

UNIT - 1

PROBLEM SOLVING

We solve problems and make decisions everyday at home, at work, at play, and even at the general store. Some problems and decisions are very challenging, and require a lot of thought, emotions and research. However, whatever the nature of the problem is, we always try to find multiple solutions so that we can have options to choose the best one.

Q.1: Define problem solving? Also write the steps to solve a problem?

Ans: Problem Solving Method:

Problem solving is a skill which can be developed by following a well-organized approach. Programming is also a problem solving activity. If you are a good problem solver, you have the potential to become a good programmer. Problem solving methods are covered in many subject areas. Business students learn to solve problems with the related systems approach, while engineering and science students use the engineering and scientific methods. Programmers use the software development method.

Following steps can be followed to solve any kind of problem solving method

- | | |
|--------------------------------|--|
| (i) Problem Identification | (ii) Specify Requirements |
| (iii) Analyze the Problem | (iv) Design Algorithm and Draw Flowchart |
| (v) Write the program (coding) | (vi) Test and Debug the Program |
| (vii) Implement the Program | (viii) Maintain And Update the Program |
| (ix) Document the Program. | |

Problem Identification:

At this stage the problem being solved is observed carefully. Major areas of concern are identified and irrelevant information is filtered out. Suppose we want to develop a simple calculator. Our major concern is how basic arithmetic operation (addition, subtraction, multiplication, and division) are performed? How result should be displayed? How input should be accepted? We are not interested in how the sine and Tan are calculated? How is the quadratic equation solved? And how are other mathematical operations performed? These are irrelevant to us, so we shall not bother about these. In this way, by filtering out irrelevant information we can concentrate on the actual problem.

Specify Requirements:

Most of the users cannot explain their exact software requirements. They are uncertain about what they want to do with the software. So they appear with a vague set of requirements in mind which may lead to a wrong solution. This stage demands to make clear the user's requirements so that a proper solution could be suggested. This stage involves the formation of a requirements document which describes the features the system is expected to provide, the restrictions under which it must operate, and an abstract description of the software which provide a basis for design and implementation.

Analyze the Problem:

At this stage the problem is decomposed into sub-problems. Rather on concentrating the bigger problem as a whole, we try to solve each sub-problem separately. This leads to a simple solution. This technique is known as **Top-down design** (also called **divide and conquer rule**). Here we may ask certain questions to approach the right solution i.e.

- (i) How many solutions are there to the given problem?
- (ii) Which one is the best solution?
- (iii) Can the problem be solved on the computer?
- (iv) What are input and output?
- (v) How can the bigger problem be divided into sub-problems?

Design Algorithm and Draw Flowchart:

Designing the algorithm requires to develop a finite list of steps to solve a problem. Writing algorithm is often the most difficult part of the problem-solving process. Most computer algorithms perform at least following three steps:

- (i) Get data(input)
- (ii) Perform computation (processing)
- (iii) Display results (output)

Once the Algorithm has been designed, it should be verified through desk checking. It is important part of algorithm design that is often over looked.

Program:

A program is a set of instruction given to the computer to solve a particular problem. It is written in a programming language.

Desk Checking:

Desk Checking is the process of carefully observing the working of an algorithm on the paper for some test data. Algorithm is provided a variable set of input for which output is examined.

Draw the Flow Chart:

Flow chart, in fact, maps the algorithm to a pictorial representation which helps in understanding the flow of control and data in the algorithm.

Write The Program (Coding):

The steps involves the conversion of an algorithm to a program, written in any programming language. For this Purpose, the programmer must know the syntax of the programming language chosen.

Syntax:

The grammatical rules of a programming language to write programs are referred to as syntax of that programming language.

Test and debug the program:

This stage requires the evaluating the program to verify that it works as desired. Don't rely on just one test case, Run the program several times using different sets of data, making sure that it works correctly for every situation provided in the algorithm.

Debugging:

Debugging is the process of finding and removing errors in the program.

Types of Error:

There can be three types of programming errors.

- (i) Syntax error
- (ii) Runtime error
- (iii) Logical error

Syntax error:

A syntax error occurs when the program violates one or more grammatical rules of the programming language. These errors are detected at compile time. For example trying to execute a wrong statement or command such as typing PINT instead of PRINT or trying to assign a value to a constant such as 5=count etc.

Runtime Error:

A runtime error occurs when the program directs the computer to perform an illegal operation such as dividing a number by zero. Runtime errors are detected and displayed by the computer during the execution of the program when a runtime error occurs, the computer will stop executing the program and may display a diagnostic message that helps in locating the error.

Logical Error:

Logical error occurs when a program follows a wrong logic. The translator does not report any error message for logical errors. These errors are the most difficult to locate. Logical error can be identified by just looking at the wrong output of the program. Logic errors can only be detected by thoroughly testing the program, observing all variables closely and testing each path of logic flow in the program.

Implement the Program:

Once the program has been as tested thoroughly, it must be installed or put into operation at the site where it will be used. This is known as implementation the Program.

Maintain and Update The Program:

Program maintenance is an ongoing process of upgrading the program to accommodate new hardware or software requirements, and introducing the minor improvement of the program. Essentially, it is the expansion, upgrading and improvement of a program after its installation. Regular maintenance is essential to the continued usefulness of a program. A proper maintenance depends on the existence of complete documentation.

Document the Program:

Documentation is a detailed description of a program's algorithm, design, coding method, testing and proper usage. Documentation is valuable for the users who rely upon the program on a day-to-day basis, and for the programmer who may be called on to modify or update it. There are no universally excepted standards concerning what should be included in a program's documentation.

In general comprehensive documentation consists of the following:

- (i) A description of what the program is supposed to do (software requirement document)
- (ii) A description of the problem solution (the algorithm)
- (iii) A description of the program design, including any aids used (flowcharts, algorithm) etc.
- (iv) A description of the program's testing process, including the test data used and results obtained
- (v) A description of all corrections, modifications, and updates made to the program since it was put into operation.
- (vi) A user manual (user guide)

Q.2: Define debugging? Also write the types of errors in detail.**Types of Error:**

There are three types of programming errors.

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- (ii) Runtime error
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Q.3: What is an Algorithm? What strategy should be adopted to develop an algorithm?

Ans: Algorithm:

Algorithm is a finite set of steps which if followed accomplish a particular tasks. It consists of a sequence numbered of steps.

Strategy for developing Algorithm:

Algorithm development involves the following steps to carry out. We can proceed to correct solution of a particular problem by adopting the following strategy.

- (i) Investigation (ii) Preliminary algorithm (iii) Refining the algorithm

Investigation:

- (i) Identify the processes (ii) Identify the major decisions
- (iii) Identify the repetitions (iv) Identify the variables

Preliminary algorithm:

- (i) Devise a high –level (general) algorithm (ii) Step through the algorithm.

Refining the algorithm:

- (i) Incorporate any refinements indicated in step 2
- (ii) Group together processes where appropriate
- (iii) Group together variables where appropriate
- (iv) Test the algorithm again by stepping through it.

Problem:

We have to bake a cake.

- (i) Heat oven to 325° F (ii) Gather the ingredients
- (iii) Mix ingredients thoroughly in a bowl
- (iv) Pour the mixture into a baking pan
- (v) Bake in the oven in 50 minutes
- (vi) Repeat Bake 5 minutes more(Until cake top springs back when touched in the center)
- (vii) Cool on a rack before cutting

Q4: Define flowchart? Also explain the purpose of flowchart symbols use in flow chart.

Ans: Flowchart:

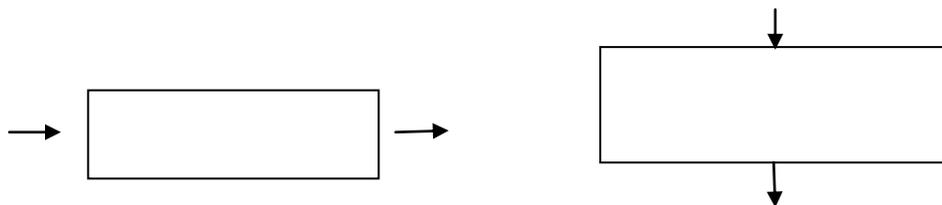
Flowchart is the pictorial representation of an algorithm. It is way of visually presenting the flow of data, the operation performed within the system and the sequence in which they are performed. The flow chart is similar to the layout plan of a building. Flowchart is drawn according to defined rules.

Symbols	Purposes
	start/end of a flow chart
	Processing
	Input/output
	Decision making and branching
	Connector

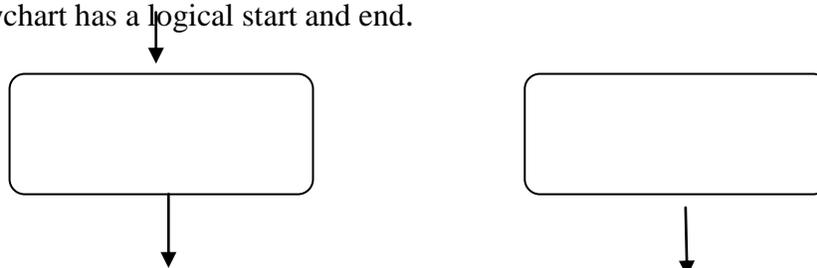
	Off-page/on-page connector
	Flow lines
	Pre-defined process (functions/sub-routines)
	Remarks

Guidelines of a Flowchart:

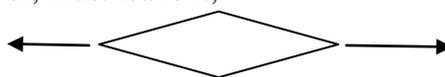
- (i) In drawing a flowchart, all necessary requirements should be listed in a logical order.
- (ii) The flowchart should be clear, neat and easy to follow. There should not be any ambiguity in understanding the flowchart.
- (iii) The usual direction of the flowchart is from top to bottom or left to right.
- (iv) Only one flow line should come out from a process symbol.



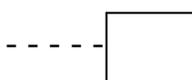
- (v) Only one flow line is used in conjunction with terminal symbols. Ensure that the flowchart has a logical start and end.



- (vi) Only one flow line must enter a decision symbol, but two flow lines, one for each possible answer, must leave it,



- (vii) Write comments within Remarks symbols, we can use the remarks (annotation) symbol to describe steps more clearly.



- (viii) It is useful to test the validity of the flow chart by passing through it with a simple test data.

Advantages of Flowcharts:

- (i) The flow chart helps in debugging process.
- (ii) With the help of flow chart the logic of an algorithm can be described more effectively.

- (iii) The flowcharts are part of the design document, hence maintenance of operational programs becomes easy.
- (iv) If the flowchart becomes complex, it is better to use connector symbols to reduce the number of flow lines. The intersection of flow lines should be avoided to make it more effective and clear.
- (v) The flow chart act as a guide for the program development therefore, they help the programmer to put efforts more efficient4ly on the underlying program.

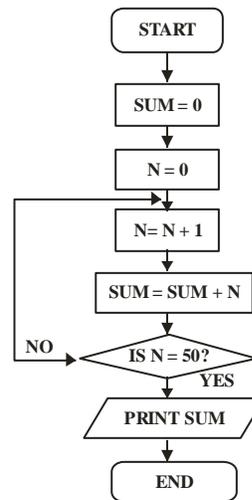
Limitation of Flowcharts:

It is difficult to draw flowchart for complex problems
 If alterations are required the flowchart is to be redrawn.

Q5: Write a program and also draw a flowchart to find the sum of first 50 Natural number.

```

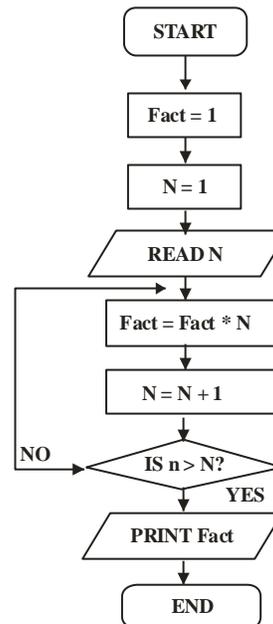
CLS
10  SUM=0
20  N=0
30  SUM= SUM+N
40  WHILE (N<= 50)
50  PRINT SUM
60  N=N+1
70  End
    
```



Q6: Write a program also draws a flow chart to find the factorial of numbers.
Program and flow chart to find the factorial of number

```

CLS
10  Fact=1
20  N=1
30  PRINT "Enter a number,";num
40  FOR N = 1 TO num
50  Fact = Fact *N
60  PRINT Fact
70  Next N
80  END
    
```



SHORT QUESTIONS**Q.1: Define Problem solving?**

Ans: problem-solving is a skill which can be developed by following a well organized approach.

Q.2: Write the steps of problem solving method?

Ans:

- | | |
|-----------------------------|--|
| (i) Problem identification | (ii) Specify requirement |
| (iii) Analyze the problem | (iv) Design algorithm and draw flowchart |
| (v) Write the program | (vi) Test and debug the program |
| (vii) Implement the program | (viii) Maintain and update the program |
| (ix) Document the program. | |

Q.3: What is meant by problem analysis?

Ans: The process of understanding the problem for developing its solution is called the analysis problem

It is very important stage in developing a solution to the problem.

Q.4: What is top down design?

Ans: The design in which a problem is divided into smaller sub-problems to approach the solution is called top down design.

Q.5: Define program?

Ans: A program is a set of instruction given to the computer to solve a particular problem. It is written in a programming language.

Q.6: Define desk checking?

Ans: “Desk checking is the process of carefully observing the working of an algorithm on the paper for same test data. Algorithm is provided a variable set of input for which output is examined”.

Q.7: What is meant by syntax of programming language?

Ans: “The grammatical rules of a programming language to write programs are referred to as syntax of that programming language”.

Q.8: Define debugging?

Ans: Debugging is the process of finding and removing error in the program.

Q.9: When syntax error occurs?

Ans: A syntax error occurs when the program violates one or more grammatical rules of the programming language.

Q.10: When runtime error occurs?

Ans: A runtime error occurs when the program directs the computer to perform an illegal operation such as dividing a number by zero.

Q.11: When logical error occurs?

Ans: Logical error occurs when a program follows a wrong logic. The translator does not display any error message for logical errors.

Q.12: What is coding?

Ans: The process of converting an algorithm to a program using a programming language is known as coding.

Q.13: Define documentation?

Ans: Documentation is a detailed description of a program's algorithm design coding method testing and proper usage.

Q.14: What is meant by program maintenance?

Ans: Program maintenance is the process of upgrading the program to accommodate the new requirements of the users and to correct errors in the program.

Q.15: What is the importance of program design in problem solving?

Ans: Designing the program is very important in problem solving. The problem can only be solved successfully if an efficient program is designed.

Q.16: Define algorithm?

Ans: An algorithm is a finite set of steps which if followed accomplish a particular task.

Q.17: Names of strategy for problem solving method?

Ans: 1- investigation 2- Preliminary algorithm
3- Refining the algorithm

Q.18: Define flowchart.

Ans: Flowchart is the pictorial representation of an algorithm.

Q.19: Symbol stand for?

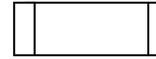
Ans:  is stands for connector.

Q.20: What are the symbols of flow lines?

Ans: Symbols of flow lines are \uparrow \downarrow \leftrightarrow

Q.21: What is the symbol and use of predefined process in the flowchart?

Ans: The predefined symbol represents the call of a function or subroutine in the main program to perform specific tasks. The symbol of pre-defined is



Q.22: Write any two advantages of flow chart?

- (i) The flow chart helps in debugging process.
- (ii) With the help of flow chart the logic of an algorithm can be described more effectively.

Q.23: Write limitations of flowchart?

- (i) It is difficult to draw flowchart for complex problems
- (ii) If alterations are required the flowchart is to be redrawn.

Q.24: Write an algorithm to find the sum of first 50 natural number?

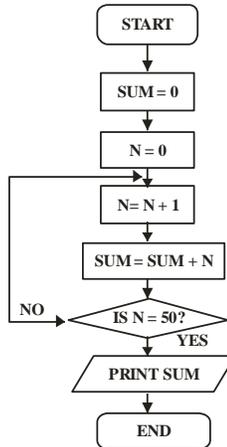
```
BEGIN
Sum=0
N=0
DO WHILE (N<=50)
Sum= Sum +N
PRINT Sum
N=N+1
END DO
END
```

Q.25: Write an algorithm to find the factorial of a given number?

```
BEGIN
Fact=1
N=1
Print "Enter a number"
Input num
For n = 1 to num
Fact = Fact*n
Next N
PRINT Fact
END
```

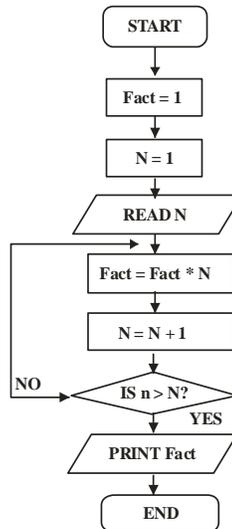
Q.26: Draw a flowchart to find the sum of first 50 natural numbers

Ans:



Q.27: Draw a flow chart to find the factorial of a number.

Flow chart



Q.28: Write an algorithm to calculate in the area of circle when the radius is given. (Area= 3.14*R*R)

Algorithm
 Begin
 PRINT “ENTER RADIUS”
 INPUT R
 AREA=3.14*R*R
 PRINT AREA
 END

Q.29: Write an algorithm to calculate the distance covered by a car moving at an average speed of v ms-1 in time T .The program should input average speed v and time T(Hints: S=vt, where S is the distance travelled)

Ans: 1- Procedure started 2- Take input of average speed as V and time as T
 3- Calculate the value of S as S =V*T
 4 -Print S 5- Stop the procedure

Q.30: Difference between flow chart and algorithm.

Flow Chart	Algorithm
A flow chart is a pictorial representation of a program. Different symbols are used to represent flow chart.	Algorithm is a step by step procedure for solving a problem. Simple English sentences are used to make an algorithm.

MULTIPLE CHOICE QUESTIONS

1. **How many possible solutions are there for a problem?**
 (a) one (b) two (c) three (d) multiple
2. **Program up gradation refers to**
 (a) Program enhancement (b) program identification
 (c) program development (d) Program implementation
3. **Which of the following tasks are performed by most of algorithm?**
 (a) input (b) output (c) processing (d) All of these
4. **Typographical error in BASIC statement is**
 (a) runtime error (b) logical error (c) syntax error (d) execution error
5. **The diamond symbol represents the**
 (a) input/output (b) Decision making (c) Remarks (d) Processing
6. **Division by zero is**
 (a) syntax error (b) logical error (c) runtime error (d) not an error
7. **Which of the following document describes various features of the software and the way it is used?**
 (a) software requirement (b) problem description specification
 (c) user manual (d) algorithm
8. **Algorithm is a**
 (a) Required document (b) design document
 (c) test document (d) user guide
9. **The technique divide and conquer is used to solve**
 (a) simple problem (b) large problem (c) complex problem (d) both b & c
10. **Which of them is sum of problem?**
 (a) instruction (b) information (c) data (d) none
11. **Which of them is formula of area of triangle?**
 (a) $\sqrt{a} * b \times c$ (b) $\sqrt{s(s-a)(s-b)(s-c)}$ (c) $S = a+b+c/2$ (d) none
12. **How many steps to solve any kind of problems?**
 (a) 5 (b) 7 (c) 9 (d) 11
13. **In problem solving the process is create a program is called**
 (a) program testing (b) Problem solving (c) Problem preparation (d) none
14. **The symbolic sequence is called**
 (a) problem solving (b) coding (c) flow charting (d) debugging
15. **The process is to write instructions is called**
 (a) algorithm (b) problem solving (c) coding (d) prototype
16. **The first step to prepare a program is**
 (a) reorganization (b) flow charting (c) coding (d) none
17. **Writing a program in any programming language is called**
 (a) coding (b) programming (c) language (d) none
18. **The symbol is used to flow charts to start or stop a process**
 (a) rectangle (b) diamond (c) oval (d) parallelogram
19. **A symbol is used in flow chart for both input and output function**
 (a) parallelogram (b) rectangle (c) diamond (d) oval
20. **A symbol is used in flow chart for processing steps**
 (a) diamond (b) rectangle (c) oval (d) flow lines

21. **Minimum steps are required in problem solving process**
 (a) two (b) four (c) six (d) eight
22. **Flow charting symbols are connected together by means of**
 (a) flow lines (b) diamond (c) rectangle (d) parallelogram
23. **At the stage the problem being solved is observed**
 (a) analyzed the problem (b) debugging (c) problem identification (d) coding
24. **In any problem decomposition in to sub problem at the stage of steps to solve the problem**
 (a) analyzed the program (b) design algorithm (c) document the program (d) none
25. **The design of algorithm required to develop a list of steps to solve the problem**
 (a) infinite (b) finite (c) many (d) none
26. **The conversion of an algorithm to the program return in any programming language is called**
 (a) debugging (b) logical errors (c) coding (d) algorithm
27. **A error occurs when the program violates one or more grammatical rules of programming language is called.**
 (a) desk checking (b) syntax (c) routine (d) algorithm
28. **A is a block diagram that reveals the structure and purpose of the program**
 (a) Flow lines (b) Flow charts (c) Runtime (d) Logical
29. **Rectangle shape is used for the purpose**
 (a) Decision (b) start-end (c) Processing (d) none
30. **The organized form of data is called.**
 (a) information (b) coding (c) program instruction (d) none

ANSWERS

1	d	2	a	3	d	4	C	5	b	6	c
7	b	8	b	9	b	10	a	11	b	12	c
13	b	14	c	15	c	16	a	17	a	18	c
19	a	20	b	21	c	22	a	23	c	24	a
25	b	26	c	27	b	28	b	29	c	30	a