Practical 1: Problem solving using computers.

Study of following Concepts:

- Computer architecture.
- Algorithm with examples.
- Flowchart with examples.

A computer is an electronic machine that processes information—in other words, an information processor: it takes in raw information (or data) at one end, stores it until it's ready to work on it, chews and crunches it for a bit, then spits out the results at the other end. All these processes have a name. Taking in information is called input, storing information is better known as memory (or storage), chewing information is also known as processing, and spitting out results is called output.

Major types of computers:

Analog computer - represents data by measurable quantities.

Desktop computer - a personal computer that fits on a desk and is often used for business or gaming.

Digital computer - operates with numbers expressed as digits

Hybrid computer - combines features of both analog and digital computers.

Laptop (notebook) - an easily transported computer that is smaller than a briefcase.

Mainframe (big iron) computer - a centralized computer used for large scale computing.

Microcomputer - generally referred to as a PC (personal computer). Uses a single integrated semiconductor chip microprocessor.

Minicomputer - an antiquated term for a computer that is smaller than a mainframe and larger than a microcomputer.

Netbook - a smaller and less powerful version of a laptop.

Personal computer (PC) - a digital computer designed to be used by one person at a time.

Smartphone - a cellular telephone designed with an integrated computer.

Supercomputer - a high performing computer that operates at extremely high speeds.

Tablet computer (tablet PC) - a wireless personal computer with a touch screen.

Workstation - equipment designed for a single user to complete a specialized technical/scientific task.

How Computer works?

The Input-Process-Output Concept:

Input: Your keyboard and mouse, for example, are just input units—ways of getting information into your computer that it can process. If you use a microphone and voice recognition software, that's another form of input.

Memory/storage: Your computer probably stores all your documents and files on a hard drive: a huge magnetic memory. But smaller, computer-based devices like digital cameras and cellphones use other kinds of storage such as flash memory cards.

Processing: Your computer's processor (sometimes known as the central processing unit) is a microchip buried deep inside. It works amazingly hard and gets incredibly hot in the process. That's why your computer has a little fan blowing away—to stop its brain from overheating!

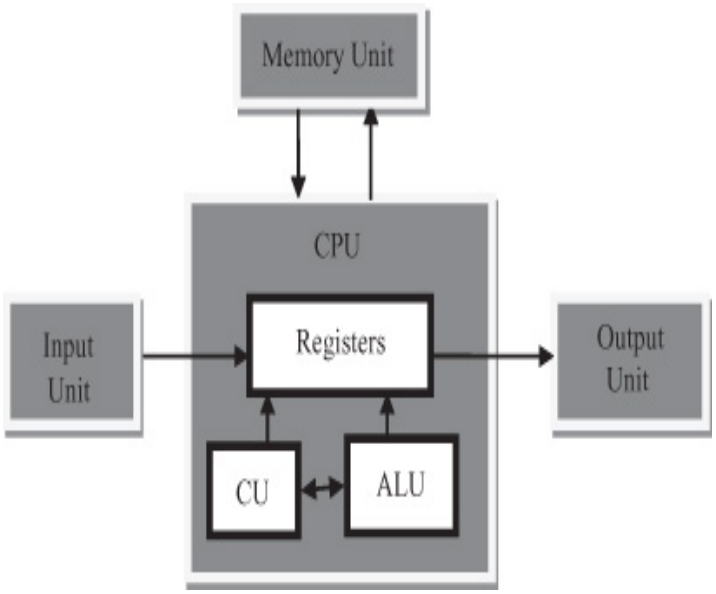
Output: Your computer probably has an LCD screen capable of displaying high-resolution (very detailed) graphics, and probably also stereo loudspeakers. You may have an inkjet printer on your desk too to make a more permanent form of output.

Components of Computer Hardware:

The computer system hardware comprises of three main components:

1. Input/output (I/O) Unit,
2. Central Processing Unit (CPU), and
3. Memory Unit.

The I/O unit consists of the input unit and the output unit. CPU performs calculations and processing on the input data, to generate the output. The memory unit is used to store the data, the instructions and the output information.



Input/Output Unit: The user interacts with the computer via the I/O unit. The Input unit accepts data from the user and the Output unit provides the processed data i.e. the information to the user. The Input unit converts the data that it accepts from the user, into a form that is understandable by the computer. Similarly, the Output unit provides the output in a form that is understandable by the user. The input is provided to the computer using input devices like keyboard, trackball and mouse. Some of the commonly used output devices are monitor and printer.

Central Processing Unit: CPU controls, coordinates and supervises the operations of the computer. It is responsible for processing of the input data. CPU consists of Arithmetic Logic Unit (ALU) and Control Unit (CU).

ALU performs all the arithmetic and logic operations on the input data.CU controls the overall operations of the computer i.e. it checks the sequence of execution of instructions, and, controls and coordinates the overall functioning of the units of computer.

Memory Unit: Memory unit stores the data, instructions, intermediate results and output, temporarily, during the processing of data. This memory is also called the main memory or primary memory of the computer. The input data that is to be processed is brought into the main memory before processing. The instructions required for processing of data and any intermediate results are also stored in the main memory. The output is stored in memory before being transferred to the output device. CPU can work with the information stored in the main memory. Another kind of storage unit is also referred to as the secondary memory of the computer. The data, the programs and the output are stored permanently in the storage unit of the computer. Magnetic disks, optical disks and magnetic tapes are examples of secondary memory.

Application of Computers:

- Scientific research
- Business application
- Education
- Entertainment
- Banks
- Communication
- Engineering
- Medicine
- Book Publishing
- Games
- Personal
- Accounting

What is problem and Problem solving?

We can say that problem is a kind of barrier to achieve something and problem solving is a process to get that barrier removed by performing some sequence of activities.

ALGORITHM: Algorithm can be defined as: "A sequence of activities to be processed for getting desired output from a given input." Webopedia defines an algorithm as: "A formula or set of steps for solving a particular problem.

Properties of algorithm:

Donald Ervin Knuth has given a list of five properties for a,algorithm, these properties are:

1) Finiteness: An algorithm must always terminate after a finite number of steps. It means after every step one reach closer to solution of the problem and after a finite number of steps algorithm reaches to an end point.

2) Definiteness: Each step of an algorithm must be precisely defined. It is done by well thought actions to be performed at each step of the algorithm. Also the actions are defined unambiguously for each activity in the algorithm.

3) Input: Any operation you perform need some beginning value/quantities associated with different activities in the operation. So the value/quantities are given to the algorithm before it begins.

4) Output: One always expects output/result (expected value/quantities) in terms of output from an algorithm. The result may be obtained at different stages of the algorithm. If some result is from the intermediate stage of the operation then it is known as intermediate result and result obtained at the end of algorithm is known as end result. The output is expected value/quantities always have a specified relation to the inputs.

5) Effectiveness: Algorithms to be developed/written using basic operations. Actually operations should be basic, so that even they can in principle be done exactly and in a finite amount of time by a person, by using paper and pencil only.

While writing algorithms we will use following symbol for different operations:

'+' for Addition

'-' for Subtraction

'*' for Multiplication

'/' for Division and

' ' for assignment. For example A X*3 means A will have a value of X*3.

Problem 1: Find the area of a Circle of radius r.

Inputs to the algorithm:

Radius r of the Circle.

Expected output:

Area of the Circle

Algorithm:

Step1: Read\input the Radius r of the Circle

Step2: Area PI*r*r // calculation of area

Step3: Print Area

Problem2: Write an algorithm to read two numbers and find their sum.

Inputs to the algorithm:

First num1.

Second num2.

Expected output:

Sum of the two numbers.

Algorithm:

Step1: Start

Step2: Read\input the first num1.

Step3: Read\input the second num2.

Step4: Sum num1+num2 // calculation of sum

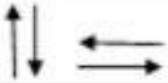
Step5: Print Sum

Step6: End.

Flowchart:

The flowchart is a diagram which visually presents the flow of data through processing systems. This means by seeing a flow chart one can know the operations performed and the sequence of these operations in a system. Algorithms are nothing but sequence of steps for solving problems. So a flow chart can be used for representing an algorithm. A flowchart, will describe the operations (and in what sequence) are required to solve a given problem. You can see a flow chart as a blueprint of a design you have made for solving a problem.

Flowchart Symbols:

Symbol	Name	Function
	**Process**	Indicates any type of internal operation inside the Processor or Memory
	input/output	Used for any Input / Output (I/O) operation. Indicates that the computer is to obtain data or output results
	Decision	Used to ask a question that can be answered in a binary format (Yes/No, True/False)
	Connector	Allows the flowchart to be drawn without intersecting lines or without a reverse flow.
	Predefined Process	Used to invoke a subroutine or an Interrupt program.
	Terminal	Indicates the starting or ending of the program, process, or interrupt program
	Flow Lines	Shows direction of flow.

General Rules for flowcharting:

1. All boxes of the flowchart are connected with Arrows. (Not lines)
2. Flowchart symbols have an entry point on the top of the symbol with no other entry points. The exit point for all flowchart symbols is on the bottom except for the Decision symbol.
3. The Decision symbol has two exit points; these can be on the sides or the bottom and one side.
4. Generally a flowchart will flow from top to bottom. However, an upward flow can be shown as long as it does not exceed 3 symbols.
5. Connectors are used to connect breaks in the flowchart. Examples are:

• From one page to another page.

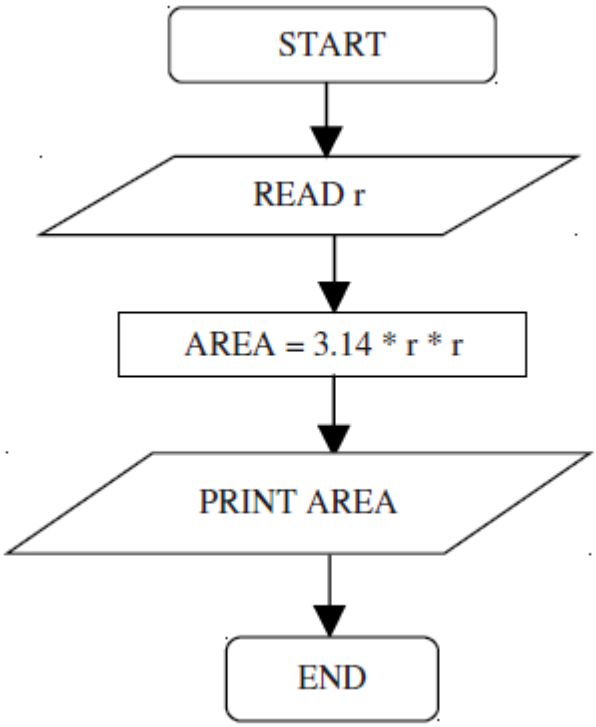
• From the bottom of the page to the top of the same page.

• An upward flow of more than 3 symbols

6. Subroutines and Interrupt programs have their own and independent flowcharts.
7. All flow charts start with a Terminal or Predefined Process (for interrupt programs or subroutines) symbol.
8. All flowcharts end with a terminal or a contentious loop.

Flowcharting uses symbols that have been in use for a number of years to represent the type of operations and/or processes being performed. The standardized format provides a common method for people to visualize problems together in the same manner. The use of standardized symbols makes the flow charts easier to interpret, however, standardizing symbols is not as important as the sequence of activities that make up the process.

Problem1: Find the area of a circle of radius r.



Problem 2: Convert temperature Fahrenheit to Celsius.