

OMKAR BHARTIKAR

112016020 E.C.E.

# Data Structure and Algorithm Laboratory - 1

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Q1. What is programming?

→ Programming is basically the process of creating a set of instructions that tells a computer how to perform a task. The instructions are called as programs. Programming can be done by using a variety of computer programming languages for eg. C, C++, Python, Java, etc.

Q2. What is Algorithm?

→ An Algorithm is a set of instructions designed to perform a specific task. It is based on conducting a sequence of specific actions that are used in going to use in programming to make it simple and sequential.

Q3. State and Explain broad categories of software with suitable examples?

→ Software are the programs that do specific task.

These are mainly two categories of software.

1) System Software

2) Application software

1) System Software : System software is a program which is design to run a computer's hardware and application software.

Examples :- Microsoft Windows, Linux, Mac OS.

2) Application software : Application software is a programs which is design to run the end users.

Examples : Internet browser, Microsoft office.

Q4. Describe

Q4. What are the basic building blocks of C++ program?

→ The basic building blocks of C++ programming are as follows:

- 1) Variables :- It is memory location whose contents can be changed.  
Ex. length, width, area, perimeter.
- 2) Function :- Collection of statements ; when executed, accomplished something . it can be predefine or standard.
- 3) Syntax rules :- Rules that specify which statements (instructions) are legal or valid.
- 4) Semantic Rules :- Determine the meaning of the instructions.
- 5) Programming language :- a set of rules , symbols and specific words.
- 6) Comments :- Comments are for the readers , not for the compiler . two types of comments are single line and multiple line .
- 7) Special Symbols :- the smallest individual unit of a program written in any language eg. +, -, \*, /, ', ;.
- 8) keywords : Cannot be redefining and cannot be used for anything other

than their intended use.

Eg. int, float, double, char, const, void,  
return.

g) Identifiers : The name of something that appears in a program.

consist of letters, digits and underscore(-)

10) White spaces: These are used to separate special symbols, reserved words and identifiers.

Eg. int a; float total;  
          ↑ white space ↑

ii) Data types : set of values together with a set of operations.

Data types in C++ is mainly divided in 3 types.

- a) Primitive data type.
  - b) Derived data type.
  - c) User-defined data type.

12) Type Casting or Conversion:- These are also of two types.

- a) Implicit.
  - b) cast operator.

Q5. Describe in detail the steps involved in problem solving process.

→ Programming is a process of problem solving.

The steps involved in problem solving are:-

Step 1 :- Analyze the problem.

- i) outline the problem and its req.
- ii) Design steps (algorithm) to solve problem

Step 2 :- Implement the algorithm.

- i) Implement the algorithm in code
- ii) Verify that the algorithm works.

Step 3 :- Maintenance.

- i) Use and modify the program if the problem domain changes.

Step 4 :- Thoroughly understand the problem and all requirements.

Step 5 :- If the problem is complex, divide it into subproblems.

Step 6 : check the correctness of algorithm.

Step 7 : Enter the program using text

editor.

Step 8: Run code through compiler.

Step 9: If compiler generates error then look at the code and check and remove the errors.

Problem



Analysis



Algorithm Design



Coding



Preprocessor



Compiler → error



No error



Linker



Execution → Error



No error



result

Q6. Describe the analysis phase of programming

→ The program

Analysis phase of programming includes:

- i) lexical Analysis
- ii) Syntax Analysis
- iii) Semantic Analysis.
- iv) Intermediate code generator.
- v) Code optimizer.
- vi) Code generator.

① Lexical analysis: It is the first phase in which compiler scans the program written by the user.

② Syntax Analysis:- This is the second phase of program analysis done by Syntax Analyzer or parser.

③ Semantic Analysis:- Semantic analysis is the third phase of program analysis. This analysis checks whether the parse tree construct follows the rules of language.

④ Intermediate code generation:- Once the semantic analysis is done, the compiler generates intermediate code

for the target machine this intermediate code needs to be generated because it makes it easy to translate it into the target.

⑤ Code optimization :- This phase removes unnecessary code line and arranges the sequence of statements to speed up the execution of the program.

⑥ Code Generation :- It is the last phase of program analysis.

Code generation involves :

- ① Allocation of register and memory
- ② Generation of correct data type.
- ③ Generation and utilization of correct references.
- ④ Generation of missing de.

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~~DSA~~ DSA Lab-1 Algorithm

Algorithm: 1. for Average marks.

Step - 1 → Start.

Step - 2 → Number of student entered

Step - 3 → A string array is declared  
of size same as no. of student  
to store name, similarly integer  
array is declared for marks

Step - 4 → Name and marks of student entered  
using for loop.

Step - 5 → total stores the sum of marks  
using for loop.

Step - 6 → 'avg' stores the average marks  
of all students:  
 $avg = total / student$ .

Step - 7 → The average marks are printed

Step - 8 → Stop.

Algorithm - 2. for Below Average marks.

Step - 1 → Start.

Step - 2 → Same steps followed till  
~~Average~~ calculation average.

Step - 3 → for loop is introduced using  
integer  $i=0; i \leq 8; i++$

Step - 4 → Inside for loop IF statement  
is declared with condition  
of marks of  $i$ th student is  
less than average marks

Step - 5 → Then the names of students  
are printed that comes under  
the if statement.

Step - 6 → Stop.

### Algorithm-3: Highest Examination Score.

Step 1 → Start.

Step 2 → String and integer arrays are declared for name and marks.

Step 3 → Enter the name and marks for student.

Step 4 → Introducing for loop using int.

Step 5 using max function for marks storing array and using it to highestmarks.

Step 6 → The highest marks are printed.

Step → 7 Stop.

## Algorithm - 4. Name of student with highest score.

Step 1 → Start.

Step 2 → String and integer arrays are declared for name and marks.

Step 3 → Enter the name and marks for student.

Step 4 → introducing for loop and calculating highest marks as same as in last subquestion.

Step 5 → Inside the for loop IF statement is declared.

Step 6 → If  $\text{highest marks} == \text{marks}[i]$  then  $i^{\text{th}}$  student with highest marks are consider.

Step 7 → All the names are printed.

Step 8 → Stop.