PF-FALL-2022

Lecture-2 outline (25th August 2022)

Lecture No.2

Topic 1: Von Neumann Architecture

Concept: Architecture of modern Computers

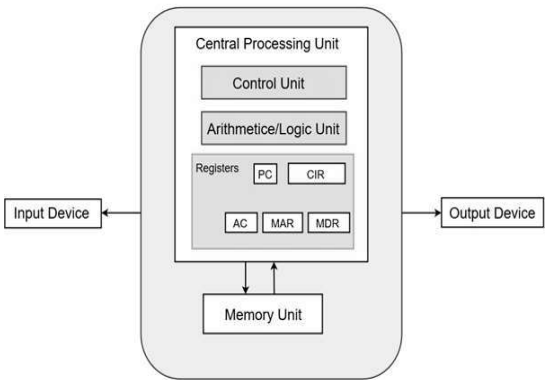
What is a computer?

Computer is an electronic machine, which takes an input, processes it, and outputs the result. It also stores data or information into its memory.

Todays/Modern computer is based on architecture proposed by a mathematician and physicist Von Neumann (Princeton Architecture) in 1945. He also delivered a computer on his proposed model around 1961 named as EDVAC (Electronic Discrete Variable Automatic Computer). There are three main contributions or innovations, which led to the foundation of modern computers:

1. Operates on **Binary Data** ('0' and '1' becomes the language of computer)
2. **First Electronic Computer** (Transistor Technology, a transistor stores states, total $2^{\text{No. of transistor}}$ states).
3. **Stored programs** (Program instructions and data is stored in main memory)
4. In addition, obviously **programmable**. We program and change states of a machine and do some fun and interesting tasks.

Von-Neumann Basic Structure:



Components of a computer System:

1. **CPU:**

   Central processing have three parts.

   a) **ALU:** Perform arithmetic (add, sub, mult, div etc), logical and relational operations
   b) **CU:** Control all activities of Computer (Brain of computer)
   c) **Registers:** (Tiny memories used to store data of current instruction which is being executed by CPU).
   d) **Clock:** A microchip that regulates the timing and speed of all computer functions. The speed of a computer processor is measured in clock speed and its unit is hertz (Hz) 1Hz is equal to one clock cycle in which one small task can be done.
   For example, 1 MHz is one million cycles, or vibrations, a second. 2 GHz is two billion cycles, or vibrations, a second.

CPU process an instruction using Instruction Execution Cycle

1. Fetch
2. Decode
3. Execute
4. Write Back

2. **Memory unit:**

Memory unit is used to store data and instructions.

- ✓ Primary memory/ Main memory/RAM/ROM/Cache
- ✓ Secondary Memory/Permanent storage/Hard Drive/Flash Drive/etc

❖ ***Remember***

Smallest unit of memory = 1 bit

Storage unit of memory = 1 Byte = 8 bits

1KB = ?
1MB = ?
1GB = ?
1TB = ?

- ***Remember all programs that are currently running are first loaded into the main memory or RAM. For example an OS is loaded into RAM first before any other application or software***

3. **Input / Output unit**
4. **Buses**

All components of a computer system are interconnected through buses.

1. Data Bus
2. Address bus
3. Control bus

    - ***Remember Memory storage unit is Byte (B) and data transfer unit is bits/second (b/s).***

Home Works:

- **Read page 1 to 7 from book [Book-1-CPP].**
- **what is problem solving?**