

Programming For Problem Solving

* what is computer?

The word computer comes from the word compute which means to calculate.

A computer is an electronic device that can perform arithmetic operations at a high speed and it can process math, pictures, sound and graphic.

It can solve the complicated problem quickly and accurately.

* Advantages of a Computer.

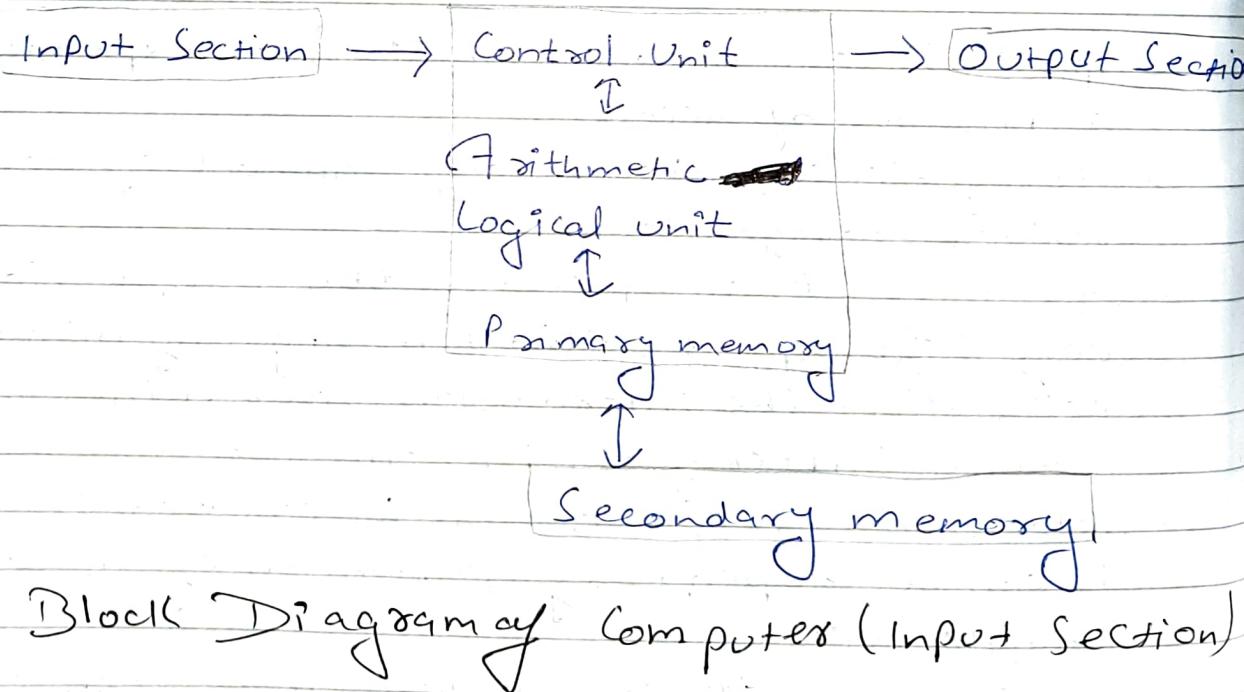
- * Speed - It can calculate millions of expression within a fraction of second.
- * Storage - It can store large amount of data using various storage devices.
- * Accuracy - It can perform the computation at a very high speed without making any mistake.
- * Reliability - The information stored in computer is available after years in same form.
- * Automation - Once the task is created in computer, it can be repeatedly performed again with a single click.
- * Multitasking - It can perform more than one operation simultaneously.

* Disadvantages of Computer:

- Lack of intelligence - It cannot think while doing work, it doesn't have natural intelligence
- It cannot think of properness, correctness or effect of work it is doing.
- Unable to correct mistakes - It cannot correct mistakes by itself if we provide the wrong info, it will produce the wrong result.

Block Diagram of Computer:

- It is a pictorial representation of a computer which shows how it works inside
- It shows how computer works from feeding / inputting the data to getting the result.



Block Diagram of Computer (Input Section)

- The devices used to enter data into computer system are called input devices.

- It converts human understandable input to computer controllable data.
- CPU accepts information from user through input device
- Examples: Mouse, Keyboard, Touch, Screen, Joystick, etc.

Block diagram of Computer (Output section)

- The devices used to send the information to the outside world from the computer is called output devices.
- It converts the data stored in LS and OS in computer to human understandable information
- Examples: Monitor, printer, plotter, etc.

Block Diagram of Computer (CPU-Central Processing Unit)

- It contains electronic circuit that processes the data based on instructions.
- It also controls the flow of data in the system
- It is also known as brain of the computer.

CPU consists of

- Arithmetic Logic Unit (ALU)
 - It performs all arithmetic calculations such as add, subtract, multiply, compare, etc. and takes logical decision.
 - It takes data from memory unit and returns data to memory unit, generally Primary memory (RAM)

- Control unit (cu)

- It controls all other units in the computer system. It manages all operations such as reads instruction and data from memory

- Primary Memory.

- It is also known as main memory.

- The processor or the CPU directly stores and retrieves information from it.

- Generally, currently executing programs and data are stored in primary memory.

Block diagram of Computer (secondary Memory)

- Secondary memory is also called Auxiliary memory or external memory.

- It is used to store data permanently.

- It can be modified easily.

- It can store large data compared to primary memory. Now days, it is available in Terabytes.

- Examples: Hard disk, Floppy Disk, CD, DVD, Pen Drive, etc.

What is Hardware

- Hardware refers to the physical parts of a computer.

- The term hardware also refers to mechanical device that makes up computer.

- User can see and touch the hardware components.

- Examples of hardware are CPU, Keyboard, monitor, hard disk, etc.

What is Software.

- A set of instruction in a logical order to perform a meaningful task is called program and a set of programs is called software.
- It tell the hardware how to perform a task.
- Types of Software.
 - System Software
 - It is designed to operate the computer hardware efficiently
 - Provides and maintains a platform for running application software.
 - Examples: windows, Linux, Unix, etc.
 - Application Software.
 - It is designed to help the user to perform general task such as word processing, web browsers etc
 - Examples: Microsoft word, Excel, Ppt, etc.

Categorizes of System Software

- Operating System.
 - It controls hardware as well as interacts with user and provides different services to user.
 - It is a bridge between computer hardware and user.
 - Examples: windows XP, Linux, UNIX, etc

System Support Software

- It provides working of hardware more efficiently.
- For example, drivers of the I/O devices or routine for socket programming, etc
- System development software
 - It provides programming development environment to programmers.
 - Example: Editors, pre-processor, compiler, interpreter, loader, etc.

Categories of Application Software

- = General purpose software
 - It is used widely by many people for some common task, like word processing, web browser, excel, etc
 - It is designed on one concept so many people can use it.
- = Special purpose software
 - It is used by limited people for some specific task like accounting software, tax calculation software, ticket booking software, banking software etc
 - It is designed as per user's special requirement

Compiler, Interpreter and Assembler.

- Compiler - translates program of higher-level language to machine language. It converts whole program at a time.

- Interpreter - translates ~~program~~ language to machine language ~~line by line~~
- Assembler - translates program of ~~assembly language~~ to machine language

Common Number System

System	Base	Symbol	Used by humans	Used in Comp.
Decimal	10	0, 1, ..., 9	Yes	No
Binary	2	0, 1	No	Yes
Octal	8	0, 1, ..., 7	No	No
Hexa-decimal	16	A - B - F 0, 1 - 9	No	No

Decimal to Binary.

• Technique

- Divide by two, keep track of the remainder
- The remainders read from bottom to top give the equivalent binary integer.

Example:

125_{10} .

2	125	1	$\Rightarrow 1111101$
2	62	0	
2	31	1	
2	15	1	
2	7	1	
2	3	1	
2	1	1	
	0		

0.6875 .

$$\begin{aligned}
 0.6875 &\times 2 = 1.3750 \rightarrow 1 \\
 0.3750 &\times 2 = 0.7500 \rightarrow 0 \\
 0.7500 &\times 2 = 1.5000 \rightarrow 1 \\
 0.5000 &\times 2 = 1.0000 \rightarrow 1 \\
 &\Rightarrow \underline{\underline{1011}}
 \end{aligned}$$

Binary to Decimal:

• Technique:

- Multiply each bit by 2^n , where n is the "weight" of the bit
- The weight is the position of the bit, starting from 0 on the right. Finally, add the results.

Example:

i) 101011

$$\Rightarrow 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ 32 + 0 + 8 + 0 + 2 + 1 \\ = 43$$

ii) 11.11

$$\Rightarrow 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} \\ = 2 + 1 + 0.5 + 0.25 \\ = 3.75$$

Decimal to Octal:

• Technique:

- Divide by eight, keep track of the remainder
- The remainders read from bottom to top give the equivalent octal integer number.

Example:

i) 125.

8	12	5
8	1	7
8	1	1
	0	

ii) 0.6875.

$$0.6875 \times 8 = 5.5000 \quad 5 \\ 0.5000 \times 8 = 4.0000 \quad 4$$

$$0.6875_{10} = 0.548_8$$

$$= 175$$

Octal to decimal.Technique:

- Multiply each digit by 8^n , where n is the "weight" of the digit.
- The weight is the position of the digit, starting from 0 on the right. Finally, Add the results.

Example:

i) 724_8

$43.25_8 = ?_{10}$

$$\begin{aligned}
 & 724_8 \\
 & 7 \times 8^2 + 2 \times 8^1 + 4 \times 8^0 \\
 & 448 + 16 + 4 \\
 & = 468_{10}
 \end{aligned}$$

43.25

$$\begin{aligned}
 & 4 \times 8^1 + 3 \times 8^0 + 2 \times 8^{-1} + 5 \times 8^{-2} \\
 & 32 + 3 + 0.25 + 0.0781 \\
 & = 35.3281
 \end{aligned}$$

Decimal to Hexadecimal.Technique:

- Divide by sixteen, keep track of the remainders.
- The remainders read from bottom to top give the equivalent hexadecimal integer number.

Example:

i) $1234_{10} = ?_{16}$.

~~i)~~ $0.03125_{10} = ?_{16}$

16	1 2 3 4	2	↑
16	7 7	13 = D	
16	4	4	
0			
$= 4D2_{16}$			

$0.03125 \times 16 = 0.5000$

$0.5000 \times 16 = 8.000$

0
8
↓

$= 0.08_{16}$

Hexadecimal to decimal.

Technique

- Multiply each digit by 16^n , where n is the "weight" of the digit
- The weight is the position of the digit, starting from 0 on the right. Finally, Add the results.

Example:-

$$ABC_{16} = ?_{10}$$

$$43.25_{16} = ?_{10}$$

$$\begin{aligned} A \times 16^2 + B \times 16^1 + C \times 16^0 \\ 10 \times 16^2 + 11 \times 16^1 + 12 \\ = 2560 + 176 + 12 \\ = 2748 \end{aligned}$$

$$\begin{aligned} 4 \times 16^4 + 3 \times 16^3 + 2 \times 16^2 \\ + 5 \times 16^1 + 3 \times 16^0 \\ = 64 + 3 + 0.125 + 0 \\ = 67.145 \end{aligned}$$

Types of Computer Languages

- Machine level language OR Low-level language
 - It is language of 0's and 1's
 - Computer directly understand this language.
- Assembly language
 - It uses short descriptive words (Mnemonic) to represent each of the machine language instructions
 - It requires a translator known as an assembler to convert assembly language into machine language so that it can be understood by the computer.
 - Example: 8085 instruction set.

- Higher level language
- It is a machine ~~language~~ independent language
- We can write programs in English like manner and therefore easier to learn and use.
- Examples: C, C++, Java, etc

Types of Computer Languages

Flowchart

Algorithm

- Flowchart is a pictorial or graphical representation of a program.
- It is drawn using various symbols
- Easy to understand
- Easy to show branching and looping
- Flowchart for big problem is impractical
- Algorithm is a finite sequence of well-defined steps for solving a problem.
- It is written in the natural language like English
- Difficult to understand
- Difficult to show branch and looping
- Algorithm can be written for any program

Symbols used in Flowchart



Start/Stop



Input/Output



Process



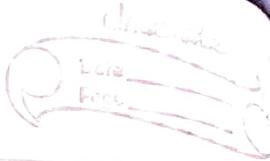
Decision Making



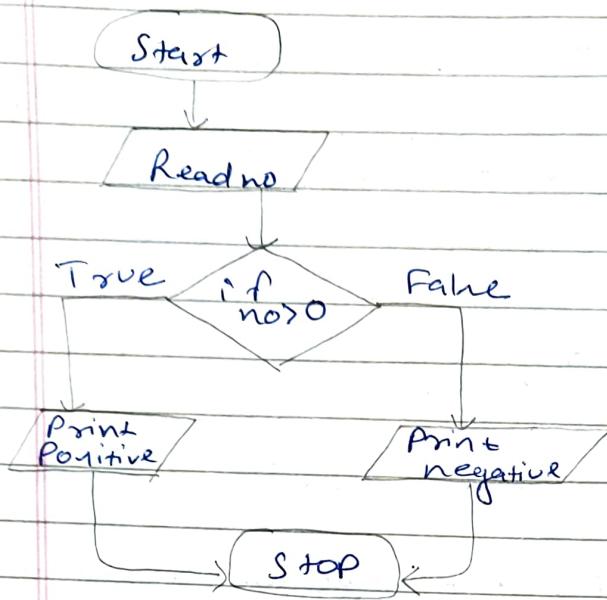
Subroutine



Arrow

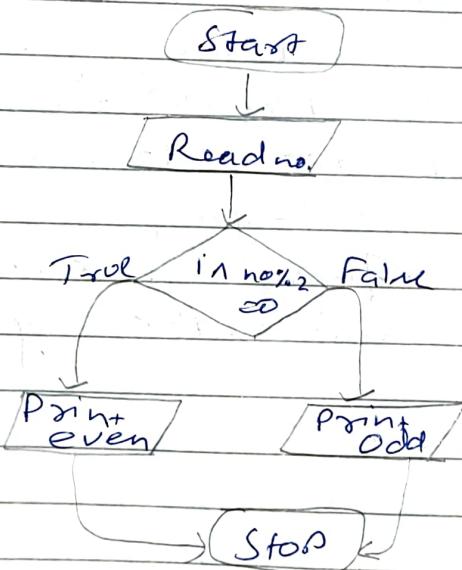


Number is positive or negative



- Read no.
- If no. is greater than equal zero, go to step 5
- Print no is a negative number, go to step 4
- Print no is a positive no
- Stop

Number is odd or even



- Read no.
- If no mod 2 == 0, go to step 5
- Print no. is a odd, go to step 5
- Print no. is a even
- Stop.