Classes of Computers

- **Personal Computer:** A **personal computer** is a general-purpose, cost-effective computer that is designed to be used by a single end-user.

  Example: Desktop computer
  Laptop computer.

- **Server:** A computer used for running larger programs for multiple users, often simultaneously, and typically accessed only via a network.

Supercomputer: A supercomputer is a large array of small computers. A class of computers with the highest performance. It is built to solve complex problem.

→ High end scientific calculations
→ Weather fore casting
→ Oil exploration
It cost hundreds of Millions of Dollars.

Embedded Computer: An **embedded computer** is a combination of hardware and software that is designated to perform a specific task.

EET

c).

Example : Smart Television
Printer
projecton

Personal Mobile Devices (PMDs): PMDs are small wireless device to connect to the internet. It is both portable and capable of storing, transmitting or processing electronic data or images.

Example: Smart Phone.

Cloud Computing: It refers to large collections of servers that provide service over internet. Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-needed basis from a cloud provider.

Example: Amazon AWS
Epsagon.

High Level Languages:

- High level languages resemble human languages in many ways.
- They are designed to be easy for human beings to write programs in and to be easy for human beings to read.

X = Y + Z

Languages : C, C++, Java, Fortran.

Low Level Languages

- The kind of language a computer can understand is called a low- level Language.
- This instruction may be unclear to human user. Low level languages do not resemble human languages. However, it is understood by the computer

ADD X9, X20, X21

// X9 = X20 + X21

X9 → X

X20 → Y

X21 → Z

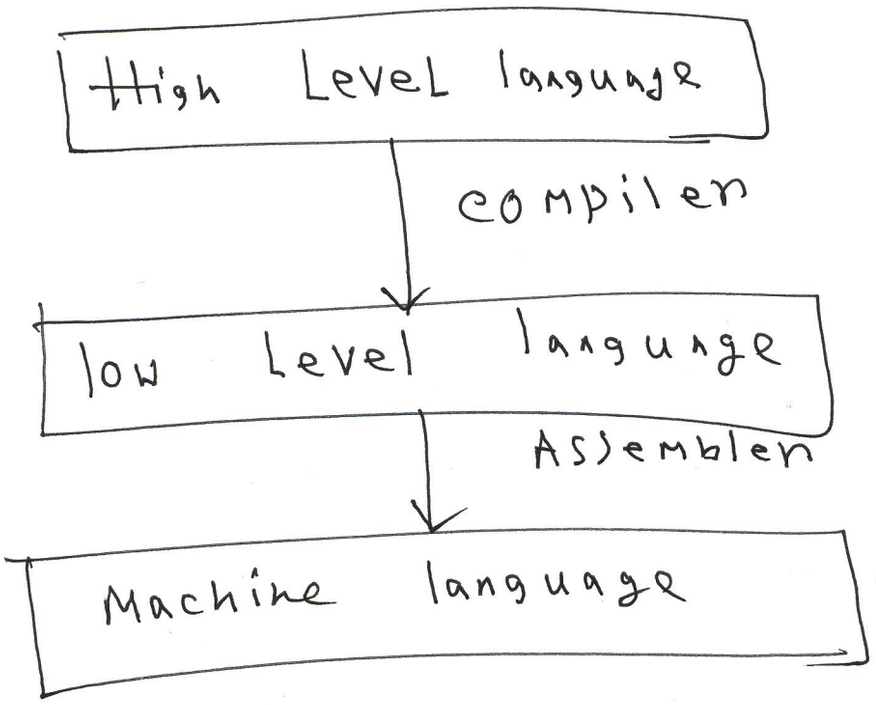
X9 → X X21 → Z
X20 → Y

Machine Languages

- Programs written in the form of zeros and ones are called machine languages.
- Any high-level language must be translated into machine language before computer can read and understand the program.

x = y + z → High Level language
→ ADD X9, X20, X21 → Low Level Language.
→ 1001 0001 1000 0000 0010 1000 0000 0110
↳ Machine Language.

High Level Language to Machine Language



x = y + z

ADD X9, X20, X21

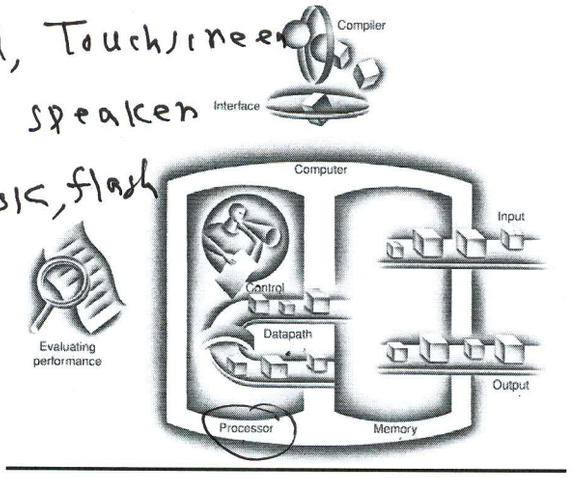
Components of a Computer

Five components: Input, Output, Memory, Control, Datapath

Input: Keyboard, Touchscreen

Output: Display, speaker

Memory: Hand-disk, flash drive.



Control:

Datapath:

Define volatile and non-volatile memory?

Volatile Memory : Loss instruction and data when power is off

Example — DRAM.

Non-volatile Memory : It does not Lose instruction or data when power is off.

Example: DVD, Falsh Memory.

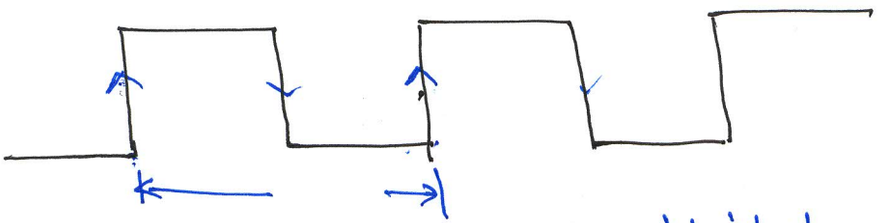
→ ADD X9, X25, X21
→ SUB X10, X19, X20

Define response time and throughput? How to improve response time and throughput?

Response Time: Time required for CPU to complete a task

Throughput : Total number of work done in a given time.

CPU Clocking - Clock Period or Clock cycle time (T) and Clock frequency or Clock rate (f):



square-wave - digital pulse.

clock-period: T Duration of a clock cycle.
The time between rising edges of a repititive clock signal.

Clock-Frequency f $\therefore f = \frac{1}{T}$.

CPU Time

The actual time the CPU spends computing for a specific task is known as CPU time. It is also called CPU execution time.

CPU Time = CPU clock cycles × clock cycle Time

$$\text{CPU Time} = \frac{\text{CPU clock cycles}}{\text{clock Rate}}.$$

Problem: A program takes 1000 clock-cycles to run a processor running at 2 GHZ. What is the time spent on the CPU by the program.

CPU Time

clock Rate.

$$\text{CPU Time} = \frac{\text{CPU clock-cycles}}{\text{clock Rate}}$$

$$= \frac{1000}{2 \times 10^9 \text{ Hz}}$$

$$= 0.5 \times 10^{-6}$$

$$= 0.5 \text{ ms}.$$

Performance

$$\text{Performance} = \frac{1}{\text{Execution Time}}.$$

Suppose, we have two computers x and y and performance of x is greater than y

$$\text{Performance}_x > \text{Performance}_y$$

$$\frac{1}{\text{Execution Time}_x} > \frac{1}{\text{Execution Time}_y},$$

$$\therefore \text{Execution Time}_y > \text{Execution Time}_x$$

Problem ~~*~~ If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, how much faster is A than B ?