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CHAPTER 1: OVERVIEW OF COMPUTER SYSTEMS

Computer professional- Is a person who has had formal education in the technical aspects of using computers.

User- is someone without much technical knowledge of computers, but who uses computers to perform professional or personal tasks or enhance learning.

Computer literacy is having an understanding of what a computer is and how it can be used as a resource.

Computer competency is applying skills with computers to meet one's information needs and improve productivity.

Computer Systems

- A computer system converts data to information.
- A computer system is made up of six parts: Hardware, Software, Data/information, procedures, people, and communications.
- Computer- is a device made up of a combination of electronic and electromagnetic components.
- Software- instructions that tell the hardware how to perform a task.
- Data- raw facts and figures processed into information.

Computer Hardware

- Can be divided into 5 categories: Input, processing, storage, output, and communications.

Input Hardware

- Collects data and converts it into a form suitable for computer processing, for example, Mouse- it is moved by hand over a flat surface to direct a pointer on the display screen.

Keyboard- has rows of keys as well as several additional keys to enter special computer codes.

Microphone

Processing Hardware

- It retrieves and executes instructions provided to the computer.
- Processing consists of performing calculations and other logical activities.
- The components of processing are:
    1. Central Processing Unit- this is the brain of the computer. It reads and interprets software and coordinates the processing activities that must take place.
    2. Main memory- It is also known as Random Access Memory, Internal memory, Primary storage, or just Memory.
        - All instructions and data ready for processing are held in the memory.
        - The amount of memory available determines whether one can run simple or sophisticated software.
        - The more memory in a computer, the more accomplishments.
        - RAM is volatile- this means that all contents inputted into a computer will be lost when the computer's power is shut off, hence data and instructions have to be saved to a storage device before the computer is turned off.

Storage Hardware

- Function: A storage hardware provides a means of storing software and data in a relatively permanent form or also known as non-volatile. This means that data is not lost when power is turned off, and it is easy to retrieve the data when needed for processing.
- Storage hardware stores data in forms of electromagnetic signals or laser-etched spots, commonly on magnetic disks or optical disk storage devices.

Output Hardware

- Function: It provides the user with the means to view information produced by the computer system.
- Information is output in either hard copy or soft copy form.
- Hardcopy output is tangible, for example, paper with texts or graphics printed on it, while softcopy output is displayed on a monitor on which one can read texts and graphics. Audio output, such as a voice recording, is also a softcopy output.

Communications Hardware

- Function: It facilitates the connections between computers and between groups of connected computers (networks).
- Common communications hardware includes: modems, cables, and fax modems.

Points to note
DEFINITIONS OF DIGITAL AND ANALOG

- Digital- these are communication signals or information represented in a binary or two-state way, for example, on/off, open/closed, positive/negative, and yes/no agreements.
  The 'on' state can be coded as a digit 1 and the 'off' as a digit 0. The 1s and 0s represent software instructions and data.
- Analog- represents continuously variable quantities. An example can be standard telephone lines, where analog signals like voice messages and on-hold music are transmitted.

1. Modems

They convert computer signals to analog signals and vice versa.

They also allow computers to communicate with each other over telephone lines.

2. Cables
   Computers communicate directly with each other via cables if the signal doesn't go over the traditional telephone lines.
   They are common where computers are part of a specially wired small network.

3. Fax modem
   A fax machine scans a paper document and converts its image into code for transmission over a telephone line to another fax machine.
   The receiving fax machine then reconverts the codes and prints out a facsimile(duplicate) of the original.

Computer Software

- There are 2 kinds of computer software:
    1 Application software- performs general-purpose tasks for users.
    2 Systems software- runs basic computer operations
    - Manages computer resources.
    - Enables applications software to run on the computer.

Software- these are instructions that tell the computer what to do, how, and when to do it.

TYPES OF COMPUTER SYSTEMS

- Computers are classified according to: - size
                                         - level of power
- They are thus classified into: -Supercomputers
                                 - Mainframe computers
                                 -Minicomputer
                                 - Microcomputer

- General users commonly deal with microcomputers, which use a chip as their CPU and have three basic hardware components: keyboard, monitor, and system unit.

1. Supercomputers
- Handle gigantic amounts of scientific computation.
- They are about 50000 times faster than a microcomputer.
- Are maintained in special rooms or environments.

2. Mainframe computers
- Are large computers housed in controlled environments that can support the processing requirements of hundreds of users and computer professionals.
- They are smaller and less powerful than supercomputers.
- They are found in airlines, banks, large insurance companies, large accounting companies, large universities, and social security administrations.

3. Mini computers
- Also known as personal computers.
- Used by one person at a time.
- Uses a chip (microprocessor) as its CPU.

NOTE:

- Storage devices are usually one or more diskette drives and a high-capacity hard disk drive.
- A diskette/floppy disk is a thin plastic disk enclosed in a paper/plastic covering that can be magnetically encoded with data.
- Hard disks are rigid disks capable of storing much more information than diskettes.

Evolution of computers

Computer Generations

- ## First Generation Computers (1944-1958)

  - Most input and output media were punched cards and magnetic tapes.
  - Main memory was made up of hundreds of vacuum tubes.

    Disadvantages of first gen computers
  - Unreliable because vacuum tubes failed frequently.
  - Were slower than microcomputers.
  - They produced a lot of heat.
  - They were very large hence not portable.
  - They ran only one program at a time.
  - Software was written using machine language which was cumbersome to use.

- ## Second Generation Computers (1959-1963)
  - Transistors and other solid-state devices, smaller than vacuum tubes were used for computer circuitry.
  - Magnetic cores were the most widely used type of main memory.
  - Second generation computers were smaller, more reliable and faster than first generation computers.

- ## Third Generation Computers (1964-1970)
  - Integrated circuits replaced traditional transistorized circuitry.
  - Magnetic disks were used for data storage.
  - Computers could perform multiprogramming.

- ## Fourth Generation Computers(1971-now)

- Large Scale Integrated (LSI) and Very Large Scale Integrated (VLSI) circuits were developed that contained hundreds to millions of transistors in a small chip.

Computing trends: Connectivity, Online access, and Interactivity

- some trends will probably intensify as IT continues to expand, i.e., connectivity, online access, and interactivity.
- Connectivity-small communications and telecommunications and networks may be connected to larger ones, for example, Telecommuting
  -Teleshopping
  - Email
  - Voicemail
- Online Information Access- 'Online' or 'on-line' refers to being connected via modem or network to other computers, that is, one is on the line with them.
  Examples include: Databases, Online services and networks, and Bulletin Board Systems BBS.
- Interactivity- this means that the user can make an immediate response to what is going on and modify the processes, for example: Using a Personal Digital Assistant.

CHAPTER 2: INPUT HARDWARE

- Input hardware is classified as keyboard entry or direct entry.
- Input hardware consists of devices that take data and programs that people

    can read or comprehend and convert them to a form that the computer can process.

- The people-readable form may be words like the ones in these sentences, but the computer-readable form consists of 0s and 1s, or off and on signals.
- Input devices are of two types: keyboard entry and direct entry.
- In a computer, a keyboard is a device that converts letters, numbers, and other characters into electrical signals that are machine-readable by the computer's processor.
- Direct-entry device refers to the many forms of data-entry devices that are not keyboards. Direct-entry devices create machine-readable data on magnetic media or paper or feed it directly into the computer's processor.
- Direct-entry devices include:
    1. Pointing devices
    2. Scanning devices
    3. Smart cards and optical cards
    4. Voice-recognition devices
    5. Audio-input devices
    6. Video-input devices
    7. Electronic cameras
    8. Sensors
    9. Human-biology input devices
- Often, keyboard and direct-entry input devices are combined in a single

computer system. A desktop-publishing system, for example, uses a keyboard,

a mouse, and an image scanner.

Keyboard Input

- Keyboard-type devices include computer keyboards and terminals.
- Computer keyboards consist of -typewriter keys
                                                -cursor-movement keys
                                               - numeric keys, function keys
                                               - special-purpose keys.

Terminals

- Terminals are of three types: dumb, smart, and intelligent.

  Keyboard-type devices include:- computer keyboards

Keyboards

- Conventional computer keyboards, such as those for microcomputers, have all the keys that typewriter keyboards have, plus others unique to computers.
  The types of keys found on the keyboard include;

  1. Standard typewriter keys:
- Typewriter keys are the same familiar QWERTY arrangement of letters, numbers, and punctuation keys found on any typewriter.
- The space bar and Shift, Tab, and Caps Lock keys have the same function on a computer as on a typewriter.
- An exception is the Enter key, which is sometimes called the Return key, is used to enter commands into the computer.

  2. Cursor-movement keys:
- The cursor is the symbol on the display screen that shows where data may be entered next.
- The cursor-movement keys/arrow keys are used to move the cursor around the text on the
  screen.
- The keys move the cursor left, right, up, or down.

- The Page Up key (PgUp) and the Page Down key (PgDn) move the cursor the equivalent of one
  page or one screen at a time up (backward) or down (forward).
- The numeric keys may also be used as arrow keys to move the cursor around.
  - Numeric keys: A separate set of keys, 0 through 9, known as the
    numeric keypad.
  - The numeric keypad has two purposes:
    - Whenever the Num Lock key is off, the numeric keys may be used as arrow keys for cursor movement.
    - When the Num Lock key is on, the keys may be used for typing numbers, as on a calculator.
- For space reasons, portable computers often lack a separate numeric Keypad.

3. Function keys:
- Function keys are the keys labeled with an F and a number, such as F1 and F2.
- They are used for tasks that occur frequently.
- Desktop microcomputers usually have 12 function keys while portables often have only 10.
- Different software has different commands for the different function keys.
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4. Special-purpose keys:
- Special-purpose keys include Backspace, Delete (Del), Insert (Ins), Escape (Esc), Control (Ctrl), and Alternate (Alt).
  - Backspace (indicated by a left-pointing arrow) erases as one moves left over the preceding text they have typed.
  - Delete (Del) erases text to the right.
  - Insert (Ins) allows one to type over (or push right) existing text to insert new text.
  - Escape (Esc) may be used to cancel whatever task a user is currently performing.

- The purposes of Ctrl (Control) and Alt (Alternate) are defined by the software being used.
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Terminals

- A terminal is an input device that consists of a keyboard, a video display screen, and a communications line to a mainframe computer system.
- They are of three types: dumb, smart, and intelligent.
    1. **Dumb**: A dumb terminal can be used only to input data to and receive information from a computer system, i.e., it cannot do any processing on its own. An example of a dumb terminal is that used by airline clerks at airport ticket and check-in counters.
    2. **Smart**: A smart terminal can do input and output and has some limited processing capability.
        - It may be able to edit or verify data before it is sent to a larger computer. However, it cannot be used to do programming
        - Examples of smart terminals are;
            ✓ Automatic Teller Machines- An automatic teller machine (ATM) is used to retrieve information on bank balances, make deposits, transfer sums between accounts, and withdraw cash.

            ✓ Point-of-sale terminals- record customer transactions at the point of sale

            Also stores data for billing and inventory purposes.

            ✓ Minitel Terminals. The Minitel is a terminal used to link citizens with an electronic phone directory and information services.
    3. **Intelligent**: An intelligent terminal is a full-fledged microcomputer with a communications link. That is, an

intelligent terminal is a device with its own input, output, processing, and storage capacity and its own software.

Pointing Devices

- Pointing devices include:
    - Mice, trackballs, and joysticks
    - Touch screens
    - Light pens
    - Digitizing tablets
    - Pen-based systems
  I. Mouse: A mouse is a device that is rolled about on a desktop to direct a
     pointer on the computer's display screen.
  II. Trackball: A trackball is a movable ball, on top of a stationary device,
     that is rotated with the fingers or palm.
  III. Joystick: A joystick is a pointing device consisting of a vertical handle
     like a gearshift lever mounted on a base with one or two buttons.

Touch screens

- A touch screen is a video display that is sensitive to input from a finger touch.
- The screen is covered with a plastic layer, behind which are invisible beams of infrared light.

Light Pen

- The light pen is a light-sensitive stylus, or pen-like device, connected by a cable to the computer terminal.
- The user brings the pen to a desired point on the display screen and presses the pen button, which identifies that screen location to the computer.

Digitizing Tablets

- A digitizing tablet consists of a tablet connected by a cable to a stylus or puck. A stylus is a pen-like device with which the user "sketches" an image.
- A puck is a copying device with which the user copies, or traces, an image.

Pen-Based Systems

- Pen-based computer systems use a pen-like stylus to enter handwriting and marks into a computer.
- There are four types of pen-based systems: - Gesture recognition
  - Handwriting stored as scribbling:
  - Handwriting converted, with training, to typed text
  - Handwriting converted, without training, to typed text

Scanning Devices

- Scanning devices translate images of text, drawings, photos, etc into digital form.
- The images can then be processed by a computer, displayed on a monitor, stored on a storage device, or communicated to another computer.
- Scanning devices include - Bar-code readers

    -Mark- and character-recognition devices

    -Fax machines

    -Imaging systems

- Mark-and character-recognition devices include
    - magnetic-ink character recognition (MICR),
    -optical mark recognition (OMR)

    - optical character recognition (OCR).

- Bar codes are read by bar-code readers, photoelectric scanners that translate the bar code symbols into digital forms.

Imaging Systems

- An imaging system (image scanner or graphics scanner) converts text,

drawings, and photographs into digital form that can be stored in a computer system and then manipulated.

Smart Cards and Optical Cards

- A smart card contains a microprocessor and a memory chip.
- An optical card is a plastic, laser-recordable card used with an optical card reader.

Voice-Recognition Systems

Limitations
1. Speaker dependence
2. Lack of comprehension

CHAPTER 3:THE PROCESSING HARDWARE

- Computers are classified into microcomputers, minicomputers, mainframe computers, and supercomputers.
- Main memory, also called memory, primary storage, internal memory, or random access memory (RAM), refers to working storage.

    Main memory:

    1. Holds data for processing

    2. Holds instructions for processing the data

    3. Holds data after it is processed

- The contents of main memory are temporary, meaning that if you turn off your computer before saving your work, you will lose your latest edits.
- Memory capacity varies in different computers. The amount of memory you have in your computer determines the level of software sophistication your computer can handle. When it comes to memory, more is better
- Registers are high-speed staging areas that temporarily store data and instructions that will be used immediately by the CPU.
    - To process an instruction, the control unit of the CPU retrieves it from memory and places it in a register. The Instruction cycle (I-cycle) refers to the retrieval of the instruction from memory and its subsequent decoding.
- The execution cycle (E-cycle) refers to the processing of the instruction and subsequent storing of the result in a register.
- Together, the instruction cycle and the execution cycle are called the machine cycle.
- Personal computers (PCs) are microcomputers that run easy-to-use software programs such as word processing or spreadsheets.
- Different sizes of PCs are available, including desktop and floor-standing units, luggables, laptops, notebooks, subnotebooks, pocket PCs, and pen computers
- Workstations are microcomputers that are more powerful than personal computers and more expensive. They are used mainly by engineers and scientists
- Minicomputers are more powerful than microcomputers and can be used as either single workstations or tied to a network of several hundred terminals.
    - Minicomputers are less powerful and expensive than mainframe computers.However, Mainframe computers are more expensive and more powerful than minicomputers.
    - Mainframe computers are used by companies that need to handle millions of transactions. In addition, mainframes are being supplanted by smaller computers that are connected together in networks

- Supercomputers are more expensive than mainframe computers. They are the fastest calculating machines ever invented. They are used for such tasks as modeling nuclear explosions.
- Vector processing and massively parallel processing (MPP) are two types of supercomputer design.
- The central processing unit (CPU) is the "brain" of the computer.
  - It has two main parts

    1. Control unit—directs and coordinates most of the computer system activities

    2. Arithmetic/logic unit (ALU)—performs arithmetic and logical (comparison) functions and controls the speed of these operations

- There are three ways to measure computer processing speeds :
  1. Time to complete one machine cycle, in fractions of a second.
     - A millisecond is one-thousandth of a second. A micro second is one-millionth of a second.
     - A nanosecond is one-billionth of a second.
     - A picosecond is one-trillionth of asecond.

  2. Time to complete instructions, in millions of instructions per second (MIPS).

  3. Time in floating-point operations per second (flops).

- Supercomputers are usually measured in megaflops,millions of floating-point operations per second.
- In a computer system, data is represented using the binary system, combinations of binary digits (bits). There are only two binary digits: 1 ("on") and 0 ("off"). During processing, 0 is represented by the electrical current being off (or at low voltage) and 1 by the current being on (or at high voltage).
- It typically takes 8 bits (binary digits) to represent a character, or byte, of data.
  - A kilobyte (K, KB) is about 1,000 bytes (1,024bytes).
  - A megabyte (M, MB) is about 1 million bytes (1,048,576 bytes).
  - A gigabyte (G,GB) is about 1 billion bytes (1,073,741,824bytes).
  - A terabyte (T, TB) represents about 1 trillion bytes (1,009,511,627,776 bytes).
- Two common binary coding schemes are ASCII-8 and EBCDIC. ASCII stands for Ameri¬can Standard Code for Information Interchange and EBCDIC stands for Extended Binary Coded Decimal Interchange.
- ASCII is typically used to represent data for microcomputers, and EBCDIC is used on larger computers, p.
- A parity bit is an extra bit attached to a byte for purposes of checking the accuracy of the stored byte. Parity schemes may be even parity or odd parity.
- The computer's system software continually checks the parity scheme for accuracy. When an error occurs, a message displays on the screen.
- The CPU understands only machine language, in which data and instructions are represented by 0s and Is—the off and on states of electrical currents. Software instructions are converted into machine language by a language translator, a type of systems software program

- The system unit contains the electrical components that make a computer work. They are:
    1. The power supply
        - Is a device that converts AC power to DC to run the computer. The power supply can generate a lot of heat; therefore a fan inside the system unit keeps the power supply (and other components) from getting too hot.
    2. The motherboard
        - Is a circuit board in the system unit, which houses the CPU chip, main memory chips, and expansion slots where additional components, such as add-on circuit boards, can be plugged in.
    3. The CPU—microprocessor chip, the "brain" of the computer.

    4. Specialized processor chips
        - The motherboard usually has slots for plugging specialized processor chips such as a math coprocessor chip and a graphics coprocessor chip. These chips help to speed up your computer system
    5. The system clock
        - clock that controls how fast all operations within a computer are performed. Speeds are measured in megahertz (MHz), with 1 MHz equal to 1 million beats (cycles) per second.
    6. RAM chips
        - Are chips that temporarily hold data and instructions that will be needed shortly by the CPU. These chips are plugged into the motherboard. RAM chips may be mounted on a small circuit board, such as a SIMM (single in line memory module). Your computer may contain four types of RAM:
            - conventional memory, upper memory, extended memory, and expanded memory
    7. ROM chips
        - Are chips containing programs that are built into the computer at the factory. These chips contain special instructions including those that execute when a user or computer professional turns on their computer.
        - Three variations on ROM chips are PROM, EPROM, and EEPROM.
    8. Other forms of memory (cache, VRAM, flash)
        - Cache memory is special high-speed memory that the CPU can access quickly.
        - Video memory or video RAM (VRAM) chips are used to store display images for the monitor.
        - Flash memory or flash RAM cards, consist of circuitry on credit-card-size cards that can be inserted into slots on the motherboard,
    9. Expansion slots and boards

    Expansion slots are sockets on the motherboard into which you can plug expansion cards, or boards. Among the types of expansion cards are:

    - expanded memory,
    - display adapter or graphics adapter cards
    - controller cards

10.Buslines

- Are electrical pathways through which bits are transmitted within the CPU and between the CPU and other devices in the system unit. The most important is the input/output bus, which links the CPU to every hardware device

11.Ports

- Are sockets on the outside of the system unit that each connect to an expansion board on the inside of the system unit. Ports are of five types:
  a) parallel ports
  b) serial ports,
  c) video adapter ports
  d) SCSI ports
  e) game ports.

12. PCMCIA slots and cards

- PCMCIA represents a new bus standard for notebooks, subnotebooks, and pocket computers.
- PCMCIA cards(for memory, disk storage, a modem, or a local area network adapter) are used to upgrade an existing system by simply sliding the card into a PCMCIA slot.

- Future processing technologies may include the following: gallium arsenide, superconductors, opto-electronic processing, nanotechnology, or biotechnology.

CHAPTER 4: STORAGE HARDWARE

Primary storage (RAM)

- RAM is volatile memory that keeps data only while power is supplied. It provides the CPU with a fast, random-access workspace for executing programs and temporarily holding data needed for current operations.

Secondary storage (non-volatile)

- Secondary media retain information permanently and include a variety of formats:

    - **Floppy diskettes** – Small, flexible magnetic sheets (3.5-in or 5.25-in) with a write-protect tab; typically 1.44 MB capacity.
    - **Hard-disk drives (HDDs)** – Internal or external magnetic platters read by moving heads; capacity ranges from tens of megabytes to multiple terabytes, with RAID configurations offering redundancy or speed.
    - **Magnetic tape** – Sequential-access cartridges used mainly for batch archiving.
    - **Optical discs** – Laser-written media such as CD-ROM (read-only), CD-R (recordable), WORM (write-once/read-many), and rewritable DVDs that store from a few hundred megabytes to several gigabytes.
    - **Solid-state/flash devices** – Memory cards, USB drives, and SSDs contain no moving parts, delivering fast random access and high durability.
    - **Other experimental media** – Bubble memory and advanced optical systems have been explored for very high-density storage.

File concepts

- A file is a collection of data treated as a single unit.
- Program files contain executable code, while data files hold user or system information.

- Master files are relatively permanent records updated periodically; transaction files temporarily store changes before they are merged into master files.

Processing modes

- Batch processing gathers data on secondary storage and runs jobs at scheduled times.
- Real-time processing acts on incoming data immediately, often using direct or indexed access to secondary media.

File organization methods

- ✓ **Sequential** – Records are stored one after another, typical for tape.
- ✓ **Direct (hashed)** – Records are accessed by a key field, common on hard disks.
- ✓ **Indexed sequential** – Data remain in sequential order, but an index provides rapid lookup, used on many magnetic and optical disks.

Compression

- Lossless compression removes redundancy without altering any original bits, while lossy compression discards some data to achieve greater size reduction, suitable for media where exact fidelity is not required.

CHAPTER 5: OUTPUT HARDWARE

1. Hard-Copy Output Devices

Impact printers – These work like a typewriter: a hammer or wheel strikes an ink-ribbon that contacts the paper.

- Daisy-wheel printers produce very crisp, letter-quality text, but they are slow (about 10-75 characters per second), noisy, and cannot print graphics.

- Dot-matrix printers have a print head with 9, 18, or 24 pins that hit the ribbon. They can print draft-quality text (about 72 dpi) or near-letter-quality (144 dpi). They are faster than daisy-wheel printers (150-300 cps) and can produce simple graphics, though they remain somewhat noisy.

Non-impact printers – No physical contact is made between the print mechanism and the paper.

- Laser printers use a laser beam to charge a drum, which attracts toner powder and transfers the image to paper. They deliver sharp text and graphics, operate quietly, and print 4-20 pages per minute on a desktop (up to 120 ppm on larger systems).

- Ink-jet (including bubble-jet) printers spray tiny electrically charged droplets of ink onto the page. They are the primary choice for color printing because the heads can hold four separate inks. Speed is comparable to dot-matrix printers (1-4 ppm).

- Thermal and thermal-transfer printers use heat to change the color of special paper or to melt wax onto paper. They produce high-quality color output but require expensive specialty paper and are generally used for low-volume jobs.

Plotters – Designed for high-quality graphics, maps, and architectural drawings.

- Pen plotters move one to four pens across flat or drum-mounted paper, allowing up to four colors.

- Electrostatic plotters create tiny charged dots on specially treated paper, capable of four-color output.
- Thermal plotters use heated pins and heat-sensitive paper; they only produce two colors.

Desktop vs. Portable Printers – Desktop units give a broader range of quality and price options and usually provide higher speed. Portable printers trade speed and page capacity for mobility; many are battery-powered for about 25-30 pages per charge and often require single-sheet feeding. Some portable models plug into an AC outlet and may include a sheet feeder (e.g., HP Deskjet Portable).

2. Multifunction Devices (MFDs)

These combine printing, scanning, copying, and faxing in a single chassis, saving desk space and reducing cost compared with buying each device separately. An example is Okidata's Doc-It, which bundles a laser printer, copier, scanner, and fax machine. Modern MFDs often support network connections (Ethernet or Wi-Fi) and mobile-printing standards like AirPrint.

3. Fonts & Page Description Languages (PDLs)

Font types –

- Resident fonts are built into the printer's ROM; they load instantly but the selection is limited.
- Cartridge fonts reside on removable ROM cartridges; they offer many faces but cannot be altered by the user.
- Soft fonts are downloaded from the computer to the printer's RAM. Although the download takes a moment (usually done once per power-up), the fonts stay in memory until the printer is turned off and can be scaled to any size because they are stored as outlines.

PDLs –

- PostScript (by Adobe) is a device-independent language ideal for complex graphics and high-quality publishing.

- PCL (Printer Control Language) (by Hewlett-Packard) is efficient for text-heavy documents and is common on HP laser printers.
- TrueType (Microsoft/Apple) provides outline fonts that can be resized without loss of quality and is widely used in Windows environments.

4. Soft-Copy Displays

CRT (Cathode-Ray Tube) – Uses an electron gun to fire beams at a phosphor-coated screen, creating images pixel by pixel. CRTs deliver bright, clear images but are heavy, bulky, and consume more power.

Flat-Panel Displays – Much thinner and lighter; three main technologies:

- LCD (Liquid-Crystal Display) – Most common; liquid crystals block or allow backlight to create images.
- EL (Electroluminescent) – Emits light when an electric current passes through a special material; less common and more expensive.
- Gas-Plasma – Uses ionized gas that glows when energized; also, less common due to cost.

Flat-panels come in two transistor arrangements:

- Active-matrix (TFT) – Each pixel has its own transistor, resulting in brighter, sharper images but at a higher price.
- Passive-matrix – Rows or columns share transistors, making the display cheaper and lower-power, though with reduced contrast and slower response.

Key display qualities:

- Resolution – Number of horizontal × vertical pixels (e.g., 1024 × 768). More pixels mean sharper images.
- Dot pitch – Distance between pixel centers; a smaller pitch yields a crisper picture.
- Refresh rate – How often the screen redraws per second (Hz); higher rates reduce flicker and improve motion smoothness.

Video adapters – The graphics card determines the supported resolution and color depth. Classic standards mentioned in the note are:

- VGA – Supports 16-256 colors depending on resolution (e.g., 640 × 480 for 16 colors, 320 × 200 for 256 colors).
- SVGA – Extends VGA to higher resolutions such as 800 × 600 or 1024 × 768, still with up to 256 colors.
- XGA – Offers up to 16.7 million colors at 1024 × 768 resolution.

5. Audio Output Hardware

Voice-output – Two approaches:

- Speech coding stores actual human-spoken words in a digital database; playback sounds natural but is limited to the pre-recorded vocabulary.
- Speech synthesis builds words from a set of about 40 phonemes; it can generate any text but sounds less human-like.

Sound-output – Two main synthesis methods:

- FM synthesis combines basic waveforms to imitate musical instruments; it was popular in early digital synthesizers (e.g., Yamaha DX-7).
- Virtual acoustics uses software models of real instruments, providing more realistic timbres (e.g., a sampled clarinet).

Both voice and sound output rely on a sound card (such as a Sound Blaster) that converts digital audio data to analog signals and sends them to speakers or headphones. A mixer balances multiple audio streams before they reach the output device.

CHAPTER 6: SOFTWARE

- Software consists of the step-by-step instructions that tell the computer how to perform a task.
- There are two basic types of software:
  - Application software -Application software, which may be custom-written or packaged, enables

  users to perform their work.

  - Systems software enables the computer to run application software.
- Application software consists of computer programs designed to satisfy a user's specific needs. The task or problem may require, for example, computations for payroll processing.
- Systems software "underlies" applications software; these programs start up the computer and function as the principal coordinator of all hardware components and applications software programs.
- Every application works through "layers" in the computer to get to the hardware and perform the desired result.
- For large computer systems, the choice of systems software tends to be made by computer specialists, and the applications software is usually custom-written for the system; this type of software is called custom software.
- Application software purchased off the shelf is often referred to as off-the-shelf, or packaged, software. Micro-computer users generally receive system software along with the computer purchase or use at work.

Applications Software

- Application software may be divided into "basic tools" and "advanced tools."
- Many applications software packages share common features such as cursors, scrolling, menus, Help screens, dialog boxes, macros, OLE, tutorials, and documentation.
- Popular types of applications software include -word processing

-   -desktop publishing

                                                      -spreadsheets

                                                      - database management

                                                      -graphics

                                      - communications

                                                      -integrated programs.

- Groupware, software suites, desktop accessories, project management software, and computer-aided design/manufacturing programs are also common.
- Application software can be acquired directly from a software manufacturer or from the growing number of businesses that specialize in the sale and support of microcomputer hardware and software.

Basic Tools Versus Advanced Software Tools

- Basic software tools: These are the programs found in most offices and probably all campuses.
- Their purpose is simply to make users more productive at performing general tasks. This category includes word processors, spreadsheets, database managers, graphics programs, communications programs, integrated programs, groupware, software suites, and desktop accessories.
- Advanced software tools: Many advanced software tools exist today. Examples of some tools that fall into this category include desktop publishing, project management, and computer-aided design/manufacturing software (CAD/CAM).

Common Features of Applications Software

- Although applications software packages differ in their use of specific commands and functions, most of them have some features in common:

cursors, scrolling, menus, Help screens, dialog boxes, macros, OLE, and tutorials and documentation

- Cursor: The cursor is the movable symbol on the display screen that

shows you where you may enter data next

- Scrolling: Scrolling is the activity of moving quickly upward or downward through the text or other screen display.
  - Panning is used to describe the process of scrolling to the right and left.

Common features of applications software.

1. Scrolling
2. Menu bar
3. Pull-down menu
4. Help screen

- Menu bar: This is a row of menu options displayed across the top or the

bottom of the screen.

- Pull-down menu: A pull-down menu is a list of command options, or

choices, that is "pulled down" out of the menu bar.

- Help menu or screen: A Help menu offers a choice of Help screens, specific explanations on how to perform various tasks, such as printing out a document.
- Dialog box: A dialog box is a box that appears on the screen and displays a message requiring a response from you, such as pressing Y for "Yes" or N for "No."
- Macros: A macro is a feature that allows you to use a single keystroke or command to automatically issue a predetermined series of

keystrokes or commands. Thus, you can consolidate several keystrokes for a command into only one or two keystrokes.

- OLE: Many software applications have the ability to integrate applications using a feature called OLE (pronounced "ole"), or object linking and embedding. This feature enables you to embed an object created using one application (such as graphics) into another application (such as word processing). It thus facilitates the sharing of information.

Word Processing Software

- Word processing software allows you to use computers to create, edit,

revise, store, and print documents.

- It enables the user to easily insert, delete, and move words, sentences, and paragraphs without ever using an eraser.

Editing Features

- Correcting: Deleting and inserting; simply place the cursor where you want to correct a mistake and press either the Delete key or the Backspace key to delete characters. You can then type in new characters.
- Check grammar: Word processing packages often include programs that check and highlight, for example, incomplete sentences, awkward phrases, wordiness, overlong sentences, and poor grammar.
- Check spelling: Many packages come with a spelling checker program that, when executed, will alert you to misspelled words and offer correct versions.
- Cut, Copy, and Paste (block move, block copy): Selecting and changing the position of a block (one or more characters) of text; this can be done within the same document or between different documents from the beginning of a document straight to the end.
- Search and replace: You can easily search through a document for a particular word, for example, a misspelled name, and replace it with another word.

Formatting Features

- Boldface / italic / underline: Word processing software makes it easy to emphasize text by using bold, italic, or underlining.
- Font choice: Many packages allow you to change the font, or the typeface and the size of the characters, to improve the document's appearance.
- Justify/unjustify: This feature allows you to print text aligned on both right and left margins or unaligned.

Word Processing Functions

- File format exchange: A file format is the structure that defines the way a file is stored and the way it appears on the screen or in print. In addition to text, word processing files also contain these formatting codes.
- Every word processing program has a different format. To exchange word processing files (for example, to work on a document in WordPerfect that was originally created in Microsoft Word), you use the program's file format conversion feature.
- Footnote placement: This feature allows the user to build a footnote file at the same time he or she is writing a document; the program then places the footnotes at appropriate page bottoms when the document is printed.
- Index creation: Using this feature, you can create an index for your document that includes page numbers for words or phrases that can be easily looked up.
- Mail merge: Most word processing programs allow the user to combine parts of different documents (files) to make the production of form letters much easier, faster, and less tedious than doing the same thing using a typewriter. For example, you can combine address files with a letter file that contains special codes where the address information is supposed to be. The program will insert the different addresses in copies of the letter and print them out.
- Outlining: Some packages automatically outline the document for you; you can use the outline as a table of contents.
- Split screen: This feature allows you to work on two documents at once—one at the top of the screen and one at the bottom. You can scroll each document independently and move and copy text between the documents.
- Thesaurus: Thesaurus programs allow the user to pick word substitutions. For example, if you are writing a letter and want to use a more exciting

word than impressive, you can activate your thesaurus program and ask for alternatives to that word, such as awe-inspiring or thrilling.

- Word wrap: As you type, the text insertion point automatically moves to the beginning of the next line when the end of the current line is reached. In other words, you may type a paragraph continuously without pressing Return or Enter.

Categories of application software

1. Desktop-Publishing (DTP)

- **What it does:** Combines text, photos, line art, and page layout in a true **WYSIWYG** (What-You-See-Is-What-You-Get) environment, so the on-screen page matches the printed output.

- **Key programs:** Aldus PageMaker, QuarkXPress, First Publisher; Microsoft Publisher is a low-end option, and many word processors now have DTP-style features.

- **Typical workflow:**

  1. Draft text in a word processor.

  2. Create or scan graphics elsewhere.

  3. Import everything into the DTP program, flow text around images, set styles, and preview with a laser printer before final production.

2. Electronic Spreadsheet Software

- **Core idea:** A digital grid where each cell can hold a value or a **formula** (e.g., **=SUM (A1:A10)**). Changing one cell automatically **recalculates** dependent cells.

- **"What-if" analysis:** You can vary a single input (price, interest rate, loan term, etc.) and instantly see the impact on totals, cash-flow projections, or charts.

- **Popular packages:** VisiCalc (historical), Lotus 1-2-3, Microsoft Excel, Quattro Pro.

- **Extra features:** Dynamic linking between workbooks, built-in charting (bar, line, pie), and macro languages for automation.

3. Database-Management Systems (DBMS)

- **Structure:** Data is organized into **tables** (files) made of **records** (rows) and **fields** (columns).
- **Key capabilities:**
    - **Querying:** Retrieve specific subsets (e.g., "all students majoring in English").
    - **Sorting & indexing:** Quickly order records by a key field.
    - **Reporting & calculations:** Built-in formulas can compute GPA, totals, etc.
- **Common products:** dBase (DOS), Microsoft Access, Paradox, FileMaker Pro.

4. Graphics Software

- **Analytical graphics:** Simple charts (bar, line, pie) that turn numbers into visual trends—often built into spreadsheets.
- **Presentation graphics:** More polished slideshows (PowerPoint, Harvard Graphics) with clip-art, animations, and multimedia.
- **Why it matters:** Visuals are processed faster and remembered longer than raw numbers or text.

5. Communications Software

- **Purpose:** Connect a PC to remote systems via a **modem** (or later, Ethernet/Wi-Fi) to exchange files, email, or run terminal sessions.
- **Typical programs:** Smartcom, ProComm, PC-Talk.
- **Impact:** Made it possible for small offices and home users to access corporate databases, share documents, and collaborate across distances.

6. Shareware & Freeware

- **Shareware:** Try-before-you-buy; users can evaluate a program for a limited period, then pay if they like it.
- **Freeware:** Distributed at no cost, often supported by ads or donations.

- **Benefit:** Lowers the barrier to testing new tools without a financial commitment.

7. Integrated Packages & Software Suites

- **Integrated packages:** One program that bundles word processing, spreadsheet, graphics, and communications (e.g., Claris Works). Less powerful individually but convenient for simple tasks.
- **Software suites:** Separate, full-featured applications that share a common UI and file format (Microsoft Office, Lotus SmartSuite, Novell Perfect Office). They cost less than buying each app separately and make data exchange smoother.

8. Groupware

- **Four types:**
    1. **Basic (e.g., Lotus Notes):** Shared databases + messaging.
    2. **Workflow:** Route tasks automatically (Action Workflow).
    3. **Meeting:** Text-based real-time collaboration (Ventana Group Systems).
    4. **Scheduling:** Shared calendars (Network Scheduler).
- **Result:** Enables many-to-many communications, improving teamwork and visibility of who is doing what.

9. Desktop Accessories / Personal Information Managers (PIMs)

- **Desktop accessories:** small utilities like a calendar, calculator, or notepad that sit on the screen for quick access.
- **PIMs:** More robust organizers (Lotus Organizer, Dynodex) that combine notes, contacts, tasks, and sometimes simple databases.

10. Project-Management Software

- **Key tools:**
    - **Gantt charts:** Bars on a timeline show task duration and progress.

- **PERT charts:** Nodes and arrows illustrate task dependencies and critical paths.
- **Typical uses:** Scheduling construction, film production, marketing campaigns, etc.

11. Computer-Aided Design (CAD)

- **What it enables:** Rapid creation of 2-D drawings or 3-D models that can be rotated, rendered, and printed quickly—drastically cutting design time for engineering and manufacturing.

12. Operating-System Tasks & Utility Programs

- **OS duties:** Memory management, device I/O, file system handling, error reporting.
- **Utilities:**
  - **Screen savers** (prevent burn-in).
  - **Backup/restore** (Norton Backup, Fastback).
  - **Data recovery** (undelete).
  - **Antivirus** (Norton Antivirus, Central Point).
  - **Compression** (ZIP utilities) to save disk space.

What systems software is and why it matters

- Systems software is the foundational layer that lets a computer run any application. It is split into three groups: **operating systems (OS), utility programs, and language translators**. Without it you can't interpret data, control peripherals (printer, keyboard, disk), or interact with the machine.

Operating Systems

- The OS is the "master" set of programs that manage resources: CPU scheduling, memory allocation, device I/O, and file storage.

- It is **boot-loaded** automatically when the computer powers on. The bootstrap loader (stored in firmware) fetches the OS from disk, loads it into RAM, and then runs diagnostic routines (RAM test, BIOS) before handing control to the OS.

- Core OS tasks listed in the note:

    1. Coordinating processing activities

    2. Managing main-memory usage

    3. Allocating peripheral devices (printers, drives, etc.)

    4. Detecting hardware faults and showing error messages

    5. Managing files on disk

Utility Programs

- Utilities are supplemental tools that **support, enhance, or extend** the capabilities of the OS or other software.

- The note highlights three common utilities:

    - **Screen saver** – moves the display to prevent "burn-in" (mostly a legacy concern).

    - **Data recovery** – restores files that were deleted but not yet overwritten.

    - **Backup** – creates duplicate copies of data, often with compression, to protect against drive failure.

- Utilities can be built into the OS (e.g., copy commands in DOS) or provided on separate media (e.g., Norton Utilities).

    Other systems software capabilities include:
    1. Multitasking
    2. Time sharing
    3. Multiprocessing