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**Методичні вказівки**  
**до практичних занять з англійської мови**  
**для студентів другого рівня**  
**вищої освіти (магістрів) спеціальності**  
**“Автоматизація та комп'ютерно-**  
**інтегровані технології”**  
**денної форми навчання**

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Методичні вказівки до практичних занять з англійської мови для студентів другого рівня вищої освіти (магістрів) спеціальності “Автоматизація та комп'ютерно-інтегровані технології” денної форми навчання. / Укл. В.Г. Кузьменко, Н.М. Жукова – Запоріжжя: НУЗП, 2024. – 52 с.

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## UNIT 1. INFORMATION SYSTEMS IN BUSINESS AND INDUSTRY

**Task I. Before reading the text translate the words and word combinations and match them with the appropriate explanation.**

- |                                      |  |
|--------------------------------------|--|
| 1. Information system                | – a) permits and users who have very little computer experience to interact easily with a computer system.   |
| 2. Management information systems    | – b) identifies fast – and slow – moving products to pinpoint areas with high sales potential to make forecasts of production requirements and to plan marketing strategy. |
| 3. Decision support system           | – c) a computer-based system that provides a data processing capability and information to help people make decisions.   |
| 4. User-friendly system              | – d) monitors the status of trucks. It detects when a truck is idle or, moving, the weight of the trucks contents and the speed of the truck.                              |
| 5. Office automation                 | – e) accepts and processes customer orders.  |
| 6. Order-entry and processing system | – f) an information system aids management in making business decisions.   |
| 7. Production scheduling system      | – g) prompts maintenance personnel to perform their routine preventive maintenance tasks, e.g. to change the oil, to replace a particular part and so on.                  |
| 8. Market analysis system            | – h) a sophisticated information   |

system that uses the latest hardware and software technologies to provide better, more timely information.

## 9. Project management and control

system

- i) computer-based applications associated with general office work including word processing, data entry, electronic mail, image processing, voice processing and information systems.

## 10. Fleet maintenance system

- j) allocates manufacturing resources in an optimal manner.

## 11. Satellite monitoring system

- k) provide management with the information necessary to keep projects within budget and on time.

### **1.1. Information systems**

We combine hardware, software, people, procedures, and data to create an information system. A computer-based information system provides both a data processing capability and information to help people make better decisions. The data processing capability, or the handling and processing of data, is only one facet of an information system. A complete information system provides decision makers with on-demand reports and inquiry capabilities, as well as routine periodic reports. Because an information system aids management in making business decisions, it is sometimes called a management information system, or MIS for short.

Until recently, most payroll systems were data processing systems that did little more than process time sheets, print payroll checks, and keep running totals of annual wages and deductions. The demand for more and better personnel information resulted in an upgrade of payroll systems such that they can predict the average number of worker sick days, monitor salary equality between minority groups, make more effective use of available skills, and so on. As a result, payroll data processing systems have evolved to human resource information systems.

A wheat cooperative operates an information system that services over 50,000 farmers and 120 grain elevators. Farmers make on-line inquiries to obtain up-to-the-minute wheat prices. Inventory and sales accounting transactions are batched and recorded daily. (Sperry Corporation)

Decision support systems provide these land developers with direct access to the information they need to make critical decisions about the ecological and economic consequences of developing certain parcels of land. A DSS can supply the information when they want it and in the form they want it. (Cullinet Software, Inc.)



A decision support system (DSS) is a sophisticated information system that uses the latest technological innovations (e.g., color graphics, data base management systems), planning and forecasting models, and query languages to produce and present information to support management in the decision-making process. Managers spend much of their day requesting and analyzing information before making a decision. Decision support systems help close the information gap and improve the quality of management decisions.

### **USER-DEVELOPED INFORMATION SYSTEMS**

Information systems are developed to meet information demands, which, in today's businesses, are almost endless. To give you an idea of just how much managers want support information, the average information services department carries a  $3 \frac{1}{2}$  year backlog of requests for the development of information systems. We have heard that "time is money"; it is also true that "information is money." Users cannot wait three or four years for the information they need, so many of them are taking matters into their own hands. With the help of user-friendly software tools such as fourth-generation languages, electronic spreadsheets, and decision support systems, they are doing it themselves.

The combination of distributed processing, powerful micros, and user-friendly software has resulted in rapidly expanding the base of computer-wise users. These users have the tools and knowledge to meet many of their own information processing needs.

User-developed information systems are usually function based; that is, they are designed to support an individual's or a department's information needs. In contrast, information systems developed by the information services department usually are integrated and are designed to support several departments, or the organization as a whole.

### SYSTEMS RIPE FOR COMPUTERIZATION

A manual system has the same components as a computer-based system – input, processing, output, and storage. If we were to talk in terms of numbers of systems, the overwhelming majority in both government and industry are still manual. This is true of large companies with complex computer networks as well as of small companies without computers. Tens of thousands of manual systems have been approved to be upgraded to computer-based information systems. Ten times that many are awaiting tomorrow's talented and creative people, perhaps you, to identify their potential for computerization.

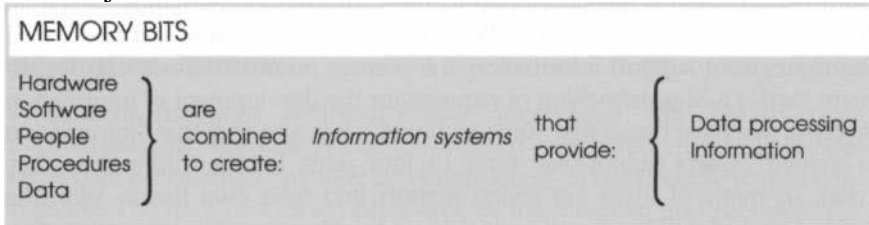
In the construction business, the accuracy of cost estimates may mean the difference between making or losing money. These engineers developed an information system that uses historical data and updated cost data to produce reliable estimates of project costs. (Honeywell, Inc.)



As in a computer-based system, a manual system has an established pattern for work and data flow. For example, a payroll clerk receives the time sheets from supervisors; the individual employee's records are retrieved from folders stored alphabetically in a file cabinet; the payroll clerk uses a calculator to compute gross and net pay, then manually types the payroll check and stub. Finally, the payroll register, a listing of the amount paid and the deductions for each employee, is compiled on a tally sheet with column totals. About the only way to obtain information in a manual system is

to painstakingly thumb through employee folders to find and extract what we need.

Today, most payroll systems have been automated. But look in any office in almost any organization and you will find rooms full of filing cabinets, tabbed three-ring binders, and drawers filled with 3- by 5-inch name-and-address cards. These manual files are symbols of opportunities to improve an organization's profitability and productivity through computerization – a type of automation intended to improve jobs, not to eliminate jobs.



## 1.2. Levels of organizational activity: who gets what information

An organization has four levels of activity—clerical, operational, tactical, and strategic. Information systems process data at the clerical level and provide information for managerial decision making at the other three levels.

The quality of an information system is judged by its output. A system that generates the same 20-page report for personnel at both the clerical and strategic levels is defeating the purpose of an information system. The information needs at these two levels of activity are substantially different: a secretary has no need, or desire, for such a comprehensive report; the president of the company would never use the report because it would take too long to extract the few pieces of important information.

Programmers, systems analysts, and users must determine the specific informational needs at each level of organizational activity during the system design process. The key to developing quality information systems is to “filter” information so that the people at the various levels of activity receive the information they need to accomplish their job function – no more, no less. The quality of an information system depends very much on getting the right information to the right people at the right time.

**Clerical Level.** Clerical-level personnel, those involved in repetitive tasks, are concerned primarily with transaction handling. You might say

they process data. At the end of each term in a college or university grade-reporting system, for example, the secretaries of each academic department enter the grades into the system.

**Operational Level.** Personnel at the operational level have well-defined tasks that might span a day, a week, or as much as three months, but their tasks are essentially short-term. Their information requirements are directed at operational feedback. In the grade-reporting system, for example, the chair man of the information systems department might want a report showing the average grade awarded for each course and any inconsistency in grading.

Managers at the operational, tactical, and strategic levels often request exception reports that highlight critical information. Such requests can be made to the information system department, or managers can make inquiries directly to the system, using a query language. For example, the chairman of the department might request an exception report listing only those instructors who awarded As or Bs to 45 percent or more of their students.



This regional sales staff works primarily at the operational level of activity. Their information horizon is normally less than three months: If they can't get their product to their customer in this time span, a competitor will.  
(Bethlehem Steel Corporation)

**Tactical Level.** At the tactical level, managers concentrate on achieving that series of goals required to meet the objectives set at the strategic level. The information requirements are usually periodic, but on occasion, managers require "what if" reports. Tactical managers are concerned primarily with operations and budgets from year to year. In the grade-reporting system, the dean of the college of business might want to know the number of grades given per professor for each department in the college (see Figure 1.1). To get a better feel for the relative workloads of the five departments, the dean requested that grades-per-faculty be graphically presented in a pie chart (see Figure 1.1).

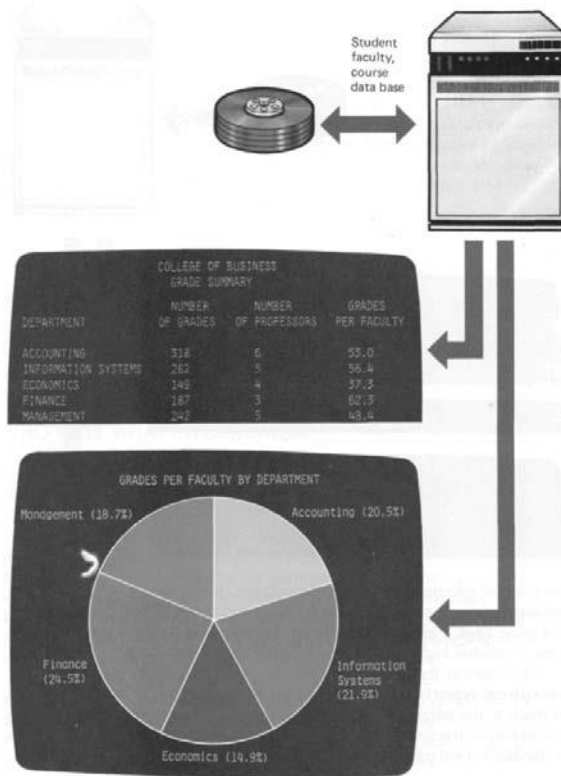


Figure 1.1. - A Tactical-Level Grade-Summary Report shown in Tabular and Graphic Form. The grade summary report and pie chart are prepared in response to inquiries from tactical-level personnel.

**Strategic Level.** Managers at the strategic level are objective minded. Their information system requirements are often one-time reports, “what if” reports, and trend analyses. For example, the president of the college might ask for a report showing the five-year trend for grade averages by college (Figure 1.2). Knowing that it is easier to detect trends in a graphic format than a tabular listing, the president requested that the annual grade data be summarized in a bar graph (Figure 1.2).

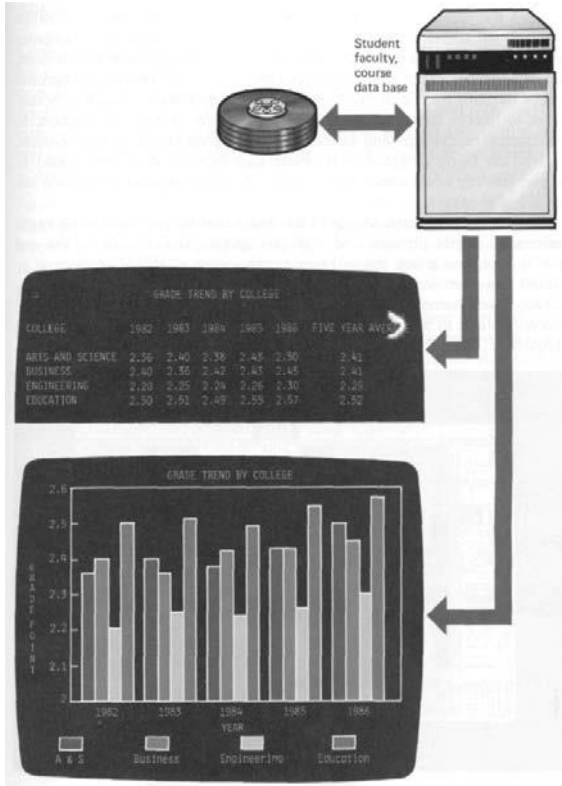


Figure 1.2 – A Strategic-Level Grade-Trend-by-College Report shown in Tabular and Graphic Form. The grade-trend report and bar chart are prepared in response to inquiries from strategic-level personnel.

## MEMORY BITS

### INFORMATION REQUIREMENTS

- |                     |   |                                 |
|---------------------|---|---------------------------------|
| ■ Clerical level    | → | Primarily transaction handling  |
| ■ Operational level | → | Short-term operational feedback |
| ■ Tactical level    | → | Long-term operational feedback  |
| ■ Strategic level   | → | "What if" and trend analysis    |

### 1.3. User-friendly software and systems

Within a few years the majority of professional people, and virtually all office workers, will spend some portion of their day interacting with a computer system. In a few more years almost everybody, including blue collar workers, will use the computer regularly. Interacting with workstations will become part of the daily routine of musicians, lawyers, shop foremen, children, housewives, architects, clerks, teachers, artists, physicians, and choreographers. In anticipation of this upswing in the number and variety of computer users, systems are being designed to be more user friendly. A system is said to be user friendly when someone with relatively little computer experience has no difficulty using it.

User-friendly systems simplify user interaction by communicating easily understood words, phrases, and even pictographs, called icons, to the end user. If confusion arises, the end user simply issues a “HELP” command to request more detailed instructions about how to proceed. Programmers occasionally insert humor into system responses to maintain the “user-friendly” philosophy and to break the monotony. For example, instead of responding “TRANSACTION COMPLETE”, one programmer designed the information system to respond randomly with one of twenty responses such as “LOOKING GOOD”, “NICE GOING”, or “JOLLY GOOD SHOW”. An input error resulted in “WHOOOPS”, or “YOU GOTTA BE KIDDING”!

A user-friendly micro software package lets users “paint” pictures on the screen. The user can pick any of several “pull down” menus (File, Edit, Mode, Tools, etc.) by using a mouse to move the arrow over the desired menu (“Tools” in the photo). The menu is then “pulled down” and temporarily superimposed over the drawing. The “painter” selects activities from the menu, then picks the appropriate icon or color (left and right of drawing) to fill the screen with the skyline of lower Manhattan.

*(Courtesy of International Business Machines Corporation)*



User-friendly systems not only assist the user while interacting with the system, but they also present information in a format that can be more readily understood. For example, user-friendly systems provide the facility to present tabular data as bar charts, pie charts, and line drawings. We can

absorb a graphic summary of information more quickly than a screen full of numbers.

#### 1.4. Information systems common to most businesses

Certain computer applications and information systems are universal and are equally appropriate at a manufacturing company, a university, a hospital, or even a cottage industry (people working out of their home). These applications normally involve personnel and monetary accounting, but they also include several other common application areas, such as inventory control and office automation. Each of these application areas can be, and usually is, integrated to some extent.

**Payroll.** Having already read several payroll-related examples earlier in the text, you should be somewhat familiar with payroll systems. The two primary outputs of a payroll system are the payroll check and stub, which are distributed to the employees, and the payroll register, which is a summary report of payroll transactions.

This portable computer has more power than some mainframes of a decade ago. This supervisor is entering data that reflect the receipt of certain building materials. The data are downloaded to the company's mainframe computer system as input to the accounts payable system.

(GRID Systems Corporation)



**Accounts Receivable.** The accounts receivable system keeps track of money owed the company on charges for goods sold or services rendered. When a customer purchases goods or services, the customer record is updated to reflect the charge. An invoice, bill, or statement reflecting the balance due is periodically sent to active customers. Upon receipt of payment, the amount due is decreased by the amount of the payment.

Management relies on the accounts receivable system to identify overdue accounts. Reports are generated that “age” accounts to identify those customers whose accounts are overdue by more than 30 days, 60 days, or 90 days.

**Accounts Payable.** Organizations purchase everything from paper clips to bulldozers on credit. So the accounts payable system is the other side of the accounts receivable system. An invoice from a creditor

company's accounts receivable system is input to the accounts payable system. When a company receives an invoice, the system generates a check and adjusts the balance. Most companies design their accounts payable system to take advantage of discounts for prompt payment.

**General Ledger.** Every monetary transaction that occurs within an organization must be properly recorded. Payment of a bill, an interdepartmental transfer of funds—both are examples of monetary transactions. The general ledger system keeps track of these transactions and provides the input necessary to produce an organization's financial statement. A financial statement includes the profit and loss statement and the balance sheet.

The Securities Exchange Commission (SEC) requires publicly held companies to file quarterly financial statements. In the past, this requirement has resulted in 6 million pages of reports being sent to the SEC every three months. Now, each report is transmitted to the SEC electronically via data communications. With the current system, stock brokers and investors can look through thousands of financial statements from their workstations, whereas in the past they had to wait several weeks before they could see the reports.

In the not too distant past, accountants manually posted debits and credits for each account in a ledger book, thus the name general ledger for today's electronic system. Other "account" systems (accounts receivable, accounts payable, payroll, and so on) are sources of financial transactions and feed data to the general ledger system.

**Inventory Management and Control.** Walk into most organizations and you see desks, file cabinets, and even computers; these items are called fixed assets. A fixed-asset inventory record is maintained for each item and includes such data as date purchased, cost, and inventory item number. These records are maintained for asset-control and tax purposes.

Manufacturing companies must also manage in-process and finished-goods inventories. These inventory systems monitor the quantity on hand and the location of each inventory item.

**Human-Resource Development.** Human resource development systems are essentially personnel accounting systems, which maintain pertinent data on employees. Besides routine historical data (e.g., educational background, salary history, and so on), the system would include data on performance reviews, skills, and professional development.

**Budgeting.** Each year, managers spend months preparing their department budgets for the coming fiscal year. To aid in this task, the budget system provides each manager with historical information on past line item expenditures (e.g., salaries, office equipment, office supplies, and so on). Based on this information and projected budget requirements, each manager can make budget requests for the next fiscal year. The budget system matches these requests against projected revenues. The process is repeated until the coming year's budget is established.

**Office Automation.** During the last ten years, much has been said and written about office automation. The term refers collectively to those computer-based applications associated with general office work. Companies using office automation extensively have experienced productivity increases of 50% to 100%, yet less than 15% of the companies can claim extensive use of office automation applications. So we have a long way to go before office automation is fully implemented. Office automation applications include word processing, data entry, electronic mail, image processing, voice processing, and office information systems. Each of these applications is discussed below.

*Word Processing.* Word processing, the cornerstone of office automation, revolves around written communication and is found wherever there is an office with a computer. Word processing means using the computer to enter, store, manipulate, and print text in letters, memos, reports, books, and so on. Like accounting and grade reporting, word processing is just another application for computers and is available for virtually every micro and mainframe computer.

Your college computers probably have word processing software that can make preparing reports and term papers much easier and neater than writing them out by hand or by typing them. With word processing, you will have to key in only the initial draft; then you can make revisions and corrections to the disk-based draft until it is ready to be printed in final form.

The fundamental concepts of word processing are discussed briefly below.

- *Formatting a Document.* When you format a document, you are describing the size of the print page and how you want the document to look when printed. As with the typewriter, you must set the left and right margins, the tab settings, line spacing, and character spacing. You can even justify on both the left and the right margins, such as in newspapers and

books. Depending on the software, some or all of these specifications are made in a layout line.

- *Entering Text.* To begin preparation of the document, all you have to do is start typing. Text is entered in replace mode or insert mode. When in replace mode, the character that you enter overstrikes the character at the cursor position.

When in insert mode, you can enter additional text. For example, suppose you entered “To: Sharon Rasley” and would like to add the title “Dr”. Simply select insert mode, place the cursor on the “S” in “Sharon”, and enter “Dr.”. The text will then read “To: Dr. Sharon Rasley”.

Word processing permits full-screen editing. That is, you can move the cursor to any position in the document to insert or replace text. When you enter text, you press the carriage return key only when you wish to begin a new line of text. As you enter text in replace mode, the computer automatically moves the cursor to the next line. When in insert mode, the computer manipulates the text such that it wraps around, sending words that are pushed past the right margin into the next line, and so on to the end of the paragraph.

- *Features.* Word processing features presented here are common to most word processing software packages. Two of the handiest features are the copy and move commands. With the copy feature, you can select a word, a phrase, or as much contiguous text as you desire, and copy it to another portion of the document. To do this, you simply issue the copy command, then tell the computer what to copy and where to put it. At the end of the copy procedure, two exact copies of the text are present in the document. The move command works in a similar manner, except the text that you select is moved to the location that you designate and the original text is deleted (see Figure 1.3).

The search or find feature permits you to search through the entire document and identify all occurrences of a particular character string. For example, suppose the meeting announced in the memo of Figure 1.4 is switched from Thursday to Friday. If you wanted to search the memo for all occurrences of “Thursday”, you would simply initiate the search command and type in “Thursday”. The cursor would be immediately positioned at the first occurrence of “Thursday”. You can also search and replace. For example, you can selectively replace “Thursday” with “Friday”. Or, you can replace all occurrences instantly with a global search and replace (see Figure 1.4).

```

To:      Field Sales Staff
From:    G. Brooks, Regional Sales Manager
Re:      Weekly Briefing Session

The Sales Department's weekly briefing session will be
held at 9:00 a.m. this Thursday. Last month's sales figures
and new sales strategies will be discussed. See you
Thursday! We'll meet in the second floor conference room.

```

```

To:      Field Sales Staff
From:    G. Brooks, Regional Sales Manager
Re:      Weekly Briefing Session

The Sales Department's weekly briefing session will be
held at 9:00 a.m. this Thursday. We'll meet in the second
floor conference room. Last month's sales figures and new
sales strategies will be discussed. See you Thursday!

```

Figure 1.3 – The Move Command in Word Processing. In the first screen, the text to be moved is identified. The cursor is then positioned at the “move to” location – in our example, after the first sentence. In the second screen, the move command is issued and the designated text is “moved” to a location following the first sentence

```

To:      Field Sales Staff
From:    G. Brooks, Regional Sales Manager
Re:      Weekly Briefing Session

The Sales Department's weekly briefing session will be
held at 9:00 a.m. this Friday. We'll meet in the second
floor conference room. Last month's sales figures and new
sales strategies will be discussed. See you Friday!
-----
Search for: Thursday
Replace with: Friday
Manual or Automatic (M/A): A
Number of replacements: 2

```

Figure 1.4 – The Global Search and Replace Command in Word Processing. All occurrences of the word “Thursday” in the memo of Figure 1.4 are replaced with “Friday” when a global search and replace command is issued

If spelling is a problem, then word processing is the answer. Once you have entered the text and formatted the document the way you want it, you can call on the spell feature. The spell feature checks every word in the

text against an electronic dictionary (usually from 75,000 to 150,000 words), then alerts you if a word is not in the dictionary.

Other word processing features, such as centering of titles, indenting, boldface, underline, header and trailer labels, and pagination (numbering of pages), are discussed later.

- *Merging Text with a Data Base.* Besides providing a faster and easier way to type, the text generated by word processing can be merged with data from a data base. For example, a typical word processing application could involve the preparation of the same letter that is to be sent to a number of people. Suppose an art studio wanted to invite 100 preferred customers to a private art showing. The secretary with a regular typewriter has two choices: either type 100 separate letters or type one letter and photocopy it 100 times. In the business world, the latter is not acceptable. Using word processing, a secretary can type the letter once, store it on the



disk, then simply merge the customer name-and-address file (also stored on the disk) with the letter. The letters are then printed with the proper addresses and salutations. Figure 1.6 illustrates how a standard letter is merged with a name-and-address file to produce a “personalized” letter.

*Data Entry.* The data entry function is usually part of a more encompassing information system, but since it is a traditional office function, data entry is sometimes associated with office automation.

*Electronic Mail.* The electronic mail, or E-mail, application lets us send messages to people in the next office, in Japan, or anywhere in the “data communications” world.

*Image Processing.* Image processing involves the creation, storage, and distribution of pictorial information. There are two levels of image processing sophistication.

At the first level, facsimile equipment, which has been around since the 1960s, transfers hard-copy documents via telephone

Computers are revolutionizing legal practices. Rather than spending days researching related cases in legal casebooks, this attorney uses key words to search a massive full-text data base containing more cases than any law office’s library. A search of applicable “computer negligence” cases was completed in 20 minutes.

(Mead Data Central)

lines to another office. The process is similar to making a copy on a copying machine, except that the original is inserted in a facsimile machine at one office and a hard copy is produced on another facsimile machine in another office.

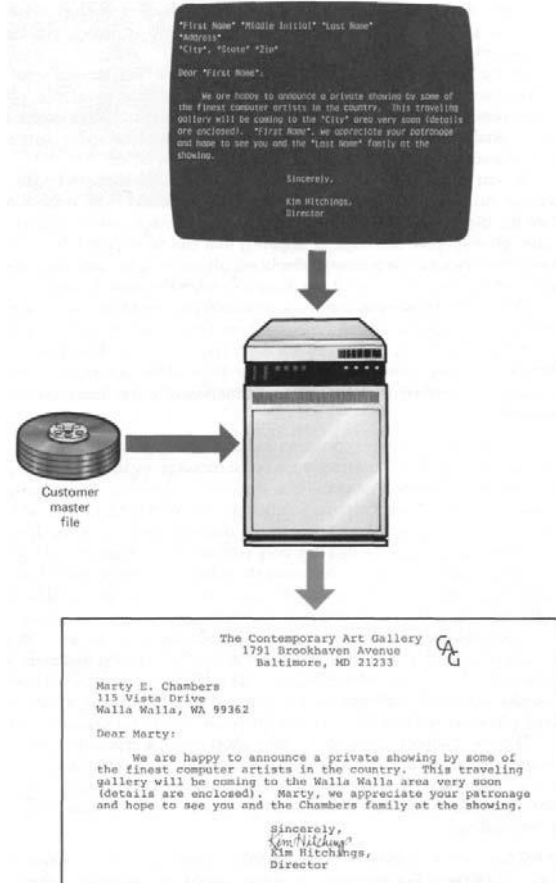


Figure 1.5 – Merging Data with Word Processing. The names and addresses from a customer master file are retrieved from secondary storage and merged with the text of a letter. In the actual letter, the appropriate data items are inserted for \*First Name\*, \*Address\*, \*City\*, and so on. In this way, a “personalized” letter can be sent to each customer

Recent technological innovations have expanded the scope of image processing. An image processor uses a camera to scan and digitize the

image; then the digitized image is stored on a disk. The image can be handwritten notes, photographs, drawings, or anything that can be digitized. In digitized form, the image can be retrieved, displayed, altered, merged with text, stored, and sent via data communications to one or several remote locations.

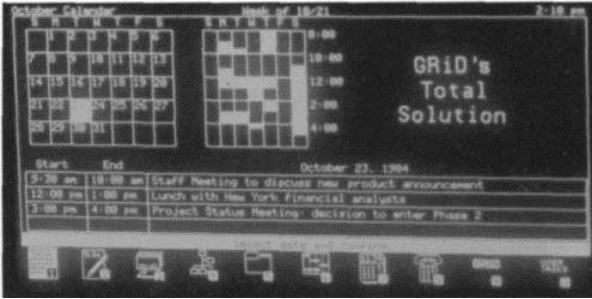
Overnight mail services use image processing to provide two-hour delivery service. The customer simply brings the documents to be sent to a local distribution facility; the documents are digitized and sent via data communications to the destination distribution facility. Hard copies are made from the digitized images, then delivered to their destination, all in less than two hours – guaranteed!

*Voice Processing.* Voice processing includes voice message switching and teleconferencing. The workstation for voice message switching (a store-and-forward “voice mailbox” system) is a touch-tone telephone. Voice message switching accomplishes the same function as electronic mail, except the hard copy is not available. When you send a message, your voice is digitized and stored on a magnetic disk for later retrieval. The message is routed to the destination(s) you designate (using the telephone’s keyboard); then it is heard upon request by the intended receiver(s). A voice store-and-forward system permits you to send one or many messages with just one phone call.

Teleconferencing enables people in different locations to see and talk to each other and to visually share charts and other meeting materials. The voice and video of teleconferencing are supported by the telephone network. The idea behind teleconferencing is that people who are geographically scattered can meet without the need for time-consuming and expensive travel.

The use of teleconferencing has fallen short of initial expectations because people have found out that electronic interaction is not a substitute for direct human interaction. The controlled teleconferencing environment does not transmit subtle nonverbal communication, which is so important to human understanding.

*Office Information Systems.* Several small information systems address traditional office tasks. For example, one system allows people to keep their personal calendars on-line. As workers schedule activities, they block out times in their electronic calendars. There are definite advantages to having a central data base of personal calendars. Let’s say that a public relations manager wants to schedule a meeting to review the impact of



The “calendar” is one of many timesaving office information systems.

(GRiD Systems Corporation)

some unfavorable publicity. To do this, the manager enters the names of the participants and the expected duration of the meeting. The conference scheduling system searches the calendars of affected people and suggests possible meeting times.

The manager then selects a meeting time, and the participants are notified by electronic mail. Of course, their calendars are automatically updated to reflect the meeting time.

Another common office application is the company directory. The directory contains basic personnel data: name, title, department, location, and phone number. To “look up” someone’s telephone number, all you have to do is enter the person’s name on your workstation, and the associated data are displayed. The beauty of the directory data base is that it is always up to date, unlike hard-copy directories which never seem to have the current titles or phone numbers.

Other systems permit you to organize personal notes, keep diaries, document ideas in a preformatted outline, and keep a tickler file. When you log-on in the morning, the tickler file automatically reminds you of “things to do” for that day.

### 1.5. How different businesses use the computer

Information systems are part of the everyday routine in every functional area in every type of organization. Application areas that are normally computerized within the various industry groups are listed in Figure 1.7 and briefly discussed in the following sections. Each of these application areas can be, and usually is, integrated (e.g., it shares a data base) to some extent.

The following is not an exhaustive treatment of computer applications in business and industry – that would take many books. These

applications are presented to illustrate and acquaint you with some of the ways computers are used in a variety of industries.

<p><b>GENERAL</b>            Payroll            Accounts receivable            Accounts payable            General ledger            Inventory management and control            Human resource development            Budgeting            Office automation              Word processing              Data entry              Electronic mail              Image processing              Voice processing              Office information systems</p>	<p><b>PUBLISHING</b>            Word processing            Typesetting            Graphics design            Page formatting            Educational support software            Customized printing on demand            Magazines on a disk</p>
<p><b>MANUFACTURING</b>            Order-entry and processing            Production scheduling            Market analysis            Project management and control            Standard costing            Manufacturing resource planning (MRP)            CAD/CAM            Robotics</p>	<p><b>TRANSPORTATION</b>            Reservations            Fleet maintenance            Satellite monitoring systems</p>
<p><b>RETAIL SALES</b>            Point of sale (POS)            Intercompany networking</p>	<p><b>INSURANCE</b>            Policy administration            Claims processing            Actuarial accounting</p>
<p><b>FINANCIAL SERVICES</b>            Electronic funds transfer (EFT)            Automatic teller machines (ATM)            Home banking            Financial planning</p>	<p><b>ENTERTAINMENT</b>            Professional sports systems            Television news (video composition)            Video games            Film industry</p>
	<p><b>THE ARTS</b>            Computer art            On-line script development            Theater set design            Dance choreography            Musical composition            Musical synthesizers</p>

Figure 1.6 – Summary of Computer Applications by Industry. These are but a few of the many computer applications for any given industry

### **MANUFACTURING**

The order-entry and processing system accepts and processes customer orders. The system then feeds data to the warehouse or plant, depending on whether the order is for stock items or special order, and to the accounts receivable system for billing. The system also tracks orders

and provides order status information from the time the order is received until it is delivered to the customer.

*Production scheduling* systems allocate manufacturing resources in an optimal manner. A well-designed system will minimize idle time for

This shop supervisor relies on a production scheduling system to help him make the best possible use of expensive computer-controlled machine tools.

(Sperry Corporation)



both workers and machines and ensure that needed materials are at the right place at the right time.

*Market analysis* systems rely on historical and current data to identify fast- and slow-moving products, to pinpoint areas with high sales potential, to make forecasts of production requirements, and to plan marketing strategy. For example, in Figure 1.7, the scatter plot of regional sales over the last four quarters demonstrates clearly that fourth-quarter sales in the northeast region did not keep pace. Based on this finding, management might elect to focus more attention on the northeast region during the coming quarter.

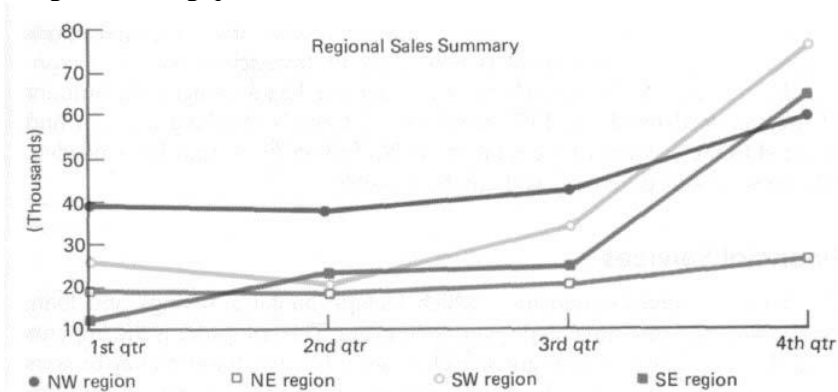


Figure 1.7 – Scatter Plot of Regional Sales. Quarterly sales figures from four regions are plotted to aid in market analysis

*Project management and control* systems provide management with the information necessary to keep projects within budget and on time.

Periodic reports would present actual versus anticipated project costs and the number of days ahead or behind schedule.

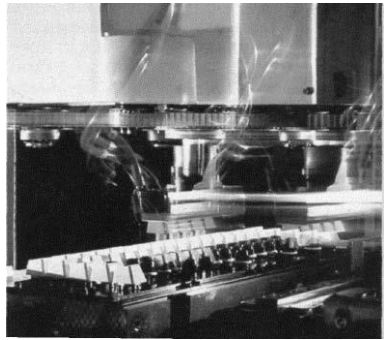
Other information systems commonly found in manufacturing companies include standard costing, manufacturing resource planning (MRP), and CAD/CAM (computer-aided design/computer-aided manufacturing). Robotics is also an application of computers in manufacturing.

With the prospect of increased productivity, manufacturing companies have been rushing to install more and more applications of computer-aided design (CAD) and robotics. In the photo, a keyboard in production is put through its paces by a robotic tester.

*(Courtesy of International Business Machines Corporation)*

### RETAIL SALES

The most prominent system in the retail sales industry is the point-of-sale (POS) system. The cash-registerlike POS workstation logs the transaction of the sale, and the sale also updates the inventory status of the item sold. This immediate feedback is valuable input to marketing strategy. For example, a department store chain relies on its POS



system to identify fast-selling items so that they can be reordered before the stock is depleted. This system also identifies slow-moving items so that management can reduce the price accordingly.

Traditionally, orders for shelf items are computer generated in hard-copy format, then sent by mail to wholesale distributors. It is not unusual for a single order from a department store chain to list thousands of items. When the wholesaler receives the order, key-entry operators enter the orders. The trend today is to use intercompany networking (linking of the computers of different companies). The orders are sent from the retailer to the distributor via data communications, thereby eliminating the need for hard-copy orders and redundant key data entry.

Before long, POS systems will be integrated with EFT (electronic funds transfer) systems, so that what is now a credit transaction will be a cash-transfer transaction. That is, when a customer purchases an item, the amount of the sale is debited, via EFT, from the customer's checking account and credited to the account of the retail store. No further funds transfer is needed. Of course, credit purchases will still be possible.

## **FINANCIAL SERVICES**

The financial services industries, which include banking, savings and loan, and brokerage firms, are entering an exciting era. The computer is the impetus behind some radical and progressive changes in the way these money brokers do business. For example, financial services organizations serve as a money “buffer” between buyer and seller. The traditional approach to money exchange has been for the seller to bill the buyer, the buyer to write a check for the amount of the bill, the seller to deposit the check, and the bank to transfer the funds from the buyer’s to the seller’s account.

In electronic funds transfer, the amount owed is transferred “electronically” from one account to another (in a bank, savings and loan, or brokerage firm). For example, rather than sending out thousands of statements that require each customer to pay the bill in his or her own way, some utility companies are cooperating with customers and banks so that payments are transferred electronically at the end of each billing period. As another example, some employers are bypassing the printing of payroll checks. Based on data supplied to the banks, pay is electronically transferred from employer to employee accounts.

*Automatic teller machines (ATMs)* are the most visible symbol of EFT. In over 100 banks, however, EFT has been extended to the home in the form of home banking systems. Subscribers to a home banking service use their personal computers as workstations to pay bills, transfer funds, and inquire about account status. Some systems also provide subscribers with other services, such as “electronic” shopping, electronic mail, and up-to-the-minute stock market quotations. Other financial services organizations offer similar systems. For example, several brokerage firms permit clients to use their PCs to tap into a data base that contains their account data as well as timely information about the securities market.

All financial institutions offer financial planning services. Part of the service involves a computer-based analysis of a customer’s investment portfolio. Input to the system includes current and anticipated income, amount and type of investments, assets and liabilities, and financial objectives (e.g., minimize taxes, pension level at age 65). The output from the analysis is recommendations aimed at optimizing the effectiveness of a particular person’s investment portfolio.

## **PUBLISHING**

Word processing, computerized typesetting, computer-aided graphics design, and page formatting have revolutionized the way newspapers, books, and magazines are produced. Reporters and writers enter and edit their stories on their portable micros or on-line workstations. Once all copy is on-line, pages are automatically formatted, according to type and spacing specifications. All these steps were traditionally handled with pencils, paper, and typewriters. The document then went on to editing, retyping, composing, proofreading, cutting, pasting, and photographing of the final page format before plates could be made for the presswork.

Publishers of books have traditionally produced hard-copy products, but more and more they will also be involved in the production of educational support software. For example, within a few years, most introductory textbooks will be accompanied by educational software (e.g., this book has a software supplement). The interactive nature of software adds a new dimension to the learning process.

Eventually, customized printing on demand will be available at bookstores. Instead of making a selection from available books, you will make a selection from a list of virtually any current book. The book will then be printed (figures and all) and bound while you wait. This approach will provide a greater selection for the customer and vastly reduce costly inventory for both bookstore and publisher.

Although customized printing on demand is a few years away, magazines on a disk are here today. These magazines are distributed in diskette format for display on home PCs. In the same vein, as optical laser technology moves into the home, dictionaries and encyclopedias will be sold in the form of high-density laser disks.

## **TRANSPORTATION**

Airline reservation systems, discussed on several occasions in previous chapters, are among the most sophisticated of information systems. Airline and travel agents have workstations on which they can make reservations for any U.S.-based airline. The tickets are even printed at the travel agents' workstations. The same is true for rail and bus services and for auto rentals.

A major concern of airlines, railroads, and bus lines is the periodic upkeep of their fleet of transport vehicles. With hundreds, and even thousands, of vehicles, it is difficult for maintenance crews to keep track of

when to change the oil, when to replace a particular part, and many other routine preventive maintenance tasks. A fleet maintenance system (see Figure 1.8) periodically prompts maintenance personnel to perform these routine tasks, vehicle by vehicle.

MAY MAINTENANCE SCHEDULE - - FIRST WEEK		
VEHICLE NO.	DESCRIPTION	MAINTENANCE ACTIVITY
7	EXECUTIVE LIMO	SEMI-ANNUAL PM
12	1-TON TRUCK	OIL CHANGE AND FILTER LUBE
22	1-TON TRUCK	ROTATE TIRES
33	9-PASSENGER VAN	REPLACE TIRES REPLACE WATER HOSES

Figure 1.8 – Fleet Maintenance Report. This report is produced periodically to alert maintenance personnel to fleet maintenance requirements

A satellite monitoring system uses satellite communications to monitor the status of trucks. The system detects when a truck is idle or moving, the weight of the truck’s contents, and the speed of the truck. As anticipated, truckers are resisting the implementation of this “spy in the sky.”

## INSURANCE

The information systems of an insurance company have more external interaction, or communication with people outside the company, than do other businesses. Most of the external communication is with customers. The volume of transactions makes computer based policy administration and claims processing systems a necessity. Insurance agents hook up to headquarters computers so they can quote, write, and deliver insurance policies while customers wait.

An insurance company makes or loses money on the basis of the accuracy of its actuarial accounting system. This system maintains countless statistics that serve as the basis for the rate structure. An actuarial system provides the following kinds of information: the probability that a 20-year-old Kansas City resident with no automobile accident history will have an accident; or the life expectancy of a 68-year-old female whose parents died of natural causes.

## **ENTERTAINMENT**

The computer is now an integral part of the entertainment industry. Football coaches rely heavily on feedback from their computer systems to call plays and set defenses during a game. The system predicts what the opposing team is expected to do based on statistics of what they have done in the past. In fact, the computer is becoming the deciding factor between evenly matched opponents in many sports. In professional tennis, specially designed portable computers are used to keep statistics on stroke effectiveness and strategies. Tennis players analyze the results; then, during play, they emphasize their strengths and attack an opponent's weaknesses.

The computer has made it possible for television network news teams to compose video pictures of key persons and locations (e.g., the President and the White House) that otherwise could not be made available because of time constraints. Also, instead of sending researchers to libraries to cull the relevant facts, reporters tap into a data base and have the facts they need in seconds.

Then, of course, there are video, or should we say "computer", games. Interest in video games seems to be lessening as people realize that what they have is a computer with a seemingly infinite number of practical applications. The computer games industry, however, is anticipating a resurgence of interest with the introduction of videodisk technology in games. With video-disk-based games (e.g., the "Dragon's Lair" game), the images are lifelike color motion pictures instead of computer graphics.

Computers have had quite an impact on the film industry. Many special effects and even the sets for some movies are generated with computer graphics. Cartoons and animated movies are no longer drawn one frame at a time. The scenes and characters are drawn, by hand or with a computer, then manipulated with computer graphics to create the illusion of motion. Computer graphics has even made it possible to revive old black-and-white movies – in color!

## **THE ARTS**

In the arts, the computer is being welcomed with open arms, but only after a long wait-and-see period. Artists and performers now realize that the computer is a human creation and it enhances our human abilities to be creative. Computer art is- now a recognized art form, just like water colors and oils. Traditional painters use computers to experiment with colors on a

display screen before committing them to canvas. Sculptors use computer graphics capabilities to generate three-dimensional sketches.

In the theater, playwrights use word processing systems that are especially designed for the theater environment. Besides the obvious benefits of word processing, there are side benefits to having the script “on-line”. Actors can learn their lines while interacting with a computer that “reads” the lines of other actors; that is, only the lines of other actors are displayed on the screen, unless the actor requests that all lines be displayed. Using computer graphics, set designers lay out the backdrops and props before they are built. Again, there are side benefits to having the set design “on-line”. The director can work out and document the stage movements of all actors before the start of rehearsals.

In dance, as in sports, computer graphics are used to refine dance movements through biomechanical analysis. Also, computers have proved handy tools by which to document the choreography of dances.

Music composition software is to composers as word processing software is to authors. This software relieves composers of much of the burden of documenting their compositions in music notation, thereby allowing them to concentrate on the more creative aspects of composing. Those who make the music are also benefitting from computers. Musicians can create a variety of new sounds with computer-based music synthesizers.

Certainly, many new applications will emerge as computers begin to play a more active role in the arts.

**Task II. Fill in the spaces with proper words from the box.**

1. We combine hardware, software, people, procedures and data to create an\_\_.

2. Pictographs, called\_\_\_\_\_, help systems to be more user friendly.

3. Claims processing systems are associated with the \_\_\_\_\_ industry.

4. The idea behind \_\_\_\_\_ is that people who are geographically scattered can meet without the need for time-consuming and expensive travel.

5. Computer-based policy administration and claims processing systems have become a necessity because of the increasing volume of \_\_\_\_\_.

6. \_\_\_\_\_ involves the creation, storage and distribution of pictorial information.

7. The quality of an information system depends very much on getting the \_\_\_\_\_ to the \_\_\_\_\_ at the \_\_\_\_\_.

8. User-developed information systems are designed to support an individual's or a department's information needs, therefore they are \_\_\_\_\_.

9. The general ledger system keeps track of \_\_\_\_\_ transactions and provides the input necessary to produce an organization's financial statement.

10. \_\_\_\_\_ system provides each manager with past expenditures and based on this information and projected budget requirements he or she can make budget requests for the next fiscal year.

(right information, teleconferencing, image processing, right time, transaction, icons, insurance, information system, right people, function based, budget, monetary)

**Task III. Decide whether the following statements are true or false. If you think a statement is false, change it to make it true.**

1. A manual system has the same components as a computer-based system.

2. Operational-level personnel are concerned primarily with transaction handling.

3. Exception reports are produced for managers at the operational, tactical and strategic levels.

4. Trends are more easily recognized when data are presented in tabular rather than graphic format.

5. The balance sheet is a by-product of a general ledger system.

6. Accounts payable is generally associated with office automation applications.

7. Automatic teller machines are an implementation of EFT.

8. Claims, processing systems are associated with the insurance industry.

9. Computer applications and information systems can not be universal.

10. Payroll system keeps track of money owed the company on charges for goods sold or services rendered.

**Task IV. Answer these questions to the text.**

1. Software for music is to composers as what is to authors?
2. How do computers help professional tennis players?
3. What is “wraparound” in word processing?
4. Electronic funds transfer is associated with what industry?
5. Which information system produces invoices? Purchase orders?

Balance sheets?

6. What differentiates a decision support system from an information system?
7. Distinguish between replace mode and insert mode in word processing.
8. List and briefly describe three manual systems with which you are familiar and that you feel are prime candidates for computerization.
9. Name three office information systems.
10. What are the levels of organizational activity, from specific to general?
11. What are the fundamental concepts of word processing?

**Task V. Explain.**

1. Would it be possible for a medium-sized insurance company to maintain a skeleton information systems department and use proprietary software for all of their computer application needs?
2. Has the application of computer technology to the arts in any way stifled artistic creativity? Has it enhanced creativity?
3. What do financial planning services involve?

**Task VI. Discuss the following matters.**

1. Why do you suppose truckers are resisting the implementation of satellite monitoring systems when they know that such a system will provide management with better control information?
2. Would you buy a “magazine on a disk” why or why not?
3. Discuss the emerging role of personal computers in electronic funds transfer.

**Task VII. Combine the answers into a short summary .****Task VIII. Compare this information with your ideas.**

## UNIT 2. INFORMATION SYSTEMS IN GOVERNMENT, HEALTH AND EDUCATION

### 2.1. Information systems in government

#### LOCAL GOVERNMENT

Local governments use a wide variety of information systems (see Figure 2.1). Most cities supply and bill citizens for at least one of the three major utility services: water, refuse, and electricity. Besides these utility billing systems, a tax collection system periodically assesses citizens for income, school, and real estate tax.

Cities also have police systems which are used for incident reporting, inquiry, and dispatching. Many police departments even have workstations mounted in their cruisers. From these workstations, officers can view the arrest record of an individual, request a “rundown” on an auto’s license number, or check out what other officers are doing. Police detectives can search data bases for suspects by matching modus operandi, nicknames, body marks, physical deformities, locations, time of day, and even footwear.

Some fire departments are electronically informed of

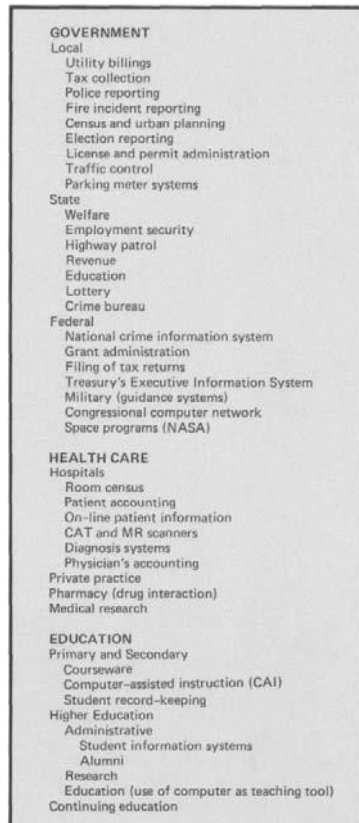


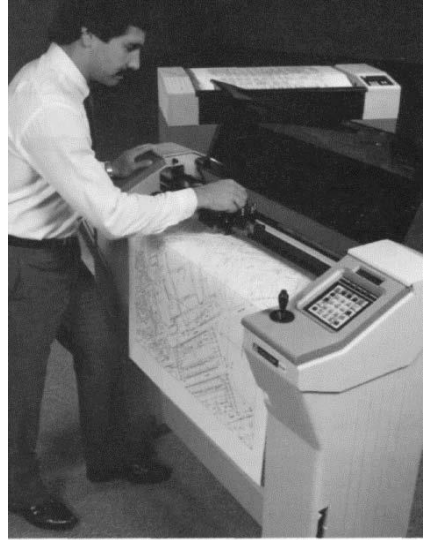
Figure 2.1 – Summary of Computer Applications for Government, Health, and Education. These are but a few of the many computer applications in these areas

the location of a fire. Here's how it works. Someone at the site of the fire calls a three-digit "fire reporting" number. In a split second, a computer system searches its data base for the address of the calling phone (therefore, the location of the fire), then automatically dispatches vehicles from the nearest fire station.



The local fire and police departments fight crime and fires and attend to other emergencies with the help of an information system. In seconds, dispatchers can select which squad car or fire station would be the most responsive to a given emergency.

*(Courtesy of International Business Machines Corporation)*



A city planner uses a plotter to produce a hard copy drawing that illustrates recent zoning changes to a city suburb.

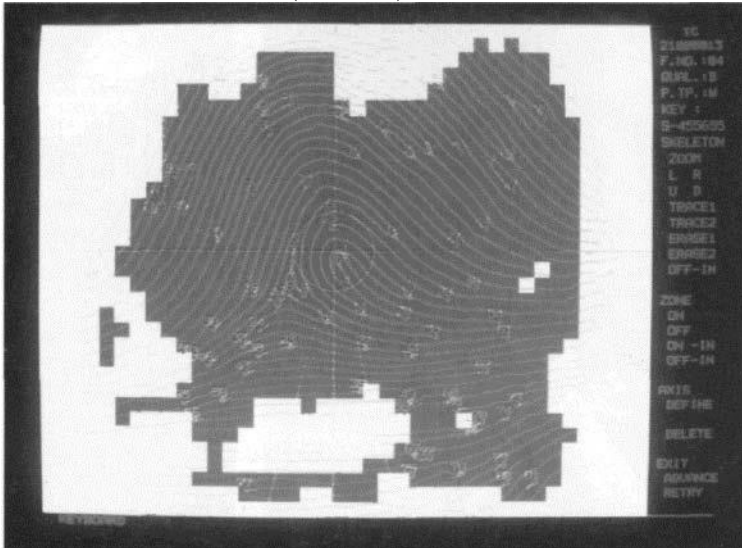
*(CalComp)*

Other systems that are typically supported by local governments include census and urban planning, election reporting, license and permit administration, traffic control, and even parking meters systems. In one case, a large city implemented a parking meter system that resulted in tens of thousands of dollars of delinquent fines being collected. The system paid for itself in the first month of operation!

## **STATE GOVERNMENT**

At the state level of government, each major agency has its own information systems department. Welfare, employment security, highway patrol, revenue, and education are only a few of the many state agencies that have information systems departments. In some states, one of the most

visible systems is the lottery agency. A bet is registered immediately at any of thousands of online workstations located in stores and restaurants throughout the state. The on-line lottery systems have made it possible for people to be “instant” winners (or losers).



Above. In the past, a manual search through a fingerprint file could take a detective months – often without success. Today, computers take only a few minutes to check fingerprints from the scene of a crime against a large data base of fingerprints – often with great success.

*(Courtesy of NEC Information Systems, Inc.)*

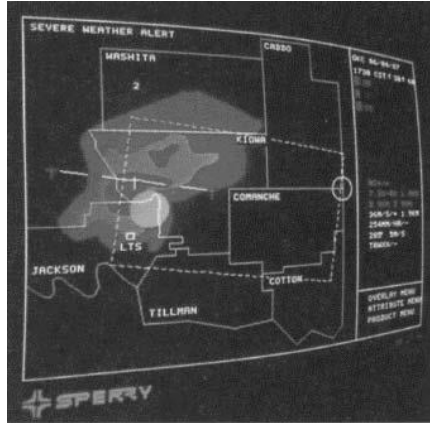
Several state crime bureaus are using computers for fingerprint identification. Once the millions of fingerprints have been converted to digital data and stored on disk, the system can check up to 650 prints per second. In a manual search, an investigator would take hours to do what a computer can do in a single second. This new technology doesn't give criminals much of a head start!

### **FEDERAL GOVERNMENT**

The federal government has thousands of computer systems scattered throughout the world. The Federal Bureau of Investigation (FBI) has its national crime information system (NCIS) to help track down criminals. The National Science Foundation (NSF) has a grant administration system that enables it to monitor the progress and budgets for research projects.

The Internal Revenue Service (IRS) now permits on-line filing of tax returns from our home PCs. This service saves us and the IRS a lot of time and money. For us, the on-line system performs all of the necessary table searches and computations, and it even cross-checks the accuracy and consistency of the input data. For the IRS, no further data entry or personal assistance is required.

The Treasury Department maintains the Treasury's Executive Information System. This system provides up-to-the-minute information on the foreign currency exchange rates and stock quotes. The Secretary of the Treasury carries a portable computer so that he can tap the system for information. The



The Next Generation Weather Radar System (Nexrad) is being developed by the U.S. Department of Commerce. The display improves severe weather forecasting by color coding varying weather conditions in a geographical area (southern Oklahoma in photo).

*(Sperry Corporation)*

timely information provided by the system is critical to the effective functioning of the Treasury Department. Each day, the Secretary makes decisions that affect the world money market.

National defense systems are becoming more “high tech”. Missiles use computer-controlled guidance systems to travel thousands of miles and land on or within feet of their targets. Some aircraft are equipped with sophisticated computer-controlled autopilots that can be activated to actually land an aircraft, even on moving aircraft carriers. Intelligence photos, taken at high altitudes, can be computer enhanced to show incredible detail – would you believe the headlines of a newspaper? The Aegis System can track hundreds of approaching missiles and aircraft and, based on system input, determine the best defense strategy, then select and activate defensive weapons systems. Controversial proposals for so-called “star wars” systems are based on sophisticated computer technology.

Computer technology has caused Congress to take on a new look. Senators and representatives have workstations in their offices that permit them to scan proposed legislation, send electronic mail, vote on legislation from their offices, do research, and correspond with constituents. The

system also allows lobbyists, reporters, and other interested persons to monitor voting records, session attendance, and other matters of public interest. Another benefit of the congressional computer network is that it lets congressional committees poll members of congress for their feedback while legislation is still in draft form, instead of waiting until the legislation is put to a vote.

This programmer is making modifications to the NORAD (North American Aerospace Defense) early warning system. The system alerts military forces of an air attack so they can take defensive action.

*(TRW Inc.)*



The most sophisticated government computer systems are associated with NASA and the space program. A mind-boggling network of ground and on-board computers must work together, without malfunction, to take people to the moon and shuttle people between the earth and orbit about the earth.

## 2.2. Information systems in health care

### HOSPITALS

In health care, the computer is a constant companion to both patients and medical personnel. This is especially so in hospitals, where at the beginning of each day the status of each room is updated in the room

The nurse's station is the hub of hospital activity and the source of information for both nurses and doctors. They use the terminals at the nurse's station to retrieve information from the hospital's information system.

*(Texas Instruments, Inc.)*



census data base (see Figure 2.2). The patient accounting system updates patient records to reflect lab tests, drugs administered, and visits by a physician. This

system also handles patient billing.

ROOM CENSUS REPORT (BY ROOM NUMBER) FIRST FLOOR		
ROOM NO.	PATIENT NAMES	
	BED 1	BED 2
101S	MARK MILLS	
102D	JAMES FLOYD	LARRY SMITH
103D	ELLEN MOREL	-----
104W4	JANE WEAR	SALLY ABLE
	NANCY YOUNG	-----
105S	FRED KENT	
106S	-----	
107D	MATT KENNEDY	HANK OREM

S-SINGLE    D-DOUBLE    W-WARD (NO. OF BEDS)

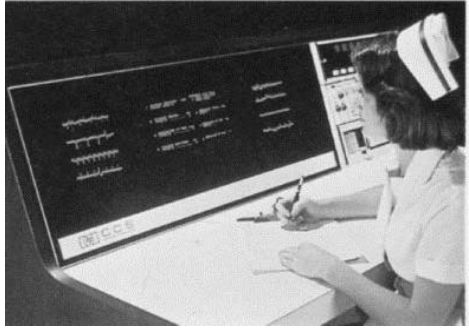
ROOM CENSUS REPORT (BY LAST NAME) FIRST FLOOR		
PATIENT NAME	ROOM NO.	
SALLY ABLE	104	
JAMES FLOYD	102	
MATT KENNEDY	107	
FRED KENT	105	
MARK MILLS	101	
ELLEN MOREL	103	
HANK OREM	107	
LARRY SMITH	102	
JANE WEAR	104	
NANCY YOUNG	104	

Figure 2.2 – Hospital Room Census Reports. Room census reports are compiled by room number (soft copy) and patient name (hard copy)

In the operating room, surgeons have on-line access to the patient's medical records. Some of these interactive systems are even voice activated to free the surgeon's hands for more critical tasks. Computers have taken some of the risk out of complex surgical procedures by warning surgeons of life-threatening situations. For example, during brain surgery, a computer monitors the patient's blood flow to the brain. Once discharged to

an intensive care unit, computers continue to monitor a patient's vital signs and alert attending personnel of danger situations. Most life-support systems (e.g., artificial lungs) are also computer controlled.

Computer-controlled devices provide physicians and surgeons with information that simply was not available a few years ago. Because surgeons can "see" more clearly into a person's body with CT or CAT (computer tomography) scanners and MR (magnetic resonance) scanners, medical procedures may be less drastic owing to improved information. For example, a surgeon may not have to amputate an entire limb to eliminate the spread of bone cancer if an MR scan detects the cancer only in a



Computer-controlled intensive care units provide nurses and physicians with a continuous graphic display of patient cardiac activity. A warning is sounded when patient data exceed acceptable limits.

*(Advanced Devices, Inc., Two Technology Way, Norwood, MA 02062)*

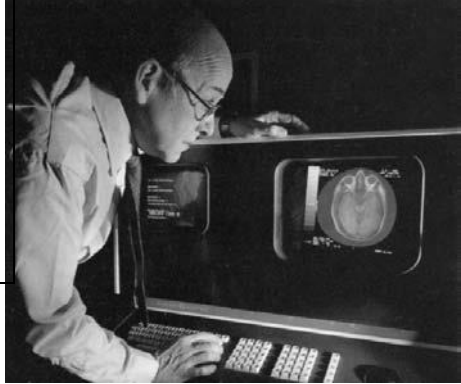
limb's extremities. CAT scanners permit the results of several scans to be combined, then forged into three-dimensional images. MR scanners, the most recent technology for viewing inside the body, combine computers and a large doughnut-shaped magnet to produce video images of a cross section of a body. MR scanners permit internal "pictures" that, before, could be obtained only through exploratory surgery. Physicians view and analyze the images from CAT and MR scanners on color graphics monitors.

"Expert" diagnosis systems help physicians identify diseases and isolate problems. The physician enters the patient's symptoms and the system queries an expert system data base to match symptoms with possible illnesses. The system will request more information from the doctor if the illness cannot be diagnosed with existing information.

In recent years the cost of a hospital room has soared, and still some hospitals operate in the red. To get back in the black, hospitals are implementing procedures to better control costs. For the first time, they are implementing systems that optimize the use of their resources, while maximizing revenue. A physician's accounting system provides hospital administrators with information about how each physician is using hospital

Data obtained during scanning by magnetic resonance (MR) diagnostic equipment are computer-reconstructed to form cross-sectional images of the body's tissues and organs. This technology enables doctors to distinguish between benign and malignant tumors, and to detect conditions that could lead to heart attacks.

*(General Electric Company)*



facilities. For example, such systems identify physicians who tend to admit patients who could just as well be treated as outpatients. These patients typically generate less revenue for the hospital and take up a bed that could best be used by a seriously ill patient.

### **PRIVATE PRACTICE**

Why does a physician or dentist need a computer in private practice? That answer is simple – private practice is a business that necessitates the handling of many administrative functions, such as patient record keeping, billing and collections, appointment scheduling, and insurance processing.



Specimens are sent to this medical laboratory for analysis. Computer controlled instruments analyze the specimens and produce reports which are distributed to the attending physicians. (William Revelli for Allied Corporation)

Of course, physicians can also use computers to improve their delivery of patient care. Doctors can tap into a variety of medical information services from their office workstations: expert diagnosis systems, medical data bases (for researching an illness), prescription data bases, and drug- interaction data bases. A physician can even link to a hospital's mainframe computer system to check patient status.

## PHARMACY

With thousands of drugs on the market, it is too time consuming for a pharmacist to manually check the drug interactions for each drug pair prescribed for each patient. Therefore, the speed of the computer is used to query a “drug-interaction” data base to ensure that a patient is not prescribed drugs that may cause an adverse reaction when combined with other drugs.

## MEDICAL RESEARCH

The microprocessor has opened new vistas for medical research. Our body is an electrical system that is very compatible with these tiny computers. Researchers have made it possible for paraplegics to pedal bicycles and take crude steps under the control of external computers. In the system, various muscle groups in the legs are excited electronically to cause the legs to perform a walking motion. The system has given new hope to paraplegics who were told they would never walk again. To be sure, much remains to be done, but researchers insist that someday, computer implants will enable paraplegics to walk.

In the past, artificial organs have been impractical because they required

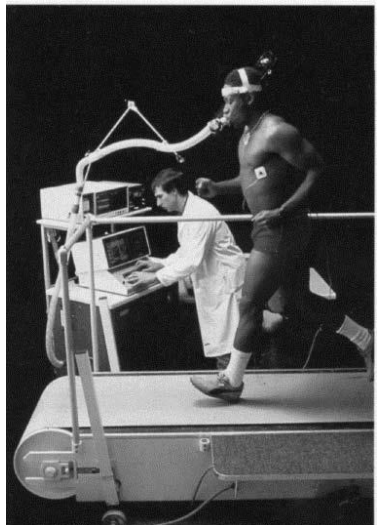
This sports physician is conducting research in the area of exercise physiology. In the photo, he is measuring the peak oxygen consumption of a sprint cyclist in a computerized pulmonary monitoring exercise laboratory.

*(Gould Inc.)*



Dental groups use this OCR system for centralized record keeping and billing. Following each patient visit, a dental assistant scans each patient's account number and preset codes for each service provided.

*(CA ERE Corporation)*



bulky external control mechanisms. Now, powerful computers, no larger than your fingernail, have the capabilities to control complex mechanical devices that can be implanted to replace malfunctioning organs. Little or no external apparatus is required. Again, this research is in the infant stages, but early limited success with artificial hearts has been encouraging.

### **2.3. Information systems in education**

#### **PRIMARY AND SECONDARY EDUCATION**

The computer has added a new dimension to the educational process. A computer can give “individual” attention to a student. This is a welcome relief to overcrowded classrooms. It is interactive and is quick to respond to a student’s input. The use of software allows for a variety of approaches to different learning styles: it incorporates the visual, the auditory, and the kinesthetic learning styles. The use of dynamic graphics and the interactive nature of software (i.e., immediate feedback) has “turned on” many students to the learning process.

Educational software, often referred to as courseware, is not limited to the sequential format of books. Computer-assisted instruction (CAI) can demonstrate and present material, provide opportunities for drill and practice, test for understanding of the material, evaluate the test results, and provide follow-up instruction based on test results. Educational software packages have been developed that reinforce and complement virtually every subject covered in kindergarten through high school – helping students learn everything from the alphabet to calculus. Moreover, many educational software packages have taken on an entertainment quality that enables students to enjoy the learning process. Educators are encouraging the use of some entertainment-oriented software packages because of their educational value.

Computers are a tool for both teacher and student. Student record-keeping systems help teachers keep up-to-the-minute data on each student and provide current information for parent/teacher conferences. Word processing software has been used in grammar and composition classes and to help children learn to read through writing. Computer literacy is begun in the early grades, where languages such as LOGO and PILOT are being used to teach logic and problem solving.

The use of the computer is allowing the handicapped to be more readily mainstreamed into the classroom. Speech synthesizers allow those

who have not been able to “talk” to take part for the first time. For visually impaired students, written text is “read” (using optical scanning), then displayed a word at a time in print large enough for the students to read.

### HIGHER EDUCATION

In colleges and universities, computer uses can be placed into three categories: administration, research, and education. The student information system is the focus of administrative computing. At the center of the student information system is the registration subsystem. Within registration are grade reporting, transcript maintenance, and class scheduling (Figure 2.3). Other student-related subsystems include job placement, housing, admissions, and financial aid.

ACADEMIC PROGRAM				STUDENT ROSTER			
COLLEGE	College of Business			STUDENT NUMBER	TERM	DATE	
CLASS	Second Semester Sophomore			461-37-4188	1987 SPRING	02/03/87	
DEGREE	B.S. Computer Information Systems			STUDENT NAME			
MAJOR 1	Information Systems			Selash, Sandy S.			
MAJOR 2	Accounting						
MAJOR 3	Drama						
ADVISOR	Prof. M. Holland						
COURSE SECTION NUMBER	SUBJECT	COURSE TITLE	CREDIT HOURS	GRADE TYPE	MEETS	BLDG/ROOM	
COLLEGE	SUBJ.	SECTION	ALPHA	ALPHA	ALPHA	ALPHA	ALPHA
218-264-03	HIST	American, 1865 to Present	3.0		M W F	08:10 - 9:00	MG 202
301-108-04	ACCT	Fundamentals of Accounting	3.0		M W F	09:10 - 10:00	WL 430
225-307-02	CIS	Structured Design Techniques	3.0		T R	09:10 - 10:00	PA 502
225-307-03	CIS	Laboratory	0.0	CR	T	13:10 - 16:00	PA 501
225-310-01	CIS	COBOL II	3.0		T R	10:10 - 11:00	PA 360
225-310-04	CIS	Laboratory	0.0	CR	R	13:10 - 16:00	PA 501
270-001-01	DRA	Improvisation	3.0		M W F	11:10 - 12:00	DH 312
150-012-06	MATH	Business Statistics	2.0		T R	08:10 - 09:00	XS 401
Hours Rostered: 17.0							

Figure 2.3 – Student Roster of Classes. A student roster is generated and distributed to each student who preregisters for the term

Upon graduation, your name will surely become a permanent entry in the alumni data base. Many college and university development offices use computer-based systems to obtain information on how they can best direct their campaigns for alumni contributions and endowments.

There are as many research uses for the computer as there are professors. Sociologists analyze large amounts of demographic data in an attempt to draw conclusions about societal trends. Psychologists employ a variety of computer-based testing techniques to prove or disprove

behavioral theories. Literature professors use text processing to analyze and compare the styles of authors. Human-factors engineers “wire” subjects directly to a computer to collect data during experiments.

In most colleges, either computer literacy has been made a general education requirement for all students, or such a requirement is being seriously considered. Dozens of colleges now require their students to own computers. In these colleges, professors in every discipline are encouraged to design their assignments to take advantage of a “computerized” student body. To get their assignments or messages from their classmates, students “log on” to the college’s central mainframe computer system.

### **CONTINUING EDUCATION**

Correspondence courses have been integral to the continuing-education effort for many years. Now, some colleges are offering continuing-education courses with a twist: “correspondence computing” Student and instructor communicate with one another, not through the postal system, but via electronic mail. For standard courses, much of the student interaction is automatic (preset assignments and testing) and does not require instructor participation. If a student has a question, it is routed to the instructor’s “electronic” mailbox. The instructor answers in a similar manner. Students prepare reports and instructors grade them at their respective workstations – no hard copy is required!

## **2.4. Technology transfer**

Undoubtedly, you are aware that there is an enormous demand for computer-related services within virtually every organization. There is so much to be done that sometimes it seems that everything must be done by yesterday!

Since most computer centers suffer from a shortage of human resources, managers are turning to technology transfer as a solution. Technology transfer is a buzz word that means applying existing technology to a current problem or situation. In all probability, some organization has, at one time or another, addressed the same problem or system on which you might be working.

All colleges, for example, need registration and class scheduling systems. All manufacturing companies need inventory management systems. All organizations use electronic spreadsheets and word processing

software. These and many other application-specific and generalized systems have been developed and “packaged” for sale by software vendors. These systems are called proprietary software, or packaged systems. The “package” sold by the software vendors consists of the programs (software) and their associated documentation. For larger, more complex packaged systems, vendors also offer training and consultation on how to use the systems.

You might ask, “Why not buy all needed software and eliminate the need for programmers and systems analysts?” It’s not that simple. Proprietary software systems, especially information systems, are not always implemented as they are designed. Often substantial in-house modification is needed to fit local circumstances. Depending on the information system, it may be easier to start from scratch than to purchase and modify a packaged system.

Fifteen years ago computer specialists had at least a passing familiarity with most of the major software packages. As people began to recognize the benefits of software technology transfer, the development of proprietary software accelerated. Personal computers then opened up a whole new market and fueled the further growth of proprietary software. Now, thousands of software vendors are producing tens of thousands of software packages from which to choose. You can purchase personal computer software that will help you with home finances for less than \$100. The software for a sophisticated corporate financial planning system may cost as much as \$100,000.

**Task I. Fill in the spaces with proper words.**

1. Educational software is sometimes called\_\_\_\_\_.
2. In pharmacy to insure that a patient is not prescribed drugs that may cause an adverse reaction when combined with other drugs the \_\_\_\_\_ is used.
3. The\_\_\_\_\_permits congressional committees poll members of congress for their feedback while legislation is still in draft form.
4. Missiles use computer-controlled\_\_\_\_\_to travel thousands of miles and land on their targets.
5. A common approach to technology transfer is to purchase and install\_\_\_\_\_.

(guidance system, packaged systems, congressional computer network, courseware, drug interaction system)

**Task II. Decide whether the following statements are true or false. If you think a statement is false, change it to make it true.**

1. Timely information is so valuable to the secretary of the Treasury that the secretary carries a portable computer.
2. The primary use of computers in hospital intensive care units is to collect patient billing information.
3. Proprietary software is software that has been packaged for sale to the general public.
4. Lottery systems are using computers for fingerprint identification.

**Task III. Answer these questions to the text.**

1. How do computers help surgeons in an operating room?
2. Name four applications of the computer in a municipal government.
3. What is “correspondence computing”?
4. Name two medical information services that are available to physicians in private practice.
5. What computer-based applications are unique to hospitals?
6. What systems are called proprietary software or packaged systems?
7. How can you explain the term “technology transfer”?
8. What computer system helps physicians to identify diseases and isolate problems?
9. Why is it unreasonable to buy all needed software and eliminate the need for programmers and system analysts?

**Task IV. Discuss.**

1. Physician’s accounting systems have been implemented under a cloud of controversy. Why?
2. Applications of the computer in a federal government.
3. Three categories of computer systems used in higher education.

**Task V. Combine the answers into a short summary.**

**Task VI. Be ready to retell the text.**

**Task VII. Compare this information with your ideas .**

## UNIT 3. SECURITY

Any information system has points of vulnerability. Too much is at stake to overlook these threats to the security of a computer center and an information system. These threats take many forms: white collar crime, natural disasters (e.g., earthquakes, floods), vandalism, and carelessness.

White collar crime is real and exists undetected in some of the most unlikely places. It is sophisticated crime with sophisticated criminals. And it is more widespread than estimates would lead us to believe. Most computer crimes are undetected; others are unreported. A bank may prefer to write off a \$100,000 embezzlement rather than publicly announce to its depositors that its computer system is vulnerable.

This section is devoted to discussing the security measures needed to neutralize threats to computer-center and information systems security (see Figure 3.1).

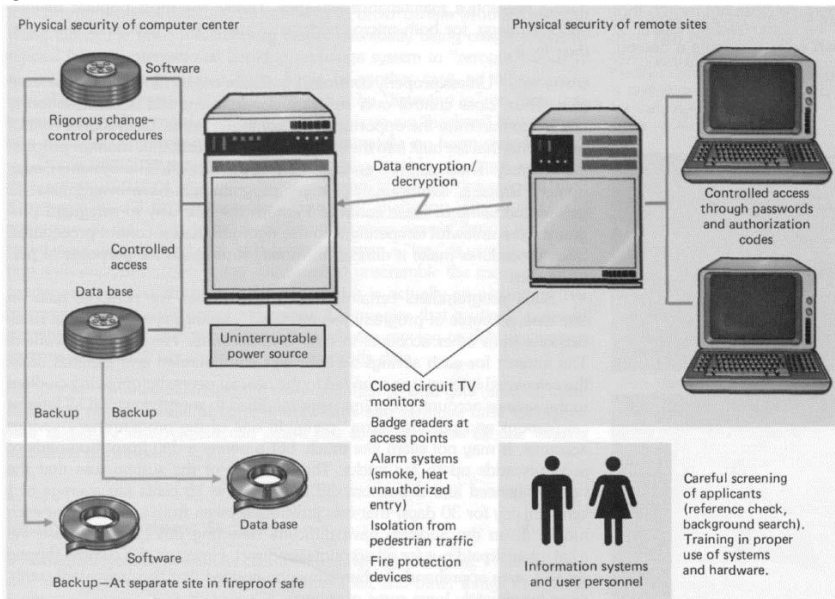


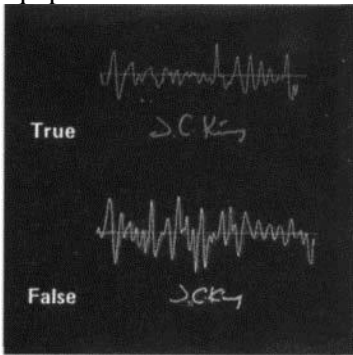
Figure 3.1 – Security Precautions. Some, or all, of the security measures noted in the figure are implemented in most computer centers. Each precaution helps to minimize the risk of a computer system’s vulnerability to crime, disasters, and failure

### 3.1. Computer center security

The vulnerable points of computer centers are the hardware, software, files/data bases, data communications, and personnel. Each is discussed separately below.

**Hardware.** If the hardware fails, the system fails. The threat of failure can be minimized by implementing security precautions that prevent access by unauthorized personnel and by taking steps to keep all hardware operational.

Common approaches to securing the premises from unauthorized entry include closed-circuit TV monitors, alarm systems, and computer-controlled devices that check employee badges, fingerprints, or voice prints before unlocking doors at access points. Also, computer centers are usually isolated from pedestrian traffic. Machine-room fires are extinguished by a special chemical that douses the fire but does not destroy the files or equipment.



Biometric identification systems are beginning to replace systems that use the plastic card (badge) as a “key” for entry to secured areas, such as computer centers. One such system asks users for their signature before permitting entry to a secured area or access to a sensitive data base. If the digitized image of the signature does not match that of the authorized signature, then entry or access is denied.

*(Courtesy of International Business Machines Corporation)*

Computers, especially mainframe computers, must have a “clean”, continuous source of power. To minimize the effects of “dirty” power or power outages, many computer centers have installed an uninterruptible power source (UPS). Dirty power, such as sags and surges in power output or brownouts (low power), cause parity errors and program execution errors. An UPS system serves as a control buffer between the external power source and the computer system. In an UPS system, the computer is powered by batteries (which deliver clean power), which in turn are regenerated by an external power source. If the external power source fails, the UPS system permits operation to continue for a period of time after an outage. This allows operators to either “power down” normally or switch to a backup power source, normally a diesel generator.

With more and more on-line systems and the improvements in computer reliability, there has been a reversal in traditional hardware maintenance strategy. For many years, customer engineers (hardware repairpersons) followed a schedule of routine, usually weekly, preventive maintenance. When they arrived at the site, the computer was shut down, even if it was working fine, and all systems were checked out. With almost all systems going online, shutting a system down may cause hundreds of workers to remain idle during preventive maintenance activities. Today, the most popular maintenance strategy, for both micros and mainframes, is to wait until it breaks, then fix it.

**Software.** Unless properly controlled, software can be modified for personal gain. Thus, close control over software development and documentation is needed to minimize the opportunity for computer crime. Operational control procedures that are built into the system design will constantly monitor processing accuracy. Perhaps the best way to safeguard programs from unlawful tampering is to use rigorous change-control procedures. Such procedures make it difficult to modify a program for purposes of personal gain.

Bank programmers certainly have opportunities for personal gain. In one case, a couple of programmers modified a savings system to make small deposits from other accounts to their own accounts. Here's how it worked: The interest for each savings account was compounded and credited daily; the calculated interest was rounded to the nearest penny before being credited to the savings account; programs were modified to round down on all interest calculations and put the "extra" penny in one of the programmer's savings accounts. It may not seem like much, but a penny a day from thousands of accounts adds up to big bucks. The "beauty" of the system was that the books balanced and depositors did not

miss the 15 cents (an average of  $\frac{1}{2}$  cent per day for 30 days) that was

judiciously taken from each account each month. Even the auditors have difficulty detecting this crime because the total interest paid out for all accounts is correct. However, the culprits slipped up and were apprehended when someone noticed that they repeatedly withdrew inordinately large sums of money.

Unfortunately, other enterprising programmers in other industries have been equally imaginative.

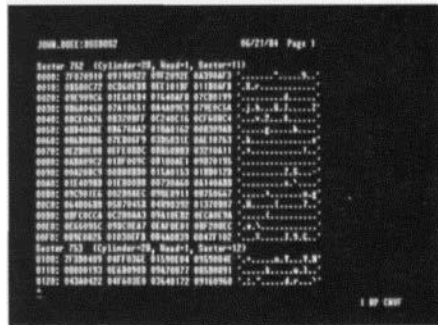
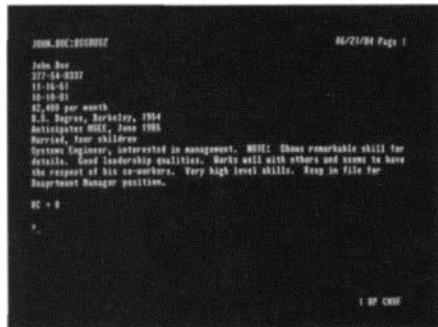
**Files/Data Bases.** The data base contains the raw material for information. In some cases, the files/data bases are the life blood of an

organization. For example, how many companies can afford to lose their

accounts receivable file that documents who owes what? Having several generations of backups to all files is not sufficient insurance against loss of files/data bases. The backup and master files should be stored in fireproof safes in separate rooms, preferably in separate buildings.

One company's file security procedures were well documented but not adhered to in practice. Machine-room operators opened the doors to the fireproof safe in the morning and did not close them until night. Backup and master files were stored side-by-side in the safe. When a raging fire destroyed the computer center and the contents of the safe, the company was forced into bankruptcy.

**Data Communications.** The mere existence of a data communications network poses a threat to security. A knowledgeable criminal can tap into the system from a remote location and use the system for personal gain. In a well-designed system, this is not an easy task. But it can be and has been done! When one criminal broke a company's security code and tapped into the communications network, he was able to order certain products without being billed. He filled a warehouse before eventually being caught. Another tapped into an international banking exchange system to "reroute" funds to an account of his own in a Swiss bank. In another case, an oil company was able to consistently outbid a competitor by "listening in" on their data transmissions. On several occasions, overzealous young "hackers" have tapped into sensitive defense computer systems; fortunately, no harm was done.



Some organizations use cryptography to scramble messages sent over data communications channels. Someone who unlawfully intercepted such a message would find meaningless strings of characters. Cryptography is analogous to the “code book” used by intelligence people during the cloak-and-dagger days. Instead of a code book, however, a “key” is used in conjunction with encryption/decryption hardware to unscramble the message. Both sender and receiver must have the key, which is actually an algorithm that rearranges the bit structure of a message. Companies that routinely transmit sensitive data over communications channels are moving to data encryption as a means to limit access to the system and its data.

**Personnel.** Managers are paying close attention to who gets hired for positions that permit access to computer systems and sensitive data. Someone who is grossly incompetent can cause just as much harm as one who is inherently dishonest.

### **3.2. Information systems security**

Information systems security is classified as physical or logical. Physical security refers to hardware, facilities, magnetic tapes, and other things that could be illegally accessed, stolen, or destroyed.

Logical security is built into the software by permitting only authorized persons to access and use the system. Logical security for on-line systems is achieved primarily by passwords and authorization codes. Only those persons with a “need to know” are told the password and given authorization codes. On occasion, however, these security codes fall into the wrong hands. When this happens, an unauthorized person can gain access to programs and sensitive files by simply dialing-up the computer and entering the codes. To thwart this, some computer systems have implemented another level of security in the form of a dial-back procedure. With this procedure, you dial-up the computer, hang up, then the computer dials-back your workstation to make the contact. The dial-back procedure deters some unlawful entry, but you lose some flexibility in that each person can access the computer only from a particular workstation.

Keeping passwords and authorization codes from the computer criminal is not easy. One computer criminal took advantage of the fact that a bank’s automatic teller machine (ATM) did not “time out” for several minutes. That is, the authorization code could be entered without reinserting the card to initiate another transaction. Using high-powered binoculars, he watched from across the street as the numeric code was being entered. He then ran over to the ATM and was waiting when the

customer left. He quickly entered the code and made withdrawals before the machine timed out. Needless to say, this design flaw has been eliminated in existing ATM systems.

#### **LEVEL OF RISK**

No amount of security measures will completely remove the vulnerability of a computer center or an information system. Security systems are implemented in degrees. That is, an information system can be made marginally secure or very secure, but never totally secure. Each organization must determine the level of risk that it is willing to accept. Unfortunately, some corporations are willing to accept an enormous risk and hope that these rare instances of crime and disaster do not occur. Some corporations have found out too late that rarely is not the same as never!

#### **CONTINGENCY PLANNING**

Most organizations maintain a contingency plan that details what to do if there is an environmental disaster, sabotage, gross negligence, or any other extraordinary event that drastically disrupts the operation of a computer center. A contingency plan describes duties and responsibilities, alternative hardware sites, and the logistics for recovering from such disasters.

### **Task I. Answer these questions to the text.**

1. What is the purpose of a "key" in cryptography?
2. Describe the dial-back security procedure.
3. What precautions can be taken to minimize the effects of hardware failure?
4. What is the best way to safeguard programs from unlawful tampering?
5. Describe the most popular maintenance strategy for computers.
6. The mere fact that a system uses data communications poses a threat to security. Why so?
7. How is information systems security classified? Explain each one.
8. Can an information system be made totally secure?
9. Describe the contents of a contingency plan.

### **Task II. Discuss.**

1. In a federal agency, passwords are given to people who need access to confidential information. A new set of passwords are issued every other month. Is this extra work of issuing new passwords really necessary?

**Task III. Combine the answers into a short summary.**

**Task IV. Review the text in written form.**

**Task V. Be ready to retell the text.**

**Task VI. Compare this information with your ideas.**