **Assumptions**

Sales: alternative 1 from Book up your cash flow

Cost of goods sold: use 45% of sales

Advertising: 5% of sales

Automobile: Company has 4 autos @ 1500 ea.
4 × 1500 = 6000 ÷ 12 = 500 per month

Bad debts: maintain @ 2% of sales – I hope!

Business promotion: Prior year was 65000. 10% increase
equals $71500 ÷ 12

Collection costs: use 1000 per month

Continuing education: $1000 per month

Depreciation: $84,000 for year – use 7000 per month

Donations: $10,000 for year = ÷ 12

Insurance—general: agent said $24000; use 2000 per month

Insurance—group: 15 employees @ 1500 ea = 22500 ÷ 12 =
monthly #.

Insurance—life: 600 per month

Interest: expect to borrow 250M @ 15% = 37,500 ÷ 12
= 3125 per month + other borrowings.

Office supplies: 2% of sales – and keep it that please!

Rent: 4000 per month

Repairs and maintenance: use 400 per month

Salaries: schedule the payroll per month

Taxes and license: Prior years was 1.5% of sales use same
this year.

Taxes, payroll: 20% of monthly payroll

Telephone—utilities: $29000 last year. Use 33000 ÷ 12
Travel – use $1000 per month.

FIGURE 6

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Sales	$129,030	$129,030	$129,030	$129,030	$192,610	$192,610	$162,690	$129,030	$192,610	$129,030	$162,690	$192,610	$1,870,000
Cost of Sales @ 45%	58,063	58,063	58,063	58,063	86,675	86,675	73,211	58,063	86,675	58,063	73,211	86,675	841,500
Gross profit	70,967	70,967	70,967	70,967	105,935	105,935	89,479	70,967	105,935	70,967	89,479	105,935	1,028,500
Advertising @ 5%	6,450	6,450	6,450	6,450	9,600	9,600	8,100	6,450	9,600	6,450	8,100	10,050	93,750
Automobile	500	500	500	500	500	500	500	500	500	500	500	500	6,000
Bad debts @ 2%	2,580	2,580	2,580	2,580	3,840	3,840	3,240	2,580	3,840	2,580	3,240	3,920	37,400
Business promotions	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,958	5,962	71,500
Collection costs	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Continuing education	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Depreciation	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	84,000
Donations	833	833	833	833	833	833	833	833	833	833	833	837	10,000
Dues & subscriptions	833	833	833	833	833	833	833	833	833	833	833	837	10,000
Insurance—general	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	24,000
Insurance—group	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	22,500
Insurance—life	600	600	600	600	600	600	600	600	600	600	600	600	7,200
Interest	3,125	3,125	3,125	3,125	4,375	4,375	4,375	4,450	4,450	4,450	4,450	4,450	47,875
Legal & accounting	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Office supplies @ 2%	2,580	2,580	2,580	2,580	3,840	3,840	3,240	2,580	3,840	2,580	3,240	3,920	37,400
Rent	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	48,000
Repairs	400	400	400	400	400	400	400	400	400	400	400	400	4,800
Salaries	21,000	21,000	21,000	21,000	21,000	21,000	24,833	24,833	24,833	24,833	24,833	24,835	275,000
Taxes & license @ 1.5%	1,935	1,935	1,935	1,935	2,880	2,880	2,430	1,935	2,880	1,935	2,430	2,890	28,000
Taxes, payroll	4,200	4,200	4,200	4,200	4,200	4,200	4,966	4,966	4,966	4,966	4,966	4,970	55,000
Telephone—utilities	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	33,000
Travel	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Profit	$(1,652)	$(1,652)	$(1,652)	$(1,652)	$25,451	$25,451	$7,546	$(7,576)	$20,777	$(7,576)	$7,471	$20,139	$85,075

A budget is a tool for both planning and control. At the beginning of the period, the budget is a plan or standard; at the end of the period it serves as a control device to help management measure its performance against the plan so that future performance may be improved. Each month, each manager with budget responsibilities receives a report showing actual expenditures compared with the budget and figures and appropriate variances, so that unusual variances need to be addressed and properly rewarded or penalized.

In addition to the budget, the financial control system generates a number of *performance measures or ratios* that enable managers on all levels to compare their performance with benchmarks such as standards or targets. There are quite a few financial or operational ratios. A couple of ratios are given as an example. One popular ratio is the *current ratio* which measures a firm's ability to pay short-term bills.

$$\text{Current ratio} = \left(\frac{\text{Current assets}}{\text{Current liabilities}} \right)$$

Another popular ratio is the *debt ratio* which reveals the amount of money a company owes to its creditors. Excessive debt means greater risk to the company.

The debt ratio is:

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}}$$

FORECASTING FINANCIAL DISTRESS WITH Z SCORE

There has been an increasing number of bankruptcies. Will your company go bankrupt? Will your major customers or suppliers go bankrupt? What warning signs exist and what can be done to avoid corporate failure?

Prediction models can help in a number of ways: In merger analysis, it can help to identify potential problems with a merger candidate. Bankers and other business concerns can use it to determine whether or not to give a new loan (credit) or extend the old one. Investors can use it to screen out stocks of companies which are potentially risky. Internal auditors can use such a model to assess the financial health of the company. Those investing in or extending credit to a company may sue for losses incurred. The model can help as evidence in a lawsuit.

Financial managers, investment bankers, financial analysts, security analysts and auditors have been using early warning systems to detect the likelihood of bankruptcy. But their system is primarily based on financial ratios of one type or the other as an indication of financial strength of a company. Each ratio (or set of ratios) is examined independent of others. Plus, it is up to the professional judgment of a financial analyst to decide what the ratios are really telling.

To overcome the shortcomings of financial ratio analysis, it is necessary to combine mutually exclusive ratios into a group to develop a meaningful predictive model. Regression analysis and multiple discriminant analysis (MDA) are two statistical techniques that have been used thus far.

Z-SCORE MODEL

This section describes the Z-score predictive model which uses a combination of several financial ratios to predict the likelihood of future bankruptcy. Altman developed a bankruptcy prediction model that produces a Z score as follows:

$$Z = 1.2*X1 + 1.4*X2 + 3.3*X3 + 0.6*X4 + 0.999*X5$$

where
   X1 = Working capital/Total assets
   X2 = Retained earnings/Total assets
   X3 = Earnings before interest and taxes (EBIT)/Total assets
   X4 = Market value of equity/Book value of debt (Net worth for privately-held firms)
   X5 = Sales/Total assets

Altman established the following guideline for classifying firms:

Z score	Probability of failure
1.8 or less	Very high
3.0 or higher	Unlikely
1.81 - 2.99	Not sure

 The Z score is known to be about 90 percent accurate in forecasting business failure one year in the future and about 80 percent accurate in forecasting it two years in the future. There are more updated versions of Altman's model.

MORE APPLICATIONS OF THE Z SCORE

Various groups of business people can take advantage of this tool for their own purposes. For example,

   1. *Merger analysis*. The Z score can help identify potential problems with a merger candidate.
   2. *Loan credit analysis*. Bankers and lenders can use it to determine if they should extend a loan. Other creditors such as vendors have used it to determine whether to extend credit.
   3. *Investment analysis*. The Z score model can help an investor in selecting stocks of potentially troubled companies.
   4. *Auditing analysis*. Internal auditors are able to use this technique to assess whether the company will continue as a going concern.
   5. *Legal analysis*. Those investing or giving credit to your company may sue for losses incurred. The Z score can help in your company's defense.

FORECASTING EXTERNAL FINANCING NEEDS-THE PERCENT-OF-SALES METHOD

Percentage of sales is the most widely used method for projecting the company's financing needs. Financial officers need to determine the next year's fund requirements,

the portion of which has to be raised externally. This way they can have a head start for arranging a least-cost financing plan.

This method involves estimating the various expenses, assets, and liabilities for a future period as a percent of the sales forecast and then using these percentages, together with the projected sales, to construct pro forma balance sheets.

Basically, forecasts of future sales and their related expenses provide the firm with the information needed to project its future needs for financing.

The basic steps in projecting financing needs are:

1. Project the firm's sales. The sales forecast is the initial most important step. Most other forecasts (budgets) follow the sales forecast.

2. Project additional variables such as expenses.

3. Estimate the level of investment in current and fixed assets that are required to support the projected sales.

4. Calculate the firm's financing needs.

The following example illustrates how to develop a pro forma balance sheet and determine the amount of external financing needed.

EXAMPLE 5

Assume that sales for 20X0 = $20, projected sales for 20X1 = $24, net income = 5% of sales, and the dividend payout ratio = 40%.

The steps for the computations are outlined as follows:

Step 1. Express those balance sheet items that vary directly with sales as a percentage of sales. Any item such as long-term debt that does not vary directly with sales is designated "n.a." or "not applicable."

Step 2. Multiply these percentages by the 20X1 projected sales = $2.4 to obtain the projected amounts as shown in the last column.

Step 3. Simply insert figures for long-term debt, common stock and paid-in-capital from the 20X0 balance sheet.

Step 4. Compute 20X1 retained earnings as shown in (b).

Step 5. Sum the asset accounts, obtaining total projected assets of $7.2, and also add the projected liabilities and equity to obtain $7.12, the total financing provided. Since liabilities and equity must total $7.2, but only $7.12 is projected, we have a shortfall of $0.08 "external financing needed."

Figure 9 presents the projected balance sheet.

The major advantage of the percent-of-sales method of financial forecasting is that it is simple and inexpensive to use. To obtain a more precise projection of the firm's future financing needs, however, the preparation of a cash budget is required. One important assumption behind the use of the method is that the firm is operating at full capacity. This means that the company has no sufficient productive capacity to absorb a projected increase in sales and thus requires additional investment in assets.

FIGURE 9
Pro Forma Balance Sheet
(in Millions of Dollars)

	Present (20x0)	% of Sales (20x0 Sales=$20)	Projected (20x1 Sales=$24)	
ASSETS				
Current assets	2	10	2.4	
Fixed assets	4	20	4.8	
Total assets	6		7.2	
LIABILITIES AND STOCKHOLDERS' EQUITY				
Current liabilities	2	10	2.4	
Long-term debt	2.5	n.a.	2.5	
Total liabilities	4.5		4.9	
Common stock	0.1	n.a.	0.1	
Paid-in-Capital	0.2	n.a.	0.2	
Retained earnings	1.2		1.92 (a)	
Total equity	1.5		2.22	
Total liabilities and stockholders' equity	6		7.12	Total financing needed
			0.08 (b)	
			7.2	Total

(a) 20x2 retained earnings = 20x1 retained earnings + projected net income
-cash dividends paid
$$=\$1.2+5\%(\$24)-40\%[5\%(\$24)]$$
$$=\$1.2+\$1.2-\$0.48=\$2.4-\$0.48=\$1.92$$

(b) External financing needed=projected total assets - (projected total
liabilities projected equity)
$$=\$7.2-(\$4.9+\$2.22)=\$7.2-\$7.12=\$0.08$$

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FINANCIAL ANALYSIS WITH SPREADSHEETS

Companies whether large or small, profit-oriented or nonprofit, employing one hundred or ten thousand, etc., live or die by the extent of their powers in financial planning. There are other important contributing factors to success in business, but nothing can send a company into the abyss of Chapter 11 bankruptcy faster than a few major ill-fated financial decisions. Financial analysis is employed in an effort to be a bit more scientific about coming to a good financial decision. Questions must be asked about the company—accurate answers found—to gain insight that will assist in determining the most prudent use of precious resources for some period in the future. The questions stem from numerous aspects of the business. Some are straightforward and easily answered: Are profits greater this year than last? Other questions are not as easily answered: Will an increase in advertising expenditures lead to increased profits? Would a price cut be more appropriate? Would some combination of the two be best?

Spreadsheet programs are ideally suited for performing financial analyses because they possess the capacity to hold and process complex formulas and functions while at the same time making modification and manipulation of one or more variables or functions an easy operation. With a micro, software, and some training and practice, you can master rather complex financial analysis techniques.

FINANCIAL RATIO ANALYSIS

Financial ratio analysis is a means of determining how well the business is performing. Problem spots can be identified, and groundwork is established for predictions and projections of future performance. The types of questions addressed include

· How well is the business doing?
· Where are its strengths?
· What are its weaknesses?
· How does the firm rate vis-à-vis other similar firms in the industry?

A checklist of relevant factors for consideration in critiquing the performance of the firm follows.

· Profitability ratios
· Liquidity ratios
· Valuation ratios
· Efficiency of asset use
· Growth ratios
· Use of debt capital

These ratios are not necessarily useful in and of themselves. To give them relevance, the financial manager should calculate these same ratios for several different periods so they can be compared and trends can be identified. They also can be compared to industry norms to see how the firm measures up.

The numbers with which these ratios are calculated come from the balance sheet and income statement for a given period. Simple formulas are entered onto the spreadsheet, which accesses the two financial statements (assuming that they, too, are on the spreadsheet) to obtain the pertinent figures, perform the necessary computations, and come up with the appropriate ratios. If the financial statements of the period for which ratios are being prepared are not contained on the spreadsheet, the pertinent figures can be manually entered to the appropriate spreadsheet cells with relative ease. If ratios are desired for a number of past periods for which only hard copies of their financial statements exist, the financial manager enters the figures for a period in the aforementioned manner, has the spreadsheet calculate the results, and then prints the results to obtain a hard copy for later comparison. You then move on to the financial statements of the next period to be analyzed, entering those figures to the spreadsheet for computation.

MAXIMUM VERSUS MINIMUM PROFITS

Accounting systems are the creations of men, and although they are usually thought of as cold and objective, they can be manipulated to arrive at different results for different purposes and based on different philosophies. The most obvious example is accounting used on one hand to increase and maximize profits in order to look good to outsiders, while on the other hand accounting is used to minimize profits for tax purposes. It is not uncommon for a company to maintain two (sometimes even more) sets of accounting records—one for each purpose. Spreadsheets can perform many functions to assist in determination of the two different bottom lines. This includes the actual production of the two opposing income statements. Basically, any calculation you might perform on paper in arriving at the two figures can be set up and performed on the spreadsheet. Also, certain calculation routines on the spreadsheet can obtain required figures from cells on the spreadsheet that contain the results of other calculations, thus avoiding repetitive entries. All of these numbers and computations should interact and funnel down to their appropriate final position in the different income statements.

PLANNING AND FORECASTING

Once you enter the realm of the future for the business through forecasting and planning, the power of a spreadsheet or integrated program can really pay off. Performing repeated "what-if" calculations is the essence of forecasting—and the electronic worksheet's specialty.

Checklist of Possible Planning and Forecasting Questions
- What will the projected profit and cash flows be, based on current operational plans?
- If the financial manager proceeds with present plans, how will it affect the company's current and fixed assets?
- What levels of expenditures are needed to increase current and fixed assets?
- What will be the additional cash requirements of the business if present plans are followed?

- What is the break-even point?
- In what areas is the firm strong and how can such strengths be maximized?
- Where is the company weak and what can be done to improve?
- What are "what-if" scenarios and their impact on profit, breakeven point, cash flow, assets required, return on assets, funding required, working capital, etc?

In performing ratio analysis, you scrutinize historical data to gain insight on things that have already occurred. In forecasting and planning on the other hand, you are creating a picture of future events if present plans are followed; you predict how future financial statements will appear.

Before embarking on this process, work with the staff to develop the best guesses possible about future market conditions, market share, net sales, and so forth. These predictions are combined with present conditions to create a model on the spreadsheet for future company performance. The methods are rather straightforward and easy to master. For example, one part of the spreadsheet would multiply current net sales by the estimated percentage of market sales increase (or decrease) to arrive at next year's projected net sales. Running the program again at this point would yield projected net sales for year 2 of the forecast (or perhaps the formula could be set up to automatically provide projected net sales in year 5 immediately, etc.); changes in the firm's market share would also be programmed in if they were anticipated.

If you change one or more figures, percentages, and so forth, the spreadsheet will provide new results for all items affected.

SHORT-TERM DECISIONS
The short-term decisions that businesses make are usually more or less involved with working capital. The types of issues addressed include:

- What is a safe minimum cash balance for the firm?
- How much does the cash flow fluctuate seasonally?
- When do these seasonal fluctuations occur?
- What are the temporary seasonal, working-capital borrowing requirements versus borrowing for more permanent items?
- The needs to increase inventory: how much should your company borrow?
- When is the best time for this borrowing to occur?
- When would it benefit most to pay it back?
- What is the cost of capital?
- What would be the effect on revenues and profit of a change in the firm's credit terms?
- What is the amount lost if the company does not avail itself of all discounts offered by suppliers for expeditious payment?

The following financial ratios are useful in determining the status of the firm, and in rating the financial manager's working capital decisions:

- Current ratio
- Quick ratio
- Net working capital
- Accounts receivable turnover
- Inventory turnover
- Sales to working capital
- Sales to fixed assets

The computations of these ratios are easily set up and performed on a spreadsheet program. A spreadsheet can also be used to generate a cash budget for determining the requirements, timing, and character of cash sought; and for analyzing the effects of credit terms as a component of the marketing mix through analysis of the following factors:

- Present sales
- Change in sales attributable to changes in credit terms
- Gross margin
- Potential effect on bad debts
- Credit terms on increase in sales
- Cost of short-term borrowing

Spreadsheets are also ideal for calculating interest received or extended in any of various credit situations, such as past due accounts receivable and missed discounts.

LONG-TERM ASSET DECISIONS

Long-term asset decisions by their very nature are encountered less frequently than the types of working capital decisions previously discussed. Issues encountered include:

- Does this particular fixed-asset purchase decision make sense and seem appropriate?
- Which of several proposals seem the most advantageous?
- Should the firm buy this item at all, or would it be better to make it?
- Based on several proposals, which should be the priority purchase if funds are limited?

Spreadsheet programs can be very helpful in answering these types of questions. One of their most useful abilities in this particular area is that of calculating present values (or the time value of money). They all have the net present value (NPV) function built in for convenience and efficiency. By calculating the NPV of two or more long-term fixed-asset options, the more advantageous option becomes evident: the highest NPV is the most profitable. Thus, use of a spreadsheet program for calculating

NPV can render fixed-asset decision making a more straightforward and less difficult process.

LONG-TERM FINANCING DECISIONS

The third major financial decision type is that of long-term financing. The types of issues addressed include:

- The lease or buy decision
- Debt versus equity as a means of raising capital
- Safe debt limitations and sources of financing

The lease-or-buy decision can involve the following:

- Production equipment
- Motor vehicles
- Buildings
- Office equipment
- Computers
- Tools

A spreadsheet can be used to determine the net cash outflow associated with leasing versus buying a given item. This can help in making the best decision, since the lower present value of net cash outflow of the two given options is the cheaper one. When deciding on the use of debt versus equity financing, the financial manager can set up formulas in the spreadsheet to show the effects of each option on the following:

- Cash flow
- Net income
- Degree of company solvency
- Company value
- Debt capacity

This is accomplished by projecting certain elements of the balance sheet and income statement, as well as certain financial ratios for each alternative. By analyzing the results and determining which alternative yields the highest earnings per share—and considering other factors such as if the debt ratio is acceptable—you arrive at the optimum alternative.

POPULAR BUDGETING AND PLANNING SOFTWARE

In addition to specialized budgeting and financial modeling software discussed previously, there are a variety of computer software designed specifically for budgeting and *Decision Support Systems (DSS)* software. Some are *stand-alone* packages, others are *templates*, and still others are spreadsheet *add-ins*.

Adaytum Planning

Adaytum Planning by Adaytum Software (**www.adaytum.com)** (1-800-262-4445) is a multi-user budgeting, planning, and forecasting system. It gives you the flexibility to:

- Update hierarchies directly from General Ledger (G/L).
- Combine top-down planning with bottom-up budgeting
- Make last minute changes to model structure
- Empower end-users to do ad hoc modeling without information system (IS) support.

Budget Maestro v5.8

Centage's Budget Maestro (www.centage.com) is probably the best answer to distributed budgeting, strategic planning and financial control. Budget Maestro shortens your budgeting cycle and puts you into control of the process. Its information-driven environment guides you through budgeting, planning, modeling, forecasting, resource management, consolidation, analysis, and reporting. CFOs and budget managers can plan, analyze and manage, in ways never before possible. Look at a user's screen and make changes directly without ever being there. Deliver budget models and deploy reconfigured software updates to many users at once. Plus manage budgetary information, even enterprise wide information systems, with a single consistent interface. Budget Maestro is designed to put CFOs and financial managers in control of all aspects of managing budgets, creating financial models and building and deploying financial plans. Budget Maestro allows business managers unparalleled flexibility in analyzing cash flow and business performance throughout the enterprise. Budget Maestro significantly shortens your budgeting and planning cycles. It eliminates rekeying and formatting of data. It increases your data accuracy and integrity. It allows your time to manage and analyze your business. It is an excellent tool that provides you the ability to perform:

- Budgeting
- Forecasting; rolling forecasts
- Planning
- What-if scenario building
- Payroll and Benefits Management
- Headcount Planning
- Capital Asset Planning
- Debt Management
- Automatic data consolidation
- Management Reports
- Extensive drill-down Reporting
- Income Statement, Balance Sheet & Statement of Cash Flows

As an alternative to spreadsheets, Budget Maestro automates many of the complex and repetitive tasks in the budgeting process while eliminating the need for creating complicated formulas and manual consolidation of multiple worksheets.

Budget Maestro offers three editions:

Desktop Edition - A single user license that is ideal for the CEO, CFO or Controller of small to mid-sized organizations that have a centralized budgeting and planning process.

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Small Business Edition - This edition supports up to 3 users operating in a collaborative environment to generate budgets, forecasts and financial reports.
Enterprise Edition - An enterprise-wide application for use by finance executives and departmental/line managers to foster a more collaborative and participatory planning environment.

Microsoft Business Solutions for Analytics—Forecaster
This is Web-based budgeting and planning solution from FRx Software (www.frxsoftware.com/). Many organizations find it difficult to perform the ongoing budgeting and planning processes necessary to keep business performance on target. Financial "surprises" are met with panic, and more often than not, companies are forced to make sacrifices in places they cannot afford. The result is a direct, negative impact on their strategic objectives. But it's not for lack of trying. Finance departments simply don't have the time it takes to combine multiple spreadsheets submitted from across the company (Let alone the resources to make sure all line managers understand the importance of the budgeting and planning process, and of submitting well-planned information on time!). *Forecaster* puts the systems and processes in place to help you immediately realize the benefits of an effective budgeting and planning process, and make it an ongoing part of your business strategy.

Host Budget V3.2
(www.hostanalytics.com) Host Budget is an integrated budgeting and planning software that provides streamlined budgeting, forecasting, reporting, and analysis. Modules are used to automatically manage, consolidate, and change information for planning and replanning. These budgeting, forecasting, and planning modules include:
- Integration with Host's Performance Measurement Scorecard
- SG&A Budget module
- Human Resources Budget module
- Sales and Operation Planning (S&OP) module
- Sales Forecasting module
- Capital Expenditure Budget module and others

Host Budget is architected for the Web so that the individuals involved in budgeting and planning can use all of the features. All that is needed by the user is a web browser to access and update the application. Microsoft Excel spreadsheets can be used "on-line" or "live" to the database for queries and updates. Or, if the user prefers to work disconnected from the central database the user can work "off-line" and easily upload the Excel file later or submit via email.

Because of the streamlined effects of Host Budget on an organization's budgeting process, budgets and forecasts can be refined on an ongoing basis. Managers can consider what has happened so far and can regularly look into the future aided by actual versus budgeted information along with current forecast projections in their effort to meet financial goals.
Executive Managers can create top down budgets and "push down" the budget to lower levels of the organization. Line managers and department heads can create budgets from the bottom up and submit budgets for approval.

Continuous rolling forecasts can easily be created with Host Forecaster and bi-directional data integration allows the detailed budgets to be loaded to or from other applications.

Based on best practices, Host Forecaster provides a rich set of tools to facilitate sales forecasting using standard methods including:

- Statistical forecasting.
- Top down forecasting allocated to the SKU level based on prior year history, current estimate, last two years average sales, and other basis.
- Bottom up forecasting for product introductions and discontinued products.
- Ability to smooth forecasts to eliminate the impact of infrequent sales events.

SRC Systems

SRC Budgeting
Balancing flexibility and control, sophistication and ease-of-use, SRC Budgeting (www.srcsoftware.com) provides the tools you need to create and execute detailed budgets—transforming strategic goals into operational plans. SRC Budgeting not only simplifies the budgeting process, but also streamlines the sharing of data with key managers. The result is: Greater accuracy, enhanced accountability, and increased ownership by business units—all while dramatically reducing the time required for the planning process.
The benefits are:

- Increase collaboration while streamlining the budget process.
- Model budgets to fit your business.
- Align budgets with strategic plans and forecasts.
- Create flexible and sophisticated budgets.

SRC Sales Planning
With SRC Sales Planning, all deals can be tracked—not just the hot ones—and sales managers can adjust focus, training, and incentives to increase sales. Greater visibility into how leads play out at various points in the sales pipeline improves management decision-making ability. Understand which leads are working and which ones are not. Understand which products and services are in demand, identify and investigate changes and fluctuations, and take appropriate action—whether it means realigning the sales force or adjusting production and distribution.
The benefits are:

- Create a robust sales forecast.
- Make more accurate and timely planning decisions.
- Align sales, supply chain, and operations.

SRC Forecasting
This system allows you to create timely, high-level, dimensionally independent rolling forecasts—driven by the strategic plan—and translated into operational targets. SRC Forecasting streamlines and speeds the forecasting cycle, leverages a sophisticated and customizable modeling process, and helps ensure organizational alignment.
The benefits are:

- Streamline financial forecasting

- Customize and model forecasts for accurate planning
- Align forecasts with detailed budgets.

THE LATEST GENERATION OF BUDGETING AND PLANNING (B&P) SOFTWARE

The new budgeting and planning (B&P) software represents a giant step forward for accountants. Finance managers can use these robust, Web-enabled programs to scan a wide range of data, radically speed up the planning process, and identify managers who have failed to submit budgets. More often known as *active financial planning software,* this software includes applications and the new level of functionality that combine budgeting, forecasting analytics, business intelligence, and collaboration. Figure 10 lists popular B&P software.

FIGURE 10
ACTIVE FINANCIAL PLANNING SOFTWARE—
NEXT GENERATION BUDGETING AND PLANNING (B & P) SOFTWARE

Companies	Websites	Software
ABC Technologies	www.abctech.com	Oros
ActiveStrategy	www.activestrategy.com	ActiveStrategy Enterprise
Actuate	www.actuate.com	e.Reporting Suite
Adaytum Software	www.adaytum.com	e.Planning
Applix	www.applix.com	iPlanning, iTM1
Brio Technology	www.brio.com	Brio.ONE, Brio.Impact, Brio.Inform
Business Objects	www.businessobjects.com	e-BI, BusinessObjects Auditor, BusinessObjects BW Connect, WebIntelligence
Cartesis	www.cartesis.com	Cartesis Budget Planning, Cartesis Carat, Cartesis Magnitude
Closedloop Solutions	www.closedloopsolutions.com	CBizPlan Manager, SpendCapManager, TopLine Manager
Cognos	www.cognos.com	Cognos Finance, Cognos Visualizer, Cognos Enterprise, Business Intelligence
Comshare	www.comshare.com	Management Planning and Control (MPC) Application, Comshare Decision
CorVu	www.corvu.com	CorManage, CorVu Rapid Scorecard, CorBusiness, CorPortfolio
E.Intelligence	www.eintelligence-inc.com	e.Intelligence Suite
Epicor	www.epicor.com	Epicor eIntelligence Suite
Geac	www.geac.com	Geac Smartstream Financials, Enterprise Solutions Expert Series, FRx
Great Plains Software	www.greatplains.com	eEnterprise, FRx Budget Controller, Dynamics
Hyperion	www.hyperion.com	Hyperion Financial Management, Hyperion Planning, Hyperion Essbase
J.D. Edwards	www.jdedwards.com	J.D. Edwards Financial Planning and Budgeting, Business Intelligence, OneWorld Xe
Lawson Software	www.lawson.com	Enterprise Budgeting SEA Applications – including E-Scorecard; Analytic Extensions
Longview Solutions	www.longview.com	Khalix
MIS-AG	www.misag.com	MIS Alea Decisionware, MIS DelaMiner, Collaborative Analytic Processing
NextStrat	www.nextstrat.com	NextStrat Strategic Implementation Portal (NextSIP)
Oracle	www.oracle.com	Oracle Strategic Enterprise Management (SEM)
OutlookSoft	www.outlooksoft.com	OutlookSoft Financial Planning and Analysis (FPA), OutlookSoft Enterprise Analytic Portal
PeopleSoft	www.peoplesoft.com	Enterprise Performance Management (EPM), PeopleSoft Balanced Scorecard, PeopleSoft Enterprise Warehouse, PeopleSoft eBusiness Analytics, PeopleSoft Activity-Based Management
SAP	www.sap.com	SAP Strategic Enterprise Management (SEM), SAP Financial Analyzer Business Intelligence with mySAP.com
SAS Institute	www.sas.com	SAS Total Financial Management, Strategic Vision, SAS/Warehouse Administrator, SAS Enabling Technology (OLAP)
Silvon	www.silvon.com	Stratum
SRC Software	www.srcsoftware.com	Budget Advisor, Payroll Planner, Information Advisor

CHAPTER 11 QUIZ

1. A financial management system that allocates funds to specific assets and allows the financial manager to make decisions regarding the mix and type of assets to acquire is:
    A. Financial analysis and planning
    B. Investment decisions
    C. Financial and capital structure decisions
    D. Management of financial resources

2. A predictive model that uses a combination of several financial ratios to predict the likelihood of future bankruptcy is:
    A. Quick ratio
    B. Current ratio
    C. Z-score
    D. Debt ratio

3. Applications of the Z-score other than predicting a firm's insolvency can include all the following except:
    A. Merger analysis
    B. Accelerated cost recovery systems (ACRS)
    C. Loan credit analysis
    D. Investment analysis

4. An example of a long-term investment decision is:
    A. What is a safe minimum cash balance for a firm?
    B. Where do the seasonal fluctuations occur?
    C. When should a firm lease or buy capital assets?
    D. What is the cost of capital?

5. Software designed to develop a budget model is.
    A. SPSS
    B. @RISK
    C. LINDO
    D. Up Your Cash Flow

CHAPTER 11 ANSWER KEY

1. (B) is correct. Investment decisions involve decisions regarding the mix and type of assets to acquire.

(A) is incorrect. Financial analysis and planning evaluates historical and current financial activities.

(C) is incorrect. Financial and capital structure decisions project future financial needs and future activities for raising funds on favorable terms.

(D) is incorrect. Management of financial resources is monitoring and controlling the use of funds over time and managing cash, receivables and inventory.

2. (C) is correct. Z-score is a predictive model that uses a combination of several financial ratios to predict the likelihood of future bankruptcy.

(A) is incorrect. Quick ratio measures a firm's current assets and liabilities

(B) is incorrect. Current ratio measures a firm's current ability to pay short-term bills.

(D) is incorrect. Debt ratio reveals the amount of money a company owes to its creditors.

3. (B) is correct. Modified Accelerated cost recovery systems (MACRS) is a way to depreciate an asset.

(A) is incorrect. Merger analysis helps identify potential problems with a merger candidate.

(C) is incorrect. Loan credit analysis is used by bankers and lenders to determine if they should extend a loan or issue credit.

(D) is incorrect. Investment analysis helps an investor in selecting stocks from potentially troubled companies.

4. (C) is correct. "When should a firm lease or buy capital assets?" is an example of a long-term financial and investment decision.

(A) is incorrect. "What is a safe minimum cash balance for a firm" is a short-term working capital decision.

(B) is incorrect. "Where do the seasonal fluctuations occur" is a short-term financing decision.

(D) is incorrect. "What is the cost of capital" is a long-term financing decision.

5. (B) is correct. Up Your Cash Flow is a program that generates cash flow and profit and loss forecasts and detailed sales by product and line.

(A) is incorrect. SPSS is a statistical package for social scientists.

(C) is incorrect. @RISK is risk analysis software

(D) is incorrect. LINDO is a linear programming package.

CHAPTER 12

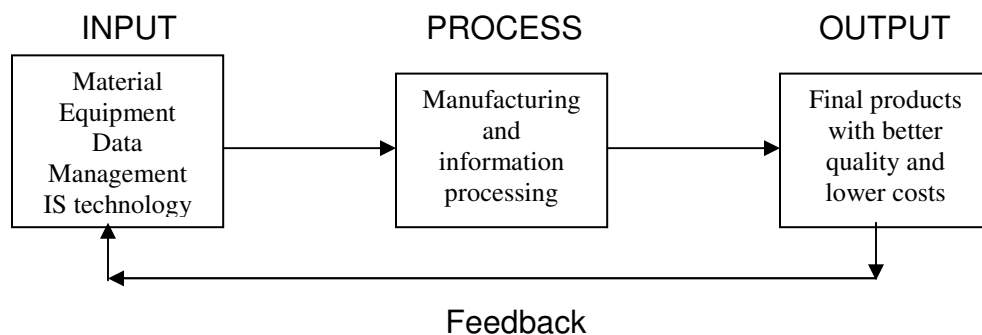## MANUFACTURING INFORMATION SYSTEMS AND PACKAGES

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Give examples of the models of the manufacturing information systems.
2. Utilize product engineering.
3. Implement a plan for facility design and scheduling.
4. Initiate a process for quality control.
5. Review and utilize manufacturing intelligence.
6. Initiate production planning.
7. Develop a system for production control.
8. Institute inventory planning and control.
9. Explain the use of Just-In-Time (JIT).
10. Establish a process of quality control and Total Quality Management (TQM).
11. Explain and give examples of Flexible Manufacturing Systems (FMSs).

Manufacturing is a broad and complicated subject. With different products manufactured, the processes and operations may be totally different. The mission of a manufacturing information system is to apply computer technology to improve the process and the efficiency of a manufacturing system so that the quality of products is better and the costs to manufacture them are lower. In other words, a manufacturing system is a system which takes material, equipment, data, management and information systems technology as the input and uses manufacturing and information processing to generate better final products as output (see Figure 1).

FIGURE 1
THE MODEL OF A MANUFACTURING INFORMATION SYSTEMS

INPUT | PROCESS | OUTPUT

Material Equipment Data Management IS technology → Manufacturing and information processing → Final products with better quality and lower costs

Feedback

Manufacturing consists of many different disciplinary areas including product engineering, facility design and scheduling, fabrication, and quality control management. Each of them can be dramatically improved by using information systems.

PRODUCT ENGINEERING

Product engineering is the starting point of the manufacturing process. It is the step in which the design and technical specifications for the product are finalized. Recently, product design and engineering are becoming more computerized through computer software packages such as Computer Aided Design (CAD) and Computer-Aided Manufacturing (CAM). With CAD, product designers use technologies to design a prototype of the product, test this product, and modify the design on the computer before it goes into production. The initial design can be input to the CAD system in various ways, including drawing sketches on a digital tablet, using a digital camera, or even a scanner to digitize photographs or pictures into the system. After the product is digitized, the design can then be simulated, tested under real world conditions, which have been predefined by the designer. As changes are suggested, the original design can be modified—similar to editing a letter on a word processing package. In addition, Artificial Intelligence (AI) has also been used in a CAD system. Artificial intelligent agents can help human designers make changes, suggestions or do tests based on different circumstances.

After the product has been designed, another important issue is how to produce this product efficiently and effectively. Designing products for easy and cheap assembly is critical since assembly often accounts for over half of the total manufacturing costs. For example, by reducing the number of components by 30%, a manufacturer can drastically cut manual assembly times and manufacturing costs. Large corporations such as IBM, GM, FORD, HP and GE have sophisticated product designs, which reflect how this product should be functioning as well as how it should be manufactured efficiently and economically.

FACILITY DESIGN AND SCHEDULING

After the product is designed, the facility or equipment used to produce the designed product should be arranged. This decision may be as simple as changing several tools or as complex as redesigning the entire plant. Some computer software packages can also arrange the plant layout based on the production information of the designed product. Many of the layout algorithms proposed use an improvement approach, a construction approach or a simulation approach.

- **Improvement approach:**

This approach requires users to specify initial conditions and parameters. A combinatorial-based approach will then be applied to improve the initial layout. This process is usually done by intelligent-search techniques to try numerous alternatives in order to find the best possible solution. For example, machine A can switch with machine B and see the effects of the manufacturing process.

- **Construction Approach:**

This approach builds one or more layout solutions from scratch with or without user's initial suggestions. The best one will then be selected.

- **Simulation**:
  Monte Carlo simulation has also been used to solve facility layout problems. This approach simulates the real production environment based on the assumption provided by the designer. This process requires lots of computer resources and time to generate good results.

FABRICATION

Fabrication or manufacturing is the process of making new products from raw materials. There are two types of production methods: 1. Job Shop production and 2. Process production.

- **Job-Shop production**
  Each work order is considered a job. Raw materials required to process the work order are routed to work centers depending on the production step required. The job shop is more flexible in terms of the products that can be produced. Therefore, a variety of products can be produced at the same time. Today, many computer software packages are able to generate a job shop schedule using mathematical programming or artificial intelligence technologies.

- **Flow-Shop production.**
  One or a few products travel through a set of fabrication activities specially arranged for the particular products. In this approach, we have repetitive manufacturing (e.g. automobile assembly line) and process industries such as oil refinery in which no significant stoppage in the flow of materials is evidenced, and flow rate becomes the critical decision. The layout of the assembly line and the flow rate can be determined by expert systems with the rule base retrieved from many manufacturing experts.

QUALITY CONTROL MANAGEMENT

Quality control relates to activities that ensure that the final product is of satisfactory quality. The quality control function is concerned with detecting existing quality deficiencies and preventing future product quality problems. If the quantity produced is small and the final product is expensive, all products are inspected for quality control. However, if the units produced is in a large quantity and inexpensive such as pencils and diskettes, a statistical sample will be used to determine if the quality of this lot of products is acceptable. Total quality management (TQM) is a quality revolution taking place in recent years. It consists of five principles:

- Customer focused: all efforts should be based on customers including external customers and internal customers such as accounting department in this company.

- Continuous improvement: TQM does not believe quality can be attained completely. Quality can always be improved.
- Everything TQM: TQM includes everything which the company produces such as a product, a service or how a customer service call is answered.
- Accurate measurement: TQM uses statistical techniques to measure all critical variables available and compares against benchmarks to identify problems.
- Empowerment of employee: TQM involves everyone in the company to improve quality. Teamwork is heavily emphasized in the TQM process.

TQM represents a counterpoint of traditional management theories that emphasizes cost reduction over anything else. The American auto industry represents a classic case of what can go wrong when attention is focused on trying to keep the cost down to improve productivity without good quality management. As the matter of fact, the productivity goes down, when defects, recalls and expensive repair of defect products were factored in.

MANUFACTURING INTELLIGENCE

Expert Systems in Manufacturing

Expert systems (See Figure 1) use a rule base to generate decision suggestions. Users can input facts and preconditions so that the rules will be triggered to provide results. Expert systems have been applied in many aspects of manufacturing. The fact is that much factory work has shifted to knowledge work such as planning, designing and quality assurance from labor work such as machining, assembling and handling. As the matter of fact, knowledge work accounts for about two thirds of total manufacturing cost. Robotics, expert systems and other information systems can improve the productivity of labor work. For example, an expert system implemented at Northrop Corporation, a major producer of jet fighter planes, is responsible for the planning of manufacture and assembly of up to 20,000 parts that go into an aircraft. A parts designer is able to enter a description of the engineering drawing of a part, and the expert system will tell him what materials and processes are required to manufacture it. This particular system actually improves the productivity of part designing by a factor of twelve to eighteen times. Without the help of an expert system, the same task would require several days instead of several hours. An expert system is a computer system including computer hardware and software, which can perform reasoning using a knowledge base.

An expert system relies on a computer's ability to make decisions in a human way. There are six components to the expert system; knowledge base, domain database, database management system, inference engine, user interface, and knowledge acquisition facility. The knowledge base contains the rules used when making decisions. The user interface has the function of providing end users with proper interactive channels so that users can interact with the system input. A knowledge base contains a set of rules or cases to provide an expert system with necessary information to conduct reasoning. An inference engine is the brain of an expert system. It receives

the request from the user interface and conducts reasoning in the knowledge base. Different rules or cases can be triggered to conclude a solution. After several questioning/answering sessions, a conclusion or suggestion can be generated and provided to the end user through the user interface. *Note:* Expert systems allow even small companies to perform activities and provide services previously only available from larger firms. The use of expert systems has helped to improve the quality of customer service in applications such as maintenance and scheduling by automating them and making them easy to perform.

Expert System Knowledge Bases

An expert system contains the subject knowledge of the human experts, called the knowledge base. The knowledge consists of two types of knowledge representations; inductive knowledge (case base) and deductive knowledge (rule base). Knowledge-based (expert) systems contain a knowledge base for a limited domain of human expertise and inference procedures for the solution of problems. They use symbolic processing based on *heuristics* rather than algorithms. A heuristic procedure is an exploratory problem-solving technique that uses self-education methods, e.g., the evaluation of feedback, to improve performance. These systems are often very interactive and provide explanations of their problem-solving behavior.

Rule Based Expert Systems

The rule base of an expert system contains a set of production rules. Each rule has a typical IF THEN clause. Expert system users provide facts or statements so that production rules can be triggered and the conclusion can be generated. Ford Motor Company uses an expert system to diagnose engine repair problems. Typically, Ford dealers will call the help line in Ford headquarters to receive a suggestion when a complicated engine problem can not be diagnosed. Today, by using an expert system, dealers can access the company's expert systems and receive correct engine diagnosis within seconds. Expert systems can be used in any type of business and at any level in an organization, for example, diagnosing illness, searching for oil, making soup and analyzing computer systems. More applications and more users are expected in the future.

Case Based Expert Systems

A case based expert system uses the inductive method to conduct expert system reasoning. In this type of expert system, a case base is employed. A case base consists of many historical cases, which have different results. The expert inference engine will search through the case base and find the appropriate historical case, which matches the characteristics of the current problem to be solved. After a match has been allocated, the solution of a matched historical case will be modified and used as the new suggestion for this current problem.

Lockheed uses an expert system to help speed the purchase of materials ranging from industrial coolant to satellite and rocket parts. The old MIS requested a purchase order to include more than 100 different forms, which are seldom completed by purchaser. Lots of time was spent to make corrections and changes to make a purchase order complete. By using an expert system, less information was asked and

the time required to finish a purchasing order is reduced. One important issue of expert systems is the knowledge acquisition. Traditionally, interviewing human experts in this field build the knowledge base. More advanced technology allows intelligent software to "learn" knowledge from different problem domains. The knowledge learned by computer software is more accurate and reliable compared with that from human experts.

Benefits of Expert Systems

For the past few years, the technology of expert systems has been successfully applied in thousands of organizations worldwide to problems ranging from cancer research to the analysis of computer configurations. The reasons that expert systems became so popular in recent years are discussed as follows:

• Increased output and productivity: Expert systems can work faster and more accurately than human experts. For examples, a system called XCON by Digital Equipment Corporation is able to provide computer system configuration for potential buyers. This Expert system increases fourfold the production preparation of minicomputers, which are customized for their clients.

• Improved quality: ES provide advice or suggestions based on preprogrammed logistics, which are consistent and accurate. This reduces possible mistakes caused by human errors.

• Capture of scarce expertise: The scarcity of experience becomes evident in situations where there are not enough experts for a task, where the expert is about to retire or leave the job, or where expertise is required over a broad geographic location.

  • Operation in hazardous environment:
  • Reliability
  • Provision of training: ES can be a very good training tool
  • Enhancement of problem solving capabilities:

Robotics in Manufacturing

A robot with AI capability is an electromechanical manipulator able to respond to a change in its environment based on its perception of that environment. The sensory subsystem is programmed to "see" or "feel" its environment and respond to it. For example, an industrial robot can manufacture one of many parts in its repertoire and manipulate it to inspect it for defects, recognizing very small departures from established standards. Robots have been used extensively in Japan to improve the quality and reduce the cost of their products. They are reliable, consistent, accurate, and insensitive to hazardous environments. A robot is a device that mimics human actions and appears to function with some degree of intelligence. Robots are commonly used in manufacturing and in other situations where it would be unsafe or unhealthy for a human to perform the same task.

Neural Networks in Manufacturing

The human is the most complex computing device known to human beings. The brain's powerful thinking, reasoning, creation, remembering and problem solving capabilities have inspired many scientists to attempt computer modeling of its operation. Some researchers have sought to create a computer model that matches the functionality of the brain in a very fundamental manner; the result has been neural computing. The neuron is the fundamental cellular unit of the nervous system and the brain. Each neuron functions as a simple microprocessing unit, which receives and combines signals from many other neurons through input processes called dendrites. If the combined signal is strong enough, it activates the firing of the neuron, which produces an output signal; the path of the output signal is along a component of a cell called the axon. This simple transfer of information is chemical in nature, but has electrical side effects, which we can measure. The brain consists of hundreds of billions of neurons loosely inter-connected. The axon (output path) of a neuron splits up and connects to dendrites (input path) of other neurons through a junction referred to as a synapse. The transmission across this junction is chemical in nature and the amount of signal transferred depends on the amount of chemical (neurotransmitters) released by the axon and received by the dendrites. This synaptic efficiency is what is modified when the brain learns.

The synapse combined with the processing of information in the neuron form the basic memory mechanism of the brain. In an artificial neural network, the unit analogous to the biological neuron is referred to as a "processing element." A processing element has many input paths and combines, usually by a simple summation, the values of these input paths. The result is an internal activity level for the processing element. The combined input is then modified by a transfer function, which can be a threshold function. This threshold function only passes information if the combined activity level reaches a certain level, or it can be a continuous function of the combined input. The output path of a processing element can be connected to input paths of other processing elements through connection weights which correspond to the synaptic strength of neural connections. Since each connection has a corresponding weight, the signals on the input lines to a processing element are modified by these weights prior to being summed. Thus, the summation function is a weighted summation. In summation, a neural network consists of many processing elements joined together in the above manner. Processing elements are usually organized into groups called layers or slabs. A typical network consists of a sequence of layers or slabs with full or random connections between successive layers. There are typically two layers with connections to the outside world: An input buffer where data is presented to the network, and an output buffer which holds the response of the network to a given input. Layers distinct from the input and output buffers are called hidden layers. Applications of neural networks are language processing (text and speech), image processing, character recognition (hand writing recognition and pattern recognition), and financial and economic modeling.

PRODUCTION PLANNING

Planning encompasses defining the organization's objectives or goals and establishing an overall strategy for achieving these goals. Planning can be classified into several categories:

- **Strategic versus Operational**

Plans that apply to the entire organization to establish the organizational overall objectives are called strategic plans. Plans that specify the detailed process of how the strategic plan can be achieved are called operational plans.

- **Short term versus Long term**

Plans that cover a longer time period are called long term. Long term plans tend to be strategic and short term plans tend to be operational.

- **Specific versus Directional**

Specific plans have clearly defined objectives while directional plans identify general guidelines. They provide focus but do not lock management into the following specific objectives or specific courses of action.

Production planning consists of four key decisions—capacity, location, process, and layout.

Capacity Planning

Capacity planning deals with determining the proper size of the plant to satisfy the demand of the market. Capacity planning begins with taking forecasts of sales demand and converting them into capacity requirements. This model can be easily entered into a spreadsheet to generate results.

CAPACITY PLANNING SPREADSHEET						
Product	Units/demand		Machine-hours/unit		Total-hour	
A	200		3		600	
B	400		2		800	
C	100		7		700	
				Total machine-hours =	2100	
Machine run time =		24				
Machine break down rate =		5%				
# of machines needed =		93				

Location Planning

When you determine the need for a new facility, you must determine where this facility should be installed. The location of the facility is dependent on which factors have the greatest impact on total production and distribution costs. These include availability of labor skills, labor costs, energy costs, proximity to suppliers or customers, and the like.

Process Planning

In process planning, management determines how a product or service will be produced. Process planning encompasses evaluating the available production methods and selecting the set that will best achieve the operating objectives.

Layout Planning

Layout planning deals with the access and selection among alternative layout options for equipment and work stations. The objective of layout planning is to find the best physical arrangement that will best facilitate production efficiency. There are four types of work flow layouts:

- Process layout

     Arrange manufacturing components together according to similarity of function.

- Product layout

     Arrange manufacturing components according to the progressive steps by which a product is made.

- Fixed-position layout

     A manufacturing layout in which the product stays in place while tools, equipment, and human skills are brought to it.

PRODUCTION CONTROL

Control can be defined as the process of monitoring activities to ensure that they are being accomplished as planned and of correcting any significant deviations. The control process consists of three steps: 1. Measuring actual performance, 2. Comparing actual performance against a standard and 3. Taking managerial action to correct deviations or inadequate standards. There are three types of controls: feedforward control, concurrent control and feedback control. Feedforward control prevents anticipated problems. Concurrent control occurs when an activity is in progress. Feedback control is imposed after an action has occurred. All three types of control can be implemented by information systems.

INVENTORY PLANNING AND CONTROL

A manufacturing company has three types of inventory: 1. Raw material, 2. Work-in-process, and 3. Final products. To reach the goals of inventory control, two objects must be achieved 1. To minimize costs due to out-of-stock situation and 2. To minimize inventory carrying costs. At the finished products level, out-of-stock can result in loss of sales and too much inventory increases the carrying cost. At the raw material and work-in-process level, out-of stock means that the production line must be stopped and too much inventory means a higher cost in final products. A mathematical model used to determine the optimal ordering point is called EOQ model.

Economic Order Quantity Model (EOQ)

The objective of EOQ model is to minimize the total carrying costs and ordering costs. As the amount gets larger and larger, average inventory increases and so do carrying costs. But placing larger orders means fewer orders and thus lower ordering costs.

Linear Programming Model

Another model uses Linear programming to determine the optimal solution. This model requires an objective function, decision variables, and constraints.

Material Requirement Planning (MRP) and Manufacturing Resources Planning (MRP II)

Material Requirement Planning (MRP) is different from its expanded version MRP II or Manufacturing Resources Planning. MRP II involves satisfying the requirements of supplying materials to shop operations. In MRP II, the MIS is used to sequence materials inputs in accordance with chronological need. The evolution of MRP II from MRP is the logical outgrowth of the maturing of the use of computer applications in manufacturing.

Computer-Aided Design (CAD) and Computer-Aided Manufacturing

CAD programs are software programs for the design of products. CAD programs can be found in all types of computers from mainframe systems to microcomputers. They are developed to help engineers design products from airplanes to pens. The advantages of CAD software are that the design can be drawn in three dimensions, the design can be simulated in the computer and design changes can be made very efficiently. Good CAD packages are AutoCAD, TurboCAD and EasyCAD2. Some CAD programs are developed for non-programmers. For example, a relatively unskilled person can use this type of software to design an office or even homes. Theses programs include libraries of options such as cabinetry, furniture, trees and even shadows. Once the design is completed, users can "walk" into the design and view this structure from different points of view. This is similar to a virtual reality system.

CAM is an umbrella term that includes almost any use of computers in manufacturing operations. It consists of the following functions:

- **Monitoring**
Computers can be used to control and monitor manufacturing operations in a dangerous environment. For example, an oil refinery facility uses CAM to open and shut valves when a certain temperature is reached in a tank.

- **Numeric Control**
Using computer technology to control the manufacturing operations. For example, CAM can help manufacturing workers produce parts which require a high degree of precision because computers are used to improve the accuracy of manufacturing.

- **Optimization**
Many manufacturing operations involve finding the best solution among others. For example, an oil refinery is looking for the cheapest way to mix crude oils to produce a finished gasoline that meets certain restrictions. Auto assembly plants try to arrange the best schedule so that the operating cost can be minimized. By using CAM techniques, optimization can be improved and the operation can be more economical and efficient.

- **Robotics**
Robotics is the use of computer-controlled machines to perform motor activities previously done by humans: welding a joint, painting, and fitting parts together. The automobile industry uses robotics to improve productivity and quality.

JUST-IN-TIME (JIT)

Just-in-time is fast becoming as familiar and identifiable in the lexicon of manufacturing terminology as "mass production." Although the term is familiar to many people, the true meaning and definition remains clouded and unclear. The most common misunderstanding of just-in-time is to deliver inventory when it is needed. That means to reduce inventory while the operation is maintained. However, this is not the true meaning of Just-In-Time. The true definition of JIT is an awareness that true optimum manufacturing performance revolves about the dictate to eliminate waste in all of its many manifestations. The goal of JIT is to eliminate all manufacturing waste, which are listed below:
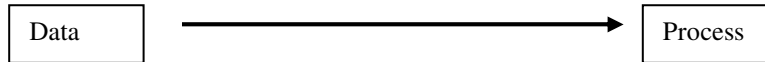
- Produce the product the customer wants
- Produce product when the customer wants
- Produce good quality product
- Produce instantly with no lead time
- Produce with no waste of labor, material, or equipment

QUALITY CONTROL AND TOTAL QUALITY MANAGEMENT (TQM)

Quality control relates to activities that ensure that the final products are of satisfactory quality. Major functions of quality control are 1. Detecting existing quality deficiencies and 2. Preventing future product quality problems. Due to the large quantity of units produced, quality control is usually conducted by sampling final products statistically. The whole lot of final products can be either rejected or accepted by a small sample collected. However, if statistically the manufacturer passes a lot, which is supposed to be rejected, the consequence would be customers will purchase defective merchandise and ruin the reputation of the manufacturer. If statistically the manufacturer rejects a lot, which is supposed to be accepted, good products can be discarded and manufacturing resources are wasted. Quality control is both an important area of expense and an important area of opportunities.

A new quality concept is emerging, called Total Quality Management (TQM). It has been touted as one of the few new management practices that will make companies competitive, particularly against the onslaught of Japanese competition. The shorthand TQM has come to mean a powerful solution to all that ails modern North American industry. It implies that if we will only pay special attention to the needs and desires of our customers, and we deliver on those aspirations, we are bound to be successful. TQM focuses on awareness techniques for making products to the best of the organization's abilities. TQM theory can be described as a triangle:

Customer

```
┌──────────┐                                    ┌──────────┐
│   Data   │ ─────────────────────────────────► │ Process  │
└──────────┘                                    └──────────┘
```

FLEXIBLE MANUFACTURING SYSTEMS

Flexible manufacturing systems (FMS) were introduced to provide shorter life cycle manufacturing process and responsive manufacturing facilities to improve competition. For example, A VCR factory can use FMS to produce different models using similar facilities which can be rescheduled and rearranged to fit into different manufacturing patterns.

SUMMARY

This chapter has presented how MIS can be used in manufacturing systems to improve the quality and productivity. Generally speaking, MIS can be applied to all four major manufacturing activities which include Product Engineering, Facility Design and Scheduling, Fabrication and Quality Control. Recently, another important technology in artificial intelligence has been used to design, perform and schedule production activities more intelligently. As a result, the manufacturing process can be more automatic and efficient by using current information technologies.

CHAPTER 12 QUIZ

1. Computer software packages that are used to arrange the plant layout based on the production information of the design product include all the following except:
    A. Improvement approach
    B. Fabrication or manufacturing approach
    C. Construction approach
    D. Simulation approach

2. Total quality control management (TQM) principles include all the following except:
    A. Data manipulation
    B. Customer focus
    C. Continuous improvement of everything
    D. Accurate measurement and employee empowerment

3. Production planning decisions include cost-based pricing.
True / False

4. One of the goals of Just-In-Time (JIT) is to produce instantly with no lead time.
True / False

CHAPTER 12 ANSWER KEY

1. (B) is correct. Many of the layout algorithms proposed use an improvement approach, a construction approach, or a simulation approach.

(A) is incorrect. An improvement approach is done by an intelligent search technique trying numerous alternatives to find the best solution.

(C) is incorrect. A construction approach builds on one or more layout solutions then selects the best one.

(D) is incorrect. The simulation approach simulates the real production environment based on assumptions provided by the designer, using lots of computer resources.

2. (A) is correct. TQM principles are: customer focused, continuous improvement, accurate measurement, and empowerment of employee.

(B) is incorrect. TQM is customer focused.

(C) is incorrect. TQM strives for continuous improvement.

(D) is incorrect. Accurate measurement and employee empowerment are two of the five principles of TQM.

3. (T) is incorrect. Production planning consists of four key decisions—capacity, location, process, and layout.

(F) is correct. Cost-based pricing is a pricing method.

4. (F) is incorrect. The most common misunderstanding of just-in-time is to deliver inventory when it is needed. Producing quality products the customer wants is also an important goal of JIT.

(T) is correct. Producing instantly with no lead time eliminates all manufacturing waste and storage requirements.

CHAPTER 13
MARKETING MANAGEMENT INFORMATION SYSTEMS AND PACKAGES

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. List inputs to the marketing MIS.
2. Outline marketing MIS systems and outputs.
3. Develop a forecasting system.
4. Perform marketing research.
5. Discuss four "P's" in marketing.
6. List popular forecasting and statistical software.

The internal accounting information system is the primary source of marketing information in most business organizations and provides two basic types of information to management: information generated from processing of sales orders, and cost reports and analysis. Profitability analysis is generated from sales data records together with product cost data. Sales data processing also includes analysis of sales trends. In addition to the accounting and marketing department, other departments within the company may contribute to the flow of information to marketing personnel. For example, the production or engineering department may provide information relating to product quality or design which is useful to product planning or to salespeople. The economics department may provide useful analysis of the economy or of the particular field within which the firm operates. The personnel department may provide information relating to potential marketing department employees. While information from all the sources may be important it is generally not as regular or as voluminous as the information provided by the accounting department. The information needs for marketers, in the order of importance, are shown in the survey results in Figure 1.
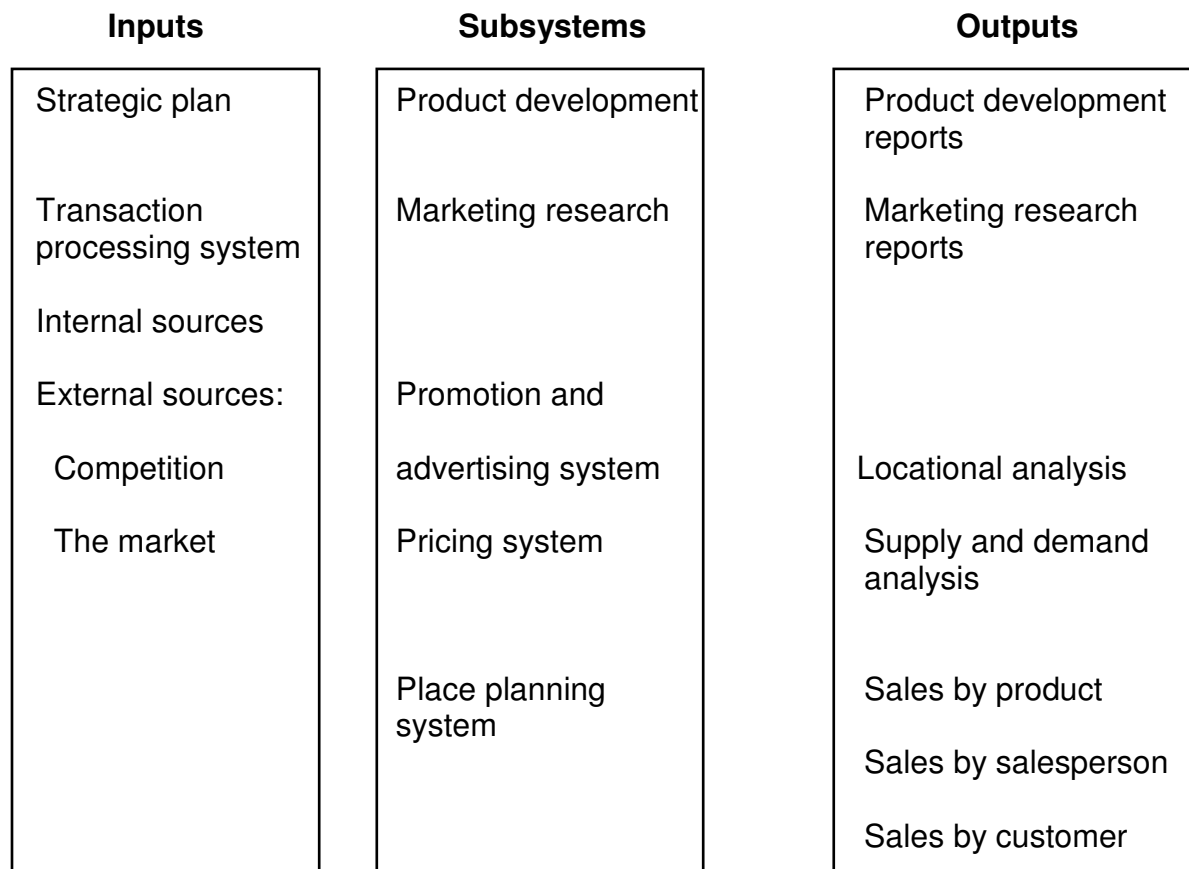
```
┌─────────────────────────────────────────────────────────────┐
│                         FIGURE 1                            │
│           INFORMATION NEEDS OF MARKETING MANAGERS           │
│                                                             │
│   Rank                    Main Information Needs            │
│                                                             │
│   1                Improving new product development        │
│   2                Improving the use of market information  │
│   3                Measuring and managing brand equity      │
│   4                Market orientation and bottom line       │
│   5                Market segmentation and implementation   │
│   6                Identifying, anticipating, and responding to competitors │
│   7                Studying buyer behavior                  │
│   8                Strategic new product issues             │
│   9                Integrating marketing mix                │
│   10               Service quality/performance links        │
└─────────────────────────────────────────────────────────────┘
```

A marketing MIS supports managerial activity in the areas of product development, marketing mix, distribution, pricing decisions, promotional effectiveness, and sales forecasting. Recall that an MIS is made up of three sets of activities: information collection, information analysis, and information dissemination. A marketing MIS is certainly no exception.

Figure 2 shows the inputs, subsystems, and outputs of a typical marketing MIS.

FIGURE 2

AN OVERVIEW OF A MARKETING MIS

Inputs	Subsystems	Outputs
Strategic plan	Product development	Product development reports
Transaction processing system	Marketing research	Marketing research reports
Internal sources		
External sources:	Promotion and	
Competition	advertising system	Locational analysis
The market	Pricing system	Supply and demand analysis
	Place planning system	Sales by product
		Sales by salesperson
		Sales by customer

INPUTS TO THE MARKETING MIS

Among the other functional areas, the marketing MIS relies more heavily on external sources of data. These sources include commercial intelligence, competition, customers, trade shows, trade journals and magazines, and other publications. There are also important internal company information sources. An overview of these inputs is presented below.

1.   *The corporate strategic plan or policies.* Marketing depends on the company's strategic plan for sales goals and projections. For instance, a strategic plan might show sales are expected to grow by a stable 5 percent for the next three years. A marketing MIS report for this company might detail current sales performance in terms of this

strategic target. In addition to sales projections, the strategic plan can spell out detailed information about anticipated needs for the sales force, pricing, distribution channels, promotion, and new product features. The strategic plan can provide a framework in which to integrate marketing information and make appropriate marketing decisions.

2a.   *The transaction processing system (TPS).* The TPS encompasses a huge amount of sales and marketing data on products or services, customers, and the sales force. Technology is revolutionizing the selling process. Most firms collect an abundance of information on a regular basis that can also be used in making marketing decisions. Sales data on products can expose which products are selling at high volumes, which ones are slow sellers, and how much they are contributing to profits. The marketing MIS might synthesize this information in such a way as to be useful in formulating promotional plans. It can also be used to activate product development decisions. Analysis of sales by customers may display which customers are contributing to profits. This data can also be disseminated to determine the products specific customers are buying to help the sales force with their promotional efforts. The performance of the sales force can also be monitored from data captured in the TPS, which can help develop bonus and incentive programs to reward well-performing salespeople.

2b.   *Internal Company Information.* Internal company information includes routinely collected accounting records, such as daily sales receipts, weekly expense records and profit statements, production and shipment schedules, inventory records, orders, monthly credit statements, and quarterly and biennial reports. Field salespeople are increasingly likely to have portable personal computers, pagers, and personal digital assistants (PDAs) to log in data for immediate transmission back to the company or customers, and to receive information from the company and customers. Technology is revolutionizing the selling process. Most companies collect an abundance of information on a regular basis that can also be used in making marketing decisions.

3.   *External sources: the competition and the market.* In most marketing decisions it is important to determine what is happening in the business's external environment, particularly anything that involves the competition, the economy, the market, and consumers. External information can be obtained from many sources. Some of the most commonly used sources are commercial intelligence, trade shows, trade journals, the government, private publications, commercial data suppliers, and the popular press. Many companies purchase their competition's products and then perform "autopsies" to find out what makes them tick so they can improve on them. Marketing managers attend trade shows and read trade journals to keep an eye on the competition.

MARKETING MIS SUBSYSTEMS AND OUTPUTS

Subsystems for the marketing MIS include forecasting, marketing research, product, place, promotion, and price subsystems. These subsystems and their outputs help marketing managers and executives increase sales, reduce marketing expenses, and develop plans for future products and services to meet the changing needs of customers.

FORECASTING

Forecasts are needed for marketing, production, purchasing, manpower, and financial planning. Further, top management needs forecasts for planning and implementing long-term strategic objectives and planning for capital expenditures. Based on the firm's projected sales, the production function determines the machine, personnel, and material resources needed to produce its products or services. Marketing managers use sales forecasts to determine 1) optimal sales force allocations, 2) set sales goals, and 3) plan promotions and advertising. Other things such as market share, prices, and trends in new product development are required. As soon as the company makes sure that it has enough capacity, the production plan is developed. If the company does not have enough capacity, it will require planning and budgeting decisions for capital spending for capacity expansion. Production planners need forecasts in order to schedule production activities, order materials, establish inventory levels, and plan shipments. Some other areas which need forecasts include material requirements (purchasing and procurement), labor scheduling, equipment purchases, maintenance requirements, and plant capacity planning. The personnel department requires a number of forecasts in planning for human resources in the business. Workers must be hired and trained, and for these personnel there must be benefits provided that are competitive with those available in the firm's labor market. Also, trends that affect such variables as labor turnover, retirement age, absenteeism, and tardiness need to be forecast as input for planning and decision making in this function. On this basis, the financial manager must estimate the future cash inflow and outflow. He must plan cash and borrowing needs for the company's future operations. Forecasts of cash flows and the rates of expenses and revenues are needed to maintain corporate liquidity and operating efficiency. In planning for capital investments, predictions about future economic activity are required so that returns or cash inflows accruing from the investment may be estimated. There are many forecasting methods in use, one of which is regression analysis. It is illustrated below, using *Excel.*

EXAMPLE 1

A firm wishes to develop a sales forecasting model, by relating sales to price and advertising.

Month	Sales (Y)	Advertising (X1)	Price (X2)
1	25	4	75
2	26	5	82
3	32	6	94
4	30	6	95
5	32	7	98
6	37	7	110
7	38	8	110
8	41	8	99
9	46	9	95
10	48	10	97

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.97366474
R Square	0.94802302
Adjusted R Square	0.93317246
Standard Error	2.0400664
Observations	10

ANOVA

	Df	SS	MS
Regression	2	531.3669036	265.6835
Residual	7	29.13309639	4.161871
Total	9	560.5	

	Coefficients	Standard Error	t Stat
Intercept	10.1734656	6.251683507	1.627316
X Variable 1	4.41923505	0.480669674	9.193913
X Variable 2	-0.0587237	0.081383757	-0.72157

USING REGRESSION ON *EXCEL*

To utilize Excel for regression analysis, the following procedure needs to be followed:

      1. Click the *Tools* menu.

      2. Click *Add-Ins.*

      3. Click *Analysis ToolPak*. (If Analysis ToolPak is not listed among your available add-ins, exit *Excel*, double-click the MS Excel Setup icon, click Add/Remove, double-click Add-Ins, and select Analysis ToolPak. Then restart Excel and repeat the above instruction.)

      After ensuring that the Analysis ToolPak is available, you can access the regression tool by completing the following steps:

      1. Click the *Tools* menu.

      2. Click *Data Analysis.*

      3. Click *Regression*

MARKETING RESEARCH

Marketing research is essentially a twofold activity. It involves (1) collecting current data describing all phases of the marketing operations, and (2) presenting the findings to marketing managers in a form suitable for decision making. The focus is on the timeliness of the information. The goal of marketing research is to conduct a systematic, objective, bias-free inquiry of the market and customer preferences. A variety of tools such as surveys, questionnaires, pilot studies, and in-depth interviews are used for marketing research. Marketing research can identify the features that customers really want in a product or from a service. Important attributes of products or services --style, color, size, appearance, and general fit-- can be investigated through the use of marketing research.

Marketing research broadly encompasses advertising research and consumer behavior research. *Advertising research* is research on such advertising issues as ad and copy effectiveness, recall, and media choice. *Consumer behavior research* answers questions about consumers and their brand selection behaviors and preferences in the marketplace. Research results are used to make marketing mix decisions and for pricing, distribution channels, guarantees and warranties, and customer service. Inexpensive software and statistical analysis software are used to analyze the data collected from marketing research endeavors. These software packages can determine trends, test hypotheses, compute statistical values, and more. This data is then often input into the marketing MIS so that marketing managers can be better informed and can better make their planning and resource allocation decisions.

PRODUCT DEVELOPMENT

Product development is one of "the four Ps" in the marketing mix --product, place, promotion, and price, each of which is explained later. Product development

involves the transformation of raw materials into finished goods and services, and primarily focuses on the physical attributes of the product. Many factors, including materials, labor skills, plant capacity, and technical factors are important in product development decisions. In many cases, a computer program for mathematical programming and simulations can be utilized to analyze these various factors and to select the appropriate mix of labor, materials, plant and equipment, and engineering designs. Make-or-outsource decisions can also be made with the assistance of computer software. A framework, called the *product life cycle* guides the manager in making product development decisions. It takes into account four stages in the life cycle--introduction, growth, maturity, and decline.

PLACE PLANNING

Place planning involves planning on the means of physically distributing the product to the customer. It includes production, transportation, storage, and distribution on both the wholesale and retail levels. Where to deliver the product to the customer and how to get the product to this location are the principal concerns of place analysis subsystems. Typically, a distribution chain starts at the manufacturing plant and ends at the final consumer. In the middle is a network of wholesale and retail outlets employed to efficiently and effectively bring goods and services to the final consumer. But where are the best places to locate manufacturing facilities, wholesale outlets, and retail distribution points?

Factors such as manufacturing costs, transportation costs, labor costs, and localized demand levels become factors that are critical to answering this issue. Today, marketing MIS subsystems can analyze these factors and determine the least-cost placement of manufacturing facilities, wholesale operations, and retail outlets. The purpose of these locational analysis programs is to minimize total costs while satisfying product demand. Digital maps combined with customer database information in computer mapping software can be used to pinpoint locations for new retail outlets. For example, Yamaha Motor Corporation, USA has made decisions as to where to locate the dealership by blending computer graphics with behavioral demographics. Behavioral demographics link psychological, life-style, and family-expenditure data to geographic locations, often by zip code.

PROMOTION PLANNING

One of the most important functions of any marketing effort is promotion. Promotion is concerned with all the means of marketing the sale of the product, including advertising and personal selling. Product success is a direct function of the types of advertising and sales promotion done. The size of the promotions budget and the allocation of this budget to various promotional mixes are important factors in deciding the type of campaigns that will be launched. Television coverage, newspaper ads and coverage, promotional brochures and literature, and training programs for salespeople are all components of these promotional and advertising mixes. Because of the time and scheduling savings they offer, computer software is widely used to

establish the original budget and to monitor expenditures and the overall effectiveness of various promotional campaigns.

Promotional effectiveness can be monitored through the TPS, or it may be monitored through a specialized functional system focusing exclusively on sales activity. For example, a significant proportion of many marketing managers' compensation is determined by the results of their promotional campaigns through specialized sales activity subsystems. Such systems often use data from retail outlet bar-code scanners to compile information on how effective certain promotions were within the promotional period. Without such sales activity, the time delay between wholesale shipments and retail sales would prevent the promotion's effectiveness from being accurately measured.

The following example illustrates the use of linear programming to determine optimal media selection.

EXAMPLE 2

The management of an electric-products company decided to spend up to $1,000,000 on the advertising of women's electric razors that it manufactures. The advertising budget is to be spent in 12 consumer magazines with full-page, full-color advertisements. Let Xi be the number of dollars spent on advertising in magazine i. Management is advised by an advertising agency that an appropriate goal is to *maximize* the number of effective exposures given the advertising budget. Management wants to assure that no more than 12 insertions are made in any one magazine and that it wishes the number of insertions in Mademoiselle and Ladies Home Journal to be less than or equal to 7 and 2, respectively. Suppose also that management wishes to specify minimum expenditures in certain of the magazines, say, $X2 \geq 17,810$, $X3 \geq 67,200$, $X5 \geq 42,840$, and $X10 \geq 32,550$. Finally, management desires an expenditure of no more than $320,000 in four of the magazines, say, 3, 9, 10, and 12. The following table presents the number of exposures and cost for each advertising media.

Media	Effective Readings per dollar spent	Cost of one full-page, full-color advertisement
1. Cosmopolitan	158	$5,500
2. Mademoiselle	263	5,950
3. Family Circle	106	33,600
4. Good Housekeeping	108	27,400
5. McCall's	65	42,840
6. Modern Romance	176	3,275
7. Film Quarterly	285	3,415
8. Soap Opera Digest	86	2,248
9. TV Guide	120	25,253
10. Women's Day	51	32,550
11. Seventeen	190	8,850
12. Ladies Home Journal	101	35,000

The LP model is:

Maximize   158 X1 + 263 X2 + 106 X3 + 108 X4 + 65 X5 + 176 X6 + 285 X7
              + 86 X8 + 120 X9 + 51 X10 + 190 X11 + 101 X12
Subject to   (1) $0 \leq Xi \leq 12$ (i = 1,2,3,...,12)
              (2) $X2 \leq 7$, $X12 \leq 2$
              (3) $5950\ X2 \geq 17{,}810$, $33600\ X3 \geq 67{,}200$,
                      $42840\ X5 \geq 42{,}840$
                      $32550\ X10 \geq 32{,}550$
              (4) $33600\ X3 + 25253\ X9 + 32550\ X10 + 35000\ X12 \leq 320{,}000$

The LINDO input and output are summarized below.

MAX 158 X1 + 263 X2 + 106 X3 + 108 X4 + 65 X5 + 176 X6 + 285 X7
+ 86 X8 + 120 X9 + 51 X10 + 190 X11 + 101 X12

SUBJECT TO

2)   X1 <= 12
3)   X2 <= 12
4)   X3 <= 12
5)   X4 <= 12
6)   X5 <= 12
7)   X6 <= 12
8)   X7 <= 12
9)   X8 <= 12
10)   X9 <= 12
11)   X10 <= 12
12)   X11 <= 12
13)   X12 <= 12
14)   X2 <= 7
15)   X12 <= 2
16)   5950 X2 >= 17810
17)   33600 X3 >= 67200
18)   42480 X5 >= 42480
19)   32550 X10 >=32550
20)   33600 X3 + 25253 X9 + 32550 X10 + 35000 X12 <=t 320000
END
LP OPTIMUM FOUND AT STEP 14

OBJECTIVE FUNCTION VALUE
      1)   15966.6100
VARIABLE   VALUE   REDUCED COST
      X1   12.000000   .000000

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X2	7.000000	.000000
X3	2.000000	.000000
X4	12.000000	.000000
X5	12.000000	.000000
X6	12.000000	.000000
X7	12.000000	.000000
X8	12.000000	.000000
X9	8.721736	.000000
X10	1.000000	.000000
X11	12.000000	.000000
X12	.000000	65.316860

PRICING

Pricing is an important managerial decision which has a long-term effect on the sales and profitability of the firm. In most instances, especially in the field of durable consumer goods, notably audio-video equipment, automobiles, etc. the scope for product differentiation allows competing firms to have considerable leeway in setting the prices of their products. Three popular pricing approaches are: a *cost-based pricing* policy, a *return-on-investment (ROI) based pricing* policy, and a *demand-based pricing* policy. The MIS can support the manager in all three pricing policies. With the cost-based approach, the accounting system can provide accurate product cost data on which to base a decision. With the other approaches, the MIS enables the manager to engage in "what-if" modeling to determine the price level that maximizes contribution to profits yet retards competitive activity.

A major factor in determining pricing policy is an analysis of the demand curve, which attempts to determine the relationship between price and sales. Most companies try to develop pricing policies that will maximize total sales revenues. This is usually a function of price elasticity. If the product is highly price-sensitive, a reduction in price can generate a substantial increase in sales, which can result in higher revenues. A product that is relatively insensitive to price can have its price substantially increased without a large reduction in demand. Figure 4 shows the relationships between price elasticity (e_p) and sales revenue (S), which can aid a firm in setting its price.

FIGURE 4

Price	$e_p > 1$	$e_p = 1$	$e_p < 1$
Price rises	S falls	No change	S rises
Price falls	S rises	No change	S falls

Computer programs exist that help determine price elasticity and various pricing policies. Typically, the marketing managers, with the aid of computer software for spreadsheets and statistical packages can develop "what-if" scenarios in which they can alter factors to see price changes on future demand and total revenues.

COMPREHENSIVE SALES PLANNING

The sales planning process is a necessary part of profit planning and control because (a) it provides for the basic management decisions about marketing, and (b) based on those decisions, it is an organized approach for developing a comprehensive sales plan. If the sales plan is not realistic, most if not all of the other parts of the overall profit plan also are not realistic. Therefore, if the management believes that a realistic sales plan cannot be developed; there is little justification for profit planning and control. Despite the views of a particular management, such a conclusion may be an implicit admission of incompetence. Simply, if it is really impossible to assess the future revenue potential of a business, there would be little incentive for investment in the business initially or for continuation of it except for purely speculative ventures that most managers and investors prefer to avoid.

The primary purposes of a sales plan are (a) to reduce uncertainty about the future revenues, (b) to incorporate management judgments and decisions into formation into the planning process (e.g., in the marketing plans), (c) to provide necessary information for developing other elements of a comprehensive profit plan, and (d) to facilitate management's control of sales activities.

Sales Planning Compared with Forecasting

Sales planning and forcasting often are confused. Although related, they have distinctly different uses and purposes. A *forecast* is not a plan; rather it is a statement and/or a quantified assessment of future conditions about a particular subject (e.g., sales revenue) based on one or more explicit assumptions. A forecast always should state the assumptions upon which it is based. A forecast should be viewed as only one input into the development of a sales plan. The management of a company comprehensive may accept, modify, or reject the forecast. In contrast, a *sales plan* incorporates management decisions that are based on the forecast, other inputs, and management judgments about such related items as sales volume, prices, sales efforts, production, and financing.

Testing the Top Line

Most companies don't really manage top-line growth. They allocate resources to businesses they think will be most productive and hope the economy cooperates. But a growing number are taking a less passive approach, and studying revenue growth more carefully. They argue that quantifying the sources of revenue can yield a wealth of information, which results in more-targeted and more-effective decision-making. With the right discipline and analysis, they say, growing revenues can be as straightforward as cutting costs. Some companies go so far as to link the two efforts. The idea is to bring the same systematic analysis to growing revenue that we have brought to cost cutting.

A sources-of-revenue statement (SRS) is useful in this effort. The information on revenue captured by traditional financial statements is woefully inadequate. Sorting revenues by geographic market, business unit, or product line tells you the source of sales. But it does not explain the underlying reason for those sales.

The SRS model breaks revenue into five categories:

1. Continuing sales to established customers (known as base retention).
2. Sales won from the competition (share gain).
3. New sales from expanding markets.
4. Moves into adjacent markets where core capabilities can be leveraged.
5. Entirely new lines of business unrelated to the core.

To product a sources-of-revenue statement, five steps are required in addition to establishing total revenues for comparable periods, as is commonly done for purposes of completing an income statement.

1. Determine revenue from the core business by establishing the revenue gain or loss from entry to or exit from adjacent markets and the revenue gain from new lines of business, and subtracting this from total revenue.
2. Determine growth attributable to market positioning by estimating the market growth rate for the current period and multiplying this by the prior period's core revenue.
3. Determine the revenue not attributable to market growth by subtracting the amount determined in Step 2 from that determined in Step 1.
4. To calculate base retention revenue, estimate the customer churn rate, multiply it by the prior period's core revenue, and deduct this from the prior period's core revenue.
5. To determine revenue from market-share gain, subtract retention revenue, growth attributable to market positioning, and growth from new lines of business and from adjacent markets from core revenue.

SALES ANALYSIS

Sales analysis assists managers in identifying those products, sales personnel, and customers that are contributing to profits and those that are not. Several reports can be generated to help marketing managers make good sales decisions. The *sales-by-product* report lists all major products and their sales for a period of time, such as a month. This report shows which products are doing well and which ones need improvement or should be discarded altogether. The *sales-by-salesperson* report lists total sales for each salesperson for each week or month. This report can also be subdivided by product to show which products are being sold by each salesperson. The *sales-by-customer* report is a useful way to identify high-and low-volume customers.

POPULAR FORECASTING AND STATISTICAL SOFTWARE

There is numerous computer software used for forecasting purposes. They are broadly divided into two major categories: forecasting software and general purpose statistical software. Some programs are stand-alone, while others are spreadsheet add-ins. Still others are templates. A brief summary of some popular programs follows.

Some popular financial forecasting software is described below.

1. Forecast Pro
Forecast Pro, stand-*alone* forecasting software, is the business software that uses artificial intelligence. A built-in expert system examines your data. Then it guides you to

state-of-the-art forecasting techniques (exponential smoothing, Box-Jenkins, dynamic regression, Croston's model, event models, and multiple level models) - whichever method suits the data best.

Business Forecast Systems, Inc.
 68 Leonard Street
Belmont, MA 02478
Tel: (617) 484-5050
Fax: (617) 484-9219
www.forecast/

2. Easy Forecaster Plus I and II
Easy Forecaster Plus I and II is a *stand-alone* forecasting software, developed by the Institute of Business Forecasting. The software's features include the following models: naïve, moving averages, exponential smoothing (single, double, and Holt's), linear trend line, and multiple regression. The program selects optimal model automatically and prepares monthly/quarterly forecasts using seasonal indices.

Institute of Business Forecasting
P. O. Box 670159, Station C
Flushing, NY 11367-9086
Tel: (718) 463-3914
Fax: (718) 544-9086
www.ibf.org

3. Autobox 5.0 for Windows 9X,ME,NT,2000 and XP
This is the software utilizing Box-Jenkins forecasting methodology.

Automatic Forecasting Systems
PO Box 563
Hatboro, Pennsylvania 19040
Tel: (215) 675-0652
Fax: (215) 672-2534
www.autobox.com

4. LifeCast Pro
LifeCast Pro is *stand-alone* new product forecasting software. It quickly allows the integration of different marketing assumptions, prices, market research, competitive intelligence, historical similarities, and expert judgment all within a graphically based product life cycle framework. Using LifeCast Pro will help you "sell" your forecasts as believable because it merges statistical diffusion theory with your own assumptions in a way easy to explain to management. Features include:
- Data availability options (high/medium/ or none)
- Incorporation of price scenarios and elasticities
- Jackknife stability analysis
- Automatic search for best saturation

- Search area analysis and precision estimates
- Life cycle analysis for mature products
- Statistical forecasting equations
- Easy to use

LifeCast Pro
6516 Wedgewood Way
Tucker, GA 30084

5. DS FM (Demand Solutions Forecast Management)
This system delivers detailed information to front-line inventory managers, as well as top-level sales forecasts to front-office executives. It is the forecasting engine and data warehouse of choice for effective supply chain management. Key benefits include:
- Forecast at any level of data - item, item/customer, item/country/customer, or however you need it
- Quantify market intelligence, promotions and other variables
- Create production and purchase plans
- Meet your inventory and sales objectives. Continuously analyze a comprehensive and accurate view of your inventory and production
- Features the new Service Level Optimizer
- Microsoft SQL Server ODBC-compliant

Demand Management, Inc.
165 North Meramec Ave.,
Suite 300
St. Louis, MO 63105-3772 USA
Tel: (314) 727-4448
www.demandsolutions.com

6. ForecastX Wizard
The ForecastX Wizard software provides:
- Full integration with Excel to eliminate the learning curve
- One Click business forecasting to pick the best method and generate award winning results
- Forecast one item or thousands of items with unlimited batch sales forecasting
- Clear, concise customizable reports to present results and collaborate with others
- Ad-Hoc planning and analysis with "what-if" scenarios
- Compelling charts and graphs that allow drag and drop adjustments
- Determine the effectiveness and timing of promotions with best/worst case analysis

John Galt Solutions, Inc.
125 South Clark Street, Suite 1950
Chicago, IL. 60603
Tel: (312)701-9026

Fax: (312) 701-9033
www.forecastxperttoolkit.com

7. Demandworks DP

The critical element in any supply chain plan is the demand forecast. Demand Works DP™ is a full-featured demand management solution that improves the entire business planning function by maximizing forecast accuracy. It leverages demand history, current sales orders, promotions, events, and user judgment to arrive at an optimal estimate of future demand and required safety stocks. Demand Works DP combines best-in-class forecasting, a powerful and highly flexible design, and 100% web architecture for better deployment and enhanced teamwork.

Demand Works Co.
16 W. Market Street
West Chester, PA 19382
Tel: (610) 701-9873
Fax: (610) 701-9875
www.demandworks.com/

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8. Roadmap Geneva Forecasting

Roadmap Geneva Forecasting uses advanced statistical techniques to forecast sales of new and established products and predict the effects of advertising, promotion, new products, pricing changes or competitive actions. Geneva Forecasting includes:
- Powerful statistical modeling.
- Collaborative planning between headquarters and field sales.
- Advanced data mining tools to uncover exceptions and trends.
- Support for remote and mobile users.
- Interfaces to SAP and Retail POS databases.
- Specialized modules for promotion analysis, sales planning and customer forecasting.

Roadmap Technologies
900 Cummings Center
Beverly, MA 01915
Tel: (978) 232-8901
Fax: (978) 232-8903
www.managingautomation.com

9. SmartForecasts

SmartForecasts Enterprise combines automatic forecasting with rapid batch processing to accurately forecast thousands or tens of thousands of items quickly and easily—more than 100,000 items per hour. Manufacturers, distributors, and retailers can easily create accurate demand forecasts for each product item in inventory, along with item-specific estimates of safety stock requirements that significantly reduce inventory costs. The

Enterprise edition provides direct connectivity and easy integration with your corporate database (including major client/server systems such as Oracle, IBM DB2 and SQL Server), as well as ERP, DRP, Supply Chain and other planning systems.

Automatic Statistical Forecasting provides fast, accurate forecasts for hundreds or thousands of product items—at the click of your mouse.

SmartForecasts' expert system selects the best forecasting method for your data and handles all the math, easily incorporating trends, seasonal patterns and the effects of promotions and other special events. Interactive (Eyeball) Adjustments let you adjust your forecast results directly on-screen based on your business knowledge, for more realistic forecasts and informed planning decisions.

Multilevel (Multiseries) Forecasting makes it easy to obtain top-down and bottom-up forecasts, by product group/item or item/region, for large groups containing hundreds or thousands of items.

Smart Software, Inc.
Four Hill Road
Belmont, MA 02478
Tel: (617) 489-2743 or 1 (800) SMART-99
Fax: (617) 489-2748
www.smartcorp.com

10. EViews 5 for Windows 98, Me, NT 4.0, 2000, and XP
EViews 5 is a *stand-alone* software that provides the tools most frequently used in practical econometric and forecasting work. It covers Estimation, forecasting, statistical analysis, graphics, simulation, data management, all in a powerful, graphical object-oriented interface.

Quantitative Micro Software
4521 Campus Drive, Suite 336
Irvine, CA 92715
Tel: (949) 856-3368
Fax: (949) 856-2044
www.eviews.com

11. SIBYL/RUNNER
Sibyl/Runner is an interactive, *stand-alone* forecasting system. In addition to allowing the usage of all major forecasting methods, the package permits analysis of the data, suggests available forecasting methods, compares results, and provides several accuracy measures in such a way that it is easier for the user to select an appropriate method and forecast needed data under different economic and environmental conditions.

CHAPTER 13 QUIZ

1. Information needed by marketing managers include all the following except:
    A. Improving new product development
    B. Improving the use of market information
    C. Measuring and managing brand equity
    D. Orientation for personal development

2. Internal inputs to the marketing MIS are:
    A.   Commercial intelligence
    B.   The corporate strategic plan or policies
    C.   Competition, customers
    D.   Trade shows, and trade journals

3. Marketing managers use sales forecasts to determine:
    A. Line security
    B. Promotions, and advertising plans
    C. Transmission security
    D. Digital signature

4. Popular sales forecasting methods do not include:
    A. Risk analysis
    B. Exponential smoothing
    C. Moving average
    D. Regression analysis

CHAPTER 13 ANSWER KEY

1. (D) is correct. Orientation for personal development is a kind of information needed by human resource managers.

(A) is incorrect. Marketing managers are responsible for improving new product development.

(B) is incorrect. Improving the use of marketing information is critical to all marketing decisions.

(C) is incorrect. Measuring and brand management is useful to the marketing manager in performing his/her duties and responsibilities.

2. (B) is correct. The corporate strategic plan or policies is an internal input to the marketing MIS.

(A) is incorrect. Commercial intelligence is an external input.

(C) is incorrect. Competition and customers are external to the marketing MIS.

(D) is incorrect. Trade shows and trade journals are external inputs rather than internal inputs.

3. (B) is correct. Promotions and advertising plans are developed from sales forecasts.

(A) is incorrect. Line security is a communication function rather than a marketing function.

(C) is incorrect. Transmission security is a communication function rather than a marketing function.

(D) is incorrect. A digital signature is not related to sales forecasts.

4. (A) is correct. Risk analysis is used for business simulations.

(B) is incorrect. Exponential smoothing is a quantitative sales forecasting technique.

(C) is incorrect. Moving average is a naive approach to sales forecasting.

(D) is incorrect. Regression analysis is a statistical techniques used for sales forecasting.

CHAPTER 14
DECISION SUPPORT SYSTEMS

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Recognize what Decision Support Systems (DSS) are all about.
2. Identify and understand the uses of DSS development tools.
3. Discuss the Palisade's Decision Tools Suite.
4. Demonstrate DSS Applications.
5. Understand the role of the Executive Information Systems (EIS).

As discussed in Chapter 1, information systems are distinguished by the type of decisions they support, the operator that uses the system, the management control level of the system, the function of the system and the attributes of the system (see Table 1). There are information systems to support structured decisions, unstructured decisions and anything in between. At the strategic level of management, decisions are unstructured, and decision styles may differ significantly among managers. Furthermore, a specific decision problem may occur only once. Thus, information systems developed for this level often are decision specific. Once the decision is made, the information system used for it is no longer applicable in its current form. For subsequent decisions, the system must be modified or discarded, a development that has major implications for the design of information systems. Whereas executive information systems and decision support systems aid in decisions that are unstructured, transaction processing systems and expert systems aid in decisions that are structured.

The manager that uses the information systems helps distinguish the systems. Transaction processing systems (TPSs) are used at the operational level of an organization such as by clerks or secretaries. Executive information systems (EISs) are used specifically by personnel at the senior management level such as vice presidents or presidents of an organization. Decision support systems (DSSs) are used by middle management such as managers of the accounting department. Expert systems (ESs) are used by personnel at all levels of an organization.

Another factor in distinguishing information systems is the function of the systems. Transaction processing systems were established to computerize manual systems. Executive information systems (EISs) were designed to aid senior mangers in decision making. Decision support systems were designed to aid middle managers in decision making. Expert systems (ESs) were designed to aid all personnel in decision making.

The final distinguishing factor of information systems is the attributes of the system. Transaction processing systems are used to handle day to day transactions such as the accounts payable system of an organization. Executive information systems attributes include visual summaries of forecasts and budgets of an organization. Decision support system attributes include visual displays of the sales, income or interest estimates for the day, month or year. Expert system attributes include systems that assess bad debt or authorize credit.

DECISION SUPPORT SYSTEM (DSS)

A DSS is a computer based information system that assists managers in making many complex decisions, such as decisions needed to solve poorly defined or semi-structured problems. Instead of replacing the manager in the decision process, the DSS supports the manager in his or her application of the decision process. In other words, it is an automated assistant that extends the mental capabilities of the manager. Most authorities view the DSS as an integral part of the MIS, in that its primary purpose is to provide decision-making information to managerial decision makers. A DSS allows the manager to change assumptions concerning expected future conditions and to observe the effects on the relevant criteria. As a result of these direct benefits, a DSS enables the manager to gain a better understanding of the key factors affecting the decision. It enables the manager to evaluate a large number of alternative courses of action within a reasonably short time frame. A DSS summarizes or compares data from either or both internal and external sources. Internal sources include data from an organization's database such as sales, manufacturing, or financial data. Data from external sources include information on interest rates, population trends, new housing construction, or raw material pricing.

DSSs often include query languages, statistical analysis capabilities, spreadsheets, and graphics to help the user evaluate the decision data. More advanced decision support systems include capabilities that allow users to create a model of the variables affecting a decision. With a model, users can ask what-if questions by changing one or more of the variables and seeing what the projected results would be. A simple model for determining the best product price would include factors for the expected sales volume at each price level. Many people use electronic spreadsheets for simple modeling tasks. A DSS is sometimes combined with executive information systems (EISs). DSS applications used in business include systems that estimate profitability, plan monthly operations, determine the source and application of funds, and schedule staff.

TABLE 1
CHARACTERISTICS OF DSS

Graphical
Large data base
Integrate many sources of data
Report and presentation flexibility
Geared toward individual decision-making styles
Modular format
Optimization and heuristic approach
"What-if" and simulation
Goal-seeking and impact analysis
Perform statistical and analytical analysis

DSS DEVELOPMENT TOOLS

DSS development tools include the following:

1. IFPS Plus (Interactive Financial Planning System), developed by Comshare, is a modeling language that allows model building for "what-if," impact and goal seeking analyses. The program contains spreadsheet analysis, word processing abilities, and a convenient report writer.

2. EIS MICRO-WORKSTATION, developed by Boeing computer services, is an integrated software package that includes database systems, modeling, statistical analysis, forecasting, graphics, and report writing.

3. ENCORE, developed by Ferox Microsystems, has good financial modeling abilities. It can assist with cash-flow analysis, financial planning, and budget development and analysis. Word processing capabilities, graphics features, and forecasting and investment analysis are also available with this package.

4. MICROFORESIGHT is a package that provides sophisticated modeling abilities. It can analyze risk and determine how sensitive results are to certain decision or model parameters. Forecasting and statistical analysis are also available. This package can support goal seeking, thus allowing a decision maker to determine what inputs are required to obtain certain goals, such as profitability levels, rate of return targets, or cost targets.

5. PRO*FAS, developed by Decision Support Technology, is a DSS package to assist with fixed asset management. It allows managers to compare various depreciation models, using "what-if" analysis capabilities.

6. CFO Advisor is a DSS software package that performs financial analysis and allows managers to analyze the impact of financial changes on future financial outcomes.

7. PRECALC developed at INSEAD In France assists decision makers choose from various options in the presence of multiple criteria in the decision. It is an interactive, menu-driven package that has graphical capabilities.

8. Commander™ Decision, developed by Comshare, is enterprise decision support software that allows you and other decision makers in your organization flexible access to the information you need--when you need it. Decision is designed for line managers, middle managers, directors, executives, analysts, and everyone who needs to work hands-on with business information to make better-grounded business decisions. Decision is especially designed for analysis applications: you gain insight by investigating plans and results by product, by market, by version, by region, and so on.

9. FISCAL, developed by Lingo Computer Design Inc., is "Groupware for Decision Support," moving your decision support a quantum leap beyond spreadsheets. FISCAL supplies a complete architecture for rapidly implementing and managing major decision support systems. FISCAL can be used to extend the functionality of any major client-server application or database by supplying full decision support functionality for that application. Some of the industry uses include financial services, insurance, mutual funds, pension funds, telecommunications, management consulting, utilities, oil and gas, healthcare, and manufacturing. FISCAL's architecture is a top-down approach to decision support and data warehousing which ensures that the system will meet the business needs of end-users.

In what follows, we will discuss one of the most popular modeling languages--IFPS/Plus--with illustrations.

PALISADE'S DECISIONTOOLS SUITE

Palisade's *DecisionTools Suite* is a DSS tool in the area of risk and decision analysis. It includes such programs *as @RISK, @RISK for Project, TopRank, PrecisionTree, BestFit*, and *RISKview.* These programs analyze risk, run Monte Carlo simulations, perform sensitivity analyses, and fit data to distributions.

-*@RISK* is a Risk Analysis and Simulation add-in for Microsoft Excel and Lotus 1-2-3. It is the risk analysis tool. Replace values in your spreadsheet with @RISK distributions to represent uncertainty, then simulate your model using powerful Monte Carlo simulation methods. @RISK recalculates your spreadsheet hundreds (or thousands) of times. The results: distributions of possible outcome values! Results are displayed graphically and through detailed statistical reports.

-*@RISK for Project* adds the same powerful Monte Carlo techniques to your Microsoft Project models allowing users to answer questions such as, "What is the chance the project will be completed on schedule?".

-*TopRank* is a What-if Analysis add-in for either Microsoft Excel or Lotus 1-2-3 for Windows. Take any spreadsheet model, select the cells that hold your results, and TopRank automatically determines which spreadsheet values affect your results the

most. TopRank then ranks the values in order of importance. Your results can be displayed in Tornado, Spider and Sensitivity high-resolution graphs, allowing the user to easily understand the outcome at a glance. TopRank works easily and effectively with @RISK, by identifying the critical cells users should concentrate on when running Monte Carlo simulations.

      -*PrecisionTree* is a powerful, innovative decision analysis tool. Enter decision trees and influence diagrams directly in your spreadsheet models. Detail all available decision options and identify the optimal decision. Your decision analysis factors in your attitudes toward risk and the uncertainty present in your model. Sensitivity analysis identifies the critical factors which affect the decision you'll make. It's a real plus for outlining all available options for a decision or identifying and presenting the best course of action. BestFit is the distribution fitting solution for Windows.

      -*BestFit* takes data sets (up to 30,000 data points or pairs) and finds the distribution which best fits the data. BestFit accepts three types of data from text files: direct entry, cut and paste, or direct link to data within Excel or Lotus 1-2-3 spreadsheets. BestFit tests up to 26 distributions types using advanced optimization algorithms. Results are displayed graphically and through an expanded report which includes goodness-of-fit statistics. BestFit distributions can be used directly in @RISK for Excel, Lotus 1-2-3, and Microsoft Project models.

      -*RISKview* is the distribution viewing companion to @RISK, @RISK for Project or BestFit. It is a powerful tool for viewing, assessing and creating probability distributions.

DSS APPLICATIONS

      There are many DSS practical applications as follows:

1. Hewlett-Packard developed *Quality Decision Management* to perform production and quality-control functions. It can help with raw material inspection, product testing, and statistical analysis.

2. *Manufacturing Decision Support System (MDSS),* developed at Purdue University to support decisions in automated manufacturing facilities, is especially useful for CAD/CAM operations.

3. RCA has developed a DSS to deal with personnel problems and issues. The system, called *Industrial Relations Information Systems (IRIS),* can handle problems that may not be anticipated or that may occur once, and can assist in difficult labor negotiations.

4*.* The Great Eastern Bank Trust Division developed a DSS called *On-line Portfolio Management (OPM)* that can be used for portfolio and investment management. The DSS permits display and analysis of various investments and securities.

5. *ReolPlan,* a DSS to assist with commercial real estate decisions, is useful for various decision aspects of purchasing, renovating, and selling property.

6*. EPLAN (Energy Pion) is* a DSS being developed by the National Audubon Society to analyze the impact of U.S. energy policy on the environment.

7. *The Transportation Evacuation Decision Support System (TEDSS)* is a DSS used in nuclear plants in Virginia. It analyzes and develops evacuation plans to assist managers in crisis management decisions regarding evaluation times and routes and the allocation of shelter resources.

8. The U.S. Army has developed an enlisted-manpower DSS to help with recruitment, training, education, reclassification, and promotion decisions. It encompasses simulation and optimization to model personnel needs and requirements. It interacts with an on-line database and other statistical analysis software packages.

9. *Voyage Profitability Estimator.* This DSS has been utilized by a shipping firm to compute the income from decisions affecting charter rates to be charged for particular trips. The system saves time and makes it possible to evaluate trade-offs between speed and fuel usage. The analysis involves ship and voyage characteristics such as tonnage, rate of fuel consumption, and port cost.

10. *Monthly Plan Calculations.* This DSS serves as a corporate budgeting tool to measure the levels of manpower needed to perform various functions, to calculate costs, and in general to evaluate the adequacy of proposed operational plans. Using simple formulas, this system calculates the cost of materials, inventory, among other items, based on input that consists of monthly production and shipment plans. Typically, the system is used iteratively in an attempt to generate a plan that is sufficiently profitable and that meets the company's goal of maintaining reasonable level production in spite of the seasonal nature of the product.

11*. Source and Application of Funds.* An on-line budget of source and applications of funds has been used for operational decision making and financial planning in an insurance company to provide monthly cash flow figures. The DSS "output" is used at weekly meetings of an investment committee to help in allocating funds across investment areas and to minimize the amount of cash that is left idle in banks.

12. *Interactive Audit Staff Scheduling Systems.* An integer programming model has been designed by Balachandran and Zoltners to assist public accounting firms in scheduling their audit staff in an optimal and effective manner. The computerized management support system for scheduling staff to an audit can include the basic model along with a judgmental scheduling system and a scheduling information database. Motivation, morale, turnover, and productivity of the audit staff can all be affected by scheduling. In the scheduling process, the audit firm needs to consider its audit philosophy, objectives, staff size, rotational plans, and auditor evaluation. Many feasible audit staff schedules may fill these needs, but the firm needs to select the schedule that best meets its own objectives.

EXECUTIVE INFORMATION SYSTEMS (EIS)

An executive information system (EIS) is a DSS made specially for top managers and specifically supports strategic decision making. An EIS is also called *an executive*

support system (ESS). It draws on data not only from systems internal to the organization but also from those outside, such as news services and market-research databases. The EIS user interface often uses a mouse or a touch screen to help executives unfamiliar with using a keyboard. One leading system uses a remote control device similar to those used to control a television set. An EIS might allow senior executives to call up predefined reports for their personal computers, whether desktops or laptops. They might, for instance, call up sales figures in many forms--by region, by week, by fiscal year, by projected increases. The EIS includes capabilities for analyzing data and doing "what if" scenarios.

Because top managers may not be familiar with (or comfortable with) computer systems, the EIS features make them easier for executives to use. Another aspect of the EIS user interface is the graphic presentation of user information. The EIS relies heavily on graphic presentation of both the processing options and data. Again, this is designed to make the system easier to use.

Because executives focus on strategic issues, the EIS often has access to external databases such as the Dow Jones News/Retrieval service. Such external sources of information can provide current information on interest rates, commodity prices, and other leading economic indicators.

Table 2 presents the attributes of an executive information system.

TABLE 2
CHARACTERISTICS OF EXECUTIVE INFORMATION SYSTEMS (EIS)

Graphical
Easy-to-use interface
Broad, aggregated, perspective
Different data sources
Optionally expand to detail level
Provide context
Timeliness crucial

A popular EIS software is Xecutive Pulse developed by Megatrend Systems, Inc. It is a Windows-based executive information system. The software interfaces with many popular LAN-based accounting applications. It provides decision makers with easy access to financial and sales information including trend analysis using drill-down and drill-across technology. Hundreds of charts, graphs, and views are available with a mouse click. The system extracts data from accounting history files, builds a database, and stores up to three years of information for each accounting period. Users can drill down through five organizational levels, compare actual vs. history and actual vs. budget, and display report or graphic results. Xecutive Pulse features extensive sales, cash flow, and human resource analysis, plus daily trends for accounts receivable, accounts payable, margins, sales, and inventory.

LIMITATIONS OF CURRENT EIS

Although they offer great promise, many EISs have not been successfully implemented and many executives have stopped using them. A common reason cited in several failed attempts is the mistake of not modifying the system to the specific needs of the individual executives who will use the system. For example, many executives prefer to have information presented in a particular sequence with the option of seeing different levels of supporting detailed information such as cost data on a spreadsheet. The desired sequence and level of detail varies for each executive. It appears that an EIS must be tailored to the executives' requirements or the executives will continue to manage with information they have obtained through previously established methods. This limitation can be corrected by *tailoring* the software based on the particular needs of the managers within the specific company. After the software has been appropriately modified, it will have significant practical applications.

EIS APPLICATIONS

There are many EIS applications for managers including:

1. EIS in Measuring Productivity. This application bears on management's concern over productivity. Management may use both internal and external information extracted from the EIS to show how productivity in an organization has declined in recent years. Financial data can be retrieved from the EIS database to demonstrate how increases in unit labor costs over time have been primarily responsible for significant increases in the product's unit cost and have been damaging to the company's competitiveness by forcing increases in the product's selling price. Executives can also compare company sales (internal data) to industry sales trends (external data) from the EIS to project market share changes in response to changes in selling price.

External information may also be extracted from the EIS database to indicate how competitors achieve greater efficiency by using less labor and more advanced technology to manufacture a quality product and a materially lower unit cost. As a result, management may demonstrate that the competition is able to sell greater quantities of their products at lower prices. This information may provide justification for closing the unprofitable plant and opening a modern facility that will enable a company to be more competitive in the industry.

2. EIS in Product Costing Decisions. Resolving the conflict between profitability in the short run and increasing market share in the long run requires a mix of both external and internal data for a rational decision. Executives need information on product demand and elasticity, competing products and strategies, the economy and other factors such as the cost of manufacturing the product and tradeoffs that exist relative to different product quality levels under different cost assumptions. Some questions executives may raise are:

- What is the current level of quality and how does the level differ from the desired level?
- What is the current full cost of producing a unit and how does the amount differ from the full cost at the desired level of quality?
- What costs are variable over different levels of product quality?
- What costs are controllable relative to producing and selling the products?

EIS can provide data for solutions to some of these questions by computation. Many internal decisions depend upon assumptions and measurements that require judgment and may be subject to different interpretations. In product costing decisions, issues involving appropriate cost and product quality tradeoffs are equally subjective and unlikely to have a unique interpretation.

CHAPTER 14 QUIZ

1. Decision support systems (DSS) often include query languages.
True / False

2. Which of the following would best be considered an example of the use of a decision support system (DSS)?
   A. A manager uses a microcomputer-based simulation model to determine whether one of the company's ships would be able to satisfy a particular delivery schedule.
   B. An auditor uses a generalized audit software package to retrieve several purchase orders for detailed vouching.
   C. A manager uses the query language feature of a database management system (DBMS) to compile a report showing customers whose average purchase exceeds $2,500.
   D. Employees have access from remote terminals for online processing.

3. Some of the popular DSS practical applications will include WAN.
True / False

4. The Executive Information System (EIS) always works well and does not need to be modified.
True / False

5. EIS (Executive Information System) product planning decisions can resolve questions such as "what is the current full cost of producing a unit? And what costs are variable?"
True / False

6. An Executive Information System (EIS) has all of the following characteristics except
   A. Focusing on obtaining strategic objectives.
   B. Giving immediate information about an organization's critical success factors.
   C. Providing information from nontraditional computer sources.
   D. Providing advice and answers to top management from a knowledge-based system.

CHAPTER 14 ANSWER KEY

1. (F) is incorrect. DSS include many tools and capabilities such as query languages, statistical analysis capabilities, spreadsheets and graphics.

(T) is correct. Query language allows decision makers to search and answer key managerial decisions.

2. (A) is correct. A decision support system (DSS) assists middle- and upper-level managers in long-term, nonroutine, and often unstructured decision making. The system contains at least one decision model, is usually interactive, dedicated, and time-shared, but need not be real-time. It is an aid to decision making, not the automation of a decision process. The microcomputer-based simulation model is used to provide interactive problem solving (i.e., scheduling) assistance, the distinguishing feature of a DSS.

(B) is incorrect because the generalized audit software package does not provide interactive problem solving assistance in retrieving the purchase orders, and thus is not a DSS.

(C) is incorrect because the query feature of a DBMS does not provide interactive problem solving assistance in compiling the report, and thus is not a DSS.

(D) is incorrect because remote access and online operation are not unique to a DSS.

3. (F) is correct. WAN is a Wide Area Network, not a DSS application.

(T) is incorrect. Practical applications used in DSS include quality decision management (HP), Industrial Relations Information system (RCA), and EPLAN (Energy Pion).

4. (F) is correct. The limitation of the EIS is that it commonly fails and requires to be modified.

(T) is incorrect. If properly constructed, the EIS provides decision makers with easy access to financial and sales information and trends

5. (T) is incorrect. EIS production planning decisions involve questions such as how many, how, what, and when to produce?

(F) is correct. These questions are addressed by EIS product costing module. They must be answered to make pricing and tactical short-term decisions such as make-or-outsource.

6. (D) is correct. An EIS serves the needs of top management for transaction processing (primarily inquiries and support for decisions), operational control, managerial control, and strategic planning. Top management needs access to the database and decision models, the use of large amounts of summarized internal and especially external data, and the capacity for ad hoc analysis. Thus, an EIS focuses on strategic (long-range) objectives and gives immediate information about a firm's critical success factors. Information is typically supplied from nontraditional computer sources. However, an EIS program can be used on computers of all sizes. An EIS is not a program for providing top management with advice and answers from a knowledge-based (expert) system.

(A) is incorrect. An EIS does focus on obtaining strategic objectives.

(B) is incorrect. An EIS gives immediate information about an organization's critical (strategic) success factors.

(C) is incorrect. An EIS does not use traditional computer sources.

CHAPTER 15

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Define artificial intelligence (AI).
2. Explain and demonstrate expert systems (ESs).
3. Discuss and identify expert system shells and products.
4. Illustrate general uses of expert systems.
5. Define fuzzy logic.
6. Clarify the benefits of automatic programming.
7. List and discuss the functional area applications.
8. Explain the process of neural networking.
9. Identify the neural network applications in business.

Artificial intelligence is the application of human reasoning techniques to machines. Artificial intelligence systems use sophisticated computer hardware and software to simulate the functions of the human mind. Expert systems are the most promising applications of artificial intelligence and have received the most attention. Expert systems are computer programs exhibiting behavior characteristics of experts. Expert systems involve the creation of computer software that emulates the way people solve problems. Like a human expert, an expert system gives advice by drawing upon its own store of knowledge, and by requesting information specific to the problem at hand. Expert systems is not exactly the same thing as decision support systems.

A DSS is computer based software which assists decision makers by providing data and models. It performs primarily semi-structured tasks whereas an expert system is more appropriate for unstructured tasks. Decision support system can be interactive just like an expert system. But, because of the way decision support systems process information, they typically cannot be used for unstructured decisions which involve nonquantitative data. Unlike expert systems, decision support systems do not make decisions but merely attempt to improve and enhance decisions by providing indirect support without automating the whole decision process.

Some general characteristics indicate whether a given business application is likely to be a good candidate for the development of an expert system. For example, application requires the use of expert knowledge, judgment and experience. The business problem must have a heuristic nature and must be defined clearly. The area of expertise required for the application must be well-defined and recognized professionally, and the organization developing the expert system must be able to recruit an expert who is willing to cooperate with the expert system's development team.

The size and complexity of the application must be manageable in the context of organizational resources, available technical skills, and management support.

EXPERT SYSTEMS

An expert system (ES), sometimes called *knowledge system*, is a set of computer programs that perform a task at the level of a human expert. Expert systems are created on the basis of knowledge collected on specific topics from human experts, and they initiate the reasoning process of a human being. Expert systems have emerged from the field of artificial intelligence, which is the branch of computer science that is attempting to create computer systems that simulate human reasoning and sensation. We describe artificial intelligence in more detail later in the chapter.

Expert systems are used by management and nonmanagement personnel to solve specific problems, such as how to reduce production costs, improve workers' productivity, or reduce environmental impact. It is a computer program which, based on methodically using a narrowly-defined domain of knowledge that is built into the program, comes up with a solution to a problem much the same way an expert would. The key to the definition is that the domain must be narrowly defined. An expert system cannot (at this point) be developed to give useful answers about all questions-it is limited as a human expert is limited to a particular field. For example, one expert system would not tell the controller both whether to lease or buy a piece of equipment based on the tax differences.
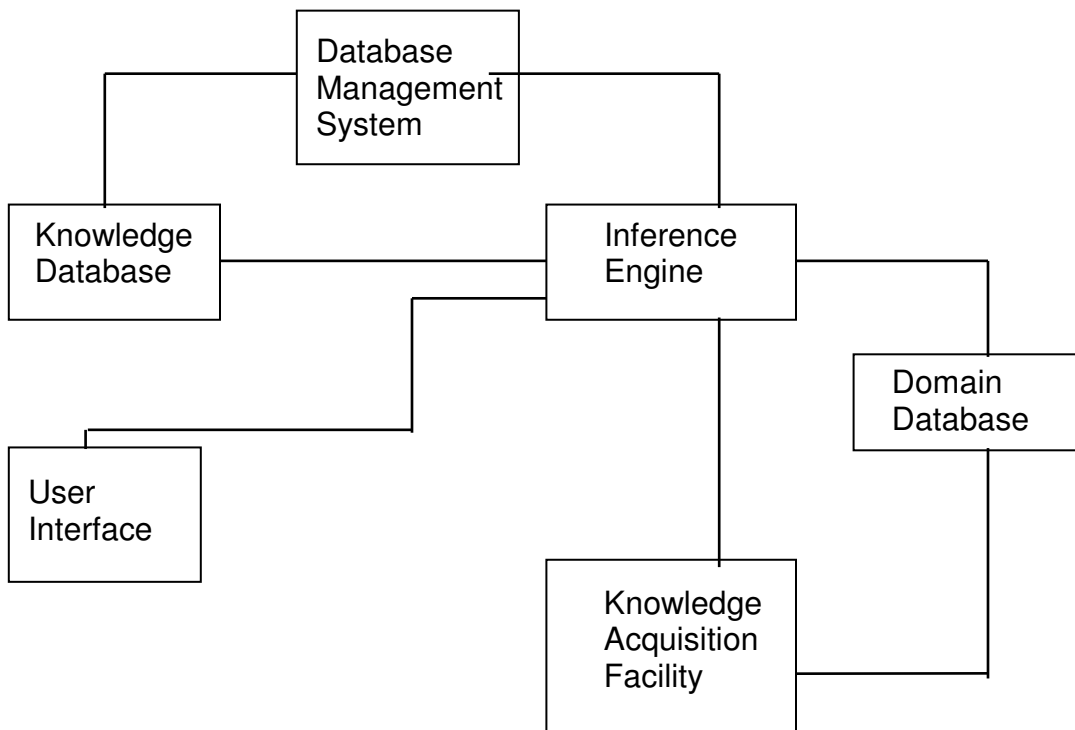
HOW EXPERT SYSTEMS WORK

Expert systems are usually considered to have six major components. The relationships of these components are illustrated in Figure 1. Based on the relationships illustrated in Figure 1, it is apparent that expert systems must work interactively with system users in assisting them in making better decisions. The system interacts with the user by continuously asking for information until it is ready to make a decision. Once the system has sufficient information, an answer or result is returned to the user. It is essential to note that not only must the system assist in making the decision itself, it must also provide the user with logic it employed to reach its decision.

The inference engine processes the data the user inputs to find matches with the knowledge base. The knowledge base is where the expert's information is stored. The user interface is what allows the user to communicate with the program. The explanation facility shows the user how each decision was derived. Expert systems are only as good as their programming. If the information in the knowledge base is incorrect or if the inference engine is not designed properly, the results will be useless. GIGO holds true: garbage in, garbage out.

The knowledge consists of two types of knowledge representations; inductive knowledge (case base) and deductive knowledge (rule base).

FIGURE 1
EXPERT SYSTEM RELATIONSHIPS

```
                    ┌──────────────┐
                    │ Database     │
                    │ Management   │
                    │ System       │
                    └──────────────┘

┌──────────────┐              ┌──────────────┐         ┌──────────────┐
│ Knowledge    │              │ Inference    │         │ Domain       │
│ Database     │              │ Engine       │         │ Database     │
└──────────────┘              └──────────────┘         └──────────────┘

┌──────────────┐              ┌──────────────┐
│ User         │              │ Knowledge    │
│ Interface    │              │ Acquisition  │
└──────────────┘              │ Facility     │
                              └──────────────┘
```

1. *Knowledge Database:* contains the rules and cases used when making decisions
2. *Domain Database*: the set of facts and information relevant to the domain (area of interest)
3. *Database Management System*: control input and management of both the knowledge and domain databases
4. *Inference Engine:* contains the inference strategies and controls used by experts to manipulate knowledge and domain databases. It is the brain of the expert system. It receives the request from the user interface and conducts reasoning in the knowledge base.
5. *User Interface*: the explanatory features, on-line help facilities, debugging tools, modifications systems and other tools designed to assist the user in effectively utilizing the system
6. *Knowledge Acquisition Facility*: allows for interactive processing between the system and the user; how the system acquires "knowledge" from human experts in the form of rules and facts. More advanced technology allows intelligent software to "learn" knowledge from different problem domains. The knowledge learned by computer software is more accurate and reliable compared with that of human experts.

Rule Based Expert Systems

The rule base of an expert system contains a set of production rules. Each rule has a typical IF THEN clause. Expert system users provide facts or statements so that production rules can be triggered and the conclusion can be generated. Ford Motor Company uses an expert system to diagnose engine repair problems. Typically, Ford Dealers will call the help line in Ford headquarters to receive a suggestion when a complicated engine problem cannot be diagnosed. Today, by using an expert system, dealers can access company's expert systems and receive correct engine diagnosis within seconds. Expert systems can be used at any types of business domains and at any level in an organization. Examples are diagnosing illness, searching for oil, making soup and analyzing computer systems. More applications and more users are expected in the future. Knowledge-based (expert) systems contain a knowledge base for a limited domain of human expertise and inference procedures for the solution of problems. They use symbolic processing based on *heuristics* rather than algorithms. A heuristic procedure is an exploratory problem-solving technique that uses self-education methods, e.g., the evaluation of feedback, to improve performance. These systems are often very interactive and provide explanations of their problem-solving behavior.

Case Based Expert Systems

A case based expert system uses an inductive method to conduct expert system reasoning. In this type of expert system, a case base is employed. A case base consists of many historical cases, which have different results. The expert inference engine will search through the case base and find the appropriate historical case, which matches the characteristics of the current problem to be solved. After a match has been allocated, the solution of a matched historical case will be modified and used as the new suggestion for this current problem.

Lockheed uses an expert system to help speed the purchase of materials ranging from industrial coolant to satellite and rocket parts. The old MIS request a purchase order to include more than 100 different forms, which are seldom completed by purchaser. Lots of time was spent to make corrections and changes to make a purchase order complete. By using an expert system, less information was asked and the time required to finish a purchasing order is reduced.

EXPERT SYSTEM SHELLS AND PRODUCTS

An ES shell is a collection of software packages and tools used to design, develop, implement, and maintain expert systems. Expert system shells exist in many different forms. There are a number of off-the-shelf expert system shells that are complete and ready to run. The user enters the appropriate data or parameters, and the expert system provides output to the problem or situation. Some of the expert system shells include *Level 5* and *VP-Expert.* Other shells are described in Table 1.

Furthermore, a number of other expert system development tools make the development of expert systems easier and faster. These products help capture *if-then* rules for the rule base, assist in using tools such as spreadsheets and programming

languages, interface with traditional database packages, and generate the inference engine.

Once developed, an expert system can be run by people with virtually no computer experience. The expert system asks the user a series of questions. Subsequent questions are often based on answers to previous questions. After the user answers the system-generated questions, the expert system generates conclusions. Many expert systems have word-processing capabilities that can generate letters asking users for additional information.

TABLE 1
POPULAR ES SHELLS

1st-Class Fusion offers a direct, easy-to-use link to the knowledge base. It also offers a visual rule tree, which graphically shows how rules are related.

Financial Advisor is an ES shell that can analyze capital investments in fixed assets such as equipment and facilities.

Knowledgepro is a high-level language that combines functions of expert systems and hypertext. It allows the setup of classic if-then rules, and can read database and spreadsheet files.

Leonardo is an ES shell that employs an object-oriented language used to develop an expert system called COMSTRAT, which can be used by marketing managers to help analyze the position of their companies and products relative to their competition.

Personal Consultant (PC) Easy is a shell used to route vehicles in warehouses and manufacturing plants.

GENERAL USES OF EXPERT SYSTEMS

Case 1

Cyc (short for encyclopedia) is an AI (artificial intelligence) application developed by Cycorp Inc. in Austin, Texas. The system is the brainchild of Douglas B. Lenat. Cyc uses a top-down system to organize knowledge within its knowledge base and to enable the storage of up 2 million rules. A half-dozen companies including Glaxo Wellcome, Digital Equipment, IBM, and United Healthcare have snapped up the first commercial versions. For United Healthcare the ability of Cyc to store mass quantities of data and rules helps them to manage huge online thesauruses of pharmaceutical and healthcare terms that have associations based on the content and/or interaction effects-limiting the need for its employees to deal with the complexity of terms.

Case 2
A newer product based on Cyc is a photo retrieval system. The knowledge base in Cyc is able to learn the relationships between different phrases and use these relationships to search related photographs stored in files along with searchable captions. Type "strong and daring person" and Cyc pulls up a picture captioned "man climbing mountain." Cyc knows that a man is a person, and that mountain climbing demands strength and is dangerous.

Case 3
Firefly is a web-based Cyc derivative that allows viewers to identify music and artist that they like. Then, based on the information that thousands of other users have entered, Firefly identifies other music in which the viewers are likely to be dead-on. Essentially, Firefly builds patterns in the data and uses the patterns to identify missing pieces in a new user profile. These missing pieces are music or artists that the viewer will likely be interested in.

Case 4
Derivative products of Cog have also found their way into commercial applications. The principles underlying Cog were used to develop a crablike robot for the Navy that can locate and detonate mines on beaches. Another robot, Hermes, will be used by NASA to explore the surface of Mars. The plan is to literally launch hordes of Hermes to scour the landscape in search of interesting items before calling in the main experimental until to collect samples.

FUZZY LOGIC

Fuzzy logic deals with uncertainty. This technique, which uses the mathematical theory of fuzzy sets, simulates the process of normal human reasoning by allowing the computer to behave less precisely and logically than conventional computers do. Fuzzy logic is a type of mathematics. It deals with non-precise values with a certain degree of uncertainty. This technology allows logistics to be utilized by non-precise information.

Fuzzy logic can be advantageous for the following reasons:
- It provides flexibility
- It gives you options.
- It gives you imagination.
- It is more forgiving.
- It allows for observation.

One example where fuzzy logic is being used extensively is in consumer products where the input is provided by sensors rather than by people. Fuzzy logic can be used when values are approximate or subject and data are incomplete or ambiguous. These systems have been applied successfully to applications such as ventilating expressway tunnels, backing a tractor-trailer into a parking space, reducing power usage in an air conditioner, selecting companies for business combinations, or detecting fraud in medical insurance claims.

AUTOMATIC PROGRAMMING

Automatic programming is described as a "super-compiler," or a program that could take in a very high-level description of what the program is to accomplish and produce a program in a specific programming language. One of the important contributions of research in automatic programming has been the notion of debugging as a problem-solving strategy. It has been found that it is often much more efficient to produce an inexpensive, error filled solution to a programming or robot control problem and then modify it, than to insist on a first solution completely free of defects.

FUNCTIONAL AREA APPLICATIONS

In addition to the applications described above, expert systems are used in accounting-related systems, capital resource planning, loan applications, strategic marketing, and developing strategic objectives for the organization.

ACCOUNTING SYSTEMS

Internal accounting systems are an ideal area for expert systems applications. Expert systems can be developed to analyze cash flows, accounts payable, accounts receivable, and the appropriate use of general ledger entries. The knowledge base can include information from accounting organizations, such as the American Institute of Certified Public Accountants (AICPA). Current tax laws, Securities and Exchange Commission requirements, and generally accepted accounting practices can also be entered into the knowledge base. The inference engine for the accounting expert system can assist in many important decisions, including financial accounting approaches, the management of cash flows, and other related accounting practices.

Four areas of accounting in which expert systems can be used are accounting standards, taxation, management and control, and auditing.

In the area of accounting standards, an expert system would apply standards in a consistent manner when preparing accounts or performing audits. This task would probably be performed more often by external auditors than by internal auditors.

Taxation is an area restricted by a complex set of rules and procedures. Expert systems make compliance with these rules much easier since all rules can be programmed into the computer. Tax planning is an area that has also benefited. More on this is explained later.

In the area of management and control, expert systems are used to supplement management information systems. Expert systems provide decision models used for planning and control. As with any new management system the internal auditor should evaluate the potential benefits and control areas. Furthermore, the auditor must periodically evaluate established expert systems to determine whether the systems continue to meet the objectives they were designed to meet.

Auditing is the final area of accounting where expert systems can be very useful. Expert systems can choose an audit program, choose test sample, determine the level of error, perform an analytical review and then make a judgment based on the findings.

Expert systems also can assist in:

- Preparing working papers
- Maintaining the ledger
- Preparing financial statements
- Planning budgets and forecasts
- Payroll preparation and analysis
- Revenue analysis by volume, price, and product-service mix
- Analyzing expenses
- Costs specified in terms of volume, price and category
- Converting from cash to accrual basis
- Aging accounts receivable
- Financial statements analysis
- Financial aspects of the business.

Currently, there are few tax expert systems available. This is due to two primary factors. First, if the information in the knowledge base is incorrect and bad decisions are made based on the system, the developer could be sued. Second, many expert systems are developed by large firms who want to protect their investment. It is not difficult to develop an expert system using a shell. The reasons may include: the Tax Code is under constant revision (more change implies higher cost to maintain the expert system), tax practitioners do not believe in the benefits of expert systems, existing CD ROM tax databases provide a lot of information, and tax-only expert systems are not sufficient to do business planning-more support is needed to make planning decisions.

There are examples of programs used in tax. *ExpeTAX* developed by Coopers and Lybrand is used in tax planning and tax accrual. It uses a question and answer format to run a maze of three thousand rules and outlines a client's best tax options. It will, for example, identify the differences between book and tax values. *Taxadvisor* is used for estate planning. *Corptax* examines the tax consequences for stock redemptions. CCH Inc. introduced *CCH Tax Assistant*. This software, while not termed an expert system by CCH, performs in many ways like an expert system. Tax Assistant uses user-entered information while making decisions. The software can reduce the time spent by accountants calculating and generating reports. In addition, lower-level accountants can complete more difficult research tasks using the software.

Some believe that expert systems are the future in tax accounting. Expert systems could be used for *compliance* work, for example, to determine whether an activity is passive. In addition, they could be used for identifying problems and for planning purposes, for example to determine whether a company is a personal holding company and how to avoid the associated penalty.

CAPITAL EXPENDITURES PLANNING

Capital investment planning involves making long-term planning decisions for alternative investment opportunities. There are many investment decisions that the company may have to make in order to grow. Examples of capital budgeting applications are product line selection, keep or sell a business segment, lease or buy, and which asset to invest in. Resource commitments may also be evaluated in the form of new product development, market research, introduction of a computer, refunding of long-term debt, and so on. Expert systems may also be used in mergers and acquisitions analysis in the form of buying another company to add a new product line. *CashValue* is a commercially available expert system in capital projects planning.

ANALYSIS OF CREDIT AND LOAN APPLICATIONS

A major part of any lending institution is making sound, profitable loans to business. A large number of risky loans can result in large financial losses and potential bankruptcy for the institution. Reliable loans to companies with little chance of defaults can substantially increase a bank's overall profitability. Due to the high degree of analytical skills and experience involved, the analysis of loan applications is quite appropriate for computerized expert systems. Extending loans and lines of credit to businesses involve several key considerations, one of which is *management attitudes and style.* Does the management have the ability to grow in adverse as well as good times? How will management use the proceeds of the loan? Are there any potential problems with the company or management? The loan analysis expert system can either accept or reject the application for loans and credit. The acceptance can also be conditioned upon some criteria. For example, the loan can be made only if the company receiving the funds agrees to make certain changes in their operation, management style, marketing strategy, and so forth. The expert system can also identify questionable loans in terms of default risk. The result could be a higher interest rate, a lower loan amount, an altered repayment structure, or higher collateral requirements.

MARKETING APPLICATIONS

Marketing expert systems can be developed to allow marketing managers to make strategic marketing-related decision making and planning activities. Establishing sales and profit goals, products and services to focus, and prospective customer profiles are examples. The marketing expert system requires a knowledge base covering relevant data on customers, the overall market structure, diverse internal and external factors, and the competition. Once the overall strategic marketing plan has been mapped out, the expert system can explore specific goals. The types of marketing mix, that is, what products and services to be produced, promotional efforts, pricing considerations, and the distribution system are resolved at this level. The product quality, style, packaging, warranties, customer services offered, features and options, and return policies are analyzed. Pricing policy decisions are equally important. The list price, discounts, and credit terms are determined as a part of price analysis. Advertising, the role of sales representatives, direct marketing, publicity, the use of marketing research firms, and using professional marketing companies are important

decisions for promotion. Finally, the distribution channel of delivering products and services to customers is examined.

APPLICATIONS IN FINANCE

A. Insurance

Underwriting: Expert systems will increase the consistency of applying company standards in evaluating various risks (fire, flood, theft, and so on)

Claims processing: Fraud detection is particularly difficult in medical insurance due to the complexity of claims. Expert systems will substantially reduce labor cost by quickly evaluating claims, and improving the detection of suspicious information.

Reserving: Deciding how much reserves to set aside for future claims and ongoing payout is similar to factory inventory schedules in many ways. ES will provide the means to consistently allocate resources to meet uncertain demands.

B. Portfolio Management

Security Selection: With over 100,000 stocks and bonds to choose from, selecting the right securities is a substantial challenge. Too much information is available than can be intelligently digested. ES will analyze data and provide recommendations. For example, Unitek Technologies' *Expert Strategist* performs financial statement analysis.

Consistent application of constraints: Managers of multiple portfolios must consistently apply multiple constraints on different portfolios. The constraints include compliance with legal SEC rules, clients' guidelines, consistency across related accounts, etc. ES will help financial professionals in applying different portfolio designs under the multiple constraints.

Hedge Advisor: The number of financial instruments available and the complexity of their relationship is increasing rapidly. These instruments vary in margin, liquidity, and price. They can be combined to create "synthetic securities," thereby hedging against market risk. ES will help the process of creating "synthetic securities."

C. Trading Advisor

Real-time data feed: Timely information is critical in any trading application. Expert systems will integrate real-time multiple external/internal data sources, and provide timely information.

Trading rules and rule generators: The conventional knowledge-engineering approach to rule writing will be replaced by rule generators. A rule generator ES will recognize data patterns, and generate immediate hypothesis (trading rules) that lead to trading recommendations.

Critics and neural nets: Critic ES will review and evaluate system-recommended trades, process explanations of those trades, and find out culprits and heroes.

D. ES in The Global Financial Market

Financial statement advice for multinational companies: Multinational firms have unique problems with regard to reporting and legal requirements. These firms must deal

with inconsistencies, such as, varying reporting formats, regulatory requirements, and account types. These problems will be solved by ES.

24 hours Trading Programs: Individual human traders can not work for 24 hours. However, ES can. With traderless expert systems, smaller companies will have a better chance of entering global markets and foreign exchange trading.

Hedges: In the international security markets, many different types of hedges are possible, including interest-rate swaps, currency swaps, options, and futures. ES can take advantage of those hedges.

Arbitrage: ES quickly will identify and evaluate arbitrage opportunities, and trigger transactions.

BENEFITS AND DISADVANTAGES OF EXPERT SYSTEMS

The following are benefits expert systems offer:

- Increased output and productivity as well as better accuracy and reliability.
- They can function as tutors since they distill expertise into clearly defined rules.
- Capture of scarce expertise.
- Knowledge sharing. The system will be available to provide second opinions within the domain, as well as provide what-if analysis where results are sought on variable changes.
- A shorter decision time. Routine decisions are rapidly made by the systems.
- Enhancement of problem solving capabilities.
- The systems are more secure than an expert employee who may be hired by a competitor.

The drawbacks to expert systems are:
- They fail to adapt to a continually changing environment.
- They are usually confined to a very narrow domain and may have difficulty coping with broad discipline knowledge decisions.

NEURAL NETWORKS

Expert systems typically require huge databases of information gathered from recognized experts in a given field. This system will then ask questions of the user and deduce an answer based on the responses given and the information in the database. These answers are not necessarily right, but should be a logical conclusion based on the information provided.   Neural networks are a developing technology in which computers actually try to learn from the database and operator what the right answer is to a question. The system gets positive or negative response to output from the operator and stores that data so that it will make a better decision the next time. While still in its infancy, this technology shows promise for use in fraud detection, economic forecasting, and risk appraisals.

The idea behind this software is to convert the order-taking computer into a "thinking" problem solver. This would allow computers to take over some of the more mundane decision-making jobs of accountants such as determining if a lease is operating or capital. Neural networks are software programs that simulate human intelligence. They are designed to learn from experience. For example, each time a neural network program makes the right decision (which is predetermined by a human instructor) on recognizing a number or sequence-of-action pattern, the programmer reinforces the program with a confirmation message that is stored. In the event of a wrong decision, a negative message is reinforced. Thus, it gradually builds experimental knowledge in that subject.

Today most neural networks take the form of mathematical simulations embedded in software that runs on ordinary microprocessors.

NEURAL NETWORK APPLICATIONS IN BUSINESS

1. At Signet Bank, neural networks read and automatically process student loan applications and canceled checks.
2. A neural network helps manage the Fidelity Disciplined Equity Fund, a fund that has consistently beat the Standard & Poor's 500 Stock Index.
3. Neuroscope is a neural network diagnostic tool that provides early warning of failure in industrial machinery.
4. Foster Ousley Conley uses a neural network-based system for residential real estate appraisal. The system performs better than humans because it can review data from hundreds of houses and analyze the data in many different ways.
5. At Mellon Bank's Visa and MasterCard operations, neural networks outperform expert systems—and the experts themselves—in detecting credit card fraud. Since the neural network can learn by experience, it can find incidences of fraud *not anticipated by an expert.*
6. Neural networks can be used to forecast a client's earnings. By comparing this forecast to actual results, the auditor can make a judgment as to the reasonableness of the actual results. The forecasted earnings can also indicate to the auditor if the client is likely to continue as a going concern.
7. A cost accountant/consultant can use a neural network to determine optimal resource allocation and production schedules. The manipulation of the hundreds of variables and constraints has traditionally been undertaken using operations research models.
8. The IRS in Taiwan is using a neural network to determine the likelihood of tax evasion and the necessity of further investigation.

The following is a list of popular neural network software.

NeuroSolutions
NeuroDomension, Inc.
www.neurosolutions.com

NeuroXL Predictor
FRANZ AG
www.neuroxl.com

NeuralWorks Predict
NeuralWare
www.neuralware.com

SUMMARY
Artificial intelligence is the research which intends to discover the humans' logic and thinking and use computer technologies to imitate human's behavior. AI development can pretty much perform human learning and reasoning activities. With AI technologies, computers can be more productive and business processes will be more cost efficient.

1. Expert systems consists of
   A. Software packages with the ability to make judgment decisions.
   B. A panel of outside consultants.
   C. Hardware designed to make judgment decisions.
   D. Hardware and software used to automate routine tasks.

2. Which one of the following incorporates making the best decisions possible, using a logical approach to solving problems, using reasoning, having the capability to learn, and allowing subjective inputs and outputs?
   A. Expert systems.
   B. Decision support systems.
   C. Multi-networking.
   D. Neural networks.

3. Prudent managers will recognize the limits within which expert systems can be effectively applied. An expert system would be most appropriate to
   A. Compensate for the lack of certain technical knowledge within the organization.
   B. Help make customer-service jobs easier to perform.
   C. Automate daily managerial problem-solving.
   D. Emulate human expertise for strategic planning.

4. The processing in knowledge-based systems is characterized by
   A. Algorithms.
   B. Deterministic procedures.
   C. Heuristics.
   D. Simulations.

5. A bank implemented an expert system to help account representatives consolidate the bank's relationships with each customer. The expert system has
   A. A sequential control structure.
   B. Distinct input/output variables.
   C. A knowledge base.
   D. Passive data elements.

6. For which of the following applications would the use of a fuzzy logic system be the most appropriate artificial intelligence (AI) choice?
   A. Assigning airport gates to arriving airline flights.
   B. Forecasting demand for spare auto parts.
   C. Ventilating expressway tunnels.
   D. Diagnosing computer hardware problems.

7. An application of an Expert System used by insurance companies to increase the consistency of applying company standards in evaluating various risks (e.g. fire, flood, theft) is:

    A. Claims processing
    B. Underwriting
    C. Reserving
    D. None of the above

CHAPTER 15 ANSWER KEY

1. (A) is correct. Artificial intelligence and its subfield, expert systems, have been identified by the AICPA Future Issues Committee as one of the major issues the accounting profession will face in the future. Expert systems attempt to permit a computer to think and make decisions in a human way. An expert system is an interactive system that asks a series of questions and used knowledge gained from a human expert to analyze answers and comet to a decision, that is, to exercise judgment. They were originally developed to make decisions in areas that did not have enough human experts to make decisions in areas that did not have enough human experts to make decisions. Some of the earliest expert systems were used by doctors to diagnose diseases. Experimental work is being done with expert systems in taxation, financial accounting, managerial accounting, and auditing.

(B) is incorrect. Expert systems do not require outside consultants.

(C) is incorrect. Hardware does not make judgment decisions.

(D) is incorrect. Automation of routine tasks is not the purpose of expert systems.

2. (A) is correct. An expert system is software designed to perceive, reason, and understand. An expert system is an interactive system that asks a series of questions and uses knowledge gained form a human expert to analyze answers and come to a decision. The system is developed by using a continuous process of revision. As new knowledge or decision-making strategies become available, prior systems must be revised.

(B) is incorrect. Decision support systems are extensions of the MIS concept that are primarily useful for semistructured problems, such as those requiring the decision maker to exercise judgment in controlling the process but allowing for certain aspects of the problem to be preprogrammed. A decision support system does not automate a decision but rather provides tools for the user to employ in applying his/her own insight and judgment.

(C) is incorrect. Multi-networking involves using multiple networks with the same computer.

(D) is incorrect. Neural networks, although similar to expert systems, can learn from making mistakes.

3. (B) is correct. Expert systems allow even small companies to perform activities and provide services previously only available from larger firms. The use of expert systems has helped to improve the quality of customer service in applications such as maintenance and scheduling by automating them and making them easy to perform.

(A) is incorrect. Expert systems codify and apply existing knowledge, but they do not create knowledge that is lacking.

(C) is incorrect. Expert systems do best in automating lower-level clerical functions.

(D) is incorrect. Expert systems concern problems with relatively few possible outcomes that are all known in advance.

4. (C) is correct. Knowledge-based (expert) systems contain a knowledge base for a limited domain of human expertise and inference procedures for the solution of problems. They use symbolic processing based on heuristics rather than algorithms. A heuristic procedure is an exploratory problem-solving technique that uses self-education methods, e.g., the evaluation of feedback, to improve performance. These systems are often very interactive and provide explanations of their problem-solving behavior.

(A) is incorrect. Algorithms are defined procedures used in typical computer programs.

(B) is incorrect. Deterministic procedures are procedures used in computer programs that permit no uncertainty in outcomes.

(D) is incorrect. Simultaneous are computer programs that permit experimentation with logical and mathematical models.

5. (C) is correct. An expert system relies on a computer's ability to make decisions in a human way. There are six components to the expert system; knowledge base, domain database, database management system, inference engine, user interface, and knowledge acquisition facility. The knowledge base contains the rules used when making decisions.

(A) is incorrect. Traditional programs, e.g., in COBOL, have sequential control structures; expert systems do not.

(B) is incorrect. Traditional programs, not expert systems, have distinct input/output variables.

(D) is incorrect. Traditional programs, not expert systems, have passive data elements.

6. (C) is correct. Fuzzy logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth. Because they use nonspecific terms (membership functions) characterized by well-defined imprecision, fuzzy logic systems can create rules to address problems with many solutions. Fuzzy logic can be used when values are approximate or subject and data are incomplete or ambiguous. These systems have been applied successfully to applications such as ventilating expressway tunnels, backing a tractor-trailer into a parking space, reducing power usage in an air conditioner, selecting companies for business combinations, or detecting fraud in medical insurance claims.

(A) is incorrect. Assigning airport gates to arriving airline flights requires an expert system that uses precise data for quick and consistent decisions.

(B) is incorrect. Neural networks provide the technology to undertake sophisticated forecasting and analysis. They emulate the processing patterns of the brain and therefore can learn from experience.

(D) is incorrect. Diagnosing problems with computer hardware requires an expert system.

7. (B) is correct. An application of an Expert System used by insurance companies to increase the consistency of applying company standards in evaluating various risks (e.g. fire, flood, theft) is underwriting.

(A) is incorrect. Claims processing evaluates claims and detects fraud.

(C) is incorrect. Reserving decides how much to set aside for future claims and ongoing payouts.

(D) is incorrect. Underwriting (B) is correct.

CHAPTER 16
CONTROL AND SECURITY OF INFORMATION SYSTEMS

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Defend against threats and attacks on computer technology.
2. Prevent financial loss and utilize the cost-benefit criterion.
3. Initiate a physical security and data security system.
4. Control physical access.
5. Plan for fire security.
6. Identify the saboteur's tools.
7. Implement communications security.
8. Establish controls.
9. Utilize application controls.
10. Facilitate electronic data interchanges.
11. Develop a system for personnel security.
12. Institute environmental security.
13. Synthesize and analyze an audit trail.
14. Develop and implement network security.
15. Define the duties of the security administrator.
16. Review the current related laws and legislation and their applications.

Every day there are news stories about computer related data errors, thefts, burglaries, fires, and sabotage. Although considerable efforts have been made to reduce vulnerability to such events, much more effort is needed. Weak computer security and lack of internal controls tremendously increases an organization's vulnerability to the following:

- Commission of fraud
- Theft of electronic information
- Theft of physical information, such as printed outputs or computer disks/tapes
- Invasion of privacy
- Damage to computers and peripherals
- Interception of communications
- Illegal recording of electromagnetic emanations from computers and peripherals
- Unintentional data errors due to carelessness or negligence
- Loss of information integrity through unauthorized alterations and modifications to data
- Sabotage by disgruntled employees or competitors

- Power failure

Crime insurance policies should be taken out covering such areas as theft, fraud, intentional destruction and forgery. Business interruption insurance covers lost profits during downtime. Insurance should also cover computer equipment in transit.

A risk analysis should be performed in planning computer security policies and financial support. Computer security risks fall into one of three major categories: destruction, modification, and disclosure. Each of these may be further classified into intentional, unintentional, and environmental attacks. The threat comes from computer criminals and disgruntled employees who intend to defraud, sabotage, and "hack." It also comes from computer users who are careless or negligent. Lastly, the threat comes from the environment; an organization must protect itself from disasters such as fire, flood, and earthquakes. An effective security plan must consider all three types of threats: intentional attacks, unintentional attacks, and environmental attacks. What is the company's degree of risk exposure?

FINANCIAL LOSS AND THE COST-BENEFIT CRITERION
The danger of financial loss to a company can be greatly reduced by increasing computer security. In all likelihood, not investing in appropriate security measures will prove to be far more expensive for a company than investing in the appropriate security measures. It would even be appropriate for a company to consider the cost of investing in computer security as a form of insurance.

The cost of security measures must always be compared with the benefits received. As Figure 1 illustrates, the optimal level of security expenditure is when the combined cost of security measures and financial loss is minimized. The law of diminishing returns clearly applies here. Additional expenditures on security measures beyond a certain point are not likely to be cost effective. While appropriate security measures can greatly reduce the likelihood of a financial loss, security measures by themselves cannot guarantee against every kind of damage and accident: a certain degree of risk will always have to be accepted.

FIGURE 1
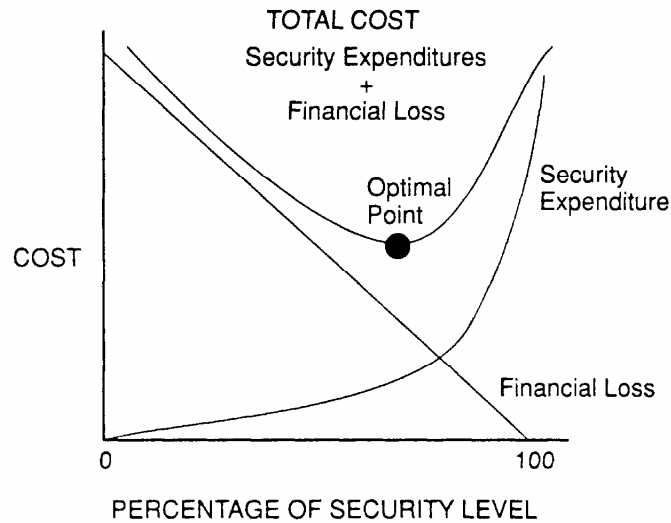
The cost-benefit criterion dictates that a company formally assesses the risks it faces. The following three questions must be answered by the organization:

- What type of threats may affect our organization?
- What is the probability that a threat will occur?
- What is the potential liability for each threat?

For each type of threat, expected loss may be calculated as follows:

Loss Expectancy = Probability of Loss x Amount of Loss

Using the above formula, expected losses may be classified into three categories. As shown in Figure 2, loss expectancy is highest for category (A) and lowest for category (C). Clearly considerable attention must be directed toward category (A) since there is both a high amount and a high probability of loss. In contrast, little attention needs to be given to category (C) items, which seldom occur and the associated loss is small. Professional judgment will be required to determine which items in category (B) require attention and which do not.

While the above model is theoretically appealing it does have serious practical limitations. The model relies heavily on estimating future probabilities and costs; it is extremely difficult to make such estimates with reasonable accuracy. When

implementing the model, it is also possible for the user to overlook many serious indirect consequences of the threat.

FIGURE 2

Amount of Loss	High	Low
High	A	B
Low	B	C

(Columns labeled High, Low at top; rows labeled High, Low under "Amount of Loss")

PHYSICAL SECURITY AND DATA SECURITY

Physical security is the first line of defense in protecting a computer system; it encompasses the plant, equipment, and personnel. Data security is also of vital concern to an organization; data integrity, data accuracy, and data privacy are of paramount importance. Physical and data security considerations are equally important. An effective security system will prevent a security breach. However, if in spite of proper protection, a system is successfully attacked, the system should create an audit trail to allow prompt investigation.

The computer room is the structure that houses the computer facilities. Unauthorized access to the computer room should be restricted. Sensing and surveillance devices may be installed. The plant should also be designed to protect the computer environment, including heating, cooling, dehumidifying, ventilating, lighting, and power. Air ducts of air-conditioning units also should be secured against access with heavy-gauge screens. Appropriate care also must be taken to protect the plant from harm from accidents and disasters such as fire and floods. Adequate emergency lighting should be available for safe evacuation in case of fire or other disaster.

Consideration must also be given to loss or damage to computer equipment and peripherals. Media, such as disks, tapes, and output, should be protected. User manuals for equipment and software must be protected to maintain continuity of proper operations. Surge protectors should be used to protect the computer system against power line disturbances. Finally, the organization must consider loss of or injury to its personnel. Not only must the organization be concerned about the physical safety of its employees; it

must also consider the threat of psychological dissatisfaction. Disgruntled employees may do intentional damage. Moreover, job turnover associated with dissatisfied employees disrupts the routine operation and maintenance of computer systems.

The integrity, accuracy, and privacy of data must be protected. Data integrity is essential to computer security. Data lacks integrity if it is missing, incomplete, inconsistent or if it is stored in a poorly designed database environment. The concept of accuracy is distinct from that of integrity. Data is accurate if it is reliable and the data is what it purports to be. Privacy means that only authorized individuals have access to data. Programmers should not have free access to the computer area or library due to possible data manipulation. Important CDs should be locked up.

CONTROLLING PHYSICAL ACCESS

Access controls guard against improper use of equipment, data files, and software. To limit physical access, a security system must be able to discriminate between authorized and unauthorized individuals. Physical access can be limited using three general methods.

Identification: Identification is based on comparing the physical characteristics of the individual with previously stored information. For example, an individual's signature, personnel number, code, voice print, palm print, fingerprint, teeth print, or other personal trait could be verified before allowing access. Secondary authentication, such as the user's place of birth, may be required for highly sensitive information.

User's Name and Passwords: Passwords are based on some memorized combination of letters or numbers. There should be no logic to the password, so it cannot be easily guessed. Individuals are authorized based on what they know. Passwords should be changed regularly. Inactive passwords (e.g., more than 4 months old) should be deleted. Passwords should be changed and confidential data withdrawn from terminated employees. If a user changes a password, controls must exist to assure the user does not use his old password. Passwords should not be shared. Access control software may be used to have a minimum password time period in which a new password cannot be changed or a new password matching an old one will be rejected.

Cards/Keys: Access also can be limited through the use of cards, keys, or badges; individuals are authorized based on what they possess. Improper access may be signaled by an alarm, and unauthorized access patterns should be investigated. Smart cards may be used in which the user enters both his or her identification number and a random generated code which changes each time the card is used or over a stated time period.

Within the plant, areas containing sensitive data should be accessible only to authorized personnel. These areas, including the computer room, should have only a single entry door, which can be operated by an appropriate encoded magnetic-strip ID card. Physical controls might include having a librarian keep a log. A lockout should occur with repeated errors. Logs should automatically be kept of the ID number, time of

access, and function performed. Further, data dictionary software provides an automated log of access to software and file information. Intrusion detection devices such as cameras and motion detectors should be used to monitor sensitive and high-risk areas against unauthorized individuals.

Are controls being diligently followed over processing, maintaining records, and file or software modification? Each individual function (e.g., accounts receivable, payroll) may have its own password so that users have access to limited areas of the database. The computer can keep an internal record of the date and time each file was last updated, and this internal record compared against the log. The hours to access "key" microcomputer files can be limited, to prevent unauthorized access after normal working hours. Files should be displayed in terms of different levels of confidentiality and security such as top secret, confidential, internal use only, and unrestricted. Confidential information should not be displayed on the screen. To control access to sensitive data, there should be a mapping of access requirements to the system components. Access rights should he based on job function, and an appropriate segregation of duties should exist. Temporary employees should be restricted to specific project, activity, system, and time period.

FIRE SECURITY

According to insurance companies, fire is the most frequent cause of damage to computer centers. Simple steps can reduce the damage caused by fire and in the process, reduce insurance premiums.

- Safes for storage of documents should have a minimum four-hour fire rating.
- Walls, floors, and ceilings of computer facilities should have a minimum two-hour fire rating.
- Fire alarm should ring simultaneously at the computer facility and the nearest fire department. In addition, fire alarm signals should be located where prompt response is assured.
- Vaults used for storing backup data and records should be located in a separate building at sufficient distance.
- Smoke and ionization detection systems should be installed throughout the ceiling of the computer facilities. Water detection systems should also be installed under the floor of computer facilities.
- Halon or a similar fire extinguishing system should he installed throughout the computer facilities. Automatic sprinkler systems can be used in the supply and support areas. In case of destruction, there should be a disaster recovery plan.
- Adherence to building code and fire marshal regulations is a must.

SABOTEUR'S TOOLS

While in recent years ingenious procedures have been developed to preserve computer security, many computer systems are still astonishingly insecure. Saboteurs may use a wide variety of tools and techniques to overcome security. Some of the methods are as follows:

Trojan Horse: The saboteur places a hidden program within the normal programs of the business. The computer continues to function normally, while the hidden program is free to collect data, make secret modifications to programs and files, erase or destroy data, and even cause a complete shutdown of operations. Trojan horses can be programmed to destroy all traces of their existence after execution.

Salami Techniques: The perpetrator can make secret changes to the computer program that cause very small changes that are unlikely to be discovered, but whose cumulative effect can be very substantial. For example, the perpetrator may, steal ten cents from the paycheck of each individual and transfer it to his own account.

Back Door or Trap Door: During the development of a computer program, programmers sometimes insert a code to allow them to bypass the standard security procedures. Once the programming is complete, such a code may remain in the program either accidentally or intentionally. Attackers rely on their knowledge of this extra code to bypass security.

Time Bomb/Logic Bomb: A code may be inserted into a computer program that causes damages when a pre defined condition occurs, such as a date or time.

Masquerade: A computer program is written that masquerades or simulates the real program. For example, a program may be written to simulate the log-in screen and related dialogue. When a user attempts to log-in, the program captures the user's ID and password and displays some error message prompting the user to log-in again. The second time, the program allows the user to log-in and the user may never know that the first log-in was fake.

Scavenging: A computer normally does not erase data that is no longer needed. When the user "deletes" some data, that information is not actually destroyed instead, that space is made available for the computer to write on later. A scavenger may thus be able to steal sensitive data, which the user thought had been deleted, but was actually still available on the computer.

Viruses: Viruses are similar to Trojan horses, except the illegal code is capable of replicating itself. A virus can rapidly spread throughout the system, and eradicating it can be expensive and cumbersome. The effects of computer viruses range from harmless messages to complete destruction of all data within the system. A symptom of a virus is the unexplained loss of, or change to, data. To guard against viruses, there should be care in using programs on CDs or in copying software from bulletin boards or other sources outside the company. The best precaution is to use a commercial virus scanner on all downloaded files from unreliable Internet sources before using them. An example is McAfee's virus scan. Virus protection and detection is crucial.

Data Manipulation: The most common and easiest way of committing fraud is to add or alter the data before or during input. The best way to detect this type of computer crime is the use of audit software to scrutinize transactions and review audit

trails that indicate additions, changes, and deletions were made to data files. The use of batch totals, hash totals, and check digits can also help prevent this type of crime. A batch total is a reconciliation between the total daily transactions processed by the micro, and manually determined totals by an individual other than the computer operator. Material deviations must be investigated. A hash total is adding values that would not typically be added together so the total has no meaning other than for control purposes. Examples are employee and product numbers. A check digit is used to ascertain whether an identification number (e.g., account number, employee number) has been correctly entered by adding a calculation to the identification number and comparing the outcome to the check digit.

Piggybacking: Piggybacking frequently is used to gain access to controlled areas. Physical piggybacking occurs when an authorized employee goes through a door using his magnetic ID card, and an unauthorized employee behind him also enters the premises. The unauthorized employee is then in a position to commit a crime. Electronic piggybacking may also occur. For example, an authorized employee leaves his terminal or desktop and an unauthorized individual uses that to gain access.

PHISHING OR SPOOFING (FRAUDULENT EMAILS)

Fraudulent emails, also known as "Phishing" or "Spoofing," are unexpected emails that appear to be from a bank, insurance company, retailer or a regulatory agency, but they are not.

- These messages look professional and official, and may even contain links or pop-up windows that also have the appearance of legitimacy. View a sample of a fraudulent email.
- The fraudulent emails require you to "verify" certain information to prevent account suspension, closing or some other urgent matter.
- These sophisticated scams may ask for ATM or credit card numbers, PINs or log-on IDs and personal information such as Social Security Number, Date of Birth, or Mother's Maiden Name; all of which can be used by criminals to perform an account takeover or even worse, commit identity theft.

Tips to avoid becoming a victim are the following:

- Delete emails from unknown parties. Don't even open them.
- Use email (SPAM) filtering software.
- Do not provide personal information, account numbers, ATM, debit or credit card numbers, PINs or log-on IDs through email links or pop-up windows. Either call the institution, or go directly to their web site at the URL you know to be correct.
- NEVER give out any personal information unless you initiated the contact, and are sure you know with whom you are dealing.

IDENTITY THEFT

Identity theft is when someone pretends that they are you when committing a crime. Crimes involving identity theft or impersonation are on the rise and are now the types of crimes that are most frequently reported to the Federal Trade Commission. The crime could be in person, over the telephone or Internet, or through the mail.

The increase in identity theft is mainly attributable to technology. As technology continues to evolve, criminals are developing new ways to exploit or defraud organizations and consumers alike, including attempts to access bank accounts, brokerage accounts, and/or steal credit information or identities. Both state and federal governments continue to enact legislation to help protect consumers and banks is diligent in its efforts to protect customers' information

How you can help prevent identity theft:
- Report any lost or stolen cards immediately.
- Pay attention to billing cycles and call if you do not receive an expected bill in a timely manner. It may mean that an identity thief has diverted the bill.
- Place outgoing mail in post office collection boxes only. Even better, consider using online banking with bill payment to send your payments. Making payments online can help prevent mail fraud while saving you time and postage.
- Shred all of your receipts and bank and credit card statements before disposing of them.
- Review your credit report from all three major credit bureaus to make sure that new credit card or other accounts have not been opened in your name. The three major credit bureaus to contact are Equifax (www.equifax.com), Experian (www.experian.com), and TransUnion (www.transunion.com).
- Make sure personal and financial information stored on your personal computers are protected with a password.
- Avoid using automatic login features that save your user name and password; and always log off when you're finished.
- Install and use a firewall on your personal computers, especially those connected to the Internet through high-speed DSL or cable modems. A firewall helps prevent hackers from accessing your computer.
- Install virus protection software on your computer and make sure it is updated on a regular basis.
- Don't give anyone your financial information unless you initiate the contact or are sure with whom you are dealing.
- Never disclose your PIN or password to anyone and always safeguard it.
- Don't print your Social Security number or driver's license number on your checks.
- Don't download files or click on hyperlinks in emails from un-trusted sources.
- Watch out for "phishing" or "spoofing" e-mails that may look like they are legitimate messages, but they are not. The sender attempts to get you to reveal confidential personal information that can be used for identity theft.

What to do if you are a victim of identity theft:
- Notify your bank or financial institution at the phone number listed on your statement along with any other financial service providers.

- File a report of identity theft with your local police.
- Contact one of the three major credit bureaus to report the incident and ask to have a fraud alert placed on your file. Once the credit bureau confirms your fraud alert, the other two credit bureaus will be automatically notified to place fraud alerts, and all three credit reports will be sent to you free of charge. Review your credit reports and notify the bureaus about anything that looks suspicious.

Additional Identity Theft Resource Materials are available for download in PDF format to help you recover from Identity Theft, including instructions on how to complete an ID Theft Affidavit, related forms and sample letters. For additional valuable information about identity theft we recommend you visit **www.consumer.gov/idtheft/index.html** or call 1-877-ID THEFT, the FTC's toll-free ID Theft Hotline.

COMMUNICATIONS SECURITY

Attacks on computer security that do not require physical access fall under the domain of communications security. The increased use of computer technology has also increased dependence on telecommunications. All types of data, including sound, video, and traditional text data, are transferred between computers over networks. Communications security means ensuring that the physical links between the computer networks function at all times. This also means that during data transmission, breakdowns, delays, and disturbances are prevented. Care must be taken to prevent unauthorized individuals from tapping, modifying or otherwise intercepting data transmission. Six considerations in communications security are:

Line Security: Line security is concerned with restricting unauthorized access to the communication lines connecting the various parts of the computer systems.

Transmission Security: Transmission security is concerned with preventing unauthorized interception of communications.

Digital Signature: This is used to authenticate the sender or message integrity to the receiver. A secure digital signature process is a method of signing a document making forgery infeasible and then validating that the signature belongs to the authorized individual.

Cryptographic Security: Cryptography is the science of secret writing. The purpose of cryptographic security is to render the information unintelligible if transmission is intercepted by unauthorized individuals. When the information is to be used, it can be decoded. Security coding (encryption) of sensitive data is necessary. A common method is the Data Encryption Standard (DES). For even greater security, double encryption may be used in which encryption is processed twice using two different keys. (One may also encrypt files on a hard disk to prevent an intruder from reading the data).

Emission Security: Electronic devices emit electromagnetic radiation which can be intercepted without wires by unauthorized individuals. Emission security is concerned with preventing the emission of such radiation.

Technical Security: Technical security is concerned with preventing the use of devices such as microphone, transmitters, or wiretaps to intercept data transmission. Security modems may be used that allow only authorized users to access confidential data. A modem may have graduated levels of security, and different users may be assigned different security codes. There can be password and call back features. There may be built-in audit trail capabilities allowing you to monitor who is accessing private files.

CONTROLS

Controls are used to reduce the probability of attack on computer security. As additional controls are placed, the overall operating costs are likely to increase. As discussed earlier, cost-benefit considerations require a careful balance of controls. There are four main classes of controls, discussed below.

Deterrent Controls: The aim of deterrent controls is to create an atmosphere conducive to control compliance. For example, the organization could impose penalties whenever a control is disregarded, regardless of the actual damage. Deterrent controls are inexpensive to implement. However, their effectiveness is difficult to measure. These controls complement other controls and are not sufficient by themselves.

Preventive Controls: Preventive controls are designed to reduce the probability of an attack. They serve as the first line of defense. Effective preventive controls will thwart a perpetrator from getting access to the computer system.

Detective Controls: Once a system has been violated, detective controls help identify the occurrence of harm. These controls do nothing to insulate the system from harm; they only serve to focus attention on the problem. For example, a bait file will identify unauthorized use. Here, a "dummy" nonexistent record is put into processing. There may be a comparison between standard run time and actual run time for an application to spot possible misuse.

Corrective Controls: After a loss has occurred, corrective controls serve to reduce the impact of the threat. Their purpose is to aid in recovering from damage or in reducing the effect of damage. For instance, lost information on floppies may be restored with utility programs.

APPLICATION CONTROLS

Application controls are built into software to deter crime and minimize errors. Application controls typically include: input controls, processing controls, change controls, testing controls, output controls, and procedural controls.

Input Controls: The purpose of input controls is to ensure that each transaction is authorized, processed correctly and processed only once. An edit program substantiates input by comparing fields to expected values and by testing logical relationships. A missing data check assures that all data fields have been used. A valid character check verifies that only alphabetical, numeric, or other special characters are present in data fields. "Dual read" is an input control in which duplicate entry or key verification verifies the accuracy of some critical field in a record by requiring that a data item is entered twice. A valid code check compares a classification (e.g., asset account number) or transaction code (e.g., credit sale entry) to a master list of account or transaction codes (master file reference). Input controls include rejecting, correcting, and resubmitting data that were initially wrong. Is input information properly authorized? Character validation tests may also be programmed to check input data fields to see if they contain alphanumerics when they are supposed to have numerics. A preprocessing edit check verifies a key entry by a second one or a visual examination. There may be a limit test check of input data fields to make sure that some predetermined limit has not been exceeded (e.g., employee weekly hours should not be automatically processed if the sum of regular and overtime hours per individual exceeds 60).

Processing Controls: Processing controls are used to ensure that transactions entered into the system are valid and accurate, that external data are not lost or altered, and that invalid transactions are reprocessed correctly. Sequence tests may be performed to note missing items. In batch or sequential processing, batch totals are used to ensure that the counted and totaled number and value of similar data items are the same before and after processing. In a parity check, because data are processed in arrays of bits (binary digits of 1 or 0), we add a parity bit, if needed, so as to make the total of all the "1" bits even or odd. The parity bit assures that bits are not lost during computer processing. Parity checks prevent data corruption. External and internal file identification labels may be used. The program may check to see if an item in a record is within the correct range. Crossfooting tests apply to logical tests for information consistency (e.g., sum totals to column totals). Application reruns assure the initial run was correct.

Change Controls: Change controls safeguard the integrity of the system by establishing standard procedures for making modifications. For example, a log file can be maintained to document all changes. A report may be prepared showing the master file before and after each update.

Testing Controls: Testing controls ensure that reliance can be placed on a system before the system becomes operational. For example, limited test data could be processed and tested using the new system. Utility programs can be used to diagnose problems in application software.

Output Controls: The purpose of output controls is to authenticate the previous controls; this is used to ensure that only authorized transactions are processed correctly. Random comparisons can be made of output to input to verify correct

processing. For example, an echo check involves transmitting data received by an output device back to its source. Output controls presume information is not lost or improperly distributed. Errors by receivers of output, such as customers, should be investigated.

Procedural Controls: Procedural controls safeguard computer operations, reduce the chance of processing mistakes, and assure continued functioning if a computer failure occurs. Processing errors must be thoroughly evaluated. Output should be distributed to authorized users of such information. A record retention and recovery plan must also exist.

ELECTRONIC DATA INTERCHANGE
Electronic data interchange, or EDI, is the electronic transfer of business information among trading partners. Thousands of businesses use EDI to exchange information with suppliers and customers. The benefits of EDI are clear. The paperwork is greatly reduced and the efficiency in accounting and processing functions is greatly enhanced. EDI also involves the electronic exchange of business transaction documents over the Internet and other networks between supply chain trading partners

The risk inherent in EDI is much greater than in standard computer processing systems. An EDI security system is only as strong as the weakest link among the trading partners. Some risks of EDI are:

- Data could be lost in the interchange.
- Unauthorized changes may be made to the data.
- The lack of paperwork means a greater likelihood that the audit trail may not be maintained.
- Authorized individuals can initiate unauthorized transactions.
- Unauthorized individuals can gain access to the system through the weakest link among the trading partners.

PERSONNEL SECURITY
Each employee should sign a nondisclosure agreement not to reveal computer security information to those outside the business or to unauthorized staff within the firm. If a staff member leaves the company certain control procedures are required including returning all badges, keys, and company materials. Access codes, passwords, and locks may need to be changed.

Specific procedures should be established for recruiting and hiring computer data processing professionals. A security investigation should include contacting the applicant's work references, checking the applicant's background with appropriate authorities, and verifying the applicant's school references. New employees should be impressed upon with the importance of computer security with respect to every phase of computer data processing. For example, to indoctrinate new employees, educational

seminars can be scheduled where security professionals can communicate the company's rules and procedures to new employees.

In addition, formal performance evaluation systems should be in place to ensure that employees' performances and skills are routinely reviewed. An effective review procedure can help prevent job frustration and stress. It also can help maintain employee morale. Discontentment often acts as a catalyst for computer crime. Possible indicators of discontentment include excessive absenteeism, late arrival, low quality or low production output, complaints, putting off vacations, and excessive unwarranted overtime. Quick action such as communicating with the employee on a one-to-one basis can minimize, if not eliminate, job discontentment.

Segregation of duties among staff is needed. For example, a programmer should not also serve as an operator. Rotation of assignments should also exist, such as programmers doing different assignments and operators working different shifts. A function may be designed to require more than one operator to make it more difficult for an individual to perpetrate an improper act since others are involved. The development and testing of software should also be separate.

ENVIRONMENTAL SECURITY

Computer areas should be properly cleaned and dusted. Facilities should be protected against adverse effects of the weather.

AUDIT TRAIL

Audit trails contain information regarding any additions, deletions, or modifications to the system providing evidence concerning transactions. An effective audit trail allows the data to be retrieved and certified. Audit trails will give information regarding the date and time of the transaction, who processed it and at which terminal.

To establish an adequate audit trail, you must analyze transactions related to the physical custody of assets, evaluate unusual transactions, and keep track of the sequential numbering of negotiable computer forms. Controls should be periodically tested. For example, the audit trail requires the tracing of transactions to control totals, and from the control total to supporting transactions. Computer-related risks affect the company's internal control structure and thereby affect the company's auditability.

Electronic Data Interchange (EDI) systems are online systems where computers automatically perform transactions such as order processing and generating invoices. Although this can reduce costs, it can adversely affect a company's auditability because of the lessened audit trail.

The AICPA has issued control techniques to ensure the integrity of an EDI system. The AICPA recommends controls over accuracy and completeness at the application level of an EDI system to include: checks on performance to determine compliance with industry standards, checks on sequence numbering for transactions, reporting irregularities on a timely basis, verifying adequacy of audit trails, and checking of embedded headers and trailers at interchange, functional group, and transaction set

level. Control techniques at the environmental level include: reviewing quality assurance of vendor software, segregation of duties, ensuring that software is virus-free, procuring an audit report from the vendor's auditors, and evidence of testing. To ensure that all the EDI transactions are authorized, the AICPA provides these authorization controls: operator identification code, operator profile, trading partner identifier, maintenance of user access variables, and regular changing of passwords.

NETWORK SECURITY

Network security is needed for both local area networks (LANs) and wide area networks (WANs). There must be positive authentication before a user can gain knowledge of the online applications, network environment, nature of applications, terminal identification, and so on. Information should be provided on "a need to know" basis only.

Access controls should exist to use a specific terminal or application. Date and time constraints along with restricted file usage may be enumerated. Unauthorized use may deactivate or lock a terminal. "Diskless" workstations may result in a safer network environment.

There must be a secure communication link of data transmission between interconnected host computer systems of the network. A major form of communication security on the network is cryptography to safeguard transmitted data confidentiality. Cryptographic algorithms may be either symmetric (private key) or asymmetric (public key). The two popular encryption methods are link-level security and end-to-end security. The former safeguards traffic independently on every communication link while the latter safeguards messages from the source to the ultimate destination. Link-level enciphers the communications line at the bit level; data is deciphered upon entering the nodes. End-to-end enciphers information at the entry point to the network and deciphers at the exit point. Unlike link-level, security exists over information inside the nodes.

Security should be provided in different layers. Security must exist over networking facilities and telecommunication elements. Controls must be placed over both host computers and subnetworks.

Network traffic may travel over many subnetworks, each having its own security levels depending on confidentiality and importance. Therefore, different security services and controls may be required. Security aspects of each subnetwork have to be distributed to the gateways so as to incorporate security and controls in routing decisions.

The architecture of a network includes hardware, software, information link controls, standards, topologies, and protocols. A protocol relates to how computers communicate and transfer information. Security controls must exist over each

component within the architecture to assure reliable and correct data exchanges. Otherwise, the integrity of the system may be compromised.

Communication security may be in the form of:

- *Access control:* Guards against improper use of the network. For example, KERBEROS is commercial authentication software that is added to an existing security system to verify a user's existence and assure he or she is not an imposter. KERBEROS does this by encrypting passwords transmitted around networks. Password control and user authentication devices may be used such as Security Dynamics' SecurID (800-SECURID) and Vasco Data Security's Access Key 11 (800-238-2726). Do not accept a prepaid call if it is not from a network user. Hackers do not typically spend their own funds. Review data communications billings and verify each host-to-host connection. Review all dial-up terminal users. Are the telephone numbers unlisted and changed periodically? Control specialists should try to make unauthorized access to the network to test whether the security is properly working.

- *Identification:* Identifies the origin of a communication within the network through digital signals or notarization.

- *Data confidentiality:* Maintains confidentiality over unauthorized disclosure of information within the communication process.

- *Data integrity:* Guards against unauthorized changes (e.g., adding, deleting) of data at both the receiving and sending points such as through cryptographic methods. Antivirus software should be installed at both the network server and workstations. Detection programs are available to alert users when viruses enter the system.

- *Authentication:* Substantiates the identity of an originating or user entity within the network. The   authenticator verifies that the entity is actually the authorized individual and that the information being transmitted is appropriate. Examples of security controls are passwords, time stamping, synchronized checks, nonrepudiation, and multiple-way handshakes. Biometric authentication methods measure body characteristics with the use of equipment attached to the workstation. Retinal laser beams may also be used. Keystroke dynamics is another possibility for identification.

- *Digital signature:* Messages are signed with a private key.

- *Routing control:* Inhibits data flow to insecure network elements such as identified unsecure relays, links, or subnetworks.

- *Traffic padding:* A traffic analysis of data for reasonableness.

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- *Interference minimization:* Radar/radio transmission interference must be eliminated or curtailed. There are various ways to backup data in networks. For a small network, one workstation may be used as the backup and restore for other nodes. In a large network, backup may be done by several servers since the failure of one could have disastrous effects on the entire system. Access to backup files must be strictly controlled.

An example of a network security package is Intrusion Detection Incorporated's The Kane Security Analyst which assesses existing security.

HOW TO AVOID SPAM

Spam is a computer term for unwanted e-mail. In a Monty Python television skit, a group of Vikings in a restaurant sing about the meat product, "Spam, spam, spam, spam, spam, spam, spam, spam, lovely spam! Wonderful spam!" until told to shut up. As a result, something that keeps being repeated to great annoyance was called spam, and computer programmers picked up on it. The spam problem has now reached epic levels, with users continuously barraged with unwanted mail. Begin fighting the problem by learning the basics of stopping spam and getting resources at your disposal.

Tips to avoid getting spam

Protect your e-mail address. Spammers either buy lists of e-mail addresses or use software programs that mine the addresses from the Internet. If your address is posted in discussion groups, on Web sites, chat rooms, etc., chances are it will end up on one or more of these lists. Only post your address publicly when absolutely necessary.
Set up multiple e-mail accounts. If you do participate regularly in online activities where you post your address, set up another e-mail account. Reveal it only to close friends and family.
Use spam filters. Many e-mail programs, such as Outlook Express, have built-in tools that block messages sent from certain addresses or that filter messages based on key words you define. Check the online help files for your e-mail software.
Use anti-spam software. You can install software designed to eliminate spam. Some work by matching incoming messages against a list of known spammers; others block messages that don't match an approved list of acceptable addresses. Check out the latest anti-spam programs at Download.com.
Report violators. A number of government agencies and private groups accept complaints. Whether they can do anything to stop the deluge is an unanswered question. Forward spam to the Federal Trade Commission at uce@ftc.gov.

THE SECURITY ADMINISTRATOR

The size and needs of the company will dictate the size of the security administration department. This department is responsible for the planning and execution of a computer security system. They ensure that the information system's data is reliable and accurate. The security administrator should possess a high level of

computer technical knowledge as well as having management skills and a general understanding of the organization's internal control structure.

A security administrator should interact with other departments to learn of the organization's changing needs and to be able to maintain and update the security system efficiently The security administrator is responsible for enacting and customizing policies and standards for the organization based on specific needs. Checks on performance and monitoring of staff should be done to ensure that these policies and standards are being complied with. In developing these policies and procedures, as well as the overall information computer security system, the security administrator must perform a risk assessment.

PROTECT YOUR COMPANY FROM INTERNET DANGERS

1. **Have an external firewall.** A firewall is simply a device that prevents hackers from gaining access to your company network. For small companies, use a broadband router, like those made by Netgear, Linksys or D-Link, that has a firewall built in.
2. **Use an anti-virus program and keep it current.** Any of the popular brands will work (e.g. Norton, McAfee, etc.). Renew your subscription every year or upgrade to the latest version. Make sure that your computers are automatically getting the latest virus definitions.
3. **Get Microsoft Windows and Office updates.** Microsoft has introduced significant security improvements in Service Pack 2 for Windows XP that can be updated for free. Older versions of Windows are more susceptible to spyware and Internet worms. Consider upgrading PCs to Windows XP or Longhorn.
4. **Use anti-spyware and anti-spam programs.** Microsoft offers a free anti-spyware program for Windows 2000 and XP. Many Internet service providers (e.g., Cox Communications, AOL, etc.) offer complimentary anti-spam services. If your provider doesn't, there are spam filter programs that work with Outlook and Outlook Express.
5. **Secure your network.** A firewall won't protect you if a hacker can figure out the password. Make sure your computer technician has changed the default password on your router. If you have a wireless network, make sure it is using WEP or WPA encryption to prevent unauthorized access.

THE LAW

The Computer Fraud and Abuse Act is a federal law making it a crime for any unauthorized use (copying, damaging, obtaining database information, etc.) of computer hardware or software across state lines. Offenders can be sentenced to up to 20 years in prison and fined up to $100,000.

SUMMARY

Computer security is intended to safeguard software, data, hardware, and personnel. Monitoring and control measures and devices are needed. Duties should be segregated and proper training should exist. Computer equipment, including peripherals, should be properly maintained and locked under supervision. Someone should be in charge of

monitoring computer security in the entire company. Periodic and surprise computer security audits should be undertaken. Employees who do not follow computer security guidelines should be identified and disciplined.

Insurance coverage should not be inadequate or excessive. If inadequate, there is a great risk of loss. If excessive, insurance costs are exorbitant. Insurance coverage depends on numerous factors including risk level, loss exposure, cost, time period, and policy provisions.

CHAPTER 16 QUIZ

1. Physical access controls used to prevent unauthorized access to equipment, data files, and software includes all of the following except:
   A. Identification
   B. User's name and password
   C. Cards and keys
   D. Firewalls

2. The saboteur's tool that is used by the perpetrator to make secret changes that cause very small changes that are unlikely to be discovered is:
   A. Time Bomb
   B. Salami technique
   C. Viruses
   D. Masquerade

3. The best preventive measure against a computer virus is to
   A. Compare software in use with authorized versions of the software.
   B. Execute virus exterminator programs periodically on the system.
   C. Allow only authorized software from known sources to be used on the system.
   D. Prepare and test a plan for recovering from the incidence of a virus.

4. Which of the following is an indication that a computer virus of this category is present?
   A. Frequent power surges that harm computer equipment.
   B. Unexplainable losses of, or changes to, data.

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C. Inadequate backup, recovery, and contingency plans.
D. Numerous copyright violations due to unauthorized use of purchased software.

5. Controls that are designed to reduce the probability of an attack are:
    A. Corrective controls
    B. Detective controls
    C. Preventive controls
    D. Deterrent controls

6. Most of today's computer systems have hardware controls that are built in by the computer manufacturer. Common hardware controls are
    A. Duplicate circuitry, echo check, and internal header labels.
    B. Tape file protection, cryptographic protection, and limit checks.
    C. Duplicate circuitry, echo check, and dual reading.
    D. Duplicate circuitry, echo check, tape file protection and internal header labels.

7. Physical protection of hardware includes:
   A. Locked rooms under surveillance
   B. Back up data files
   C. Documentation is duplicated
   D. Backup files are placed in offsite storage

8. The Computer Fraud and Abuse Act makes it a Federal crime for any unauthorized use of all the following except:
   A. Copying
   B. Debugging
   C. Damaging
   D. Obtaining unauthorized database information

CHAPTER 16 ANSWER KEY

1. (D) is correct. Firewalls work by blocking unwanted and unauthorized people from viewing company databases.

(A) is incorrect. Identification uses physical characteristics to identify approved users.

(B) is incorrect. A user's name and passwords allow access to authorized personnel.

(C) is incorrect. Cards and keys limit access to the holders of the cards and keys.

2. (B) is correct. Salami technique is a tool that is used by the perpetrator to make secret changes that cause very small changes that are unlikely to be discovered.

(A) is incorrect. The Time Bomb is a code inserted into a computer program that is used to cause damage at a predefined time or condition.

(C) is incorrect. A virus is an illegal code capable of replicating itself.

(D) is incorrect. A masquerade is a program that simulates the real program and captures the user's ID and password.

3. (C) is correct. Viruses are a form of computer sabotage. They are programs hidden within other programs that have the capacity to duplicate themselves and infect other systems. Sharing of storage media or participation in computer networks creates exposures to viruses. Also, obtaining software from a shareware network or by downloading from an electronic bulletin board is a typical cause of infection.

(A) is incorrect. Comparing software in use with authorized versions of the software is a detective, not a preventive, measure.

(B) is incorrect. Executing virus exterminator programs periodically on the system is a detective/corrective measure.

(D) is incorrect. Preparing and testing a plan for recovering from the incidence of a virus is a corrective measure.

4. (B) is correct. The effects of computer viruses range from harmless messages to complete destruction of all data within the system. A symptom of a virus is the unexplained loss of, or change to, data.

(A) is incorrect. Power surges are caused by hardware or power supply problems.

(C) is incorrect. Inadequate backup, recovery, and contingency plans are operating policy weaknesses.

(D) is incorrect. Copyright violations represent policy or compliance problems.

5. (C) is correct. Preventive controls are designed to reduce the probability of an attack. They serve as the first line of defense. Effective preventive controls will thwart a perpetrator from getting access to the computer system.

(A) is incorrect. Corrective controls are used after a loss occurs to recover from the damage.

(B) is incorrect. Detective controls are designed to reduce the probability of an attack.

(D) is incorrect. Deterrent controls aim to create an atmosphere conducive to control compliance.

6. (C) is correct. Hardware controls include parity checks, echo checks, dual read-write heads, dual circuitry, diagnostic routines, boundary protection, interlock, and a file protection ring.

(A) is incorrect. Internal header label is not a hardware control.

(B) is incorrect. These are not hardware controls.

(D) is incorrect. Internal header label is not a hardware control.

7. (A) is correct. Physical protection of hardware includes locked rooms under surveillance.

(B) is incorrect. Back up data files protect the data integrity.

(C) is incorrect. Documentation that is duplicated protects the data integrity.

(D) is incorrect. Backup files are placed in offsite storage protect the data integrity.

8. (B) is correct. Debugging means tracing and correcting flaws in software programming.

(A) is incorrect. Unauthorized copying is illegal under federal law.

(C) is incorrect. Federal law prohibits unauthorized damaging.

(D) is incorrect. It is legally disallowed under federal law.

CHAPTER 17
WIRELESS TECHNOLOGY

LEARNING OBJECTIVES:

After studying this chapter you will be able to:

1. Describe what wireless technology means.
2. Differentiate between Bluetooth and Wi-Fi.
3. List some advantages and drawbacks of going wireless.
4. Explain how wireless networks affect businesses.
5. Identify the accountant's role in wireless networking.

Wireless networking is fast becoming a viable alternative for companies that can utilize the advantages it provides. It can provide businesses with enhanced connectivity and flexibility. For companies seeking to expand a computer network or make their employees more mobile. Major technology companies are behind its standards and the price and choice of products should only improve.

Two major developing technologies are changing the computer networking landscape: Wi-Fi (Wireless Fidelity) and Bluetooth. These two forms of wireless technology can change the entire infrastructure of business networks. Many new hardware and software products, produced by many big-name technology companies, are equipped for use with Bluetooth and Wi-Fi. The Bluetooth Special Interest Group (SIG; www.bluetooth.com) and the Wi-Fi Alliance (www.weca.net) are groups formed to help effectively develop, integrate, and implement these wireless technologies globally. These two groups have created global standards for each technology, which must be met by any company producing hardware or software to operate with Bluetooth or Wi-Fi.

BLUETOOTH

Bluetooth is a radio frequency specification for short-range data transfer. Any device containing Bluetooth technology, whether it be a handheld PC, cell phone, laptop, or standard PC, receives the signal broadcasted by the network. As aforementioned, the Bluetooth SIG was formed to develop and maintain a global standard for Bluetooth wireless technology. This facilitates interoperability, advancement, and development of the technology. Over 2000 companies from around the globe are members of this industry group. The Bluetooth SIG consists of leaders in telecommunications and computing including such household names as Ericsson, IBM, Intel, Microsoft, Motorola, Nokia, and Toshiba. The Bluetooth specified standard contains the information necessary to ensure that all devices supporting Bluetooth are able to communicate with each other globally. This means that it will not matter who manufactured a device. As long as it has the Bluetooth logo or label on it, it can be fully synchronized with any other Bluetooth device. This is a huge step towards full integration. Instead of using many independently operating devices to accomplish one task, businesses may utilize these devices as one tool by integrating their performance.

Using Bluetooth can also give a business many more options in terms of purchasing new hardware and upgrades in the future. Because all Bluetooth devices are fully interoperable, businesses are not forced to go back to the same manufacturer. They can look for the best prices, as long as the alternative device supports Bluetooth.

The current Bluetooth specified standard calls for the support of several elements. First off, there must be general access among devices. This means that they must be able to link, synchronize, and communicate with each other. Next, cordless telephony must be supported. This means that cell phones with Bluetooth must be able to operate as cordless phones when they are in proximity to their base station. For example, the cell phone would act as a cordless phone and a laptop or desktop the base station. The serial ports on Bluetooth supportive devices will act similar to wire serial ports. Each device will also be able to receive and transmit voice data as well as send faxes. Dial-up networking between a cell phone and a laptop computer are also part of the standard. As already mentioned, Bluetooth devices will have full wireless personal area network (WPAN) access, with the ability to transfer files.

Bluetooth Networks
Bluetooth provides a 10-meter personal bubble. It supports the simultaneous transmissions of information and voice data. A network of Bluetooth devices is called a piconet. Each piconet can support a maximum of eight devices and a minimum of two. Any and all devices containing Bluetooth can be potentially networked with each other. Each piconet has a master unit and slave units. The master unit synchronizes all of the slave units. The slave units are all of the other networked devices, besides the master unit. Piconets may be integrated to form a scatternet by setting up a master device to synchronize several piconet master devices. Therefore, the master device of a piconet can also be a slave in a scatternet. The gross data transfer of Bluetooth devices is 1 megabyte per second, while the actual data rate is 432 kilobytes per second. Bluetooth technology is as secure as a wire with up to 128-bit public/private key authentication. Furthermore, it supports good encryption. As mentioned earlier, Bluetooth transmits its signal for up to 10 meters. That is only when a 0 dBm radio is used. Using a +20 dBm radio, the link range can be increased to up to 100 meters.

Practical Uses
The most attractive feature of Bluetooth is that all products containing this technology will work together. All manufacturers implementing Bluetooth into their products must get them tested and certified, as to insure interoperability. Accordingly, this feature is perhaps the most attractive for your client's business. All of a company's hardware will be integrated and able to share information. One will be able to synchronize their mobile computer with their desktop, simply by placing the mobile computer near the desktop. This will save much of the time wasted plugging and unplugging. This technology is also useful outside of the office. You can leave your cell phone in your pocket and, using your laptop, dial up to the Internet, as opposed to lining up the phone's infrared port with that of your mobile computer. The best part is that this synchronization will be unconscious and automatic when the devices are within a certain range of each other.

Currently, Bluetooth's most practical usages are its ability to wirelessly synchronize devices, and to serve as small networks. Its range limits its ability to serve the needs of large networks. For small business or sole practitioners, which require smaller networks, Bluetooth can serve this purpose. The main advantage of Bluetooth, though, is the ability a CPA and businessperson has when making use of this technology. A person can coordinate each piece of his or her equipment to create a more powerful and efficient business tool. For more information about Bluetooth technology, see www.bluetooth.com/, or see the websites of any of the Bluetooth SIG member companies. To learn more about the Bluetooth SIG and its members, go to www.bluetooth.com/sig/about.asp.

WIRELESS FIDELITY (WI-FI)

Wireless Fidelity (Wi-Fi), also known as 802.11b, has a range that is longer than that of Bluetooth. Wi-Fi transfers data at 11 megabytes per second. (However, note that Wireless-G operates at speeds almost 5 times faster than 802.11b.) Wireless-G is compatible with 802.11b products. Many large corporations use Wi-Fi wireless devices to extend standard wired networks to areas such as training classrooms and large public spaces. In addition, many companies make use of Wi-Fi to provide wireless networks to their workers. These wireless networks may also be accessed remotely from workers' homes or other offices. Wi-Fi also is used to bridge the information flow between two or more offices in different buildings.

Wi-Fi networks are also found in public places such as hotels and airports. When in an area that supports Wi-Fi, a Wi-Fi certified product is automatically linked to the network when the device is turned on. Wi-Fi is ideal for mid- and large-sized companies. It enables businesses to boost productivity and efficiency through constant real-time information flows, full sharing of data, and constant, uninterrupted communication. People are able to continue to work on projects or prepare for meetings in the airport while they are waiting to board their flight. With wireless technologies such as Wi-Fi, companies can keep their employees, whether they are in or out of the office, up-to-date at all times. Costly omissions of information will be virtually unheard of. As time progresses, Wi-Fi networks will be just about everywhere. Members of the Wi-Fi Alliance plan to bring Wi-Fi to urban areas, central cities, and even some major highways. Now, in reading this, one might be reluctant to believe that such an implementation will take place. Just take a look at some of the members of the Alliance. They are all major players in their respective markets. The site is www.weca.net/OpenSection/index.asp.

Another advantage of Wi-Fi is mobility. Having a wireless network gives your client company many options. It is easy to add other computers to the network. To add another wireless computer to a Wi-Fi network, just plug in your card or universal serial bus (USB) connection. After doing so, the computer is instantly networked. Computers can just as easily be removed. Furthermore, if your client's business needs to move, the company will not have to abandon its network infrastructure or hire someone to rewire its new office location. All that needs to be done is simply unplug at the old office and

plug in the base station to a power outlet at the new office. Then turn on the other devices. Presto! A wireless network has been assembled.

Range and Security

When a Wi-Fi computer is close to the base station, it is capable of transferring and receiving data at a rate of up to 11 Megabytes per second. As the Wi-Fi device is moved further away from the base station, the data rate will drop to around 5.5 Megabytes per second. Generally, the lowest data transfer rate at the maximum range from a base station will not drop below one or two Megabytes per second. This is a drastic deterioration from the 11 Megabyte maximum transfer rate. However, transferring information at one Megabyte byte per second is still an acceptable performance level, as compared to other connection-types. For instance, one Megabyte per second is faster than most DSL and cable connections. Therefore, it is still an above average high-speed transmission. This makes it more than adequate for such tasks as sending and receiving e-mail, browsing the Internet, and entering data from a mobile computer. A standard Wi-Fi antenna broadcasts from 750-1000 feet outdoors, in open spaces. In an office or other work-place setting, which has other stimuli that could interfere with the signal, the standard antenna broadcasts from 150-350 feet. Keep in mind that dense materials such as certain metals may affect the transmission of radio waves, and therefore affect a Wi-Fi broadcast. If the walls in your office are heavily reinforced with such materials as metal, heavy wood, brick, or stone, Wi-Fi devices may have difficulty transmitting from one room to another.

Wired Equivalent Privacy (WEP) is 802.11's encryption standard. WEP works by encrypting the data transferred between the Wi-Fi computer and the Wi-Fi access point. A Wi-Fi access point (AP) is a hardware device or software that acts as a communication hub for wireless devices to connect to a wired local area network (LAN). They provide wireless security, while extending the service range that a user of wireless can access. When data is sent to the access point, it is done so via the public Internet. Therefore, unless it is encrypted, the data is unprotected during its transmission over the public Internet. When the data reaches the access point, it is encrypted and transferred to a Wi-Fi device by WEP. Other wireless technology standards with better security are also in development. IEE 802.1X is a more secure wireless access, which makes use of an Extensible Authentication Protocol (EAP). There have been several security problems with WEP. Therefore, the Wi-Fi Alliance is planning on implementing a new security standard. This new standard is Wi-Fi Protected Access (WPA). Wi-Fi Protected Access implements 802.1X and the EAP to provide better security.

Many corporations use Virtual Private Networks (VPNs) to protect remote-access to their WLAN's. The VPNs also protect their connections. A VPN creates a secure virtual tunnel from the worker's computer all the way to the corporation's server. This means that a secure connection is established from the worker's Wi-Fi hardware, through his or her Wi-Fi access point, over the public Internet, through the corporation's access point, to the corporation's hardware. Existing systems can be modified to make use of VPN as to support a Wi-Fi network. There are many different types of VPNs, some of which are very expensive. Microsoft, however, provides a very basic VPN

technology that is free. The VPN is provided with Microsoft's advanced server operating systems. For more information, visit microsoft.com/ntserver/support/faqs/VPNSecFAQ.asp. The site is a Q & A covering the Microsoft VPN. A VPN works through a company's server. It encrypts any data transferred to company computers from outside the office. VPN software also operates on remote computers and laptops. Virtual Private Networks enable the transfer of data, while protecting that data from being viewed by intruding parties. Setting up a VPN gives a company a lot of mobility. It supports communications from areas such as airports and hotels, enabling people to stay abreast of developing situations, which may be crucial to your client company. Through VPNs, individuals can access information in company networks from anywhere. With VPNs, companies can expand their networks to the homes of their employees. Therefore, through the use of a WLAN with a VPN, part-time employees can do more from the personal computers in their homes. In addition, full-time employees can spend more time with their families, due to the fact that they can perform a variety of tasks from their homes. Another important aspect of Wi-Fi security is its ability to provide different levels of access. For example, a company can provide top-notch security while allowing open access to the Internet and email accounts for guests on the network. This is accomplished by granting network access at different levels. Therefore, a company's visitors can still have unlimited access to the Internet and e-mail, while the VPN access is only given to authorized employees.

In addition to a VPN, wireless networks have a standard technology called Remote Access Dial-Up User Service (RADIUS). RADIUS is used to protect access to wireless networks. Remote Access Dial-Up User Service is security that allows only approved users to access the network. In order for someone to access the network, and the corresponding files contained on the network, he or she must input a user name and password. The RADIUS server then verifies the name and password, and if correct, allows that person to access the network. A key feature to RADIUS is that it may be used to provide different types of access levels. A company may use a RADIUS server to provide access to the Internet, another one for network databases, and another one for access to email. Microsoft provides a basic RADIUS server with its advanced server operating systems for free. Other RADIUS servers may be purchased in the forms of software and hardware, but can be rather pricey.

One of the most formidable lines of system defense is the firewall. Firewalls work by blocking unwanted and unauthorized people from viewing company databases. Many Wi-Fi access points have built-in firewalls. In addition, all Wi-Fi's include a network capability enabling a group of devices to share one Internet provider (IP) address, regardless of whether the IP is from a dial-up, cable, or digital service line (DSL) connection. This capability is called Network Address Translation (NAT). NAT works by creating new IP addresses for each computer of the group from the original single IP address. Therefore, the new IP addresses are invisible to users of the public Internet. The new IP addresses function separately "under the cover" of the original one.

Public Wi-Fi
Wireless networks are not only making their way into today's businesses, they are steadily becoming a reality in many public areas, as well. Companies such as

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Wayport, a company that provides Wi-Fi to hotels, airports, and other public areas around the country, are teaming up with major companies such as 3Com, Sony, Sharp, and other members of the Wi-Fi Alliance to provide wireless fidelity. Major hotels such as Four Seasons, Holiday Inn, Hampton Inn, Ramada, and many others are also teaming up to provide wireless fidelity, through Wayport, in their hotel chains. With members of industry groups such as the Bluetooth SIG and Wi-Fi Alliance pushing the development and advancement of a global wireless infrastructure, more hardware will be built on this standard. If you haven't noticed, this is already happening. Cellular phones and laptops equipped with Bluetooth and Wi-Fi certification are already on the market. Eventually, wired connections will be a thing of the past. With hotels and airports around the world upgrading to wireless, companies that go wireless will be a step ahead. They will have the up to the minute information needed, full integration of technological equipment, full access to their network databases, and the infrastructure to make it possible from anywhere in the world. An interested party's best bet is to begin researching the benefits and detriments of going wireless. The benefits of going wireless are: (1) it is cost effective because you do not incur the cost of wiring and the cost of labor to do so (you only have to set up a software protocol); (2) it is a portable network so you can just move computers around the wireless router (a radio transmitter); and (3) it is peer-to-peer flexible because of the absence of wires, so a traditional wired router is not needed. The detriments of going wireless are: (1) transmission time is slower than the fastest wired networks; (2) radio frequency transmission is believed by some to cause health problems similar to microwaves (this is controversial); and (3) there may be security problems. Of course, with the use of a *bridge* a wireless network may be hooked up to a wired network. Therefore, a company's system may have an integration of wired and wireless networks. Beginning to upgrade now may be beneficial in the long run.

WIRELESS VS. WIRED

Mobility and efficiency are the advantages of using wireless. Using other network technologies like wired, phone line, or power line based networks require connections through wire or cable. Wireless uses radio waves that are capable of traveling through walls and floors. Furthermore, you can connect from anywhere, regardless of whether you are in or outdoors. Wireless networks do not require phone jacks to be close to the devices for them to be networked with the rest of the system. This completely eliminates the inefficient and expensive task of hiring people to rewire an office to support a wired network. Furthermore, wireless technology simply eradicates the clutter of wires around offices. In addition, power line networks are generally more expensive than Wi-Fi networks. Plus, transformers, large appliances, and surge protectors may interfere with power line networks (a type of wired network). Lastly, no wired network is portable. It is completely fixed when it is in tact.

An employee at an office with a wired network cannot pick up his or her laptop and go to another part of the office to continue his or her work, unless there is an available connection. With wireless networks, having a limited number of connections in an office will not be an issue, because everywhere is a connection. Probable situation: you already have an expensive wired network in your office, and would like to add

wireless components. This would not be a problem. Wireless components can be added to your existing wired network. Many wireless access points and gateways allow users to connect to wired equipment, as well. Many corporations frequently do this. Companies can extend their wired networks by adding Wi-Fi networks. By connecting wireless access points to an existing wired network, a company can provide wireless access to all areas of its office.

The major problem with wireless technology is its price tag. The components for wired networks are still cheaper than wireless network components. Access points are just a few hundred dollars. Therefore, the cost of hardware that supports wireless connections can be easily two to four times more expensive than wired network components. The argument, however, is that this higher cost for hardware is offset by the ease of installation and maintenance. Accordingly, long-run costs to maintain the equipment are lower. There will be no expenditures to replace old wires. Furthermore, companies using wireless will never have to hire an electrician to run electrical wiring or install outlets to make a part of the office network-able. If the company is wireless, all that need be done is power on the new hardware, and it is instantly networked. For a wireless network, the major expenditures will be for new hardware to add to the network. Lastly, companies will not have to drill holes or run wires through floors and ceilings when installing a wireless network.

Access points are a bit pricey, but in most instances the purchases of additional access points will be few and far between. The only foreseeable instance, in which the purchase of a new access point will be necessary, is when a company needs to significantly expand its network. Another point to keep in mind is the fact that wireless technology is still relatively unknown because it has not caught on yet. Therefore, as more and more hardware is produced to support wireless, more and more people will switch to this newer technology. Therefore, as demand grows, the price will decline. Also offsetting the higher costs of wireless are the savings the technology generates. As a result of lower maintenance costs, companies will spend less on information technology (IT). This coupled with greater efficiency and a higher level of productivity (generated through the use of wireless), will mean higher bottom lines.

EXPECTED GROWTH OF WIRELESS

The following section contains supplemental information. Keep in mind that the independent study discussed in this section is displayed on the Bluetooth website. Read about it at www.bluetooth.com. The information contained in the study is significant when one considers the size and composition of the Bluetooth SIG. The companies that make up this industry group are household names. Furthermore, many of them are also members of the Wi-Fi Alliance.

Promoter Members of the Bluetooth SIG:
(www.bluetooth.com/sig/membership/promoter.asp)
- 3Com
- Agere
- Ericsson Technology Licensing AB

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- IBM Corporation
- Intel Corporation
- Microsoft Corporation
- Motorola
- Nokia
- Toshiba Corporation

*For a complete list of the group's members, please see the above website.

Some Members of the Wi-Fi Alliance:
(www.weca.net/OpenSection/members.asp?TID=2)
- 3Com
- Agere
- Apple
- Epson
- Ericsson Technology Licensing AB
- HP
- Intel Corporation
- Microsoft Corporation
- Motorola, Inc.
- Nokia
- Sharp
- Sprint
- Toshiba Corporation
- U.S. Robotics
- Yamaha

*For a complete list of the group's members, please see the above website.

Recently, the Bluetooth Special Interest Group, contracted with a research firm to project future demand for wireless technology. The group that performed the independent study is the Zelos Group LLC. The Zelos Group LLC is an advisory service firm, which helps assess the nature and timing of the adoption of new products and services by consumers. The group serves technology industries. Their website is www.zelosgroup.com. The group predicts that over the next four years, Bluetooth technology will generate around $12 billion. The majority of this revenue will be the result of purchases of Bluetooth-enabled equipment used to link pocket computers with mobile handsets, equipment used to wirelessly view and download personal data assistant (PDA) files, and other equipment capable of wirelessly accessing email and the public Internet. The United States and Western Europe were covered in the studies for the years 2001 through 2006. The study assessed likely usages of Bluetooth in those regions to be for PDA's, headsets, handsets, notebook PCs, and automobiles. This information is not just beneficial to businesses seeking to go wireless, but also businesses that distribute hardware, software, and the like. Please view the website for more information.

UPS GOING WIRELESS

Shipping giant United Parcel Service has decided to implement a wireless tracking system into its operations. The company has begun to deploy a wireless tracking system that combines Bluetooth with Wireless Fidelity. UPS plans to issue Bluetooth bar code readers to 55,000 of its package handlers. This is the first major wireless implementation of such a system. The project will cost around $120 million.

This large-scale implementation, which combines Bluetooth with Wi-Fi to create one system, may be an indication of future trends. As discussed earlier, Bluetooth's strength seems to be in its capabilities to facilitate communication between devices. On the other hand, Wi-Fi is more adept at providing wireless and remote access to the public Internet and private networks. Combining these technologies may prove to be the most efficient means of building a company's network. Wi-Fi access points could be used to provide access to a network, and Bluetooth can be used to connect devices. For example, a person would be able to access his or her email from their laptop wirelessly through Wi-Fi. That person could then download it, forward it, or edit it. Suppose the person wanted to print it. Bluetooth would enable the transmission of information from the laptop to a printer, and command the printer to print the document wirelessly. It's kind of like a "one-two wireless punch." There must be a reason for a company the size of UPS, which must keep track of a huge number of shipments daily, to spend $120 million on this new technology. Furthermore, a significant number of blue-chip technology companies are members of both the Bluetooth SIG and the Wi-Fi Alliance. Perhaps they too see the potential relationship between Bluetooth and Wi-Fi.

WIRELESS NETWORKS AND YOUR CLIENT'S BUSINESS

Wireless systems have all the aspects needed to alter the way in which people work. Through remote access, more can be done from the home and on the road. Important information can be received in real time, virtually anywhere. The need to spend long hours in the office over weekends is greatly decreased by Wi-Fi. Small and medium sized businesses can now obtain the same, and many times better, technology to keep track of its inventory as its larger competition. The best part is that a small business can install the wireless network itself. It will not have to enlist outside help for installation. Businesses can now have live streaming, real time inventory data. This type of wireless technology is ideal for retail, wholesale, shipping, and manufacturing companies.

THE ACCOUNTANT'S ROLE

The accountant must be abreast of the latest developments in wireless networks to practically use within the CPA firm, and to properly advise client companies. The CPA must be familiar with the various business applications of wireless networks, the benefits, the drawbacks, and getting the most out of the system to enhance efficiency, productivity, timeliness, and profitability. The use of wireless networks will optimize computer operations and corporate activities. In a wireless network, a wireless network adapter is installed in each computer so there is no need to drill holes and run cables.

However, the further the wirelessly networked computer is from a wireless access point, and the greater the number of solid objects standing in the way, the slower will be the connection. SUGGESTION: To optimize network speed and range, position the wireless access point at least a few feet above the floor and *not* close to metal objects. It is suggested to position the access point in the center of the coverage area. However, another approach is to position the access point so it is as close to the largest number of computers as is feasibly possible. With larger areas, or those with many obstructions, multiple access points are needed. WARNING: Make sure the access points have the same settings. Almost all wireless network adapters support "roaming." When access point coverage areas overlap, the adapter will latch on to the strongest signal.

Reliability, performance, and range depend on signal quality. SUGGESTION: Add an *extra* antenna to your network adapter and access point to materially improve the quality of the signal. Signal strength, your card's ability to receive data under different conditions, is crucial. As you move away from the gateway, there is a degradation of the signal strength and performance. The measure of gateway performance is the combination of range and throughput. Range means how far you can go from the gateway and still have an acceptable signal. Throughput measures the amount of work performed by a computer system over a specified time period. Throughput decreases dramatically when several users access the gateway simultaneously. The card in the gateway has a fixed bandwidth that all client cards must share. TIP: For security reasons, mix numbers and letters in your wireless network's Service Set Identifier, which each wireless device on your network uses to log in.

WHAT DOES IT ALL MEAN FOR CEOS, CIOS AND USERS?

CEOs

Mobile working can dramatically boost productivity and improve an organization's responsiveness and flexibility, but it also poses challenges for the chief executive. But as the trend towards mobile working gather's pace, these are issues that executives cannot afford to ignore. As wired and wireless network-enabled notebook PCs, personal digital assistants (PDAs) and smart phones proliferate, mobile working is becoming a reality, not just for a select few corporate 'road warriors,' but for a much larger group of employees.

This expansion has significant advantages—and risks—for corporate managements. On the positive side, mobile and remote access to corporate systems such as e-mail, enterprise portals and to applications like contact management and customer relationship management systems often provide a competitive edge for companies, while improving both customer and employee satisfaction. But on the other hand, mobile technologies and services tend to come with premium price tags, pushing costs up at a time when chief executives are still under pressure to improve margins and show rapid returns on investments.

Mobile systems are also notoriously difficult to manage and control and perhaps most seriously, ad-hoc arrangements can represent a real threat to enterprise system

security. Balancing the risks and rewards of mobile working and establishing a corporate policy framework to cover, for example, remote access to corporate networks has become an important issue for chief executives—an issue that they ignore at their peril.

CEOs will want to ensure that they are getting value for money when they invest in mobile working infrastructure, so they will probably want to see estimates - and subsequently evidence - of productivity gains and other tangible improvements. They will also want to see investment return projections, and probably be involved in making choices about competing projects.

They will probably also be concerned about how to ensure that mobile and remote workers are earning their keep when they are out of the office. Most consultants suggest that trust plays a key role in enabling a mobile workforce. They add that it is important to lay down guidelines and keep a watch on costs to ensure they do not spiral out of control. Given the growing threat posed by e-mail viruses, 'spyware' and other unwelcome network intrusions, most CEOs are well advised to take steps to ensure that the benefits of mobile working are not negated by the threat it can pose to corporate security. But while it may be tempting to use security as an excuse for inaction, the competitive and financial risks of not adopting mobile working practices when competitors are pushing forward may be even greater.

CIOs

Like it or not, mobile devices ranging from Wi-Fi enabled notebook PCs and PDAs to data-centric communicators such as the Treo 600 or RIM's Blackberry are finding their way into the corporate environment.

Sometimes they are part of a corporate roll-out and can therefore be planned and controlled. But more often than not they are surreptitiously introduced by individuals who have tasted the benefits of remote access and mobile working as consumers and now want to use the same devices and services at work.

One of the key challenges for CIOs in either case is to find ways to accommodate a diverse group of mobile devices while protecting the corporate IT infrastructure and minimizing the network security threat they can pose.

Given the fast pace of change in the technology industry - particularly in the mobile device sector - it is also often a challenge for a CIO to keep up with hardware, software and service developments and to provide the level of support - often with reduced resources - that users have come to expect.

One way to minimize the support overhead is to standardize on a set of devices such as notebook PCs, PDAs, mobile phones and communicators. However this often delays deployment and can lead to end user frustration.

Another option is to outsource the provision of devices and services. For example US-based Aruba, which supplies secure Wi-Fi networks for corporate

customers, says many of them also want it to manage the deployment and maintenance of the Wi-Fi system.

One of the fastest growing areas in the mobile technology sector is security. Typically, larger companies will deploy virtual private networks to facilitate secure access for mobile and remote users such as home office workers to a corporate network.

However there are secure alternatives including remote access programs such as LapLink and the GoToMyPC remote access service that can be rolled out across an enterprise, or made available to a few users.

There is also a growing market for software and hardware such as mini-USB drives and biometric devices such as fingerprint readers designed to protect confidential or sensitive data stored on a portable PC.

Other vendors have developed systems designed to enable secure access to e-mail and other corporate services from internet public access points such as hotels, conference centers or even Wi-Fi hotspots.

Most CIOs already have discovered that the trend towards mobile working is like a runaway steamroller - it is not about to stop. So while it makes sense to lay down guidelines about which mobile devices are supported and how they should be used, ultimately the CIO has to deal with the realities of mobile working.

USERS

The rapid growth of mobile working and the proliferation of new hardware devices, software and services designed to enable mobile workers to do their jobs from virtually anywhere, poses both great opportunities and challenges.

For many employees, the availability of basic tools like portable PCs, pocket-sized PDA organizers and the now nearly ubiquitous mobile phone, gives them much greater freedom and flexibility.

For example, salespeople can use mobile technologies to update customer profiles, download price quotes and provide their audiences with dazzling multimedia presentations. Executives can send and receive email messages, peer into the corporate ERP system or check share prices and competitors' websites while traveling using Wi-Fi or W-LAN wireless connections.

For mobile professionals in particular, as a recent study conducted by Intel, the US chipmaker, showed technology has dramatically changed their lives making it much easier to stay in touch while traveling and respond to colleagues and customers in a more timely fashion.

Meanwhile, a growing number of employees now have broadband internet access at home or work in remote local offices and yet can tie back into corporate

headquarters securely via a virtual private network connection. But while more and more employees have 'always-on' wired and wireless Internet access, they are also finding that they need to set boundaries in order to ensure that they retain a balance between home and office lives and that they are the masters of technology rather than its slave.

Individual attitudes towards mobile technology also vary. So for example, while some employees relish the idea of being able to deal with the overnight flood of e-mail using a wireless device on the train before they reach the office, others balk at the idea of work intruding into another part of their life.

Balancing the demands of work and private lives in the age of mobile technology— when the pressure for greater productivity is often unrelenting —has become one of the more interesting questions probed by sociologists.

Fortunately, the wide range of technologies available mean that most employees can pick and choose which technologies to adopt, and just how much they should intrude into their home lives. Arguably however, portable PCs, mobile phones and PDAs enable employees to work more flexibly and at times that best suit them. Provided a balance is kept, mobile devices and technologies can be valuable tools that enrich both work and private lives.

CHAPTER 17 QUIZ

1. Two major developing technologies are changing the computer networking landscape. They are:
    A. HiFi and Transistor
    B. Wi-Fi and Bluetooth.
    C. MTV and VH-1
    D. BETA and ALPHA

2. The company wanted the features, functionality, and control of a sophisticated voice and data network without the cost of the components or the staff to maintain it. Which of the following options would be most suitable?
    A. Private wide area network.
    B. Integrated services digital network.
    C. Value-added network.
    D. Virtual private network (VPN).

CHAPTER 17 ANSWER KEY

1. (B) is correct. Two major developing technologies are changing the computer networking landscape: Wi-Fi (Wireless Fidelity) and Bluetooth. These two forms of wireless technology can change the entire infrastructure of business networks.

(A) is incorrect. These are frequency and transmission technologies.

(C) is incorrect. These are cable TV music networks.

(D) is incorrect. BETA and ALPHA are used in connection with security analysis or regression analysis.

2. (D) is correct. A virtual private network (VPN) is a carrier-provided service in which the public switched network provides capabilities similar to those of dedicated   private lines but at a lower cost. In effect, an unlimited number of virtual networks can be created from the single common physical network. Virtual networks are made possible by intelligent networking technology, which provides the means for routing telephone calls over the best paths without dedicated lines. Thus, the telephone carrier serves as a PBX.

(A) is incorrect. A private wide area network is one that an individual business firm maintains for its own use.

(B) is incorrect. Integrated services digital network (ISDN) is an international standard for transmitting voice, video, and data over phone lines.

(C) is incorrect. A value-added network is a data-only, multipath, third-party managed network.

GLOSSARY

802.11 a family of specifications developed by the US Institute of Electrical and Electronics Engineers (IEEE). There are currently three specifications in the family (802.11a, 802.11b and 802.11g), with more being developed. The 802.11b standard often referred to as Wi-Fi - is currently more widespread. However, hardware manufacturers are increasingly offering multi-standard equipment that can work with various standards.

APPLICATION PROGRAM computer software written specifically to process data in an information system. It performs tasks and solves problems applicable to a manager's work.

ARTIFICIAL INTELLIGENCE (AI) thinking and reasoning software based on information input into it by a human expert. The reasoning process involves self-correction. Significant data are evaluated and relevant relationships uncovered. The computer learns which kind of answers are reasonable and which are not. Artificial intelligence performs complicated strategies that determine the best or worst way to accomplish a task or avoid an undesirable result. Examples of applications of AI are tax planning and capital budgeting analysis.

AUDIT SOFTWARE computer programs designed to examine and test a company's accounting records. Some packages aid in gathering evidence, performing analytical tests, sampling data, appraising internal control, audit scheduling, and printing exception reports. The software is used by internal auditors.

AUTOMATIC PROGRAMMING process of using one program to prepare another program.

AUTOMATIC RECOVERY PROGRAM program enabling a system to continue functioning even though equipment has failed.

BACKGROUND PROCESSING lower-priority programs are executed when the system is not being used by higher-priority programs.

BAUD serial information transfer speed with which a modem receives and sends data.

BLOCK DIAGRAM   diagram using symbols to explain the interconnections and information flow between hardware and software.

BUDGETING MODELS   computer-based mathematical models generating all kinds of corporate budgets (e.g., cash flow, profitability). The models help managers look at a variety of "what-if" questions. The resultant calculations provide a basis for choice among alternatives under conditions of uncertainty.

BUFFER area of a computer's memory set aside to hold information temporarily.

CATALOG directory of locations of files.

CHAIN LINKS series of linked data items.

CORPORATE PLANNING MODEL computer-based integrated business planning model in which production and marketing models are linked to the financial model. It is a description, explanation, and interrelation of functional areas of a business (accounting, finance and investments, marketing production, management, economics), expressed in terms of mathematical and logical equations so as to generate a variety of reports including financial forecasts. Corporate planning models may also be used for risk analysis and "what-if" experimentation. The goals of the model include improving the quality of planning and decision making, reducing the decision risk, and favorably influencing the future corporate environment.

CYBER INVESTING Investing such as on-line trading on the Internet.

CYBERSPACE Originally used in "Neuromancer," William Gibson's novel of direct brain-computer networking, refers to the collective realms of computer-aided communication.

DATA INTERCHANGE FORMAT (DIF) FILE system to transfer computer files from one program to another.

DATA BASE MANAGEMENT SOFTWARE computer programs used to manage data in a data base. It is a set of programs that provide for defining, controlling, and accessing the data base. The software allows managers to enter, manipulate, retrieve, display, select, sort, edit, and index data.

DEBUG process of tracing and correcting flaws in a software program or hardware device. Computerized routines may be used to find bugs.

 DECISION SUPPORT SYSTEM (DSS) branch of a management information system that provides answers to management problems and that integrates the decision maker into the system as a component. DSS software provides support to the manager in the decision making process. It analyzes a specific situation and can be modified as the manager desires. Examples of applications include planning and forecasting.

EXPERT SYSTEMS computer software involving stored reasoning schemes and containing decision making processes of business experts in their specialized areas. The software mimic the way human experts make decisions. The expert system appraises and solves business problems requiring human intelligence and imagination that involve known and unknown information. The components of the expert system include a knowledge base, inference engine, user interface, and knowledge acquisition facility.

FINANCIAL ANALYSIS SOFTWARE   software capable of taking financial data (e.g., on-line information on the World Wide Web) and performing trend and ratio calculations. Investment and credit decisions are based on the analysis results.

FINANCIAL MODEL a functional branch of a general corporate planning model. It is essentially used to generate pro forma financial statements and financial ratios. A financial model is a mathematical model describing the interrelationships among financial variables of the firm. It is the basic tool for budgeting and budget planning. Also, it is used for risk analysis and what-if experiments. Many financial models of today are built using special modeling languages such as IFPS or spreadsheet programs such as Excel.

GRAPHIC SOFTWARE program showing business information in graphic form, including charts and diagrams. This enhances the understanding of the information including in terms of trends and relationships.

HOTSPOT provides high-speed wireless Internet access in convenient public locations or at home. Using either a laptop or PDA that is 802.11 wirelessly-enabled, people can download their email attachments, watch a live webcast, or listen to streaming audio.

HYPERTEXT data base approach linking related data, programs, and pictures.

INTEGRATED SOFTWARE software package that combines many applications in one program. Integrated packages can move data among several   programs utilizing common commands and file structures. An integrated package is recommended when identical source information is used for varying managerial purposes and activities.

INTERFACE means of interaction between two computer devices or systems that handle data (e.g., formats, codes) differently. An interface is a device that converts signals from one device into signals that the other device needs.

INTERNET international network connecting smaller networks linking computers of different entities.

INTRANET internal company Web sites. It is developed by the company itself.

LOCAL AREA NETWORK (LAN) linking of computers and other devices for intersite and intercompany applications in a small geographic area.

MANAGEMENT INFORMATION SYSTEM (MIS) a computer-based or manual system which transforms data into information useful in the support of decision making.

MATERIAL REQUIREMENT PLANNING (MRP) a computer-based information system designed to handle ordering and scheduling of dependent-demand inventories (such as

raw materials, component parts, and subassemblies, which will be used in the production of a finished product).

MODELING LANGUAGES usually English-like programming languages that are used to solve a specific task and generate various reports based on the solution and analysis. For example, financial planning modeling languages such as IFPS (Integrated Financial Planning System) are computer software packages that help financial planners develop a financial model in English terms (not requiring any computer programming knowledge on his part), perform various analyses such as what-if analysis, and further generate pro forma financial reports.

MULTITASKING simultaneous execution of two or more computer functions.

NETWORK 1. interconnected nodes (points where working units interreact (link) with others. 2. connection of computers and devices.

NEURAL NETWORKS a technology in which computers actually try to learn from the database and operator what the right answer is to a question. The system gets positive or negative response to output from the operator and stores that data so that it will make a better decision the next time. While still in its infancy, this technology shows promise for use in fraud detection, accounting, economic forecasting, and risk appraisals.

ONLINE SEARCHING using a computer retrieval system to obtain information from a database such as on the Internet.

OPTICAL CHARACTER RECOGNITION computer tool that recognizes typed or printed characters on paper so they can be recorded on disk.

REAL TIME computer processing of data in connection with another process outside the computer.

RELATIONAL DATABASE a database consisting of relationships between data items.

SIMULATION   an attempt to represent a real life system via a model to determine how a change in one or more variables affect the rest of the system, also called what-if analysis.

SPEECH RECOGNITION SOFTWARE program in which verbal commands activate the computer to perform functions.

SPREADSHEET table of numbers arranged in rows and columns to make accounting, finance, marketing and other business calculations. Spreadsheets facilitate end-result summary numbers, "what-if" experimentations, and projections.

STATISTICAL SOFTWARE computer program making quantitative calculations such as standard deviation, coefficient of variation, regression analysis, correlation, and   variance analysis.

TAX SOFTWARE tax modules preparing federal and state income tax returns. Tax planning modules exist to examine tax options and alternatives to minimize the company's tax liability in current and future years. "What-if" tax situation scenarios may be evaluated.

TEMPLATE computer-based worksheet that includes the relevant formulas for a particular application but not the data. It is a blank worksheet on which data are saved and filled in as needed for a future business application and to solve problems. Templates are predefined files, including cell formulas and row and column labels for specific spreadsheet applications. Templates allow for the referencing of cells and formulations of interrelated formulas and functions. They are reused to analyze similar transactions.

TERMINAL input-output device allowing a user to communicate directly with a computer.

THINKING SOFTWARE   computer programs used by managers preparing written reports including specialized analyses of corporate operations. The software contains aids to improve writing skills and idea formulation so managers can better create an outline and written report. The information is labeled, organized, and structured.

TIME SOFTWARE computer program that tracks hours worked by employees by function, operation, or activity. It prepares an analysis of the variance between budgeted and actual hours as well as prepares trends in actual hours over a stated time period (e.g., quarterly comparisons).

UTILITY PROGRAM program supporting the processing of a computer such as diagnostic and tracing programs.

WIDE AREA NETWORK (WAN) network comprising of a large geographic area.

WI-FI Wi-Fi short for "wireless fidelity," the popular term for a high-frequency wireless local area network. The Wi-Fi technology is rapidly gaining acceptance in many companies as an alternative to a wired LAN. It also can be installed for a home network.

WIRELESS TECHNOLOGY a variety of technologies to communicate without wires, namely radio transmissions. Examples are cellular, microwave, infrared, and satellite.

W-LAN one in which a mobile user can connect to a local area network (LAN) through a wireless (radio) connection. A standard, 802.11, specifies the technologies for wireless LANs.

WORLD WIDE WEB (WWW) Internet system for world-wide hypertext linking of multimedia documents, making the relationship of information that is common between documents easily accessible and completely independent of physical location.