COMPUTER SYSTEM

3.Processing hardware

Basic components of a CPU

- ***CPU is said to be the brains of any computer system. It provides all the timing and control signals necessary to transfer data from one point to another in the system.*** It has the following components.

  - **ARITHMETIC LOGIC UNIT (ALU)**
    - Performs logical operations like comparisons of figures
    - Performs basic arithmetic calculations

    -Arithmetic operations are performed using binary number system

    - The ALU of the CPU is the place, where the actual execution of the instruction of the place, during the data processing operation.

Basic components of a CPU

- **CONTROL UNIT (CU)**
  - Controls all the functions inside the computer.
  - The control unit of the CPU selects and interprets program instruction, and then sees that they are executed.
  - Instructs the ALU on which arithmetic and logical operations to be performed
  - Acts under the direction of the system clock and sorts out all internal data paths inside the computer to make sure that data gets from the right place and goes to the right place.

- ***REGISTERS***
  - ***Registers are devices for storing data.***
  - Storage location (special memory units used to hold info. On a temporary basis, and are part of the CPU, not main memory).

MEMORY

PRIMARY MEMORY

- **Primary storage** or **memory**: Is where the data and program that are currently in operation or being accessed are stored during use.
  - Consists of electronic circuits: Extremely fast and expensive.
  - Two types:
    - **RAM** (non-permanent)
      - Programs and data can be stored here for the computer's use.
      - Volatile: All information will be lost once the **computer** shuts down.
    - **ROM** (permanent)
      - Contents do not change.
      - System software stored in it like os for booting computer

MEMORY(ROM)

- Memory stores groups of bits called words
- The number of bits in each word is called the word length,
- and can range from 16 to 64 bits, typically.
- Many different types, based on the application:
  - ROM (Read-Only Memory)
    - contents of memory are fixed; cannot be reprogrammed.
- – EPROM (Erasable Programmable ROM)
  - erased using ultra-violet light, through small window in chip.
  - needs high voltage to be programmed.
- – EEPROM (Electrically Erasable Programmable ROM)
  - no ultra-violet light needed.
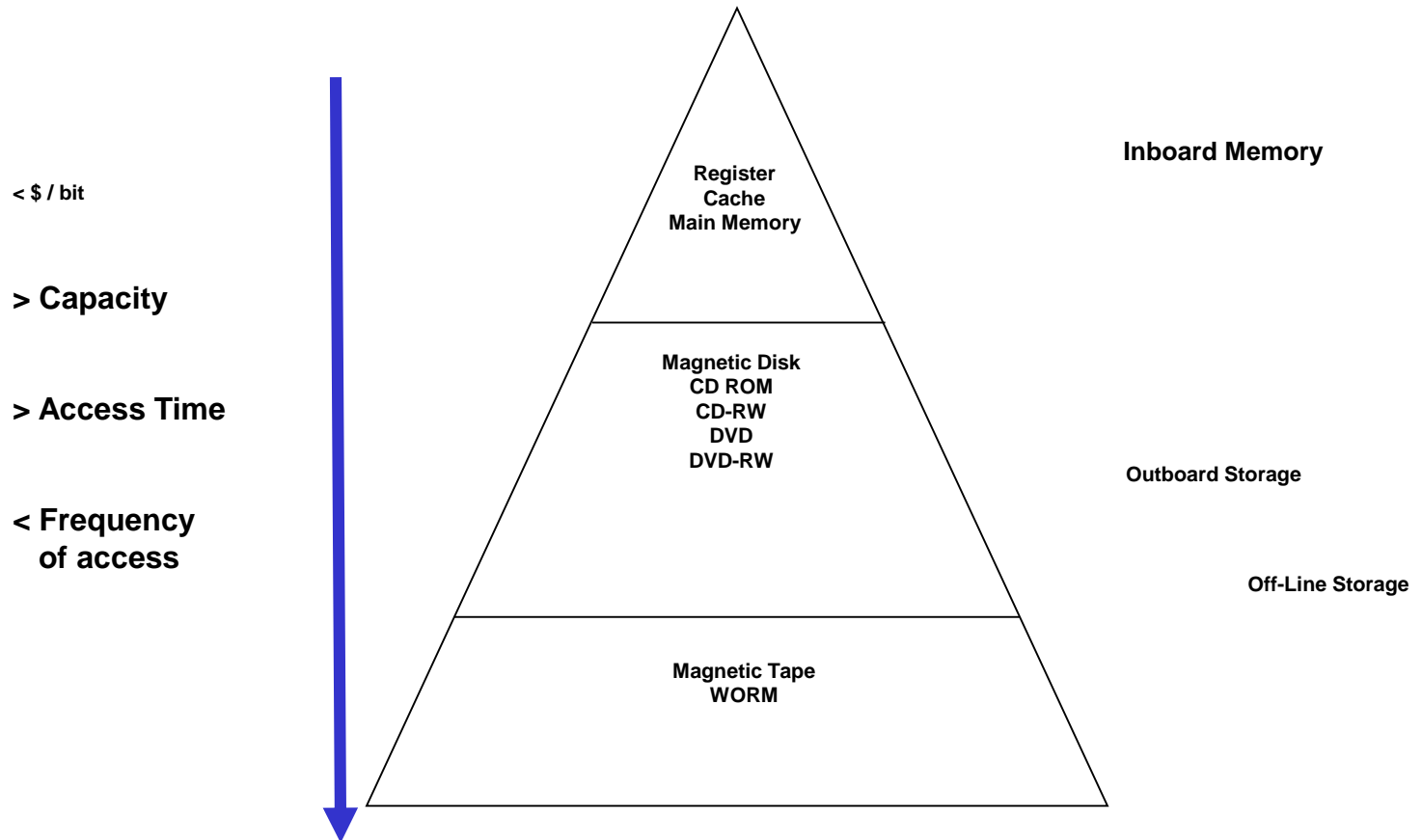- – Flash Memory
  - a special type of EEPROM.

MEMORY -RAM

- RAM (Random Access Memory)
  - memory used in programming to store data and methods.
- As opposed to ROMs, RAM loses its contents when the system is powered off.
- Types of RAM
  - SRAM (Static RAM)
    - Fast memory, but requires 5 or 6 transistors per bit to perform a read or write operation.
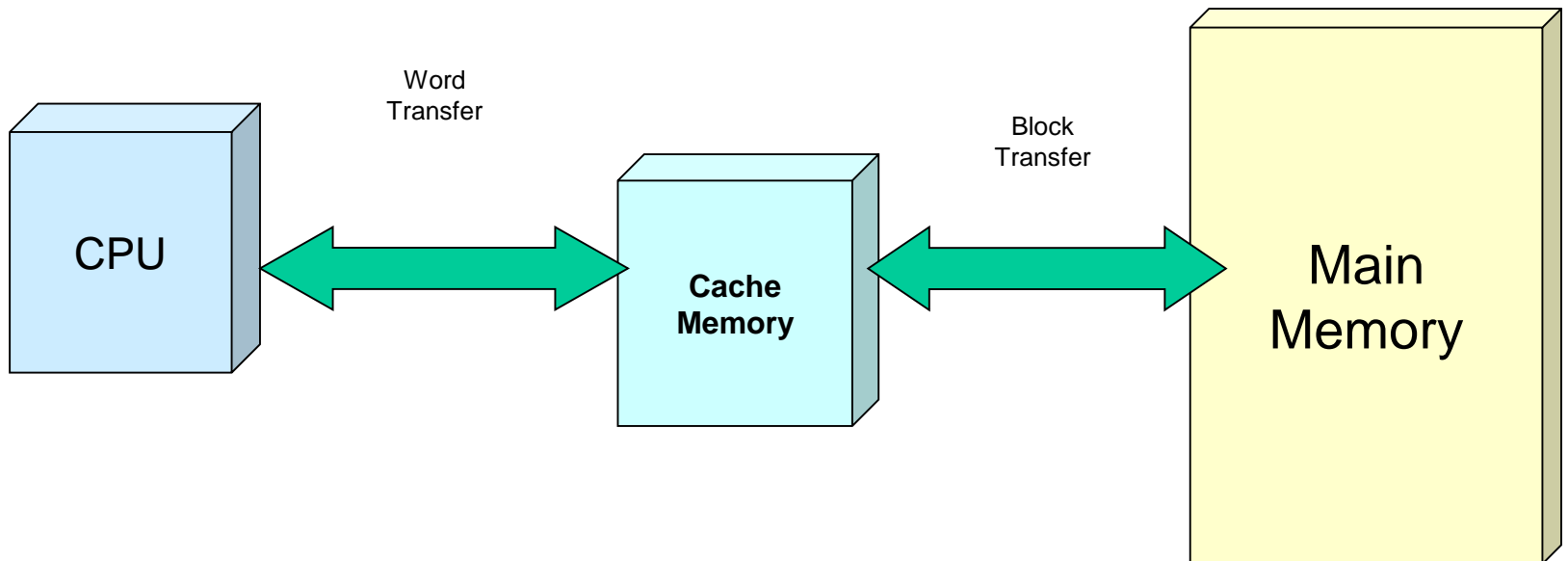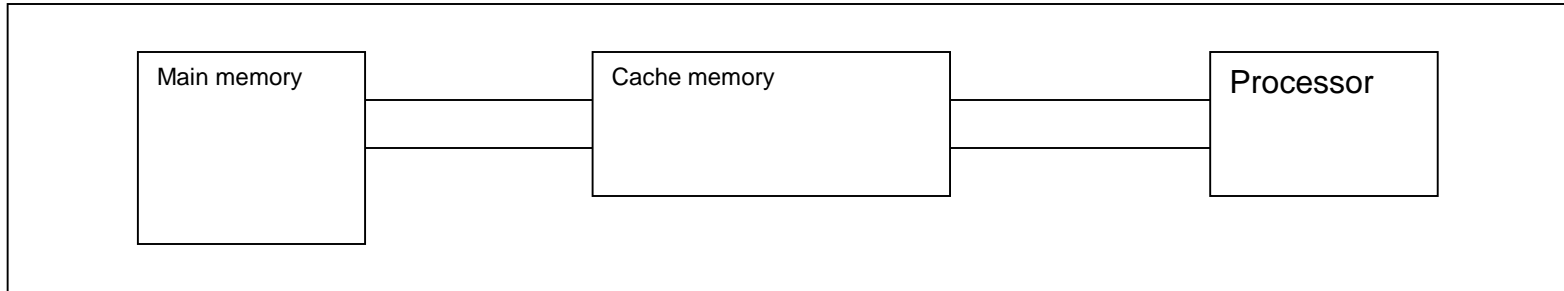 - used for cache memory.

Types of RAM cont…..

- – DRAM (Dynamic RAM)
  - relatively slow, but only requires one transistor per bit to perform an operation.
- – used for computers' main memory
- – can be "leaky" ⬚ requires refresh circuitry.
- – VRAM (Video RAM)
  - – stores contents of current screen display.
  - – read and write from CPU.
  - – output to video display.

Memory Hierarchy

< $ / bit

> Capacity

> Access Time

< Frequency of access

Register
Cache
Main Memory

Magnetic Disk
CD ROM
CD-RW
DVD
DVD-RW

Magnetic Tape
WORM

Inboard Memory

Outboard Storage

Off-Line Storage

MEMORY

Main memory	Cache memory	Processor

Word
Transfer

Block
Transfer

CPU ⟷ **Cache Memory** ⟷ Main Memory

CPU Performance

- CPU performance/speed is influenced by several factors such as clock rate, word size, cache and instruction set size.

- Clock rate A computer contains a system clock that emits pulses to establish the timing for all system operations. The "system clock" is not the same as "real-time clock" that keeps track of the time of day. The system clock sets the speed for data transport and instruction execution.

CPU perfomance

- The clock rate set by the system clock determines the speed at which the computer can execute an instruction. The time to complete an instruction circle is measured in megahertz (MHz).

CPU Perfomance

- Word Size

- This refers to the number of bits the CPU can manipulate at a time. e.g. CPU with 8 - bit word size is referred to as an 8 -bit processor. Today's faster computers use 32 bit or 64 - bit micro processors.

- Cache

- This is a special high-speed memory that give the CPU more rapid access to data.

Cache

- The cache can also be constructed as part of the processor chip e.g. Intel processor versions have a cache of 8196 bytes.

- **_Note._** In many situations, the performances of the processors are limited due to the slow speed of the main memory. A technique used to compensate for the mismatch in operating speeds is to employ an extremely fast, small memory between the CPU and main memory

CPU perfomance

- whose access time is close to the processing speed of the CPU. This type of memory is called a ***high speed buffer or cache memory***

- As you begin a task, the computer anticipates what data the CPU is likely to need and loads or caches this data into the cache area. The CPU then takes the data from cache instead of fetching it from RAM, which takes longer. Therefore more cache means faster processing

CPU Perfomance

- Instruction Set Complexity
- A computer with a complex instruction set is known as a complex instruction set computer (CISC). A computer whose CPU has a reduced instruction set called a reduced instruction set computer (RISC) has a limited set of instruction that it performs very quickly. Therefore RISC machine is more faster than CISC machine for most processing tasks

Questions

- A Student has bought a computer for use at home. The computer had the following peripherals: Monitor, Printer, Keyboard and mouse. It also had the following specifications:
  - 1.8 GHZ, 256MB RAM and 20GB hard disk.
- State the purpose of each Peripheral device named above.
- Give an example of a hard copy and a soft copy Out put device.
- The student also wanted to play games using the computer. State the input device the student can use to play games
- What do the following specifications mean?

    - 1.8 GHZ
    - 256MB RAM
    - 20GB hard disk

4.SECONDARY STORAGE

- Secondary storage (Auxiliary storage –is any storage device designed to retain data and instructions in a relatively permanent form.
- **Advantages of secondary storage**
- *store data permanently (it doesn't disappear when you turn off the power)*
- *Volume/bulky storage/large quantities*
- *Back up to main memory*
- *Portable-used to move data from one comp to another*
- The following are the main forms and elements of secondary storage:-
  - **Magnetic disk.**Diskette (floppy disks) and Hard disk.
  - **Optical disk-**CD ROMS,CD-RW,DVD
  - **Magnetic tape.**Tapes

MAGNETIC DISKS

- All magnetic disks are round platters. They come in different sizes, different types of packaging, and can be made of rigid metal or flexible plastic.
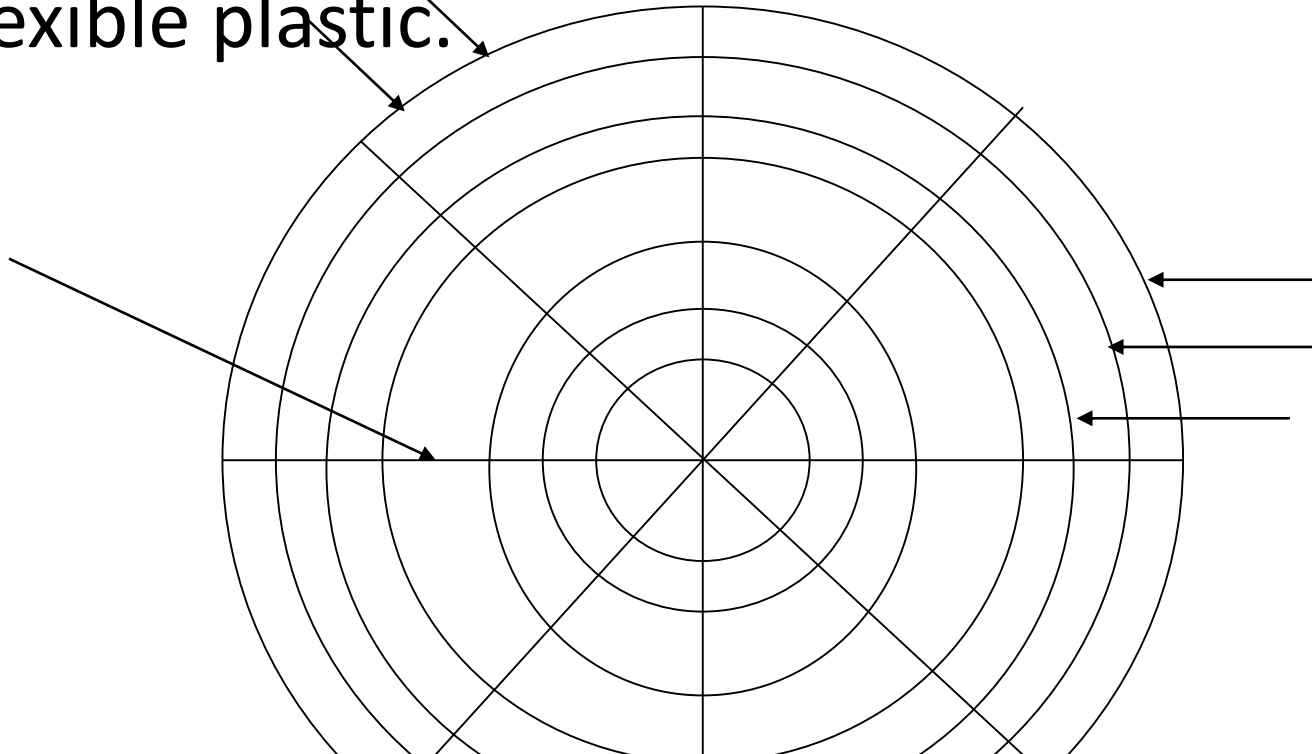
Magnetic disks

- Data is stored on tracks sectors and cylinders

1.Floppy disk (diskettes)

- is a removable disk containing a rotating platter made of some flexible material. It stores data as magnetized spots. Today's standard floppy size is 3.5 inches. The diskette drive on a PC is usually referred to as drive A:, sometimes also as drive B:.

- Distribution of software by vendors. Originally sold software or software updates are often distributed by vendors on floppy disks and Zip disks

Zip &floppy

Zip disks (Iomega): 100 and 250 MB

SuperDisks (Imation): 120 MB

3½" disk: 1.44 MB

2.Hard disks

- A hard disk is usually non-removable. It uses the same basic storage concept as the floppy; the difference is that a hard disk usually has several platters of metal. The hard disk on a PC is usually referred to as drive C:
- They are tightly sealed within an unity to prevent any foreign matt getting inside.
- Several disk may be mounted tog vertical shaft where they rotate at speed of approximately 3500 revolutions per minute.

Hard Disk

There are 2 kinds of hard disk systems:-

1. Removable packs (exchangeable disks)

- Contains 6-20 hard disk of 10 ½" or 14" diameter aligned one above the other in a sealed unit.

2. Winchester disks.

- Are high speed, high capacity disks that are housed in their own cabinet.

- Are not removable or but have greater storage capacity and are more reliable than removable disk.

- For large online storage

3. Optical disks

- is a disk that is written and read by lasers. If you have used music CDs, you are already familiar with optical disks.

- Data are recorded by laser beams rather than by magnetic means.

Optical disk

The following are types of optical disk: -

- **CD ROM** (Compact Disk -Read only memory)
- CD may hold about 650 MB of data and is read only memory
- **The CD-ROM drive on a PC is often referred to as drive D:**
- **WORM** (Write Once Read Many)
- It is a CD format that allows you to write data into a specially manufactured disk that can be read by CD ROM drive. **i.e can be written only once.**

Optical disks

- **CD RW** (Compact disk recordable or rewrite-able)

- It is a CD formats that allows you to write data into a special manufactured disk that can be read by CD ROM drive.can write more than once

Magnetic tape

Magnetic tape

- It is a thin plastic tape coated with a substance that can be magnetized.

- Data are recorded on the tape in the form of tiny invisible magnetized and non-magnetized spots (representing Is and Os) on the coated surface of the tape.

- The tape ribbon is itself stored in reels or a small cartridge or cassetteIt is made from the same material used for audio and videotape.

- It has a plastic base coated with magnetisable material one side .
- Data is stored in tracks, which run the length of the tape.
- Can store up to 2.5GB(Gigabytes) .

ADVANTAGES OF MAGNETIC TAPES.

- Very low in cost
- It is relatively fast storage media.
- It is re-usable i.e. can be overwritten– Its content can be erased to used in storing new information .

- **<u>DISADVANTAGES</u>**
- It can only store information sequentially.
- If its continuously reused the quality of the tape depreciates which also affects the quality of data
- **NOTE**
- Magnetic tape is appropriate for storing large amounts of amounts of data offline.
- Hard disk, floppy disk, zip disk and tape uses magnetic technology/semiconductor

Review question

- Write three differences between magnetic tape and magnetic disks

VIRTUAL STORAGE

- Useful since secondary memory are slow compared to CPU

- Virtual memory management is a flexible and efficient way of managing memory. Processes to be run are held on disk and when a process's turn for CPU time comes around, the operating system transfers the currently running process out of memory to make room for the one. These enables more programs to be run simultaneously than would otherwise be possible.

VIRTUAL STORAGE

- Not all of the process needs to be in memory even when it is running, so only the section of the program containing the instructions currently being executed needs to be copied into main memory. This technique enables a program which is too large to be held in main store all at once to be run as only part of the program needs to be in memory at any particular time. Data is transferred into memory in blocks. These are strategies for data transfer

5.BASIC Communication devices

- Used for electronic transfer of data. Digital communication means that data is transferred as 0s and 1s, while analog communication includes non-digital forms of voice and video. Typical communication devices:

MODEM

- Allows computers to communicate over analog telephone lines:
-A modem translates the digital signals of computer A into analog signals.
-The analog signals travel over telephone lines to another modem at computer B.
-This modem translates the analog signals back to digital ones.
Modem is an acronym for MOdulator-DEModulator.

Network card

- If the signal travels on a digital line, computers can communicate without modems. This is the case for computers that are part of a network like the local area network we have in the computer labs. Note that the Internet is simply a network of networks connected by backbone lines.

NIC

A Network interface card (NIC) is the add-in card that you put in a slot in your desktop system, in a PC Card (PCMCIA) socket in your laptop, or possibly attach through a parallel port.
 The NIC takes the data to be sent, breaks it into packets, transmits it to the destination system, and puts the packets back into the original file or data structure.

Important to note

The lessons have covered the components of modern computer system in earlier diagram