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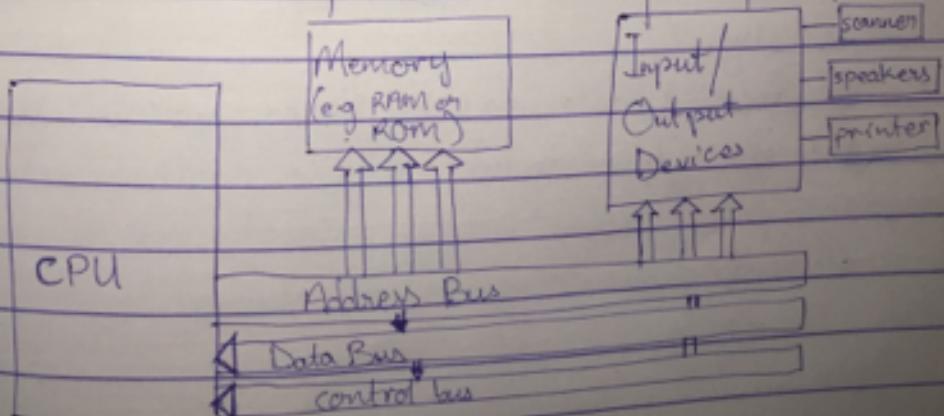


# Gwali notes for *Physical sciences*



# Introduction to Microprocessor Systems

- A computer is an electronic device that accepts data as an input, processes the data with the help of CPU, stores the processed information and brings out the result of the processing as an output.
- All computers consist of basic functional blocks that include the central processing unit (CPU), memory and input/output ports. These functional blocks are connected together with 3 internal buses namely:
  - Data bus, Address bus and Control bus.
- Input and Output devices are connected through the input/output ports.
- A port is a physical interface in a computer through which data are passed to and from peripherals



Block diagram of a computer system

## Basic Parts of CPU (3)

- Register (Memory Unit)
- ALU (Arithmetic and Logic Unit)
- Control Unit (CU)

- Address Bus holds the address of the data stored in the memory.
  - Data bus tells the computer the type of data stored in the memory (whether int, char ... etc) <sup>category</sup>
  - Control bus controls the movement of data in the computer (controls the flow of data).
- Instructions and data are stored in memory in specific locations determined by the program. Each location has a unique address associated with it. Instructions are obtained by the CPU by placing an address in the address bus. Instructions are transferred via the data bus as they are requested by the CPU. The CPU executes instructions sequentially.

Processed data may be stored back in memory or sent to an output device via the data bus.

## Central Processing Unit (CPU)

- the CPU is the "brain" of the computer; it oversees everything that the computer does.
- Another name for the CPU is Microprocessor or Processor
- the CPU is a microprocessor with associated circuit that controls the running of the computer software program. Basically, the CPU fetches each program instruction from memory & executes the instruction. After completing one instruction, the CPU moves on to the next one and in most cases can operate on more than one instruction at the same time.
- This fetch and execute process is repeated until all the instructions in a specific program have been executed.

For example, an application program may require the sum of a series of numbers. The instructions to add the numbers are stored in the form of binary codes that direct the CPU to fetch a series of numbers from memory, add them, and store the ~~long~~ result back in the memory.

NB: bits = (binary + digits) = '0' or '1'



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ASCTT standard

8bits = 1 byte = 1 character

American Standard Code for Information Interchange

$$R = 1010010 = 01010010$$

SIT DOWN

01010011  
01001001

NB: Primary memory = RAM & ROM

### Memory and Storage

- Several types of memories are used in a typical computer system. The RAM stores binary data and programs temporarily during processing (RAM is volatile memory, ROM is non-volatile)
- The RAM is volatile means that information is lost if power is turned off or fails, therefore any data or program that needs to be saved should be moved to non-volatile memory before power is removed
- The ROM stores a permanent system program called BIOS and certain locations of system program in memory. It is non-volatile meaning that it retains its contents when there is power failure. As the name implies, the programs and data in ROM cannot be altered. Sometimes it is referred to as firmware because

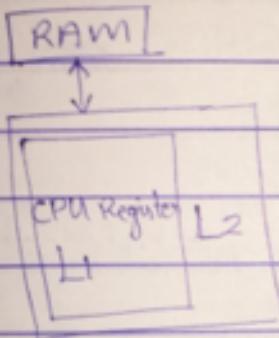
it is a permanent software for a given system. Every device has its own firmware.

## - The Cache Memory

- It is of 2 types:

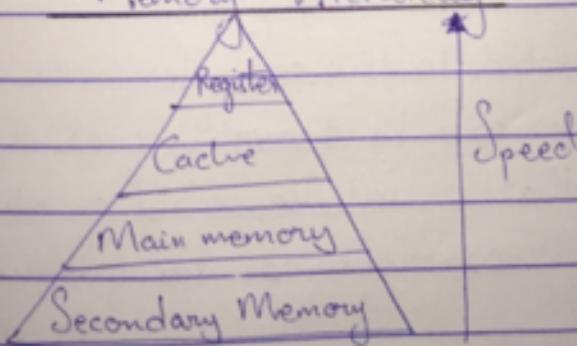
- L1 cache → found in the CPU (Microprocessor)

- L2 cache



- Register is the fastest memory in computer system !

Memory Hierarchy



## Input / Output Ports

Generally, the computer sends data to a peripheral device through an output port and receives its data through input port. Ports can be configured in software to be either an input or output port. The keyboard, mouse, video monitor, printer and other peripherals communicate with computer through individual ports.

Ports are generally classified as either serial ports or parallel ports.

Serial

Parallel



→ carries multiple datalines

→ transmits one dataline

## Buses

Peripherals are connected to the computer ports with standard interface buses. A bus can be thought of as a highway for digital signals that consists of a set of physical connections as well as electrical specifications for the signals.

Example of Serial Bus is USB (Universal Serial Bus) which has essentially become a DeFacto standard.

The most common parallel bus is simply called the Parallel Bus which connects to a port referred to as



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the printer port.

- Another example of a parallel bus for connecting lab instruments to a computer is the General Purpose Interface Bus (GPIB).

The three basic types of internal buses that interconnect the CPU with memory and storage and with input and output ports are:

- Address Bus

- Data Bus

- Control Bus

- The address bus is used by CPU to specify memory locations or addresses and to select ports

- The data bus is used to transfer program instruction and data between the CPU, <sup>memories</sup> and ports

- The control bus is used for transferring control signals to and from the CPU