

Lecture 1: Software Engineering- Setting the Context

Before starting the subject **Software Engineering**, let's have a look on some basic concepts of the software and the computer science field.

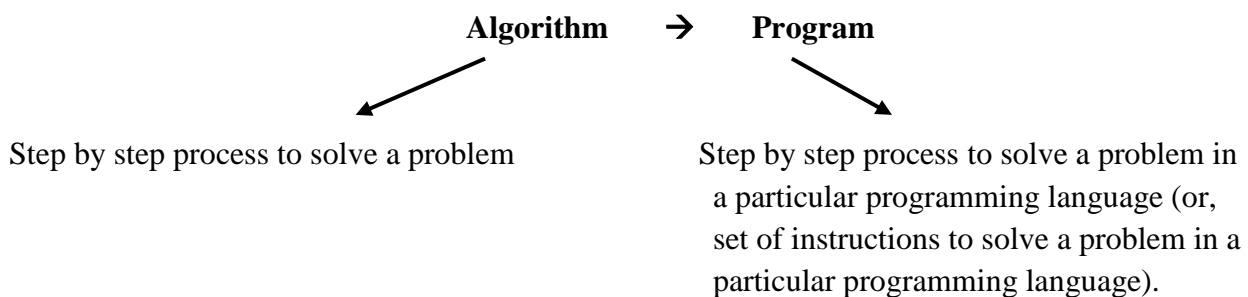
Two fundamental constructs of computer science, especially in programming, are:

1. **Algorithms or Logic**, and
2. **Data (or Data structures)**

1. **Algorithms:** As we know, the definition of Algorithm is: “Step by step process to solve a problem”. I must clear that algorithms are **step by step process to solve a problem but not to execute a program**. In computer science, algorithms are also known as Logic.

- This word algorithm is derived from the name of a Persian scientist named “Abu Abdullah Mohd Ibn Musa **Al-Khwarizmi**”.
- In second century, he has written a research paper on Indian numerals. In 12th century, his research was published in a Journal with the Title- “Al-Khwarizmi on Indian Numerals”.
- When this paper was translated in Latin, they converted “Al-Khwarizmi” as “**Algoritmi**” as they were unaware of the name Al-Khwarizmi. And in Latin, Algoritmi means “**Step by step Process**”.
- Later in 17th century this word “Algoritmi” is again converted into a new word “**Algorithm**”, but the meaning remains same, that is “Step by step process”. In 19th century, finally this word is defined as “Step by step process to solve a problem”.

In the definition of algorithm, when we add some new terms, it becomes the definition of a Program, that is- “Step by step process to solve a problem in a programming language” is known as a program.



Remember that, if you say “**set of instructions**” as the definition of a program, then this definition is incomplete, as set of instructions is a vague statement. An algorithm is also a set of instructions. That's why algorithms are called as “**Pseudo code**”, that is non-executable code.

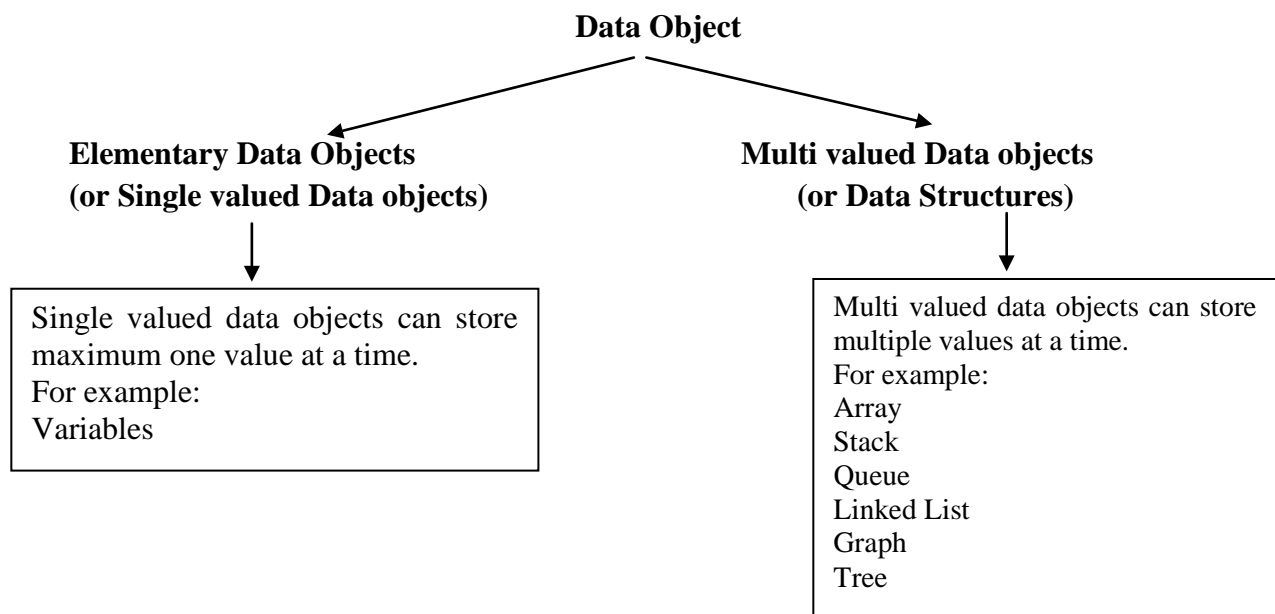
Algorithms have no language, they can be expressed or written in English, Hindi, Maths, or even simply in notations, that is without using any language.

Properties of an Algorithm:

Every algorithm must have some properties, like:

- a. **Input:** Every algorithm should take some input either directly from the user or from some other software.
 - b. **Output:** Every algorithm should have an output. Either in the form of data or message.
 - c. **Processing:** Every algorithm should have processing steps, through which input is processed into output.
 - d. **Finiteness:** Every algorithm or program must have finite number of steps, or in other words every algorithm or program should terminate after a finite number of steps or finite period of time.
 - e. **Definiteness:** Each and every case of the algorithm must be defined without any ambiguity or confusion. That is, if-then-else must be clearly defined.
2. **Data (or Data Structures):** Data is the basic construct or object on which these algorithms or programs work. Every program requires some input, or generates some output in the form of data.
- All the processing of an algorithm or program depends on the data. You can not imagine a single program which has no requirement of any kind of data.
 - Every program requires data in one or another form.
 - Parent class of data is “**data object**”.
 - Data object means a place holder where user defined values can exist in the program.

In programming languages, we use two types of data objects: Elementary (or Single valued) data objects and Multi valued data objects.



In this subject “Software Engineering”, our emphasis is on first construct, that is Algorithm or Program or Process or ultimately Software.