

## INTRODUCTION TO COMPUTER

### Computer :

#### Lesson Number : 1

→ "Computer" word comes from the word COMPUTE, which means to Calculate. So a Computer is normally considered to be a calculating device that can perform arithmetic operations at an enormous speed. It operates on data. The data can be the details of a student such as name, age, mark etc, when the Computer is employed for making student information system.

### Definition :

"Computer is an Electronic device which accept the data supplied by the user as input, stores and execute the data (the raw material supplied by the user), performs mathematical and logical operations and display the results as per the users requirement."

### Types of Computers :

→ Computers are classified into 2 types.

1. According to their operation.
2. According to their size.

→ According to the operation, the Computer is classified into 3 types.

- a. Analog Computer : The Computer which can process analog quantities, is called analog Computer. Analog Computer handle or process information, which is of a physical nature, for example temperature, pressure etc. Today analog computers are rarely used. They were used to solve differential equations.
- b. Digital Computer : The Computer which can process digital quantities (1's & 0's), is called digital Computer.

c. Hybrid Computer : The computer which can process both the analog and digital quantities is called hybrid computer.

→ According to the size, the digital computers are classified into 4 types.

- a. Micro Computer (small)
- b. Mini Computer (medium)
- c. Mainframe Computer (large)
- d. Super Computer (very large)

a. Micro Computer : A microcomputer's CPU is a microprocessor. The microcomputer originated in late 1970's. The first microcomputers were built around 8-bit microprocessor chips.

8-bit chip means that the chip can retrieve instructions/data from storage, manipulate and process an 8-bit data at a time.

b. Mini Computer : The term minicomputer originated in 1960s. Initial minicomputers were 8 bit and 12 bit machines but by 1970's almost all minicomputers were 16 bit machines. The 16 bit minicomputers have the advantage of large instruction set and address field, and efficient storage and handling of text in comparison to lower bit machines.

c. Mainframes : Mainframe Computers are generally 32-bit machines. They are suited to big organization to manage high volume applications. Few popular mainframe series are MEDHA, DEC, IBM, HP, ICL etc. Mainframes are also used as central host computers in distributed systems.

d. Super Computer : The upper end of the scale of the old mainframe machine are the supercomputers. They are amongst the fastest machines in terms of processing speed and use multiprocessing techniques, where a no. of processors are used to solve a problem.

Few manufacturers who dominate the market of supercomputers are; CRAY (CRAY YMP, CRAY 2), ETA (CDC-ETA 10, ETA 20), and IBM 3090 (with vector), NEC (NEC SX-3) and HITACHI (S series).

### Characteristics of Computers :

→ The characteristics of Computers include ;

1. Speed
2. Reliability and Accuracy .
3. Memory capacity .
4. Automation .
5. versatility .
6. Diligence. 7. capability to be programmed .

1. Speed : Computer has the ability to perform calculation at a fast speed . small computers take a few ~~see~~ micro seconds to execute an arithmetic operation whereas large computers takes only few nano ( $10^{-9}$ ) seconds for the same . some latest computers take only a few pico seconds for an operation .

2. Reliability and Accuracy : since it is very accurate , it is reliable . It is estimated that a human being commits at least one error for every 1000 operations . But computers do millions of operations in a second committing no error .

3. Memory Capacity : It has the ability to store large amount of data and information compactly and retrieved almost instantaneously .

4. Automation : Once the program or software is available . then the data are only supplied . when the command for execution

is given, the computer does the work in an orderly manner and gives out the result. No human intervention is needed at this stage. If we want to repeat the same process for another set of data, we need not feed the program once again. We need to give the execution command and the fresh data.

5. Versatility: Computers have got varieties of application. Computers are used in banks, in the field of education, machines etc.
6. Diligence: A computer never becomes tired. If we program it once, it can work as many times as we want with the same accuracy and efficiency.
7. Capability to be programmed: A program is a set of instructions. If a computer is programmed once, then the same program can be executed as many times as we need.

### Data Storage in a Computer:

Storage of data in a computer is always in the form of Binary Digits (bits).

4 bits = 1 Nibble

8 bits = 1 Byte

1024 Bytes = 1 K or 1 KB (KiloByte)

1024 KB = 1 MB (MegaByte)

1024 MB = 1 GB (Giga Byte)

Assignment: What is Computer?

→ "Computer" word comes from the word COMPUTE, which means to calculate. So, a computer is normally considered to be a calculating device that can perform arithmetic operations at an enormous speed.

It operates on data. The data can be the details of a student such as name, age, mark etc. when the computer is employed for making student information system.

Definition: [LectureNotes.in](http://LectureNotes.in)

"Computer is an Electronic device which accept the data supplied by the user as input, stores and executes the data (the raw material supplied by the user), performs mathematical and logical operations and display the result as per the users requirement."

Assignment: Describe the types of computer briefly.

→ Computers are classified into two types.

1. According to their operations

- a. Analog Computer
- b. Digital Computer

2. According to their size

- a. Micro Computer
- b. Mini Computer
- c. Mainframes
- d. Super Computer.

1. a. Analog Computer: The computer, which can process analog quantities is called analog computer. Analog computer handle or process information, which is of a physical nature. For example temperature, pressure etc. Today analog computers are rarely used. They were used to solve differential equations



b. Digital Computer: The computer which can process digital quantities (1's and 0's), is called digital computer.

2. According to the size, digital computers are classified into 4 types.

a. Micro Computer: A micro computer's CPU is a microprocessor. The micro computer originated in late 1970's. The first micro computer were built around 8-bit microprocessor chip. It is very small in size.

b. Mini computer: The term mini computer originated in 1960s. Initial minicomputers were 8-bit and 12 bit machines but by 1970's almost all microcomputers were 16-bit machines. Mini computers were medium in size.

c. Mainframes: Mainframe computers are generally 32-bit machines. These are suited to big organization to manage high volume applications. Few popular mainframe series are: MEDHA, DEC, IBM, HP, ICL etc. Mainframe computers are larger in size.

d. Super Computer: The upper end of the state of the art mainframe machines are the super computers. These are amongst the fastest machines in terms of processing speed and use multi-processing techniques, where a no. of processors are used to solve a problem.

Assignment: Write down the characteristics of a computer.

The characteristics of a computer include;

1) speed: Computer has the ability to perform calculation at a fast speed. Small computers take a few micro seconds to execute an arithmetic operation whereas large computers take only few nano ( $10^{-9}$ ) seconds for the same. Some latest computers take only a few pico seconds for an operation.

- 2) Reliability and Accuracy: Since it is very accurate, it is reliable. It is estimated that a human being commits atleast one error for every 10000 operations. But computers do millions of operations in a second committing no error.
- 3) Memory Capacity: It has the ability to store large amount of data and information compactly and retrieved almost instantaneously.
- 4) Automation: Once the program or software is available then the data are only supplied. When the command for execution is given, the computer does the work in an orderly manner and gives out the result.
- 5) Versatility: Computer has got varieties of application. Computers are used in banks, in the field of education, machines etc.
- 6) Diligence: A computer never become tired. If we program it once, it can work as many times as we want with the same accuracy and efficiency.
- 7) Capability to be programmed: A program is a set of instruction. If a computer is programmed once, then the same program can be executed as many times as we need.

Assignment: How data are stored in a computer?

Storage of data in a computer is always in the form of Binary digits (bits).

4 bits = 1 Nibble    8 bits = 1 byte    1024 Bytes = 1 KB

1024 KB = 1 MB

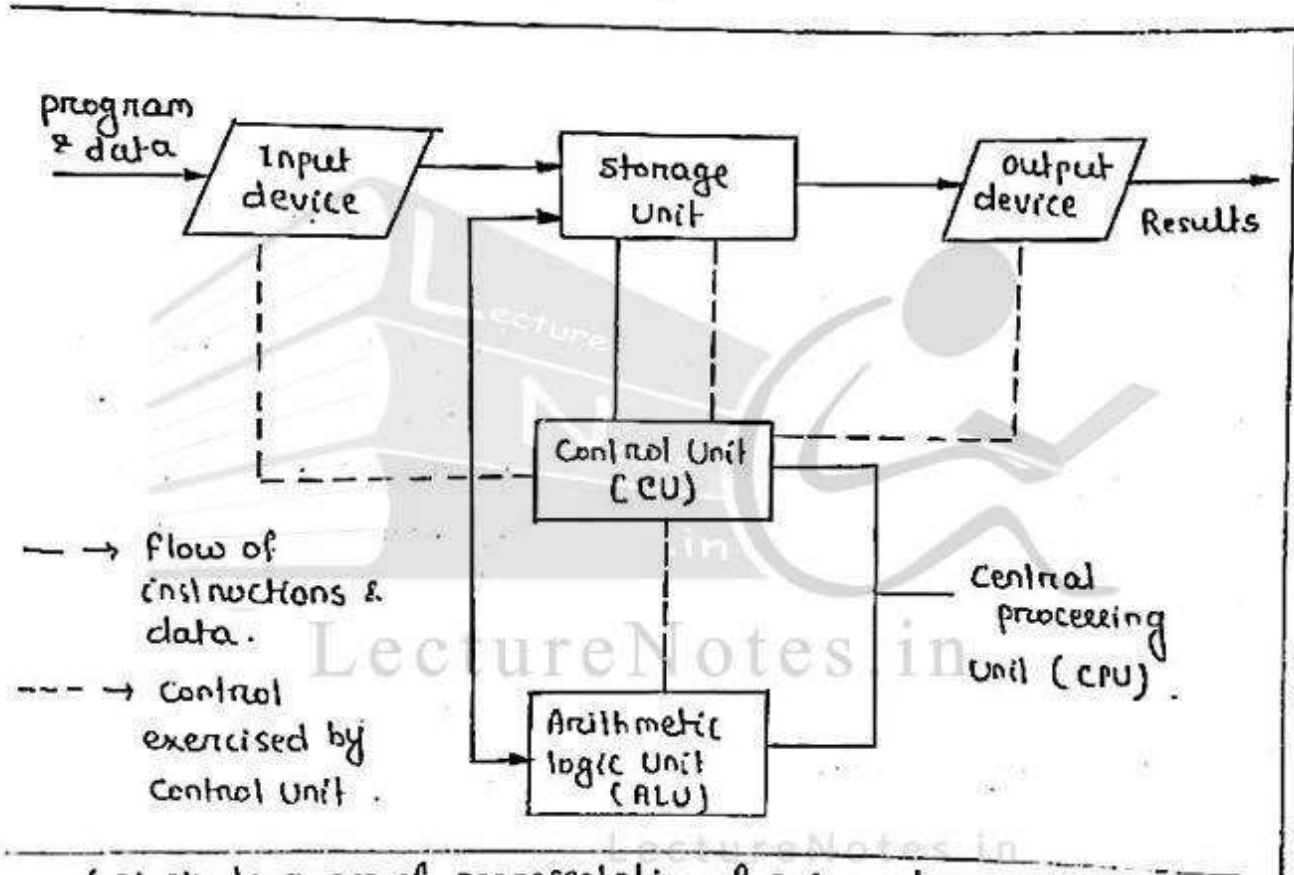
1024 MB = 1 GB.

## Lesson Number : 2

### Functional unit of a Computer :

→ The five major functional units of a computer are :

1. CPU (Central processing unit)
2. Input device
3. Output device
4. Storage device
5. Communication interface



(Block diagram of representation of a computer system).

- CPU : CPU or central processing unit is the brain of the computer. It makes all major calculations, manipulations and comparisons. The CPU is also responsible for activating and controlling the operations performed by all units of the computer system.



The major parts of CPU are ;

- a) Arithmetic and logic Unit (ALU)
- b) Control Unit (CU)
- c) Main memory or primary memory.

The processing and manipulation of data is done in ALU. ALU are designed to perform 4 basic operations - add, subtract, multiply, divide and logic operations or comparisons such as less than, equal to or greater than.

Control unit of a CPU controls the entire operation of the computer. It controls all the devices such as memory, input and output devices. ALU connected to the CPU. It fetches instruction from the memory, and decodes the instructions and interprets the instruction to know what task are to be performed. Then it send suitable control signal to the other component to perform further necessary steps to execute the instructions. It gives order to ALU what operations are to be performed. It generates timing signals and control signals, provide them for all operations.

The instructions are fetched from memory one after another, Under the control of control unit for execution until the all instructions are executed.

2. Input device : Data and instructions are entered into a computer through input devices. An input device converts input data and instructions into a suitable binary form, which is accepted and stored in main memory of a computer. The most commonly used input device is the keyboard.
3. Output device : Output devices are used to show the info. stored in a computer or the result of any processing.

done by the computer to the outside world. The most common output devices are monitor and keyboard.

4. Storage unit : The instructions that are entered into the computer system, through input units are stored in the storage unit before the actual processing starts. Similarly the result produced by the computer after processing must also be kept inside storage unit before display.

5. Communication interface : A group of lines through which data and information flow is called communication interface or Bus. So the various input/output devices and memories are connected to the CPU by a group of lines called a bus. Three types of bus are there.

- 1) Address Bus : This carries the address of a memory location or I/O device that a CPU has to access. It is unidirectional.
- 2) Data Bus : It is used to transfer data between the processor and memory or I/O devices.
- 3) Control Bus : It is used to carry control signals between CPU and various devices connected to it.

### Hardware and Software :

There are two parts present in computer system.

1. Hardware : It represents the physical part of a computer.  
Example : keyboard, Monitor, Mouse etc.

2. Software : Software represents the programs which contain a set of instructions written to perform certain tasks on the computer. That means a computer cannot run without software. It is again classified into two types.

- a. system software
- b. Application software

a. System Software : system software is a set of one or more programs that are basically designed to control the operation of a computer system.

Exp: Language translator : It is a software that converts the source code to machine code. It is of 3 types.

i) Interpreter : It is a program written in machine level language which reads only one line of a source program at a time and converts it to object code.  
i.e. high level program to machine level program.

ii) Compiler : A Compiler reads the entire program and converts it to object code.

iii) Assembler : It is a program written in assembly level language and it translates assembly level program into machine level program.

[ Machine language : It is the first generation language. Here the instructions are written in the binary form and is referred to as low-level language.

Assembly language : It is the 2nd generation language. Here the instructions are written with mnemonics (symbolic instructions). It is low-level language.

High level language : It is the 3rd generation language. The commonly used HLL are COBOL, FORTRAN, C, C++ etc.

Fourth generation languages refers to software packages written in any HLL for any specific application. This is also called Command line language. Example : FoxPro, MS Excel, PageMaker, IDEAS, ANSYS etc. ]

operating system : OS is the interface between the user and the hardware.

Example : MS-DOS, LINUX, WINDOWS etc.

Utility program : These are the programs that are pre-written by manufacturer and supplied with hardware.

Example : Text editor.

b. Application Software : It is the set of programs necessary to carryout operations for a user's applications. For example ; programs to solve a set of equations, business problems etc. C is also known as an application software.

Program : Collections of instructions given to the computer is called program.

Programming language : Languages used for working communication with computer is called programming language.

Process to develop a program :

user requirements → problem analysis → Input and output

program coding ← Designing Algorithm

Designing of program : This is the 1st step to write a program. It is done in two methods.

1) Top-down method : starts from top level to lowest level.  
Example : C

2) Bottom-up Method : starts from lowest level to top level.  
Example : C++, Java

Assignment: What is the function of CPU in a computer?

Sol<sup>n</sup>. CPU or central processing unit is the brain of the computer. It makes all major calculations, manipulations and comparisons. The CPU is also responsible for activating and controlling the operations performed by all units of the computer systems.

Assignment: Describe the major parts of a central processing unit in a computer.

Sol<sup>n</sup>. The major parts of CPU in a computer are;

- a) Arithmetic logic unit (ALU)
- b) Control unit (CU)
- c) Main memory or primary memory.

The processing and manipulation of data is done in ALU. ALU are designed to perform 4 basic operations - add, subtract, multiply, divide and logical operations or comparisons such as less than, equal to or greater than.

Control unit of a CPU controls the entire operation of the computer. It controls all the devices such as memory, input, output devices.

The instructions are fetched from main memory one after another, under the control of control unit for execution until all instructions are executed.

The instructions are entered into the computer system through input units and are stored in the main memory or storage unit before the actual processing starts. Similarly, the result produced by the computer after processing must also be kept inside storage unit or main memory before display.



Assignment : what do you mean by hardware and software ?

Soln. Hardware : Hardware represents the physical part of a computer. Example: Monitor, Keyboard, Mouse, etc.

Software : Software represents the program which contains set of instructions written to perform certain task on the computer. That means, a computer cannot run without software.

Assignment : what is application software and what is system software ?

Soln. Application Software : It is the set of programs necessary to carryout operations for a user's applications.

For example : programs to solve a set of equations, business problem, process examination results etc. are the application softwares.

System software : System software is a set of one or more programs that are basically designed to control the operation of a computer system.

For example : operating system, language translator, linker and loader are the system software.

Assignment : what is language translator ?

Soln. Language translator is a software that converts the source code to machine code. It is of 3 types.

a) Interpreter : It is a program written in machine level language which reads only one line of a source program at a time and converts it to object code.

b) Compiler : A compiler is a program written in machine level language which reads the entire source program at a time and converts it to object code.

c) Assembler: An assembler is a program written in assembly language and it translates assembly level program into machine level program.

Assignment: what is programming language?

soln: The languages used for working communication with computer is called programming language. programming language is classified into;

a) Machine language: It is the 1st generation language. Here the instructions were written in binary form and is referred to as low level language.

b) Assembly language: It is the second generation language. Here the instructions are written with mnemonics (symbolic instructions). It is low-level language.

c) High level language: It is third generation language. The commonly used HLL are COBOL, FORTRAN, C, C++ etc.

d) Fourth generation language: It refers to software packages written in any high level language (HLL) for any specific application. This is also called command line language.

Example: FoxPro, Ms Excel, PageMaker, IDEAS etc.

Assignment: what is a utility program?

soln: Utility programs are the programs that are pre-written by manufacturer and supplied with hardware.

Example: Text Editor.

## Algorithm :

### Lesson Number : 3

- The word algorithm comes from the name of a Persian author, Abujafar Mohamad ibn Musa al Khowarizmi.
- This word has taken a special significance in computer science as it is used as a tool for solving a well specified computational problem.
- This is what makes algorithm different from words such as process, techniques or methods.

#### Definition :

" An algorithm is a finite set of instruction that if followed, accomplishes a particular task."

or

" An algorithm is any well defined computational procedure that takes some value or set of values as input and produces some value or set of values as output."

#### Characteristics Of an Algorithm :

An algorithm must have the following characteristics.

(According to D.E. Knuth)

1. Input .
2. Output .
3. Definiteness
4. Finiteness
5. Effectiveness .

#### 1. Input :

Zero or more quantities are externally supplied .

Reference : Computer fundamental & C programming, Amiya Kumar Rath

## 2. Output :

Atleast one quantity is produced.

## 3. Definiteness :

Each instruction is clear. Each operation must be definite means it must be perfectly clear what we should done, means  $x+5$ ,  $y+5$  or  $3/0$  is not permilled. To achieve the criteria of definiteness algorithm must written in a programming languages. Languages are designed in such a manner that it has a unique meaning. A Control is occur that controls each sentence sequentially.

## 4. Finiteness :

If we trace out the instruction of an algorithm, then for all cases, the algorithm terminates after a finite number of steps. A related consideration is that the time for termination should be reasonably short.

## 5. Effectiveness : LectureNotes.in

Every instruction must be very basic that it can be carried out only by using pencil and paper. LectureNotes.in

## Study of an algorithm :

The study of an algorithm includes many important and active areas of research. These are ;

1. How to devise an algorithm ?
2. How to validate an algorithm ?
3. How to analyse an algorithm ?
4. How to test a program ?

### 1. How to devise an algorithm?

Creating an algorithm is an art which may never be fully automated. The purpose of study various design techniques that to yielded good algorithms. By mastering these design strategies, it will become easier to devise new algorithms.

### 2. How to validate an algorithm ?

Once, an algorithm is devised, it is necessary to show that, it computes the correct answer for all positive possible legal inputs. We refer this process as algorithm validation. The algorithm not yet be expressed as a program. Once validity of the method has been, a program can be written in second phase. This phase is referred to as program proving or program verification.

### 3. How to analyze an algorithm ?

As an algorithm is executed, it uses the Computer's central processing unit (CPU) to perform operations and its memory. Analysis of an algorithm refers to the task of determining how much computation time and storage it requires.

### 4. How to test a program ?

Testing of program consists of two phases.

These are :

1. Testing Debugging.

and

2. profiling.



Debugging is the process of executing programs on sample data sets to determine whether 'faulty' results occur, if so, correct them.

profiling or performance measurement is the process of executing a correct program and measuring the time and space it takes to compute the results.

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### Notation of an algorithm:

The notation used for algorithm specification must confirm to a basic set of criteria:

- i. It must be concise.
- ii. It must be unambiguous.
- iii. It must be capable of machine execution.
- iv. It must promote elegance in the solution.

#### i. It must be concise:

We must be able to describe the solution to a problem without writing multiple pages of text.

#### ii. It must be unambiguous.

The description of the procedure must not be open to alternative interpretation. We must remember that the algorithm will be executed by a machine, which has no 'Common Sense' or in-built knowledge of the nature of the problem.

#### iii. It must be capable of machine execution.

The actions described must be capable of translation into precise, machine-executable operations. This

precludes such statements as "choose the best candidate". If this were the object of the operation, the steps involved in evaluating the exact criteria for what constituted "best" must be clearly set out.

iv. It must promote elegance in the solution.

The test tool must prevent the programmer from using practices at design stage, which lead to poor programming style during implementation.

### Example of an Algorithm:

Suppose, we have to develop an algorithm to convert an integer numerical score (0 to 100) scored by a student in a particular test into letter grades (A, B, C, D, E, F, O) using the following procedure.

Letter grade	Numerical Score
'O'	100 to 90
'E'	89 to 80
'A'	79 to 70
'B'	69 to 60
'C'	59 to 50
'D'	49 to 35
'F'	Below 35

Algorithm is defined as follows :

Step 1 : INPUT the score of a student .

Step 2 : If the score is less than 35 then print "F" : END

Step 3 : If the score is greater than or equal to 35 and less than 50, then print "D" : END .

Step 4 : If the score is greater than or equal to 50 and less than 60 then print "C" : END .

Step 5 : If the score is greater than or equal to 60 and less than 70 then print "B" : END .

Step 6 : If the score is greater than or equal to 70 and less than 80 then print "A" : END

Step 7 : If the score is greater than or equal to 80 and less than 90 then print "E" : END .

Step 8 : If the score is greater than 89 then print "O" : END .

Step 9 : End

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The algorithm terminates after 9 steps. This explains the features of finiteness. Action of each step is precisely defined. In this example, each step requires simple comparison and printing operation. This explains the feature of definiteness and effectiveness. Input of our algorithm is the marks secured by a student and output is the grade awarded according to the range.

Example : write an algorithm to find the sum and product of two numbers.

Algorithm :  
Step 1 : Start  
Step 2 : Read a, b  
Step 3 :  $sum \leftarrow a + b$   
Step 4 :  $product \leftarrow a \times b$   
Step 5 : print sum, product  
Step 6 : Stop.

Example : write an algorithm to Convert the temperature in F to  $^{\circ}C$  using the formula  $C = \frac{5}{9}(F - 32)$ .

Algorithm :  
Step 1 : Start  
Step 2 : Read temperature in F.  
Step 3 :  $C \leftarrow \frac{5}{9}(F - 32)$   
Step 4 : print C  
Step 5 : stop.

Example : write an algorithm to find the greatest between two numbers.

Algorithm :  
Step 1 : Start  
Step 2 : Read a, b  
Step 3 : if a is greater than b then  
Step 4 :  $big \leftarrow a$   
Step 5 : else  $big \leftarrow b$   
Step 6 : print big  
Step 7 : Stop.

Assignment: what is an algorithm? Write down the characteristics of an algorithm.

Soln. "An algorithm is a finite set of instructions that if followed, accomplishes a particular task."

or

"An algorithm is any well defined computational procedure that takes some value or set of values as input and produces some value or set of values as output."

Characteristics of an algorithm include;

- 1) Input: zero or more quantities are externally supplied.
- 2) Output: At least one quantity is produced.
- 3) Definiteness: Each instruction should be clear.
- 4) Finiteness: The algorithm must terminate after a finite number of steps.
- 5) Effectiveness: Every instruction must be very basic that it can be carried out only by using pencil and paper.

Assignment: write an algorithm to find the area of a triangle whose sides are a, b, c.

Algorithm:

- Step 1: Start
- Step 2: Read the sides of a triangle a, b and c
- Step 3: Find the semiperimeter (s) of the triangle by using the formula  $s = \frac{a+b+c}{2}$
- Step 4: Area =  $\sqrt{s(s-a)(s-b)(s-c)}$
- Step 5: print Area
- Step 6: Stop



Assignment: write an algorithm to find the greatest between 3 numbers.

Algorithm: Step 1: start

Step 2: Input  $a, b, c$  as 3 numbers.

Step 3: Declare a variable  $g$  and assign  $g = 0$ .

Step 4: If  $g$  is smaller than or equal to  $a$ , then  $g \leftarrow a$ .

Step 5: If  $g$  is smaller than or equal to  $b$ , then  $g \leftarrow b$ .

Step 6: If  $g$  is smaller than or equal to  $c$ , then  $g \leftarrow c$ .

Step 7: print  $g$ .

Step 8: Stop.

or

Algorithm:

Step 1: start

Step 2: input three numbers  $a, b$  and  $c$ .

Step 3: if  $(a > b)$  then  $large \leftarrow a$ .

Step 4: else  $large \leftarrow b$ .

Step 5: if  $(large < c)$  then  $large \leftarrow c$ .

Step 6: else Print  $large$ .

Step 7: stop.

Assignment: write an algorithm to find the area and perimeter of a square.

Algorithm: Step 1: start

Step 2: Read side of a square  $a$ .

Step 3: Area =  $a \times a$

Step 4: perimeter =  $4 \times a$ .

Step 5: print area, perimeter.

Step 6: stop.

Assignment : write an algorithm to find the roots of a quadratic equation.

Algorithm : Step 1 : Start

Step 2 : Read co-efficients  $a, b$  of  $x^2 + x$  and the constant  $c$  of a quadratic equation  $ax^2 + bx + c = 0$

Step 3 : Find Discriminant

$$D = \text{Sqrt}((b * b) - (4 * a * c))$$

Step 4 : If ( $D \geq 0$ ) then

Step 5 :  $\text{root1} = (-b + D) / (2 * a)$

Step 6 :  $\text{root2} = (-b - D) / (2 * a)$

Step 7 : print  $\text{root1}, \text{root2}$ .

Step 8 : Else print imaginary roots.

Step 9 : Stop.

Assignment : write an algorithm to find the area and perimeter of a circle.

Algorithm : Step 1 : Start

Step 2 : Read the radius  $r$  of a circle.

Step 3 : assign  $\pi = 3.141$ .

Step 4 :  $\text{Area} = \pi * r * r$ .

Step 5 :  $\text{perimeter} = 2 * \pi * r$

Step 6 : print  $\text{Area}, \text{perimeter}$

Step 7 : Stop.

Assignment : Write an algorithm to convert the temperature from Kelvin (K) to degree Celsius ( $^{\circ}\text{C}$ ).

$$\frac{F - 32}{212 - 32} = \frac{C - 0}{100 - 0} = \frac{K - 273}{373 - 273}$$

Algorithm : Step 1 : Start

Step 2 : Read temperature K in Kelvin .

Step 3 :  $C \leftarrow K - 273$

Step 4 : print C

Step 5 : Stop.

Assignment : Write an algorithm to convert the temperature from Fahrenheit (F) to Kelvin (K).

Algorithm :

Step 1 : Start

Step 2 : Read temperature F in Fahrenheit .

Step 3 :  $K = \frac{5}{9} (F - 32) + 273$

Step 4 : print K

Step 5 : Stop.