



Introduction to Computers and Automation



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Introduction

Overview

We live and work in an information age and are seeing technological changes occurring all around us. Many of these changes are driven by the increased use of computers to manipulate data and produce information.

Computers are making our lives easier in more ways than any of us realize. By the introduction of computerized manufacturing processes, American companies are becoming more competitive in markets around the world. Individuals and companies who invest time in learning to use computers will be in the best position to benefit from the advances to come in the future.

Knowledge Worker

Computer technology is redefining the workplace. New terms are being coined to describe the new workforce being created through the use of technology. One of these terms is “knowledge worker.”

In the past, job functions were accomplished by several levels of workers. However, due to the efficiencies produced by computerized technology, the new worker is being asked to be a participant in various phases of the job. For example, in an office environment, a manager may have had a secretary to do letters, an accountant to compile financial data and a graphic artist to produce the printed reports. In the new work environment, the manager has access to word processing, accounting software, database information, and desktop publishing software so that an entire report can be generated by the manager.

Production workers may also be expected to perform additional tasks related to tracking production flow and monitoring the production process. They will use increasingly sophisticated computerized equipment. This new “knowledge worker” is being asked to work more efficiently using available computer technology.

Lifelong Learning

Lifelong learning is another concept that owes its popularity to the rapid changes in technology. In the new workplace, workers' skills need to be constantly upgraded to keep up with the needs of the job. Therefore, companies are spending more time and money in training programs for workers.

Objectives

The information, activities, and practice provided during this unit will enable you to:

1. Describe the importance of computers in manufacturing, business and in our daily lives.
2. List and describe the hardware components of a computer system.
3. Identify basic computer terms.
4. Demonstrate the use of the keyboard and the mouse to enter computer data.
5. Define automation and discuss its advantages.
6. Describe computer-integrated manufacturing.
7. Identify the parts of the screen for the Microsoft Windows operating system.
8. Demonstrate the basic use of the Microsoft Windows operating system.



Computer Systems

Benefits of Computers

The personal computer has become an indispensable part of daily life for many people. Computers are in stores, schools, businesses, and homes. They are touted as timesavers, development tools, creativity media, educational assistants, recreational marvels and as a medium through which you can access the “information superhighway,” the Internet.

There are several basic reasons for the proliferation of personal computers:

Time Savings

Because they can process information quickly and simplify many daily tasks, personal computers can increase productivity both at home and at the office.

Accuracy

Computers can perform multiple calculations rapidly and accurately.

Repetitive Tasks

A computer is the perfect tool for performing repetitive, mundane tasks such as adding columns of numbers, replacing a word in a document, spell checking, mail merges, and envelope and label addressing.

Adaptability

Computer applications are designed to be flexible and customizable so that they can be tailored to fit a user’s needs. New software is constantly being developed to address new needs.

Data Storage

The trend is slowly moving towards a paperless office. Data that used to be stored in large, overflowing paper files can now be stored neatly and efficiently on digital storage media such as diskettes, hard drives, CD ROM or tape.

Ease-of-use

Once you become comfortable with your computer system and what it can do, you will wonder how you ever managed without it.

NOTE: Computers use whatever data they are provided with to perform calculations. If any of the information that is provided is incorrect the computer generates incorrect results.

Keys to Success with Computers

In order to be successful when working with computers, you should:

1. Be interested in learning what computers can do for you.
2. Be willing to spend a minimal amount of time practicing with the computer.
3. Be motivated and don't be afraid to learn something new or to take chances in unfamiliar environments.
4. Be willing to learn about computers. No prior experience is needed.
5. Accept the fact that computers are a part of our world.
6. Realize that everyone makes mistakes. No one is perfect. Learning is a time for experimenting, errors and corrections.
7. Expend the effort to learn; otherwise time and equipment are wasted.
8. Use experience and other forms of education as a foundation for learning computers, not a roadblock against it.
9. Keep abreast of technology, once the initial training is over. Be an active member of the technology team.
10. Realize that new technologies will continue to make changes in the work place more common.



The Term Computer

A computer is a device used to electronically store, retrieve, and manipulate information.

Computer information is referred to as data. You can use computers to store, retrieve, and manipulate almost any type of data, and do so at very high speeds.

Computers perform tasks by running programs. A program is a set of instructions that specify or determine how the computer will manipulate the data.

The History of Electronic Computers

The first electronic digital computer developed in the United States was created at the University of Pennsylvania in the 1940s and was called ENIAC. ENIAC weighed 30 tons and contained 18,000 vacuum tubes. The failure rate of these tubes was approximately one every seven minutes.

Since the days of ENIAC, smaller and more powerful computers have been developed. In the late 1950s and early 1960s, smaller and more reliable solid-state components replaced vacuum tubes.

Perhaps the most important event in the history of computers was the development of the microprocessor in the early 1970s. A microprocessor is a sliver of silicon (called a chip) approximately 1/4 square inches in area and as thin as a sheet of paper. A single microprocessor can do the work of tens of thousands of vacuum tubes or solid-state components.

The implementation of microprocessors made great reductions in the size and cost of computers possible even as computers became faster and more powerful. Computers that operate with just one or two microprocessors are known as microcomputers.

Recent history has seen companies dramatically increase the use of computers to improve manufacturing efficiencies. Computer technology shows great promise in improving industry's ability to make products that are competitive in a global market place.

Classifications of Computers

Beginning with the largest and most expensive and ranging to the smallest and least expensive, computers can be classified as follows:

- Mainframe
- Minicomputer
- Microcomputer (includes laptop and notebook computers)

The larger computers may be expected to have larger storage capacity (more memory) and to process data more quickly.

Mainframe

A mainframe is a very large computer that can be used by many different people at (what appears to the users to be) the same time. A mainframe computer together with its supporting equipment may occupy a large room.

Minicomputers

A minicomputer is smaller than a mainframe and larger than a microcomputer. The minicomputer can be almost as powerful as the mainframe computer.

Microcomputers

The microcomputer is usually small enough to sit on a desktop or to fit into a briefcase. Microcomputers are sometimes called personal computers and are usually intended to be used by one person at a time. The larger computers may be expected to have larger storage capacity (more memory) and to process data more quickly.



Computer Terms

Computers and Programs

A computer is a device used to electronically store, retrieve and manipulate information. Computer information is referred to as data. You can use computers to store, retrieve, and manipulate almost any type of data at very high speeds.

Computers perform tasks by running programs. A program is a set of instructions that specifies or determines how the computer will manipulate the data.

The “Glossary” section of the Participant Guide contains a listing of many of the most common computer terms that are used when working in a computer environment.

The following basic terms are defined here, as they will be used during this course.

Output

Movement of data out of the computer. This can be via the screen, printer, or other device.

Input

Movement of data into the computer.

Cursor

An indicator, often a blinking arrow or rectangle, of where the next entry on a computer monitor will be.

Central Processing Unit (CPU)

Part of the computer in which all arithmetic and logical calculations are carried out.

Data

Any information given to or used by the computer.

Hardware

Equipment used in computer systems.

Hard Copy

The printed output from a computer.

Network

A system in which many computers and other devices are linked by cable or other means.

Modem

A device that translates the digital signals of a computer into signals that can be sent over the telephone.

Software

The set of instructions that tell the computer what to do.



Components of a Computer System

Just as learning to drive a car or use a telephone requires a rudimentary knowledge of the system components, so does learning to use a computer. From the user's viewpoint, a computer system consists simply of hardware and software.

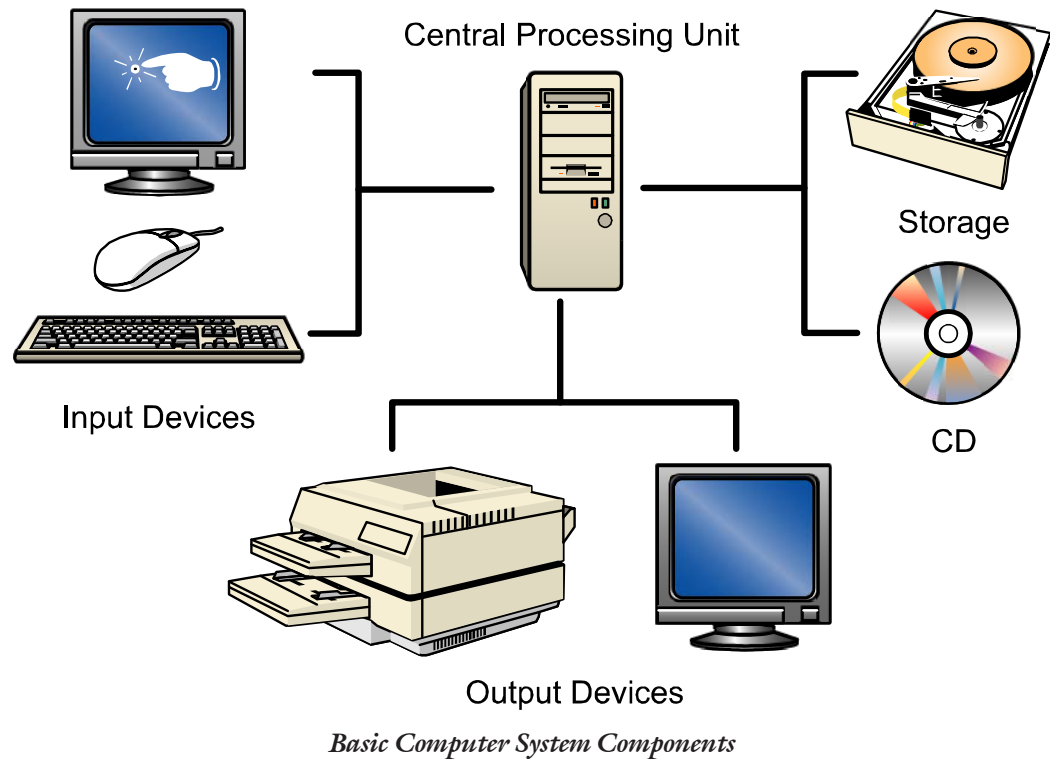
Hardware and software components enable the computer to process data and produce information. Hardware devices are those components you can see and touch. Software programs are sets of instructions, which tell the computer hardware what to do. Computer hardware cannot operate without software.

Hardware

Computer hardware includes all the input, output, processing and storage devices such as monitors, central processing units, printers, modems, keyboards, and scanners. The computer user inputs data into the system by using a keyboard, mouse, touch screen or some other input device.

After data is input to the computer, it is processed through the microprocessor in the central processing unit (CPU). The CPU controls the flow of information and performs any calculations required. It is sometimes thought of as the “brains” of the computer system. The speed of the microprocessor is determined by its clock rate. Think of the clock rate as the heartbeat or “pulse” of the computer. Clock rate is measured in megahertz (MHz), millions of cycles per second or in gigahertz (GHz), billions of cycles per second. The higher the megahertz, the faster the computer can process data and output information.

Processed information can be stored using hard drives, floppy diskettes, tapes, CDs and other types of storage devices or output by being displayed on the monitor or printed. Information that is printed on paper is known as hard copy. Hardware components that are external to the computer, such as the printer, monitor, mouse, or scanner, are called peripheral devices.



CPU

The CPU is the part of the computer where all the arithmetic and logical calculations are carried out — thus it is sometimes thought of as the “Brains” of the computer.

The CPU contains the computer’s microprocessor. The microprocessor performs the actual computing or processing of data after it has been input into the computer.



Software

Software is the term used to refer to the programs and data that instruct the computer to carry out tasks. A program is a set of instructions that the computer follows in processing data. Programmers write these instructions to control how the computer processes data.

Software can be divided into two general types: systems software and applications software. Systems software includes the programs that run the fundamental operations for your computer, such as starting the computer, loading programs and data into memory, executing programs, saving data to a disk, displaying information on the monitor screen, and performing many other basic functions. Applications software is used to perform many common tasks for personal and business use.

Systems Software

Systems software has been designed for mainframe and for microcomputers. Unix is a mainframe operating system developed by AT&T and used by many other large organizations. MS-DOS, Windows, and Macintosh are three of the most popular operating systems for microcomputers.

Most computer operating environments use graphics to make it easier for users to enter commands. Pointing and clicking with a mouse on a graphic symbol is often easier than remembering the specific commands.

Applications Software

Applications software for manufacturing may include programs specifically written for a company to accomplish its manufacturing, administrative, and other needs. These software programs may be customized programming written specifically for that company's specialized needs. This type of software may be created by the company using its own information systems specialists or may be customized by an outside vendor specializing in this type of software.

Applications software for personal and business use are available to perform many common tasks such as word processing, financial spreadsheets, presentations, project management and desktop publishing.

Software for manufacturing includes programs specifically written for a company to accomplish its manufacturing, business and other needs. These software programs may be customized programming written specifically for that company's specialized needs. This type of software may be created by the company using its own information systems specialists or may be customized by an outside vendor specializing in this type of software.



Input, Output and Storage

Computer Memory

As data is entered into the computer by the user, it becomes an electronic file in the computer's memory. This file can be saved, retrieved, and used later. There are two types of computer memory which are shown below:

RAM

This is an acronym for Random Access Memory. RAM is an area inside the computer that stores programs and data while it's in use. RAM is the working memory of the computer existing only while the computer is operating and is lost when the computer is powered off.

ROM

This is an acronym for Read Only Memory. This area contains permanently stored information that is necessary for the operation of the computer system. The information can include programs and diagnostic tests that are required by the computer during system start up. ROM storage is fixed and cannot be erased or added to.

Computers store data in groups of eight bits (binary digits with a value of 0 or 1). Eight bits is referred to as a byte. One byte may be thought of as equivalent to one character. Millions and sometimes-even billions of bytes can be stored on the hard drive of a computer.

The measurements used for computer storage or memory are listed below:

- Kilobyte (K or Kb) 1,000 bytes
- Megabyte (Mb) 1,000,000 bytes
- Gigabyte (GB) 1,000,000,000 bytes

Key points about computer memory:

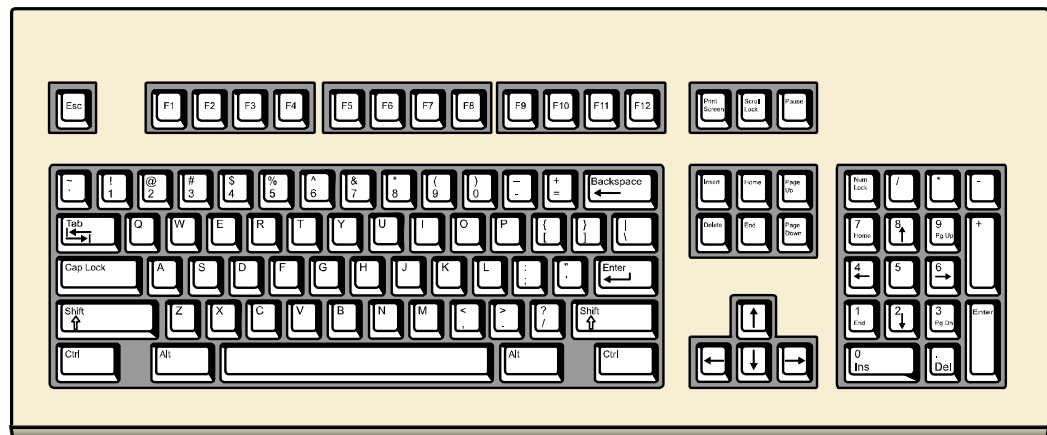
- RAM is working memory of a computer.
- RAM exists only while the computer is operating and is lost when the computer is turned off.
- ROM is the computer's permanent storage capacity.
- ROM is retained even when the computer is turned off.

Input Devices

Input devices are used to transfer data and instructions for processing the data into the computer. The keyboard and the mouse are typical input devices for a microcomputer system. Other input devices include graphic pads, light pens, touch screens, cassette tape players and disk drives. We will discuss the keyboard, the mouse, the touch screen, voice recognition and scanner.

The Keyboard

The computer keyboard is the input device most familiar to computer users. A keyboard may be housed in the same cabinet with the computer or in a separate cabinet connected to the computer by a cable. Most keyboards contain discrete keys that are laid out as those on a standard typewriter keyboard.



The Keyboard



While the keyboard layout of various computers may differ, they all have the same general functions as described below. Locate each key on the keyboard at your desk as they are discussed.

Shift

Used with other keys to control their action. For example, it may be used to change the case of letters or to print symbols instead of numbers.

Caps Lock

Changes letters to upper case.

Tab

The Tab Key moves a preset number of spaces (usually 5) to right. When used with the Shift Key, the Tab Key moves preset spaces to the left.

Backspace

Moves one space to the left. On a computer, this key frequently deletes the letter to the left.

Space bar

Inserts a space in typed text.

Additional keys that are found on a computer are used and identified by the software being used. These keys and their most frequent uses are:

Function Keys

Used to perform special functions as designated by the (F1-F12) computer software program being used.

Ctrl (Control)

Used with other keys to change their action. Control is Similar to the Shift Key on a typewriter.

Alt (Alternate)

Used with other keys to change their action.

Enter

Signals the computer to accept the information that has been typed or entered.

Insert

Toggles between “Insert” and “Type Over” modes.

Delete

Deletes the character at the insertion point.

Esc (Escape)

Exits the program or moves back one screen.

Num Lock

Switches between numbers and cursor movement keys on numeric pad.

The following keys are used to move the cursor or the viewing area of the document:

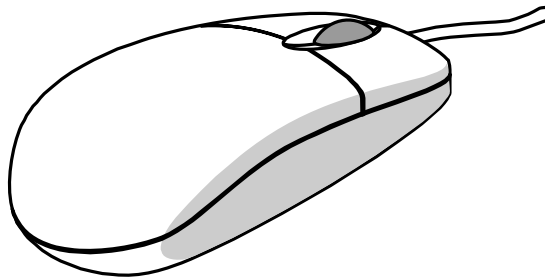
- Home
- End
- Up Arrow
- Down Arrow
- Page Up
- Page Down
- Right Arrow
- Left Arrow

The Mouse

The mouse is used to move the arrow (also called the mouse pointer or insertion point) on the computer screen. A rolling ball is visible on the underside of the mouse. As the mouse is moved on the desktop, the ball rolls and moves the arrow on the computer screen. If it is necessary to reposition the mouse on the desktop without changing the location of the pointer on the screen, simply raise the mouse and move it to another location on the desk.

To select an object on the screen, position the mouse pointer on the object and click the left mouse button.

Sometimes you will be instructed to double click with the mouse. A double click is two rapid clicks of the left mouse button.



The Mouse

Newer mouse technology utilizes optics to record the motion of the mouse. This type of mouse is very accurate and does not utilize a rolling ball. It is commonly referred to as an “optical mouse.”

Trackball

A trackball resembles an upside-down mouse. When using a mouse, the entire device is moved to cause the pointer to move on the screen. With a trackball, the device remains stationary and the trackball is rolled to move the pointer on the screen. Just like the mouse, the pointer is used to select pictures and text, and to run programs. Trackballs are sometimes used with desktop computer systems, but they are most often found on laptop computers.

Track Pointer

This device resembles a pencil eraser and is often found on laptop computers. It is usually located somewhere on the keyboard. A track pointer can be thought of as a tiny joystick. Pushing the track pointer left, right, up and down, moves the pointer around the screen.

Touch Pad

The touch pad is a small display pad that plugs into the mouse port. To make the mouse pointer move around on the screen, move your finger on the touch pad. The touch pad includes mouse-like buttons for selecting, but it allows you to tap your finger on the pad to select objects. Today we see the touch pad built into laptop computers much the way trackballs are.

The Touch Screen

The touch screen is an input device similar to a keyboard, only the choices are displayed on a monitor, or screen. To make a selection using a touch screen, simply touch the selection on the monitor, or screen, using your finger or other pointing device. The computer recognizes the input and the selection is processed.



The Touch Screen



When using the touch screen, a user may have to make choices from several pages or screens, such as when choosing merchandise from a catalog.

At some point during the selection process, the user may be asked to type information, using the keyboard, so that the computer will know how to process the data to give the desired results.

Voice Recognition Devices

Voice recognition technology has existed for a long time, but until recently has been used mainly for persons with physical disabilities. In the last few years, voice recognition software programs have increased in popularity. This combination of software and hardware allows the user to create documents in a word processing program by speaking each word into a microphone. Many experts feel that voice recognition is the wave of the future.

Scanner

A scanner is a specialized piece of hardware that is used to import or “scan in” typed text and graphics so that the information can be used in a software package. Scanners can be extremely useful for scanning in company logos, artwork, and other graphics. They are also useful for scanning in text that was created by other means (such as a typewriter) so that the data does not have to be typed in again. There are two types of scanners: desktop (compact and flatbed) and handheld.

Output Devices

After data has been processed it is sent to storage or to an output device.

Output devices include the monitor and printers. Information is displayed on the monitor for reading. Printed output is called hard copy.

Information may also be stored and retrieved for later use. Information may be stored on hard disks inside the CPU. The information may also be stored on floppy disks, diskettes, tapes, or CDs for use later.

Monitor

The monitor is the screen that displays programs and data. There are different monitor qualities available. In general, the higher the monitor quality, the more crisp and clear images and text appear.

Printers

These are devices used to produce a printed copy (sometimes referred to as a hard copy) of information displayed on the monitor. There are many different types of printers available. The difference is in the quality of the printed material and the speed with which they print.

Dot Matrix

The printed pages created by installation of dots on the page. The print head or actual printing device uses small pins to push the printer ribbon onto the paper causing a small dot to appear. By using several passes of the print head, dots are made to overlap giving pretty good (near letter) quality output. This type of printer is normally pretty loud, and the quality can be compromised as the printer ribbon begins to wear out.



Ink Jet

Ink jet printers do not use a ribbon, but the idea of placing dots on paper is the same. An ink jet printer comes with a replaceable print cartridge that contains a supply of ink. As it prints the cartridge shoots ink onto the page. These cartridges have many small nozzles and can shoot many drops of ink on each pass, similar to a dot matrix printer. This mist of ink is sprayed with great accuracy giving a very fine letter quality output. Quality is constant for the life of the ink cartridge. This type of printer is quieter than a dot matrix and produces a cleaner, better looking output. However, it cannot be used for multi-copy paper (NCR) paper.

Laser Printers

These printers produce the highest quality of output. They utilize laser technology to imprint the information on paper. A small laser beam moves back and forth over rotating cylinder called a drum. As the beam passes over the drum it fires at certain points magnetizing the drum. As the drum continues to rotate, and magnetic toner (much like copier toner) is sifted onto the drum. Where the drum is magnetized, the toner sticks and the rest falls away. As the drum continues to rotate it encounters the paper where the drum is demagnetized and the toner is transferred to the paper. The paper continues under a heating element and the toner is heated and fused to the paper. Toner is very fine, and can support very high resolutions.

Color Printers

There are many different types of printers that are capable of color output. Some are “color ready” and can print colors without any additional purchase. Other printers are capable of printing colors with the addition of special options. Color printers achieve variety of colors by blending a few basic colors such as blue, red and yellow.

Modems (Modulation/Demodulation)

Computer users want to be able to correspond with other computer users via electronic mail and faxes. They also want to be able to access external resources (such as libraries) without leaving their home or office. Modems are hardware solutions that are used to allow a computer to communicate with another computer via telephone lines, cable or even satellites. The modem changes the computers digital signal to an analog signal that is transported across the phone line. A modem on the other end of the line translates the signal back into a digital signal that the computer can understand.

Storage Devices

Hard Drives

A hard drive is a magnetic storage device composed of the combination of several metal desks built into a disk drive, and is physically located inside the computer. It functions similarly to a diskette for data and program storage.

There are several benefits to using a hard drive:

- Because it is located inside the computer and is not physically handled by the user, there is less chance for accidental damage.
- A second benefit is that a hard drive holds many times the amount of information that a diskette does. The average size hard drive is 20 GB in size and, unlike a CD ROM; the hard drive can be erased and written over.
- One additional benefit is the speed increase that comes from using the hard drive. Because of the mechanics of the equipment, it is much faster to access information on a hard drive than it is to access information on diskette. Hard drive access speed is measured in milliseconds and represents the amount of time it takes a drive to locate and retrieve one piece of information. The lower the access time, the faster than drive.



The three most important hard drive considerations are access speed, data transfer speed and the storage capacity.

CD ROM Drives

This is the unit that reads information from CD ROM (Compact Disk Reading Only Memory) disks. CD ROM drives come in two types: internal and external. Internal drives reside inside the computer case. External drives are located outside the computer case and are connected to the computer via a cable.

CD ROM technology has been around for some time. With the advent of multimedia came the need for a storage method that provides both portability and a large amount storage space. Storage of sound clips and graphic images takes up a lot of space.

CD ROM disks fulfill that need. Each disk can store approximately 660 MB of data. CD ROM disks are more durable, less prone to damage and hold up better than diskettes. Plus, it is actually cheaper to produce a program on CD than it is to produce it on diskette. Many office and personal computers now available have CD ROM drives that have the ability to read and write data to CD ROM disks.

Removable Disk Drives

As programs and files such as graphical, video, and sound files, require larger storage capacity, the plastic 1.44 MB diskette is no longer sufficient to transfer data. There are a variety of removable disk drives with disk capacities from 100 MB to two plus GB, which are either internally or externally attached to the computer. Such drives include both diskette-type and CD recordable drives from many manufacturers. One example is this type of drive is a Zip drive that uses a diskette-type media.

Tape Drives

With the implementation of larger and larger hard drives came the need for an efficient method of “backing up” hard drive information. Data, whether it is stored on a diskette on a hard drive should be duplicated somewhere else in case the diskette or hard drive fail. When hard drives were smaller, it was easy to copy the information to multiple diskettes. This is simply not practical with the larger drives. So, tape drives became the viable option. One tape can hold many times the data of the diskette, so it is an effective means for storing data.

Diskettes

Diskettes are portable, magnetic storage devices used to hold data and applications. Once information is stored on a diskette, the diskette can be removed from the computer and stored in a safe and convenient location. It can also be used in another computer.



Sharing Computer Information

Networks

In the business world they usually work as part of a team. As a team member, they may use a network. A network is a collection of connected computers and equipment that allows them to share information with other members of their team. Typically, one of the computers on the network is equipped with a high-capacity hard drive and is designated as the file server. This computer shares files and data with the other computers on the network. The most common type of network for microcomputers is the local area network or LAN.

Mainframes

Some organizations use a mainframe computer system. A number of “dumb” terminals are connected to one large mainframe system. The terminal is referred to as dumb because all of the processing takes place in the mainframe. The terminal is merely used to input or output data.

Electronic Mail

Electronic mail makes it possible for users to send information electronically via networks from one computer to another. Electronic mail can also be sent over telephone lines or communications networks by using a modem. The modem converts computer signals into signals that can be sent over telephone lines to be received by another computer. The receiving computer must also have a modem to convert the signals back to computer format.

Internet

The Internet is an electronic communications network that connects computer networks and organizational computer facilities around the world.

Intranet

The Intranet is a network operating like the World Wide Web but having access restricted to a limited group of authorized users (as employees of a company).



Progress Check #1

Match the computer terms and definitions listed below.

- | | | |
|--------------------|----|---|
| _____ hardware | A. | Movement of data out of the computer. This can be via the screen, printer, modem, punch cards, or even speech synthesis. |
| _____ input | B. | A flexible external storage device; the most popular storage device used with microcomputers. |
| _____ output | C. | Temporary or working memory that is erased when the computer is powered down. |
| _____ hardcopy | D. | A display for the computer similar to the one on television, can be monochrome or color. |
| _____ hard disk | E. | Programmed instructions that tell a computer what to do. |
| _____ floppy disk | F. | Information printed on paper; also called printout. |
| _____ RAM | G. | The central processing unit. |
| _____ ROM | H. | All the tangible parts of a computer and its peripherals. |
| _____ modem | I. | Resident memory that exists in the computer even after the power is powered down. |
| _____ monitor | J. | A rigid sealed metal platter used to store (or CRT) data and programs. |
| _____ software | K. | Movement of data into the computer. |
| _____ CPU | L. | A device that translates the digital signals of the computer into signal that can be sent over the telephone or communications network. |
| _____ input device | M. | Devices used for entering information into the computer such as keyboard, mouse, or touch screen. |

[illegible]



Computers and Automation

Automation in Manufacturing

Throughout the history of manufacturing people have looked for more efficient ways to make products. Efforts have taken two directions:

- designing products that can be made more efficiently
- improving the efficiency of the production process

In order to be competitive in the world market, companies seek continuous improvement in both areas. Continuous improvement means that product design and manufacturing processes are continuously reexamined in an effort to identify areas that could be improved.

The key component of manufacturing efficiency is automation.

Automation – the replacement of direct human control with electronic devices to control manufacturing equipment, processes or systems.

Early Automation

Early roots of automation include mechanical toys, music boxes, and musical clocks developed in Europe during the early 19th century. These devices included mechanisms to rotate disks with ridges or holes that encoded a program of detailed operating instructions. These operating instructions produced music or chimes according to the program on the disk.

The idea of programmed cards or disks was adopted by the French loom maker, M.J. Jacquard. In the early 1800's Jacquard used a series of punched cards to program looms to produce elaborate woven patterns in fabrics and carpet.

This same principle, a punched tape program, was tried on manufacturing machines in the 1900's. These machines, called numerical control (NC) machines introduced the age of automation.

The development of the first electronic computer in 1945 revolutionized the potential for automation in manufacturing by adding computer technology to industrial control devices.

Advantages of Automated Manufacturing Systems

Automated manufacturing systems allow industry to:

- Reduce the cost of labor and materials
- Increase product quality and consistency
- Improve manufacturing flexibility
- React more quickly to changes in market demands

Using Computer Technology in Manufacturing

The use of computers in manufacturing may be divided into two broad categories:

- CAD computer-aided design
- CAM computer-aided manufacturing

Computer-aided design (CAD) includes engineering designs of product ideas and solutions as well as computerized drawings. CAD also includes design analysis to evaluate product designs using computer-simulated tests, such as tests for stress or heat transfer.

Computer-aided manufacturing (CAM) is the use of computer technology to manage and control a manufacturing operation. It includes the use of computerized control devices to direct machines or robots through a series of steps to process materials. It also includes gathering data on machine status, part counts, and production status to determine the effectiveness of an operation and support the manufacturing process.

CIM—Computer-integrated manufacturing

Manufacturing which includes both CAD and CAM is known as CIM, computer-integrated manufacturing. In CIM all manufacturing activities are computerized, from the recognition of the need for a product through the design development and marketing of the product. CIM is the ultimate goal of many manufacturing industries.



Machine and Process Control

Numerical Control (NC)

Numerical control, as described earlier, is programmable control of manufacturing machines using a code of instructions composed of numbers, letters, and other symbols. The controls activate mechanisms that produce a specific part. If the specifications for the part change, the code of instructions must also be changed.

The three major components of an NC machine are:

Machine tool – A power-driven machine used for shaping, cutting, turning, boring, drilling, grinding, or polishing materials.

Control unit – A unit that sends pre-programmed signals to control the operation of the machine tool.

Program – A detailed set of instructions used by the control unit to direct the machine tool's operations.

Classes of NC Machines

NC machines are used for a variety of manufacturing operations. These include metal and wood cutting operations, tube and rod bending, assembly, bending and shearing presses, and welding and flame throwing equipment.

There are three classes on NC machines that are distinguished by their tool or cutting element positioning. These are:

- Point-to-point machines
- Straight-cut machines
- Contouring machines

Point-to-point machines position the tool above a point on a workpiece (unit of material to be processed). The machine performs a specific operation. After the operation is completed, another workpiece is positioned and the same operation is repeated.

Straight cut machines make straight line cuts through a workpiece. These machines produce parts with rectangular shapes. They cannot produce angular cuts. Straight cut machines can also perform point -to-point operations.

Contouring machines are the most complex and expensive NC machines. These machines allow the tool to follow curved paths. They can also be used to perform point-to-point and straight line work.

Industrial Robots

Automation often includes automatic material handling to move parts from one machine to another. One of these systems is the computer-directed automatic storage and retrieval system (AS/RS). This system is used to automatically locate and retrieve parts and materials located in special warehouse racks.

Another material handling system uses automatic guided vehicles (AGVs). These are driverless vehicles designed to move parts to and from machines. A computer commands the AGV to move to a specified location. It moves by following guideways on the floor to the location determined by the computerized instructions.

Applications of Robots

Robots are used for a number of reasons. They can perform routine tasks, such as loading and unloading parts into machines. They can perform repetitive tasks, such as painting and welding. They can also perform operations that would be unsafe for humans. For example, they are ideal for handling hot, corrosive, or toxic materials that would be unsafe for humans.



Types of Robots

Robotic control units may be designed for a fixed or variable sequence.

A fixed sequence robot (pick and place robot) is a simple robot with limited versatility. It often uses a pick and place action such as that used to load or unload a machine. The robot moves into position, picks up a workpiece, and moves to a second position. It places the workpiece in a die or another machine part. Later the robot picks up the finished part and places it on a tray or on a conveyor. This picking and placing action gives the robot its name.

Variable sequence robots are more complex and versatile. They can be programmed to perform a specific task. Tasks may include welding a bead, painting a surface, picking and placing, or various other tasks. When the task is no longer needed, the robot is reprogrammed to perform another task.

Robotic Tools

Robotic end-effectors located at the end of a robot's arm are the tools that perform the actual work of the robot. End-effectors fall into two broad categories: Grippers and Special Purpose.

Grippers

Grippers include devices for grasping, hooking and scooping. Adhesive, vacuum and magnetic end-effectors are also included in this category.

Special Purpose

Special Purpose end-effectors are used for welding, painting and sanding. They may also be used for drilling, grinding, polishing, de-burring, as well as nut and screw driving. Special Purpose end-effectors are also used in inspection operations for measuring.

Progress Check #2

Match the terms with their definitions.

- | | |
|-----------------------------------|---|
| _____ Automation
(Definition) | A. Can be reprogrammed to perform various tasks |
| _____ CIM | B. reduces the cost of labor and materials
increases product quality and consistency |
| _____ Robots | C. the replacement of direct human control
with electronic devices to control
manufacturing equipment, processes
or systems. |
| _____ Variable
Sequence Robots | D. Computer-integrated manufacturing
sequence robot |
| _____ Machine Tool | E. Can be used to perform repetitive tasks
unsafe for humans. |
| _____ Control unit | F. A unit that sends pre-programmed signals
to control the operation of the machine tool |
| _____ Automation
(Advantages) | G. A unit which includes a tape reader and a
device which sends and receives signal to
control the operation of the machine tool. |
| _____ Program | H. Power-driven machine used for shaping,
cutting, turning, boring, drilling,
grinding, or polishing materials. |



Computer Activities

Questions

Using the Keyboard

Name the keys which may be used to move the cursor up, down, left, or right on the monitor. (10 Points)

Which ten to twelve special keys found along the top of a computer keyboard may be programmed to perform a particular task? (20 Points)

Which key is pressed to enter data into the computer's memory? (30 Points)

Which key is pressed to activate the numeric keypad? (40 Points)

Which three keys are used with other keys to perform particular tasks? (50 Points)

Input Devices

Which input device has letters, numbers, and special function keys? (10 Points)

Which input device is used for pointing and clicking to give instructions to the computer? (20 Points)

Which input device can be used to input instructions by touch? (30 Points)

Which input device "sees" written or printed characters? (40 Points)

Which input device is used to draw, move, or delete lines on a computer screen? (50 Points)

Computer Components

Which output device produces paper copies (hard copies) of computer files?
(10 Points)

Which output device displays information on a screen similar to a TV screen?
(20 Points)

Which hardware component performs information processing tasks and is considered the “brains of the computer?” (30 Points)

Which device is used to translate the magnetic impulses on a floppy disk into signals the computer can process? (40 Points)

Which device is used to translate the digital signals of a computer into signals that can be sent over the telephone? (50 Points)

Memory

Which term means a string of electronic pulses that the computer interprets as a piece of code? (10 Points)

Which term means approximately 1,000 bytes? (20 Points)

Which term means approximately 1,000,000 bytes? (30 Points)

What is the term for the permanent memory which is built into the computer and which cannot be changed? (40 Points)

What is the term for the internal memory used to store data and instructions while the computer is working on them? (50 Points)



Hodge-Podge

What is the indicator, often a blinking arrow or rectangle, of where the next entry on a computer monitor will be seen? (10 Points)

What is the master set of programs which controls a computer's routine operations? (20 Points)

What is the symbol which shows that the computer is ready to accept an input or command? (30 Points)

Which term describes a software program used for a specific task? (40 Points)

What is a network that connects computer and other devices in a limited geographical area? (50 Points)

Final Round

Name two of the four well-known computer operating systems. (100 Points)

Notes:



Glossary

Applications Software	A program designed to perform a specific task; for example, word processing.
Arrow Key	A key used to move the cursor on the monitor.
Artificial Intelligence	Computer systems that can imitate human thought patterns.
Backup Copy	A copy of an original disk.
Bit	A single binary digit of information used by a computer.
Buffer	An area of RAM where information is temporarily stored.
Byte	A group of eight bits of information in a computer's memory.
CD-ROM (Compact Disc-Read Only Memory)	A type of optical disk on which data cannot be changed.
Central Processing Unit (CPU)	Part of the computer in which all arithmetic and logical calculations are carried out.
Clip Art	A file of stock illustrations that can be used with graphics software.
Clip Board	A part of desktop applications software in which information can be stored temporarily.
Command	A program instruction; for example, copy a disk.

Communications Software	A type of applications software that enables you to send and receive information to and from other computers.
Computer	A device that receives and processes data to output information.
Computer-aided Design (CAD)	A type of graphics software that allows objects to be designed in three dimensions.
Computer-aided Manufacturing (CAM)	Software that automates the manufacturing process.
Computer-integrated Manufacturing (CIM)	The computer is used at every stage of the manufacturing process, from the time the manufacturing process begins until the product is shipped.
Computer Animation	An application of computer graphics in which cartoon frames can be created by the computer.
Computer Simulation	A software program that imitates something real; often used in training.
Control Panel	The display of information that helps you use the program (in spreadsheet software).
Copy Protection Scheme	A special program or other technical device designed to prevent the duplication of software.
Cursor	An indicator, often a blinking arrow or rectangle, of where the next entry on a computer monitor will be.



Cut and Paste	A feature in word processing programs that allows you to cut, delete or copy from one place to another.
Cyberphobia	The irrational fear of computers; an unusual reluctance to use computers.
Database	A collection of related information.
Debugging	The process of testing and revising a computer program to make sure it works.
Desktop Accessories Software	A program that enables you electronically to manage desktop items, such as a calendar, note pad, to do list, and so on.
Desktop Publishing	The use of computer hardware and software to create text, design page layout, integrate graphics and print a document.
Directory	A list of files on a disk that gives the file names and sizes.
Disk Drive	A device that translates the magnetic impulses on a floppy disk into signals the computer can process.
Disk Operating System (DOS)	An operating system on a disk that must be loaded into a computer's RAM.
Documentation	The how to printed material that comes with software programs.
Document	Memos, letters, reports, and books that you create.

Downloading	Receiving a file (in telecommunications).
Editing	The process of changing or correcting information.
Electronic Mail	A system in which messages can be sent and stored by the computer.
Encryption	A security technique in which data is scrambled and then unscrambled only for users who have a special code.
External Modem	A modem connected to the computer by a cable.
External Storage Device	An item used to store information outside a computer; for example, a disk.
Facsimile (Fax Machine)	A device that scans a document and sends its image over telephone lines to another facsimile machine, which prints a copy.
File	The group of related information stored on a disk; a group of related records (in database management software).
Floppy Disk	A flexible external storage device, the most popular storage device used with microcomputers.
Font	A complete set of characters in a particular typeface and size.
Footer	A line of text printed at the bottom of all pages in a file.



Function	A code that describes an instruction to the computer; for example, SUM means addition in a spreadsheet program.
Function Key	A key that can be programmed to perform a particular task.
Gigabyte (GB)	Equal to one billion bytes.
Graphics	A type of applications software that enables you to create, revise, and print graphs and drawings.
Hard Copy	The printed output from a computer.
Hard Disk	A rigid sealed metal platter used to store data and programs.
Hardware	Equipment used in computer systems.
Header	A line of text printed at the top of all pages in a file.
Ink-jet Printer	A non-impact printer that produces an image by firing a jet of ink onto paper.
Input	Data and instructions entered into a computer.
Input Device	A piece of equipment used to enter data into a computer system; for example, a keyboard.
Internal Memory	A part of the central processing unit of a computer in which information is stored.
Internal Modem	A modem built into a computer.

Internet	An electronic communications network that connects computer networks and organizational computer facilities around the world.
Intranet	A network operating like the World Wide Web but having access restricted to a limited group of authorized users (as employees of a company).
Joystick	An input device that uses a moveable lever to control the position of the cursor.
Justified	An even margin. An even right margin is achieved in some programs by inserting extra spaces between words.
Keyboard	An input device that has letters, numbers and special function keys.
Kilobyte (K or KB)	Equal to 1,024 bytes.
Landscape Orientation	The printing of a document in a shape that is short and wide, commonly 11" x 8 1/2" paper size.
Laptop Computer	A small portable battery-operated microcomputer.
Laser Printer	A non-impact printer that uses beams of light to produce images on paper.
Light Pen	An input device with which you can draw, move, or delete lines that appear on the computer screen.



Local Area Network (LAN)	A network that connects computers and other devices in a limited geographic area.
Mainframe computer	The largest, fastest, and most powerful computer.
Megabyte (MB)	Equal to one million bytes.
Memory	The ability to store information.
Menu	A lists of tasks that a hardware program can perform; the user selects a task from the menu.
Microcomputer	The smallest and least expensive computer; also called a personal computer or a home computer.
Microprocessor	A silicon wafer that contains all the components needed to carry out basic arithmetic calculations.
Minicomputer	A smaller version of a mainframe computer and almost as powerful.
Modem	A device that translates the digital signals of a computer into signals that can be sent over the telephone.
Mouse	A pointing and selecting input device often used to give the computer instructions.
Network	A system in which many computers and other devices are linked by cable or other means. See local area network.
Non-impact Printer	A printer that uses heat, ink jets, or laser beams to place images on paper.

On-line	Connected by telecommunications to another computer.
Operating System	The master set of programs that controls a computer's routine operations.
Output	The information a computer produces as a result of processing.
Page Break	The point at which one page ends and another begins.
Point-of-sale Terminal (POS)	A computerized cash register linked to the store's computer.
Printer	An output device that displays information on paper.
Programmer	A person who writes instructions for the computer.
Programs	Sets of instruction for the computer.
Project Management Software	A type of applications software that can help develop and monitor schedules.
Prompt	A message displayed on a monitor that indicates the computer is waiting for you to supply some information.
Protocol	A rule that specifies how messages are to be telecommunicated.
Quit	To end work on a program.



Random-access Memory (RAM)	A type of internal memory in which data and instructions are stored while the computer is working on them.
Read-only Access	A type of security system in which users can use but not change information in a file.
Read-only Memory (ROM)	The permanent memory built into the computer that cannot be changed.
Record	Related fields stored together in a database.
Save	To store a file electronically on a disk.
Scanner	An input device that “sees” written or printed characters.
Scrolling	Moving the lines on a computer monitor up, down, left, or right.
Search and Replace	To look through a file to find particular information and replace it with other information.
Soft Copy	Computer generated information displayed on a CRT or monitor.
Software	The set of instructions that tells the computer what to do.
Software Piracy	The unauthorized duplication of a computer program.
Sort	To rearrange information.

Spell Checker	A program that compares the words in a file to words in a stored dictionary to locate misspelled words.
Spreadsheet	A form with a grid on which data are recorded.
Spreadsheet Software	A type of applications software that enables you to create, revise, manipulate, print, and save numeric information.
Supercomputer	An exceptionally large and powerful mainframe computer system.
Systems Software	A program that controls the operation of a computer system.
Telecommunications	The sending of messages between computers over telephone and other lines.
Telecommute	To work at home and communicate with the office by telecommunications.
Teleconference	A long-distance meeting of several people using telecommunication.
Template	A programmed pattern that contains a format and labels but no specific data.
To-do List	Part of desktop applications software that allows you to keep a list of tasks to be done.
Toggle	To switch back and forth between two things.



Touch-sensitive Screen	A computer monitor whose screen can be used to input instructions by touching it.
Universal Product Code	A series of bars and numbers that when scanned indicate the item and price (used on product labels).
Uploading	Sending a file (in telecommunications).
User Friendly	A software program that has clear and simple instructions and is easy to use.
Utility	A program that performs tasks required by applications software or that enables the computer to perform additional tasks.
Vacuum Tube	A glass tube like a light bulb that controls electrical current, used in first-generation computers.
Value	A number used to express an amount (in spreadsheet software).
Variables	Data that can be changed.
Video Display Monitor	A screen connected to a computer that gives immediate access to information.
Virus	A program intended to vandalize another computer system.
Voice Messaging System	A computer system that allows spoken messages to be transmitted and stored.

Voice-recognition System	A system that converts human speech to input for the computer.
Window	A box on a computer screen that displays a portion of a program or file.
Word Processing	A type of applications software that makes writing easier by enabling you to compose, revise, and print a document electronically.
Word Wrap	The automatic moving of a word to the next line when the end of a line is reached.
Worksheet	A grid with rows and columns used to record numeric data.
WYSIWYG (what you see is what you get)	A display that shows the copy on the screen in the same format it will be printed.