**Assignment 1**

1. **What is Data structure? Explain different types of data structures.**

Data Structure can be defined as the group of data elements that provides an efficient way of storing and organizing data in the memory. Some examples of Data Structures are arrays, Linked List, Stack, Queue, etc.

* 1. **Array** – It is a collection of items of similar datatype and each item is called an element of the array. The element can be of any valid datatype such as char, int, float or double. An array can either be 1-dimensional or multi-dimensional (2-D, 3-D).
  2. **Linked** **List** – A linear data structure that is used to maintain a list in the memory. It can be seen as a collection of nodes stored at non-contiguous memory locations. Each node of the list contains a pointer to its adjacent node.
  3. **Stack** - A linear data structure that follows a particular order, either LIFO (Last In First Out) or FILO (First In Last Out) in which the operations are performed.
  4. **Queue** – A linear data structure that follows a particular order, First In First Out (FIFO) in which the operations are performed.
  5. **Graph** – It can be defined as the pictorial representation of the set of elements (represented by vertices) connected by the links known as edges.
  6. **Tree** – These are multilevel data structures with a hierarchical relationship among its elements known as nodes. The bottom-most nodes in the hierarchy are called leaf node while the top-most node is called root node. Each node contains pointers to point adjacent nodes.

1. **Explain different Operations that can be performed on Data Structures.**
   1. **Traversing** – Every data structure contains a set of data elements. Traversing the data structure means visiting each element of the data structure in order to perform a specific operation.
   2. **Insertion** – The process of adding an element to the data structure at any location is called Insertion. If the size of data structure is n then we can only insert n-1 data elements into it.
   3. **Deletion** – The process of removing an element from the data structure is called Deletion. We can delete an element from the data structure at any random location.
   4. **Searching** – The process of finding the location of an element within the data structure is called Searching. There are two algorithms to perform searching, Linear Search and Binary Search.
   5. **Sorting** – The process of arranging the data structure in a specific order is known as Sorting. Many algorithms can be used to perform sorting, such as insertion sort, selection sort, bubble sort, etc.
   6. **Merging** – When two lists, List A and List B of size M and N respectively, of similar type of elements, clubbed or joined to produce the third list, List C of size (M+N), then this process is called merging.
2. **Differentiate between Data and Information.**

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| **Data** | **Information** |
| Data is raw, unorganized facts that need to be processed. Data can be something simple and seemingly random and useless until it is organized. | When data is processed, organized, structured or presented in a given context to make it useful, it is called information. |

1. **Write an algorithm FIND (DATA, N, LOC1, LOC2) which finds the location LOC1 of the largest element and the location LOC2 of the second largest element in an array DATA with n>1 elements.**
2. **Write a program to insert a new element in the given unsorted at Kth position.**
3. **Write an Algorithm to multiply to matrices of size N\*N each. Also prove that complexity of this algorithm is O(N3).**
4. **What do you understand by complexity of an Algorithm? Explain Big O (O), Omega (Ω) and Theta (Ѳ) Notations.**
5. **Let A be an n x n square matrix array. Write a module which**
6. **Finds the number NUM of nonzero elements in A.**
7. **Finds the SUM of the elements above the diagonal, i.e. elements A [I,J] where I < J.**
8. **Finds the product PROD of the diagonal elements (a11, a22, ..... ann)**