Why Data Structures?

Problem solving is more related to understanding the problem, designing a solution and implementing the solution, then what exactly is a solution?

In a very crisp way, it can be demonstrated as a solution which is equal to a program and it is also approximately equal to an algorithm.

Algorithm

An algorithm is a sequence of steps that take us from the input to the output. An algorithm must be Correct. It should provide a correct solution according to the specifications. Finite. It should terminate and general. It should work for every instance of a problem is efficient. It should use few resources (such as time or memory).

Data organization

Any algorithm we come up with will have to manipulate data in some way. The way we choose to organize our data directly affects the efficiency of our algorithm.

Solution = algorithm + data organization, Both components are strongly interconnected.

Information

The study of Computer Science includes study of information. Information in the substratum of entire field. In computer all information stored in form of a collection of bits, it is smallest unit of information, it has only one value.

Data Type

It is representation of information using a set of value and set of operations required for deriving further results and consider an example A day’s rain is expressed in discrete form as millimeter.

This value can be subjected to a set of operation such as add to derive the total rain in a year, Division to derive average rain in a year. Unstructured or scalar: Integer, float, char and Pointer, homogenous: Array, string, enum, structure and Union, heterogeneous: ADT like list, queue, stack, tree and Graph.

Data structure
It is way of organizing value with help of existing data types, ex: Accumulation of rain data for one year and apply some operation to derive statistical results. Data of 365 days need integer to store 365 value in the list- one dimension and 10 different regions require to store – 2D. It is a aggregation of different type of data by which the stored data can be made more explanatory. Hence, the Data structure is require through knowledge of data types available in a Programming Language.

Data structure can be also defined as, it is the mathematical model which helps to store and retrieve the data efficiently from primary memory. It helps to consistently maintain the data as well as the implementation functions of interest for data.

**Data structure** (definition by Prof. S Sahani)

It is data object together with the relationship which exist the relationship among the instance and among the individual elements that compose instance. Relationship provided by specifying the function of interest. When study data structure, we are concern with representation of data object as well as the implementation functions of interest for data object. Representation of each data object should facilitate an efficient implementation of function.

**Atomic and composite data**

Atomic data types is a single and non decomposable entity. Set of atomic data type having identical properties and consider an example the book price: Rs:250.

Composite data type, which cannot be broken out into subfield that having meaning consider an example Mobile number.

**Data structure**

It is an aggregation of atomic and composite data types into a set with defined relationships. Structure is set of rules that holds data together. An arrangement of data in a computer’s memory. Algorithms manipulate the data in these structures in order to accomplish some task. Consider an example like inserting an item, search for an item, sorting. In other worlds, it is conceptual and concrete ways to organize data for efficient storage and manipulation.

**Why do we need data structure?**

Computer takes on more and more complex tasks and its software implementation and maintenance is difficult, also clean conceptual frame work allows more efficient more correct code. Argument against: Packages are already written, Why not just read documentation of their interfaces and use them? The more you know, the better you can choose the tools, You can modify tools, You can create entirely new tools, You are to become experts!
We will learning the following concepts

What are some of the common data structures, What are some ways we can implement them, How can we analyze their efficiency, How can we use them to solve some, practical problems and Known data structures are tools for solving your future problems.

The following ways are possible to used the data structure. As an actual way to store real-world data, let we consider an example queues as a tool to be used only within a program, and graphs as a model of real-world situations.

Importance of different data structure

Each data structure has different advantages and disadvantages, and will be useful for different types of applications and for example of fast access of memory, if we know the

Data in Different volume

The amount of data and instructions are stored in different hierarchical memory is varies. The CPU can hold very small amount of data than cache memory and cache accommodate lesser than main memory, similarly main memory have less space than secondary memory. The data structure can comfortable access the data from main memory, if it is beyond the main memory, but the scope of data structure limited to main memory only. If at all needed to access the data from secondary memory then we need a concept called data mining which is explained in the figure 1.

Figure 1: Concept used to access the data