Chapter 3: Input, Output, and Storage

Instructor: Dr. Tarek Abd Elhamid
Chapter 3: Input, Output, and Storage

Learning Objectives:

Define input and describe the available types of keyboards and pointing devices
Describe scanning and image-capturing device types and features
Define output and explain the types of output devices available
Differentiate between types of monitors and explain their features
Differentiate between types of printers and identify the best printer for a task
Chapter 3: Input, Output, and Storage

Learning Objectives (continued):

Classify storage devices according to their capacities, interface, and media

Explain cloud and network storage and identify online and network-based storage technologies
**INPUT DEVICES**

**Input device: Hardware** that enables the computer to accept commands or data from human user, or allow the user to communicate with the operating system and applications.

**A keyboard:** enable you to enter typed data—letters, numbers, and symbols. A keyboard can be a separate device that plugs into the system unit (desktop PC) or built-in keyboard (notebook PC)
Keyboards

There are many types of keyboards, but most English-language keyboards use the same key arrangement, called QWERTY.

**Function keys**: (F1 through F12) perform special actions

**Toggle keys**: turn a feature on or off each time the key pressed. (*Caps Lock, Num Lock*)

**Modifier keys**: Change the meaning of other keys when they are pressed in combination with them (*Shift key, when pressed in combination with a letter, makes that letter uppercase, Ctrl+c for copying selected content*)

**Positional keys**: such as Home, End, Page Up and Page Down + arrow keys.
Specialty Keyboards

**Wireless:** does not require a cable connection to the computer.

**Ergonomic:** is a keyboard that is designed to minimize the stress on the user’s body.

**Such as:**

**Bilingual:** has characters in more than one language on its keys.
Using a virtual keyboard

Devices that don’t have physical keyboard like Tablets and smartphones, use a **virtual keyboard**, which is a software, follow these steps to use the virtual keyboard in Windows 8.1

1- from start screen, type **key** and then **click On-screen keyboard**. A window appears showing a virtual keyboard.
Pointing Devices

A Pointing device: is a piece of hardware that used to control the movement of a cursor on a computer screen.

Mouse: is the most common pointing device. A mouse can be either

- **Mechanical (ball)**: has a chamber on its underside with a rubber ball in it.
- **Optical**: A mouse that operates by bouncing light off a flat surface and measuring the reflection.
Pointing Devices

**Trackball:** A pointing device in which the user moves the pointer by rolling a ball with his or her fingers. Like mice, trackballs may have buttons for selection and other functions.
Pointing Devices

**Touchpad:** A pointing device consisting of a touch-sensitive pad on which the user drags a finger across to move the pointer.

- Most laptops have touch pads. This is a tactile sensor which is used by moving fingers over the pad to move the cursor.
Pointing Devices

**Touch screen:** A touch-sensitive display monitor that functions both an input and output device, can enable you to use finger as a pointing device.
Pointing Devices

Joystick: A pointing device consisting a vertically mounted stick that can be tilted in any direction, used in gaming.
Drawing Tablet

**Drawing Tablet**: is designed for drawing. The user draws on the tablet with inkless pen-shaped pointer called a **stylus**, and the drawing shows up onscreen.

A **stylus**: a pen-shaped pointer used to drag across the surface of a touch-sensitive screen for creating digital artwork.
Scanning Devices

To convert hard copy photos and documents to digital and store them.

Uses a photosensitive charge-coupled device (CCD)

**Types of scanners**

- **Document feeder**
  When you scan text, Optical Character Recognition (OCR) Software to convert image to Text.

- **Bar code reader**
  - Universal product code (UPC)
  For identifying products for sale.
Other Input Devices

**Magnetic card reader**: a scanner that reads the information on magnetic strip on a credit card or any other ID card.
Capture Devices

- Digital camera
- Digital video camera
- Web cam
Audio Input Devices

Audio adapter (sound card)

Microphone

- **Voice recognition software**: recognize spoken words that match words in its database to digitize spoken language.
- **Speech recognition software**: can learn an individual’s pronunciation and vocal inflection and translate it into digitized text.
Display Screens

**Display Screens**: is a screen that the computer uses to provide information to a human user. Can be built into a device (Smartphones, Tablets and Notebook PCs), or a separate unit (monitor) like desktop PCs. Display is made up of individual *tiny dots* called *pixels*.
Role of Output Devices

- For displaying information stored in the computer system to the user
Current Monitor Technologies

Built-in display screens are thin and flat, and most of them use Liquid Crystal Display (LCD).

**Liquid Crystal Display (LCD):** A flat screen display technology that passes electricity through liquid crystals to create a display image.

**Light-Emitting Diode (LED):** Some new devices use **Organic Light-Emitting Diode (OLED):** A flat screen technology that uses organic matter that lights up in response to electrical current to create a display image.

**Digital projector:** A projector that accepts input from a computer.
Cathode Ray Tube (CRT)
Older technology, mostly uses a large vacuum tube with electron guns that to create a display image on a phosphor-covered glass.

The phosphors are arranged in Triads.

**Triads**: A cluster of three phosphors: one red, one green, and one blue.

**CRT monitors** are heavy and bulky (*big*) compared to LCDs.
Resolution

**Resolution:** Measured the number of pixels that comprise a display, such as 1024 x 768.

**Native resolution:** Each display has a maximum (native) resolution. LCD and LED displays look best at their native resolution.

**Aspect ratio:** is ratio of width to height, such as 4:3 or 16:9

When selecting a display mode in the operating system, you should choose one that matches the aspect ratio of the display screen.
Resolution

**Horizontal resolution:** number of pixels horizontally. For example, 1600

**Vertical resolution:** number of pixels vertically. For example, 900

**Aspect ratio:** ratio of horizontal to vertical resolution. For example, 1600:900 is a 16:9 ratio.
Resolution

Higher Image Resolution → Higher Quality Images

Low Resolution (fewer pixels) → High Resolution (more pixels)
Other Measures of Monitor Performance

**Refresh rate:**
- Number of times each pixel is refreshed per second

**Color depth:**
- Number of bits required to describe the color of each pixel, such as 32-bit or 16-bit for most operating systems.

**Display Adapter:**
The **hardware** that helps the operating system communicate to the monitor what should be displayed.
May be built into the motherboard or may be a separate circuit board installed on the motherboard.
If separate, has its own memory.
Requires a device driver installed in the operating system.
Printers

Printers: generate hard copy. That is, physical printed pages you can hold in your hands.

When selecting a printer there are a number of factors to consider:

- **Initial cost**
- **Per-page cost:** printing supplies that must be replaced with use, such as paper and ink.
- **Resolution** (dots per inch) (dpi) measurement of a printed image quality.
- **Speed:** How many pages per minute can the printer output? *The speed of printer is measured in CPS (Characters per Second)/ LPM (Lines Per Minute)/ PPM (Pages Per Minute).*
- **Color:** Does the printer print in color, or just black-and-white?
Printers

- **Paper handling**: Does it have multiple paper trays, so you can have two sizes of paper loaded at once. How much paper can it hold at once.

- **Interface**: Most printers use the USB interface to connect to a computer. Can the printer also connect to a network? Does it require a cable to connect it to network, or can it connect wirelessly?

- **Multiple functions**: It is just a printer, or can it perform other tasks too, like scanning, copying, and / or Faxing. A multi-function device (MFD) can save your money and space.
Impact against Non-Impact Printers

Impact printers: Creates the image on the page by striking the page through an inked ribbon to make a mark on the paper.

Impact printers are: slow and noisy, print only one color and do not print graphics with a good way.

- Dot matrix printers: work like a typewriter transferring ink from a ribbon to paper with a series or matrix of tiny pins.
Impact against Non-Impact Printers

Dot Matrix Text

System where a child allow us to commercial supplier.

Dot matrix letter ribbon

Print head
Impact against Non-Impact Printers
Impact against Non-Impact Printers

Non-impact printers: This type of printer does not involve actually striking the paper. Instead, it uses ink spray or toner powder.

- Inkjet
- Laser
- Thermal

Advantages: Quiet and can handle graphics and often a wider variety of fonts than impact printers.

Disadvantages: These are more expensive than impact printers.
Inkjet Printer

**Ink jet printers**: work like dot matrix printers but a stream of liquid ink onto the page through a stream of ink from a cartridge (very small nozzles (ink jets)) directly onto the paper to form characters. It consists of separate cartridges filled with liquid ink.

**Advantages**: Quiet, high quality text and graphics, some can do color, cheaper than laser printer.
Inkjet Printer

- Most common printer type
- Quiet during operation, but printing speed is low
- Can produce high resolution graphics
- Ink cartridges are expensive
Laser Printer

Uses powdered toner: It uses the same technology as photocopier using heat to transfer toner onto paper.

Can be color or black-and-white

Initial cost is higher than inkjet

Cost per page of toner is low

Laser Printers are page printers, quiet and faster than other non impact printers.
Laser Printer

- Produces high resolution text and graphics
- Quiet and high printing speed
- Make uses of toner cartridges
# Comparing Printer Types

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<th>Dot Matrix</th>
<th>Inkjet</th>
<th>Laser</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Cost</strong></td>
<td>Medium</td>
<td>Inexpensive</td>
<td>Expensive</td>
</tr>
<tr>
<td><strong>Per-page Cost</strong></td>
<td>Inexpensive</td>
<td>Expensive</td>
<td>Inexpensive</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>Poor</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>Slow</td>
<td>Medium</td>
<td>Fast</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>No</td>
<td>Yes</td>
<td>Some models</td>
</tr>
<tr>
<td><strong>Paper handling</strong></td>
<td>Continuous feed</td>
<td>Single low-capacity tray</td>
<td>Multiple high-capacity trays (some models)</td>
</tr>
<tr>
<td><strong>Suitable for</strong></td>
<td>Multi-part forms, text-only printouts</td>
<td>Photo printing, home use</td>
<td>Business printing, high-volume printing</td>
</tr>
</tbody>
</table>
Specialty Printers

Thermal Printers

- Use special thermal paper
- Commonly used in printing receipts

Receipt printed using thermal paper

Total: 171.60
## Comparison of Printers

<table>
<thead>
<tr>
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<th>Dot-matrix</th>
<th>Inkjet</th>
<th>Laser</th>
<th>Thermal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed</strong></td>
<td>Low to High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Noisy</td>
<td>Quiet</td>
<td>Quiet</td>
<td>Quiet</td>
</tr>
<tr>
<td><strong>Print Quality</strong></td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Running Cost</strong></td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>
Primary storage: memory (RAM) temporary storage. RAM: is known as primary storage.

Secondary storage: retains data after the computer is turned off, include hard disk drives and solid-state drives, CDs and DVDs. (permanent storage)

Evaluations of storage: Storage devices are evaluated in these ways:

- **Capacity**: How much can it hold?
- **Cost**: How much does the storage cost per megabyte or gigabyte?
- **Access speed**: How quickly can the data be written and retrieved?
- **Interface**: How does it connect to the computer, and how fast is that connection?
- **Media type**: Is it magnetic, optical, or solid-state?
- **Portability**: Is the storage inside the system unit, or connected to it externally?
- **Removability**: Is the disk removable from the drive that reads and writes it, or are they one inseparable unit?
Data Storage Basics

**File:** a named collection of bits that work together to represent a single object under a single name.

**Folder:** A logical organizing unit for grouping related files together.

**Subfolder:** a folder within another folder.

Files and folders are stored in **volumes**.

**Volume:** A physical storage device or a portion of one that is assigned an identifying letter such as C: or D:.

**Drive:** A physical storage device, or the mechanical parts that spin a disk so that data can be written and read on it.

**Disk:** A spinning platter that holds data
Files are stored in folders, which are stored in volumes.
HDD: is the most popular type of secondary storage for personal computers. Although newer technologies are emerging, HDDs remain the standard because of their high capacity and low cost.

Read-write heads inside HDD access the stored data. Data is stored in binary form changes between positive and negative magnetic polarity.

Transitions between positive and negative magnetic polarity indicate a 1 bit, and lack transition indicate a 0 bit.
Hard Disk Drives (HDD)

An HDD: consists of a stack of metal platters (usually 4 to 6) that are coated with iron dust.

A set of read/write heads inside HDD casing reads and writes data on the platters; there are heads on each side of each platter.
Hard Disk Drive (HDD) is organized into tracks, cylinders, heads, and sectors.
Hard Disk Drive (HDD) is organized into tracks, cylinders, heads, and sectors.
Optical Drives

optical drives (Compact discs CDs, Digital versatile disc DVDs and Blu-ray disc) use light beam and sensor to read the data. The surface of the blank optical disc is shiny and reflects light strongly. Shiny areas are called land.
Less shiny areas are called pits.
Transitions between areas of greater and lesser reflectivity indicates a 1, and a consistent level of reflectivity indicates a 0.
Types of Optical Drives

Compact Disc (CD): An optical disc used for storing music and data, holding up to 900 MB.

Digital Versatile Disc (DVD): An optical disc used for storing standard-definition movies and data, holding up to 4.17 GB per side per layer.

Blu-ray disc (BD): An optical disc used for storing high definition movies and data, holding up to 128 GB.
Types of Discs

All types of discs (CD, DVD, Blu-ray) can be:
Read-only, write-once (R) , or rewriteable (RW)
Single-sided or double-sided
Single-layer, double-layer
# Types of Discs

<table>
<thead>
<tr>
<th>Disc</th>
<th>Capacity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD-ROM</td>
<td>650 to 900 MB</td>
<td>Read-only, used to distribute commercial music and software</td>
</tr>
<tr>
<td>CD-R</td>
<td>650 to 900 MB</td>
<td>Recordable once, used to burn CDs that will not change</td>
</tr>
<tr>
<td>CD-RW</td>
<td>650 to 900 MB</td>
<td>Rewriteable, used to burn CDs that might need to be changed later</td>
</tr>
<tr>
<td>DVD-ROM</td>
<td>4.7 GB per side and per layer</td>
<td>Read-only, used to distribute standard-definition music and software</td>
</tr>
<tr>
<td>DVD+R</td>
<td>4.7 GB per side and per layer</td>
<td>Recordable once, used to burn DVDs that will not change</td>
</tr>
<tr>
<td>DVD-R</td>
<td>4.7 GB per side and per layer</td>
<td>Two competing standards; most optical drives in computers support both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DVD drives also support CDs.</td>
</tr>
<tr>
<td>DVD+RW</td>
<td>4.7 GB per side and per layer</td>
<td>Rewriteable, used to burn DVDs that might need to be changed later</td>
</tr>
<tr>
<td>DVD-RW</td>
<td>4.7 GB per side and per layer</td>
<td>Two competing standards; most optical drives in computers support both</td>
</tr>
<tr>
<td>Blu-ray (BD)-ROM</td>
<td>25 to 128 GB, depending on number of layers</td>
<td>Read-only, used to distribute commercial high-definition movies</td>
</tr>
<tr>
<td>BD-R</td>
<td>25 to 128 GB depending on number of layers</td>
<td>Recordable once, used to burn BDs that will not change BD drives also support CDs and DVDs</td>
</tr>
<tr>
<td>BD-RW</td>
<td>25 to 128 GB, depending on number of layers</td>
<td>Rewriteable, used to burn BDs that might need to be changed later</td>
</tr>
</tbody>
</table>
Solid-State Drive  Page 93

Solid-state drive (SSD): Uses to store data in tiny transistors.

Solid-state Hard drive (SSHD): A high capacity solid state storage device that substitutes for an HDD as the main storage drive in a computer.

Solid-state drives are: silent because they don’t have any moving parts, and the access time is very fast because there are no read/write heads that have to move anywhere to get data. More expensive than HDDs
## Troubleshooting

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<thead>
<tr>
<th><strong>Problem</strong></th>
<th><strong>Probable Cause</strong></th>
<th><strong>Solution</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Keyboard</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyboard not responsive</td>
<td>Connector not firmly plugged in, or keyboard has failed</td>
<td>Check connectors; try a different keyboard.</td>
</tr>
<tr>
<td>One key is not working</td>
<td>Key is stuck, or debris under key</td>
<td>Turn keyboard upside down and shake it, or use compressed air to blow out the debris under the keys.</td>
</tr>
<tr>
<td><strong>Mouse</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No response from mouse</td>
<td>Connector not firmly plugged in</td>
<td>Check connectors.</td>
</tr>
<tr>
<td>Mouse doesn't move in one direction</td>
<td>Contacts inside mouse are dirty or debris is covering a sensor</td>
<td>Clean the mouse.</td>
</tr>
<tr>
<td>Pointer jumps around erratically on screen</td>
<td>Display adapter is malfunctioning</td>
<td>Restart the computer. If the problem is not resolved, update the display adapter driver.</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No display, no lights on monitor</td>
<td>Monitor is not powered on</td>
<td>Check power cord, press the Power button.</td>
</tr>
<tr>
<td>Monitor has amber light on front, and no display</td>
<td>Monitor is not getting a signal from the computer</td>
<td>Check connector, and make sure computer is on.</td>
</tr>
<tr>
<td>Display shows a green, blue, or red overall tint</td>
<td>Monitor cable connector is loose</td>
<td>Check connector.</td>
</tr>
<tr>
<td>Display is garbled or distorted</td>
<td>Display adapter driver is corrupted</td>
<td>Download a new copy of the driver and reinstall.</td>
</tr>
<tr>
<td>Some graphics don't appear correctly in certain games</td>
<td>Display adapter driver's current version is not compatible with the game</td>
<td>Download an updated version of the driver and reinstall.</td>
</tr>
</tbody>
</table>
## Troubleshooting

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<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Solution</th>
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</thead>
<tbody>
<tr>
<td><strong>Printer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical stripes, missing or wrong colors on inkjet printout</td>
<td>Inkjets are clogged</td>
<td>Run printer’s cleaning utility (check printer documentation to find out how).</td>
</tr>
<tr>
<td>One edge of printout from a laser printer appears dirty, or stray toner overall on page</td>
<td>Loose toner inside printer</td>
<td>Clean printer thoroughly, following procedures in printer documentation.</td>
</tr>
<tr>
<td>Printing appears light or faded</td>
<td>Low toner</td>
<td>Shake toner cartridge from side to side to distribute remaining toner. Replace cartridge when possible.</td>
</tr>
<tr>
<td>Smudged ink on inkjet printout</td>
<td>Page is still wet</td>
<td>Let page dry before handling it.</td>
</tr>
<tr>
<td>Loose toner on laser printout</td>
<td>Fuser isn’t working</td>
<td>Have printer serviced.</td>
</tr>
<tr>
<td>Blank pages from laser printer</td>
<td>Out of toner, or printer is malfunctioning</td>
<td>Replace toner cartridge; if that doesn’t work, have printer serviced.</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No sound from speakers</td>
<td>Speakers are not plugged in, or volume is muted or turned down</td>
<td>Check volume control in the operating system, check connection to speakers.</td>
</tr>
<tr>
<td>Inadequate volume level</td>
<td>Speakers are not being powered, or main volume is turned down too low in operating system</td>
<td>Check speaker power source. Check volume control in operating system; there may be a mixer utility with separate controls for main (overall) volume and individual types of sounds, such as system sounds and music playback.</td>
</tr>
<tr>
<td>Operating system does not show any audio adapter installed (for example, no volume controls available)</td>
<td>Audio adapter driver is corrupted or audio adapter is failed</td>
<td>Restart the computer.</td>
</tr>
<tr>
<td>Sound is garbled or crackles</td>
<td>Audio adapter is malfunctioning, or speakers are damaged</td>
<td>Restart the computer. If problem persists, try replacing speakers, or have computer serviced.</td>
</tr>
</tbody>
</table>
# Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard disk drive</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard disk drive not recognized by computer</td>
<td>Drive has failed, or connector has come loose</td>
<td>Check cable connectors between computer and drive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check BIOS Setup program to see if BIOS recognizes the drive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have computer serviced to replace drive and recover data if possible.</td>
</tr>
<tr>
<td>Read or write errors reported by operating system</td>
<td>Physical bad spots on the disk surface</td>
<td>Run a disk scanning program such as Check Disk in Windows 7.</td>
</tr>
<tr>
<td>Hard disk makes read/write noises almost continuously, even when you are not working with any files</td>
<td>There is not enough RAM in the computer, so the hard disk is being used for virtual memory</td>
<td>Install more RAM in the computer if possible.</td>
</tr>
</tbody>
</table>

| **Optical discs**                            |                                                                               |                                                                          |
| Read errors                                  | The disc is dirty or scratched                                                | Clean the disc with a soft cloth. Use a scratch repair kit or service if the disc contains important data that needs to be recovered. |
| Disk won't eject using Eject button on computer or drive | Button may be malfunctioning                                                  | Open a file management window in the OS, right-click the drive, and choose Eject. Restart the computer. On some desktop optical drives that use a tray, there is a small hole in the front panel; straighten a paperclip wire and stick it in the hole to manually eject the tray. |
| Errors when writing to a disk                | The recording speed is too high for the drive to handle, or other operations may be interfering with the CPU's attention to the writing process. | Try recording at a slower speed; do not use the computer for anything else while the recording is taking place. |
active matrix
direct thermal printer
fuser
aspect ratio
direct-attached storage
hard copy
audio adapter
direct-attached storage
(DAS)
bar code reader
hard disk drive (HDD)
Blu-ray disc (BD)
high-definition
charge-coupled device
multimedia interface
cathode ray tube (CRT)
(HDMI)
cloud
digitization
cloud storage
direct thermal printer
cluster
hard copy
charge-coupled device
digital camera
hard disk drive (HDD)
color depth
high-definition TV
compact disc (CD)
digital camera
compact disc (CD)
digitize
digital projector
direct attached storage
digital versatile disc
dash
(DVD)
digitize
display adapter
impact printer
digital video camera
display screen
inkjet printer
digital whiteboard
dithering
drawing tablet
drawing tablet
document feeder
drawing tablet
dot matrix
draw
duplexing
drive
drum
duplexing
drum
input device
drawing tablet
disk
drive
insertion point
disk
dispersing
drums
drawing tablet
drum
drawing tablet
drum
joystick
digitize
liquid crystal display
joystick
magnetic card reader
LCD
lumens
magnetic ink character
recognition (MICR)
magnetic card reader
Cathode Ray Tube (CRT)
maximum resolution
charge-coupled device
cluster
mechanical mouse
charge-coupled device
downstream point
e-paper
flatbed scanner
file
file
folder
folder
frame
frame

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<th>Term</th>
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<td>mouse</td>
<td>chip</td>
<td>thermal wax transfer printer</td>
</tr>
<tr>
<td>multi-function device</td>
<td>read/write head</td>
<td>thin-film transistor (TFT)</td>
</tr>
<tr>
<td>NAS appliance</td>
<td>redundant array of inexpensive disks (RAID)</td>
<td>toner</td>
</tr>
<tr>
<td>network-attached storage (NAS)</td>
<td>refresh rate</td>
<td>touch screen</td>
</tr>
<tr>
<td>non-impact printer</td>
<td>resolution</td>
<td>touchpad</td>
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<tr>
<td>optical drive</td>
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<td>track</td>
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<tr>
<td>optical mark recognition (OMR)</td>
<td>sector</td>
<td>trackball</td>
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<tr>
<td>optical mouse</td>
<td>solid-state hard drive (SSHD)</td>
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</tr>
<tr>
<td>organic light-emitting diode (OLED)</td>
<td>speech recognition software</td>
<td>triad</td>
</tr>
<tr>
<td>passive matrix</td>
<td>storage-area network (SAN)</td>
<td>Universal Product Code (UPC)</td>
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<td>pixel</td>
<td>striping</td>
<td>virtual keyboard</td>
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<td>stylus</td>
<td>voice recognition software</td>
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<td>volume</td>
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<td>thermal dye transfer printer</td>
<td>webcam</td>
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<tr>
<td>QR code</td>
<td>thermal printer</td>
<td>wireless keyboard</td>
</tr>
<tr>
<td>QWERTY</td>
<td></td>
<td>wireless mouse</td>
</tr>
<tr>
<td>radio frequency identification (RFID)</td>
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QUIZ 1

1. Information system is ...........
2- Parts of an information system are ......, ........., .........., ........,
QUIZ 1

1. Information system is ...........

2- Parts of an information system are ......, ........ , ........ , ........, ........
QUIZ 1

1. Define the information processing cycle.
2. Types of networks are ...., ........
QUIZ 1

1. Define the information processing cycle.
2- Each CPU includes the following components
......, .......... , .........