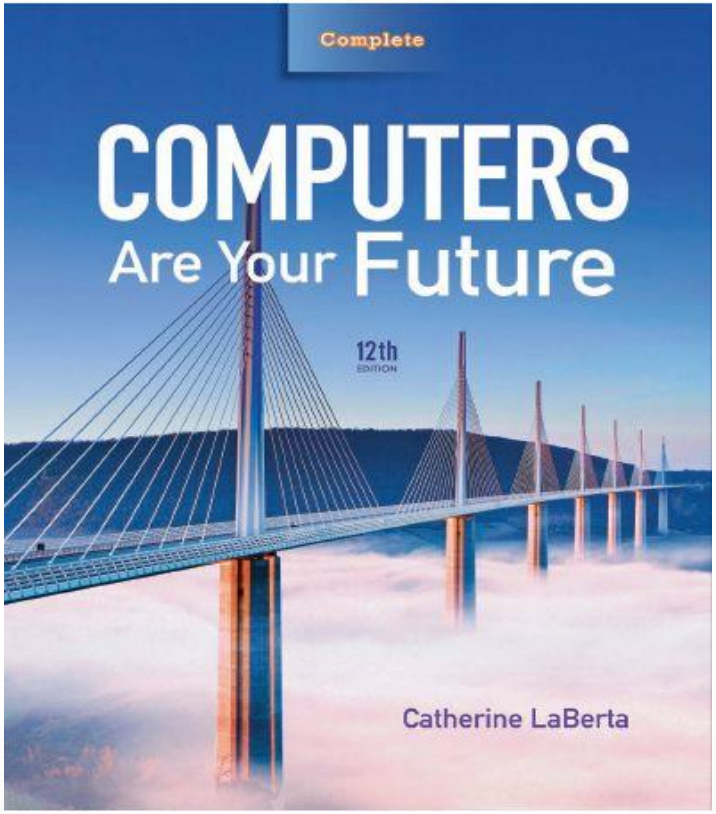
Computers Are Your Future

Twelfth Edition

Chapter 3: Input/Output and Storage



Input Devices: Giving Commands

- **Input**
  - Data or instructions entered into a computer
- **Input device**
  - Hardware that gives users the ability to enter data and instructions into the computer's random access memory (RAM)

Input Devices: Giving Commands

- **Input device (cont.)**
  - **Keyboard**
    - Most common input device—enables data and instruction entry through the use of a variety of keys
  - **Enhanced keyboards**—additional keys, such as media control buttons to adjust speaker volume, or Internet control buttons that open e-mail, a browser, or a search window with a single keystroke

Input Devices: Giving Commands

Input Devices: Giving Commands

- **Key matrix**
  - Grid of circuits located under the keys
- **Character map**
  - Chart that tells the processor what key has been pressed

Input Devices: Giving Commands

- **Keyboards**
  - Connect with:
    - PS/2 cable
    - Universal Serial Bus (USB) connector
    - Infrared
    - Radio frequency
    - Bluetooth
- **Wireless keyboards**
  - Connect to the computer through infrared (IR), radio frequency (RF), or Bluetooth connections

Input Devices: Giving Commands

On-screen intelligent keyboard

Mini-keyboard

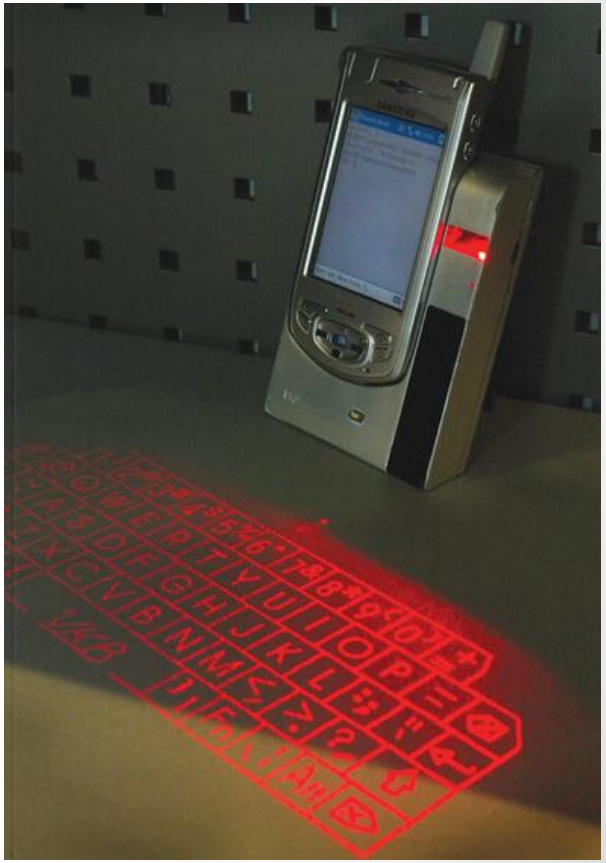
Keypad

Input Devices: Giving Commands

- **Alternate keyboards**
  - **Soft keyboard (on-screen keyboard)**—a touch-sensitive screen; accepts input with a stylus or finger
  - **Smartphone**
    - **Mini-keyboard**—keys for each letter of the alphabet; option on many smartphones
    - **Keypad**—smaller, more compact, has keys that represent multiple letters

Input Devices: Giving Commands

- **Alternate keyboards**
  - **Virtual laser**—used with devices as smartphones, generates an image of a full-sized keyboard onto almost any surface.
  - **Flexible keyboards**—full-sized, lightweight portable devices



Input Devices: Giving Commands

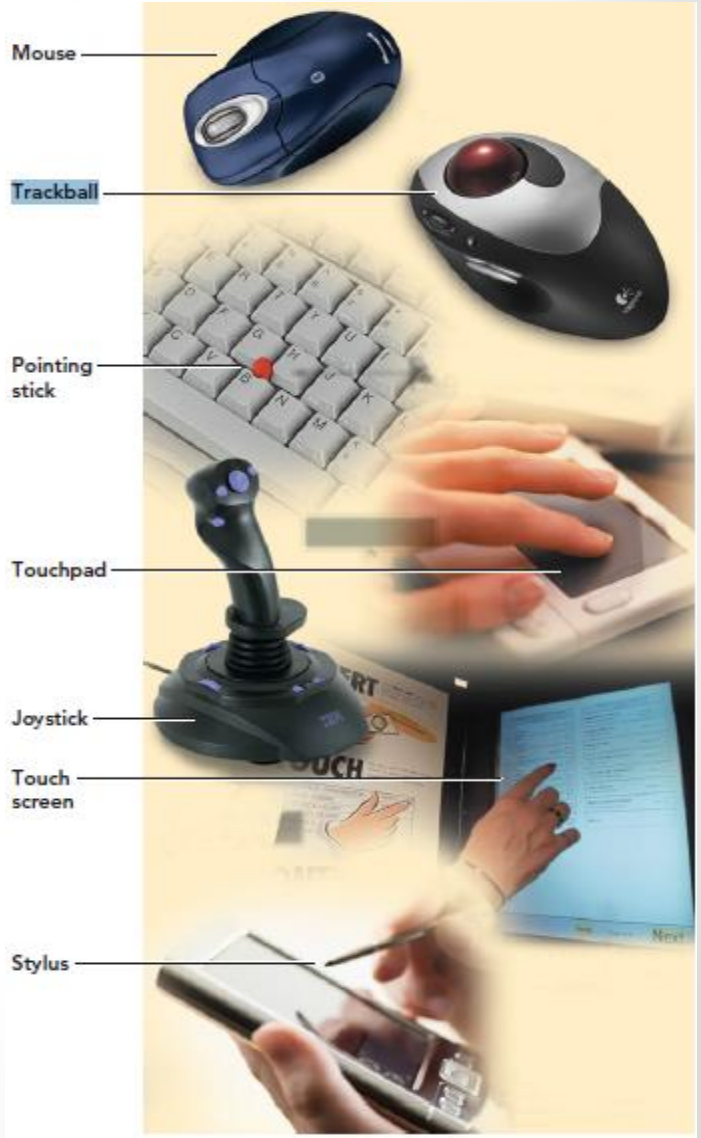
- **Pointing device**
  - Controls an on-screen pointer's movements
- **Pointer**
  - On-screen symbol that signifies the command, input, or possible response

Input Devices: Giving Commands

- **Mice**
  - **Optical**—most popular pointing device
  - **Travel**—all the capabilities of a normal mouse, half the size
  - **Wheel**—has a wheel for easy vertical scrolling
  - **Wireless**—connects through an infrared or radio signal (RF)
  - **Air—**does not need to work on a surface, works as it moves through the air

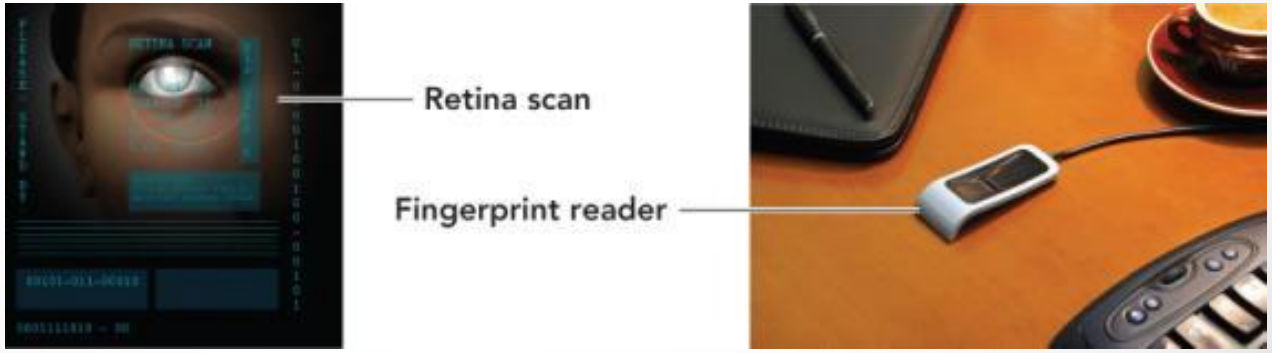
Input Devices: Giving Commands

- **Mice alternatives**
  - Trackball
  - Pointing stick
  - Touchpad (trackpad)
  - Joystick
  - Stylus
  - Touch screen



Input Devices: Giving Commands

- **Alternative input devices include:**
  - Microphones for speech or voice recognition
  - Scanner
  - Bar code reader
  - Biometric input device
  - Digital cameras
  - Webcams



Output Devices: Engaging Our Senses

- **Output devices**
  - Enable users to see, hear, or feel the end result of processing operations
  - The two most popular output devices
    - **Monitors** (also called displays)
    - **Printers**

Output Devices: Engaging Our Senses

- **Monitors**
  - Display a temporary copy (**soft copy**) of processed data
  - Types of monitors include:
    - **Cathode-Ray Tube (CRT)**
    - **Liquid Crystal Display (LCD)**

Output Devices: Engaging Our Senses

- **Monitors (cont.)**
  - **CRT** displays:
    - Legacy technology
    - Very bulky -Usually connected to older desktop computers
  - **LCD** (**flat-panel**) displays:
    - Are used with newer desktops and notebooks
    - Have a thin profile

Output Devices: Engaging Our Senses

- **Monitors (cont.)**
  - Size is diagonal measurement
  - Quoted size—the size of the screen
  - Viewable area—the area unobstructed by the housing
  - Both must be disclosed by the manufacturer.

Output Devices: Engaging Our Senses

- **Resolution**
  - Refers to the sharpness of an image
  - Number of pixels (picture elements) controls the resolution
  - The higher the better
  - **Video Graphics Array (VGA)**—lowest resolution standard (640 × 480)
  - **Extended Graphics Array (XGA)**—most used by computers today (1024 × 768)

    1,024 distinct dots on each of 768 lines

Output Devices: Engaging Our Senses

- **Printers**
  - Supply a **hard copy** of output displayed on a computer's monitor
  - Types include:
    - Dot-matrix
    - Inkjet
    - Laser
    - Photo
    - Plotters

Output Devices: Engaging Our Senses

- **Printers (cont.)**
  - **Dot-matrix** (impact)
    - Older, less popular
    - Used mostly for printing multipart forms (invoices) and backup copies
    - Advantages
      - Able to print 3,000 lines per minute
    - Disadvantages
      - Poor print quality
      - Noisy

Output Devices: Engaging Our Senses

- **Printers (cont.)**
  - **Inkjet** (nonimpact)
    - Popular with home users
    - Provide excellent images—made up of small dots
    - Advantages:
      - Inexpensive
      - Generate professional color output
    - Disadvantages:
      - Relatively slow

Output Devices: Engaging Our Senses

- **Printers (cont.)**
  - **Laser** (nonimpact)
    - Use electrostatic reproductive technology to produce high-quality output
    - Advantages:
      - High-resolution
      - Print faster than inkjet printers
      - Black-and-white printing costs less per page than inkjet printing
    - Disadvantages
      - Color laser printers more expensive

Output Devices: Engaging Our Senses

- **Printers (cont.)**
  - **Photo**
    - Uses special ink and paper
    - Often are inkjet printers
    - Prints directly from a digital camera or memory card
  - **Plotters**
    - Produce images through moving ink pens
    - Used for making oversized prints (i.e., maps, charts)

Output Devices: Engaging Our Senses

- **Other output devices include:**
  - Speakers
  - LCD projectors

Storage: Holding Data for Future Use

- **Storage**
  - Process of saving software and data
  - Also called **mass storage, auxiliary storage**, or **secondary storage**

Storage: Holding Data for Future Use

- **Storage devices**
  - Hardware that contains the tools to place data on the **recording media**
  - **Recording media**—hold data
    - Floppy disks
    - Hard disks
    - Flash memory
    - CDs and DVDs

Storage: Holding Data for Future Use

Hard drive with enclosure opened

Flash memory card in reader

USB drive

DVD

Storage: Holding Data for Future Use

- **Memory (RAM) versus storage**
  - Storage devices retain data even if power is turned off
  - Data stored in memory (RAM) will be lost
  - Storage devices are less expensive than memory

		Access Speed	Cost per MB	Storage Capacity
Memory	Cache memory	Fastest	Highest	2 MB
	RAM	Fast	High	4 GB
Storage	Hard disk	Medium	Medium	1 TB
	CD-R disc	Slow	Low	700 MB

Storage: Holding Data for Future Use

- **Memory (RAM)**
  - Primary memory
  - Temporary holding area for items in use
  - Primary storage
- **Storage devices**
  - Required during the computer system's start-up operations
  - Used for saving data
  - Secondary storage

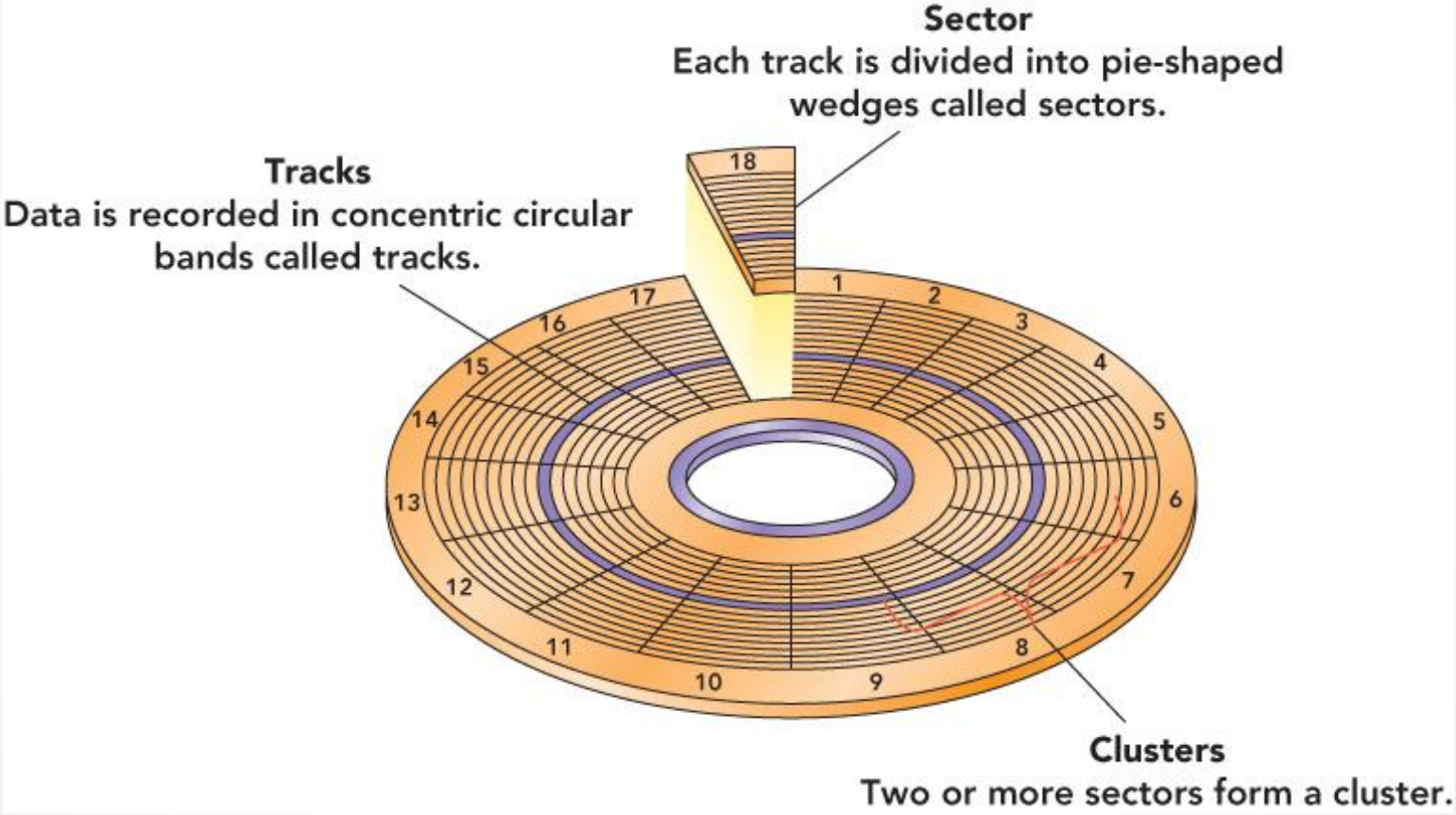
Storage: Holding Data for Future Use

- **Hard disk drive (hard drive)**
  - Most important storage device
  - High-capacity, high-speed device
  - Considered **secondary storage** (**fixed storage**), compared with memory/RAM, which is categorized as primary storage
  - **Random access storage devices**—permit direct retrieval of desired data
  - **Magnetic storage** —contain a coating of magnetic material used for data storage

Storage: Holding Data for Future Use

- **Platters**—rapidly rotating disks on which programs, data, and processed results are stored
- **Tracks**—concentric bands on which data is recorded
  - Are divided into **sectors**
  - Two or more sectors form a **cluster**.
- To communicate with the CPU, hard disks require a **hard disk controller**.

Storage: Holding Data for Future Use



Storage: Holding Data for Future Use

- The computer's operating system stores a file's name and its location on the disk in a table
- This table contains the name of each file and the file's exact location on the disk
- The current system for Windows 7 is known as **New Technology File System (NTFS)**

Storage: Holding Data for Future Use

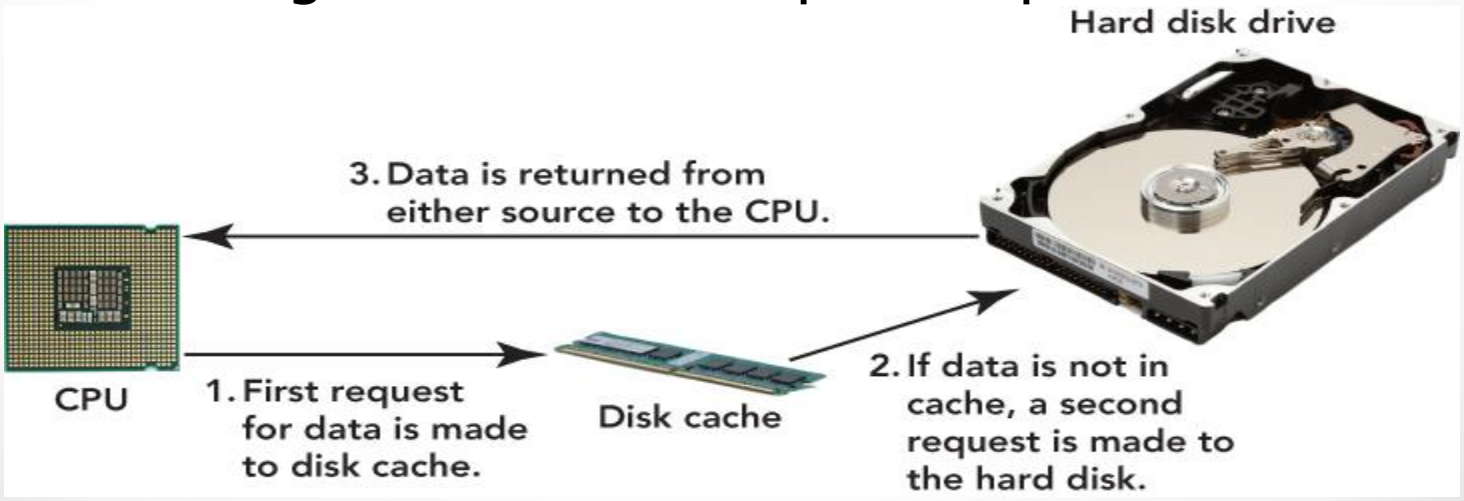
- **Partitions**
  - Portion of a hard disk set aside as if it were a physically separate disk
  - Can be used to house different operating systems
  - Allows users to use programs developed for different systems

Storage: Holding Data for Future Use

- **Hard disk performance**
  - **Positioning performance**—how quickly the read/write head can get into position to transfer data
  - **Transfer performance**—how quickly the transfer is made from the disk to RAM
  - Affected by **bad sectors**—damaged portions of the disk that cannot reliably hold data

Storage: Holding Data for Future Use

- **Hard disk performance (cont.)**
  - **Disk cache**—type of cache memory
    - Type of RAM usually incorporated on the circuit board within the hard drive case
    - CPU looks here first before the hard disk
    - Using the disk cache speeds up data retrieval



Storage: Holding Data for Future Use

- **Flash drive** (**Solid-State Drive (SSD)**)
  - Storage devices that use solid-state circuitry; have no moving parts
  - Increasing in use

- **Flash memory**
  - **Nonvolatile** electronic memory stored in **blocks** on a chip
  - Limited to 100,000 write cycles (information can be written and erased 100,000 times to each block)

Storage: Holding Data for Future Use

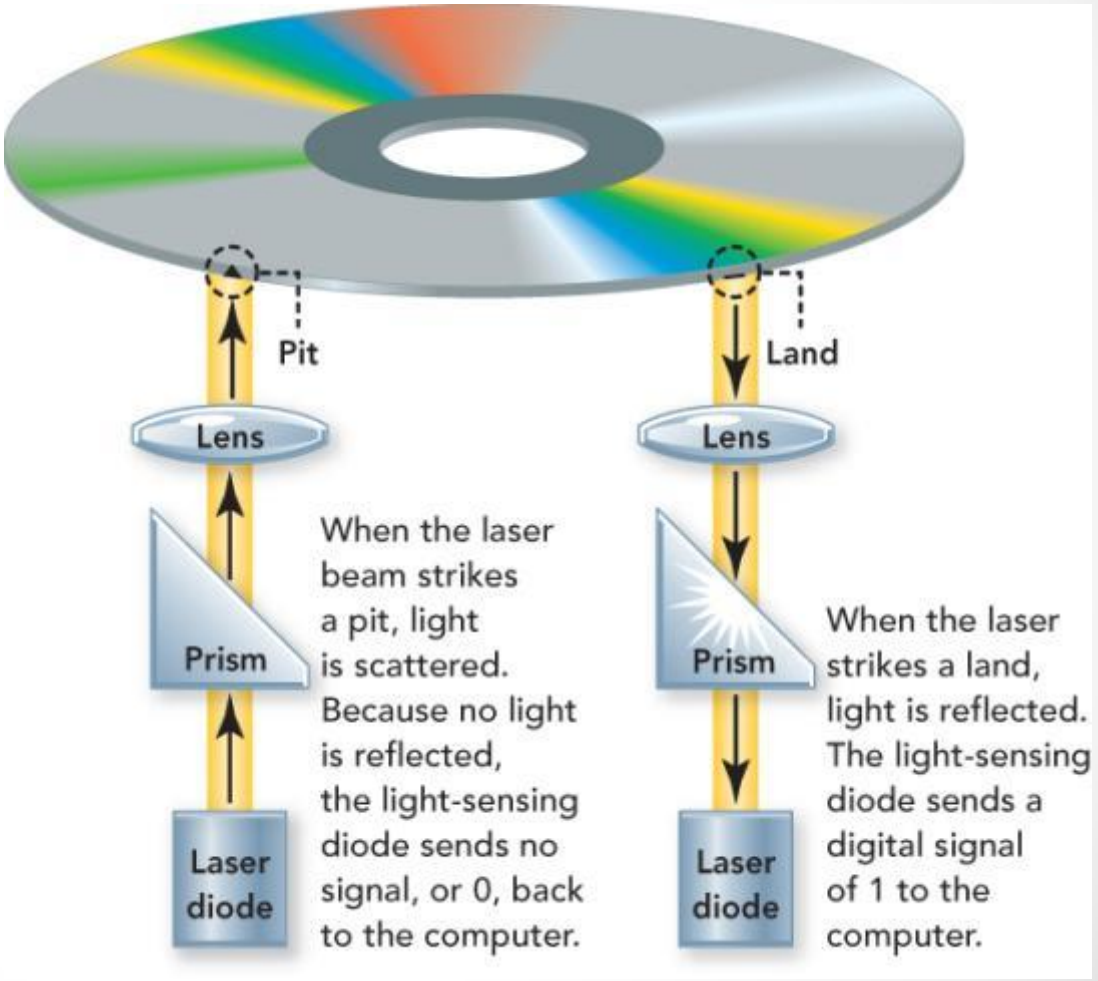
- **USB flash drives (memory stick, thumb drive, jump drive)**
  - Popular **portable** or **removable storage devices**
  - Replace legacy technology of floppy disks
  - Do not require a device driver
  - Should be removed only when not actively in use

Storage: Holding Data for Future Use

- **Compact Disc (CD) and Digital Video Disc (DVD) drives**
  - **Optical** storage devices
  - Use laser beams to store data through:
    - **Pits**, the indentations, a binary 0
    - **Lands**, the flat reflective areas, a binary 1

- **CD-ROM** or **DVD-ROM (Read-Only Memory)**
  - Data can be read, not altered
  - Most popular, least expensive
  - Music CDs

Storage: Holding Data for Future Use



Storage: Holding Data for Future Use

Additional types of optical storage

- CD-R (CD-recordable)
- CD-RW (CD-rewritable)
- DVD+R (DVD recordable plus)
- DVD-R (DVD recordable dash)
- DVD+RW (DVD rewritable plus)
- DVD-RW (DVD rewritable dash)

Storage: Holding Data for Future Use

- **R:** disc is recordable.
- **-R:** single session media (being a CD/DVD). You cannot add more data to the disc once the burning has locked it.
- **+R:** multi-sessions. You can add data to the disc in sessions (over a period of time).
- **RW:** rewritable. Data can be erased and rewritten.

Storage: Holding Data for Future Use

- Blu-ray Disc (BD) Format
  - Enables recording, rewriting, and playing back of high-definition video (HD), as well as storing large amounts of data.
  - The format offers more than **five times** the storage capacity of traditional DVDs.
    - BD-ROM (Blu-ray Disc read only)
    - BD-R (BD recordable)
    - BD-RE (BD rewritable)

Storage: Holding Data for Future Use

- **Protect your discs**
  - Do not expose discs to excessive heat or sunlight.
  - Do not touch the underside of the disc—hold the edges.
  - Do not write on the label side of the disc with a hard implement.
  - Do not stack discs to avoid scratches.
  - Store discs in cases when not in use.

Storage: Holding Data for Future Use

- **ExpressCard**
  - Notebook accessory—size of a credit card
  - Can be used as a modem, as an extra memory, or as a network adapter

Storage: Holding Data for Future Use

- **Flash memory cards**
  - Solid-state storage device
  - Used with MP3 players, smartphones, digital cameras
- **Flash memory reader**
  - Slot that allows access to files stored on the card

Storage: Holding Data for Future Use

- **Smart card/chip card/ Integrated Circuit Card (ICC)**
  - Combines flash memory with a small microprocessor
  - Stores and processes information
  - **Digital cash system**—smart card application enables users to purchase a prepaid amount of electronically stored money

Storage: Holding Data for Future Use

- **Backup**
  - Copy of programs, data, and information created in one secondary storage medium duplicated to another
  - **Secondary storage devices,** such as USB drives and portable (external) hard drives, can be damaged or "lost."
  - Prevents permanent loss of programs, data, and information
  - Keep on a regular schedule

Exercises

- Differentiate between:
  - Positioning and transfer performance.
  - Primary and secondary storage.
  - CRT and LCD displays.
  - Inkjet and laser printers.
- Sort ascendingly according to access speed: HD, CD-R, RAM, cache memory.

Exercise: Match

Answer	Column A		Column B	
E	1.	Character Map	A.	Grid of circuits located under the keys
F	2.	Partitions	B.	On-screen symbol that signifies the command, input, or possible response
A	3.	Key matrix	C.	Generates an image of a full-sized keyboard onto almost any surface
B	4.	Pointer	D.	Rapidly rotating disks on which programs, data, and processed results are stored
G	5.	Resolution	E.	Chart that tells the processor what key has been pressed
D	6.	Platters	F.	Portion of a hard disk set aside as if it were a physically separate disk
C	7.	Virtual Laser	G.	Number of pixels which controls sharpness of image

Exercise: Complete

1. Optical storage devices use laser beams to store data through ---------- and ----------.
2. Upon data request, CPU looks in ---------- first before the hard disk.
3. ---------- printers are used mostly for printing multipart forms and backup copies.
4. ---------- are storage devices that use solid-state circuitry, which have no moving parts.
5. ---------- is a notebook accessory which can be used as a modem, as an extra memory, or as a network adapter.
6. Damaged portions of the disk that cannot reliably hold data are called ---------- .
7. A ---------- is a storage device that do not require a device driver.

Exercise: True/False

1. Dot matrix printer is mainly used for making oversized prints (i.e., maps, charts). ✗
2. BD format offers more than five times the storage capacity of traditional DVDs. √
3. Backup is to copy programs, data, and information created in one secondary storage medium to another medium. √
4. CD-ROM is a popular, inexpensive media that enables recording and erasing data. ✗
5. Using the disk cache slows down data retrieval because of extra disk cache check. ✗

Thank you