B2.1-R3: DATA STRUCTURE THROUGH ‘C’ LANGUAGE

NOTE:

1.	There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2.	**PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3.	Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE – 40; PART TWO – 60)

PART ONE
(Answer all the questions)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one and enter in the “tear-off” answer sheet attached to the question paper, following instructions therein. (1 x 10)

1.1 Number of subtrees of a node in a Tree/Graph is called
A) Order
B) Degree
C) Level
D) Depth

1.2 An undirected graph with ‘n’ vertices and ‘e’ edges will require a memory space of n locations plus:
A) 2e+1
B) 2e-1
C) 2e
D) None of the above

1.3 Which data structure is implemented in automatic variable declaration?
A) Queue
B) Stack
C) Heap
D) Graph

1.4 An ordered set of items from which items may be deleted inserted at either end
A) Queue
B) Graph
C) Heap
D) Dequeue

1.5 Order of magnitude of an algorithm refers to
A) Frequency of execution
B) Computing time
C) Sum of frequencies of all its statements
D) None of the above

1.6 When bucket size in the hash table is one
A) Only collision occurs
B) Collisions and overflows occur simultaneously
C) Only overflow occurs
D) None of the above

1.7 In a stack, top=0 denotes that
A) stack is empty
B) stack is full
C) top has no element
D) none of the above

1.8 The correct increasing order of magnitude of computing time is-
A) $O(1) < O(\log n) < O(n) < O(n \log n) < O(n^2) < O(n^3) < O(2^n)$
B) $O(2^n) < O(n^3) < O(n^2) < O(n \log n) < O(n) < O(\log n)\ O(1)$
C) $O(\log n) < O(n \log n) < O(n) < O(n^2) < O(n^3) < O(2^n) < O(1)$
D) None of the above

1.9 Which of the following is true in case of null pointer?
A) marks the end of the node
B) is equal to '\0' in c
C) is the address of some node
D) is called as void pointer in C

1.10 Suppose the union is declared like

```
union
{
        float x;
        char c[10];
        int y;
}num;
```

Assuming that float requires 4 bytes, char requires 1 byte and int requires 2 bytes, the memory space used by the variable num is

A) 16 bytes
B) 10 bytes
C) 4 bytes
D) 7 bytes

2. **Each statement below is either TRUE or FALSE. Choose the most appropriate one and ENTER in the "tear-off" sheet attached to the question paper, following instructions therein. (1 x 10)**

2.1 Row major order in 2-dimensional array refers that all elements of a row are stored in memory in sequence followed by next row in sequence and so on.
2.2 Siblings are nodes at the same level and of different parent.
2.3 A forest is obtained when a subtree is removed from a tree.
2.4 A complete binary tree, with the property that the value at each node is at least as large as the values at its children, is an AVL tree.
2.5 Hashing refers to the process of deriving a record key from storage address.
2.6 Folding is a method of generating a hash function.
2.7 Breadth first search scans all incident edges before moving to other vertex.
2.8 In linked list, the logical order of elements is same as their physical arrangement.
2.9 Queue needs one pointer to handle addition and deletion of an item.
2.10 Depth-first traversal of a direct acyclic graph produces a reverse topological ordering of the nodes.

3. **Match words and phrases in column X with the closest related meaning/ word(s)/phrase(s) in column Y. Enter your selection in the "tear-off" answer sheet attached to the question paper, following instructions therein. (1 x 10)**

X		Y	
3.1	Huffman code	**A.**	O(n)
3.2	Add a note to the front of list	**B.**	Fixed length code
3.3	Elements in an intrinsic ordering in a data structure	**C.**	Add operator
3.4	Towers of Hanoi	**D.**	Queue
3.5	Space requirements of address calculation sort for *n* elements in an array	**E.**	Variable length code
3.6	Efficient search technique	**F.**	Iterative algorithm
3.7	Garbage collection	**G.**	Push operator
3.8	Efficient Prim's algorithm for finding minimum spanning tree with *n* nodes and *e* edges	**H.**	*n* + temporary variables
3.9	Depth first traversal	**I.**	Recursive algorithm
3.10	In address calculation sort	**J.**	Priority Queue
		K.	2**n*+ temporary variables
		L.	Interpolation search
		M.	Free nodes
		N.	O(*e n* log *n*)
		O.	Hashing
		P.	Used nodes
		Q.	O((*n*+*e*)log *n*)
		R.	directed graph
		S.	Binary Search
		T.	O(n^2)
		U.	Acyclic Graph

4. Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Enter your choice in the "tear-off" answer sheet attached to the question paper, following instructions therein. (1 x 10)

A.	Null	**B.**	n^2	**C.**	Selection sort
D.	Shuttle sort	**E.**	Symmetric	**F.**	Underflow
G.	Position of element in the pattern	**H.**	Overflow	**I.**	n
J.	Balanced	**K.**	Recursive	**L.**	Terminal
M.	Iterative	**N.**	Parent	**O.**	Bubble sort
P.	ABEDFC	**Q.**	Heap sort	**R.**	FDBEAC
S.	Quick sort	**T.**	$O(n \log n)$		

4.1 In pattern matching ________ is returned if smaller string is not present in bigger one.

4.2 Attempting to delete a node in empty link list results in ________.

4.3 Space complexity of Merge sort is ________.

4.4 Other name of insertion sort is ________.

4.5 A digraph in which out degree is same as in degree is called ________.

4.6 In a tree, a node that has no children is called a ________ node.

4.7 A function which calls itself is said to be ________ function.

4.8 ________ sort does not use divide & conquer methodology .

4.9 The Inorder traversal of some binary tree produced in the sequence DBEFCA. The corresponding preorder traversal will be ________.

4.10 For sorting contiguous list of records ________ sort may be preferred over merge sort because it does not require extra space for an auxiliary space.

PART TWO

(Answer any **FOUR** questions)

5.

a) What is a binary search tree? How does it differ from sorted linear arrays & linked lists?

b) Write down an algorithm to insert a node in the binary search tree (BST). Using the algorithm, construct a BST by following data to be added in a tree one by one 12, 30, 11, 90, 75, 9, 2

(6+9)

6.

a) What are the differences between internal sorting and external sorting? When is a sorting technique said to be stable?

b) Write an algorithm to implement merge sort with n elements. Explain with an example.

(6+9)

7.

a) What do you mean by graph traversal?

b) Define depth-first traversal (DFS) of a graph. Write an algorithm of non-recursive depth first traversal.

c) Give an application of DFS.

d) Compare and contrast: DFS and BFS (Breadth First Search).

(2+[3+4]+2+4)

8.

a) Differentiate between linked list and an array.

b) What are the disadvantages of a linked list? How can you overcome those?

c) Write an algorithm to insert a node at the end of a noncircular singly linked list.

(5+5+5)

9.

a) Define an algorithm. Mention the basic criteria to be satisfied by an algorithm.

b) What do you mean by performance measurement of an algorithm? Illustrate with an example.

c) Illustrate the concept of double hashing with an example.

(5+5+5)