C2-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 Maximum number of nodes in a binary tree of depth K
A) 2^{K-1}
B) 2^{K}
C) $2^{K}-1$
D) $2^{K}+1$

1.2 If the records to be sorted are in auxiliary storage, sorting is called
A) Internal
B) External
C) Stable
D) None of the above

1.3 An ordered set of items from which items may be deleted at either end and into which items may be inserted at either end is called.
A) Queue
B) Stack
C) Heap
D) Dequeue

1.4 The property of hash function is that
A) it minimizes the rate of overflow
B) it preserves the order of key values.
C) it minimizes number of collisions.
D) none of the above.

1.5 Binary Search Tree is a
A) tree whose right and left sub-tree has value less than root.
B) tree whose right and left sub-tree has value more than root.
C) tree whose left sub-tree has value less than root and right sub-tree has value more than root.
D) none of the above.

1.6 A forest is obtained from a tree when
A) its children are removed
B) a sub-tree is removed
C) root of the tree is removed
D) none of the above

1.7 To implement the problem which checks whether parentheses, braces and brackets are in proper position or not, stack has been used. If ((H)*{([J+K])}) is the expression, what will be the content of stack from bottom when input pointer is at J.
A) ({([
B) (( ){([
C) {([( )
D) ( )({([

1.8 Which of the following statements are true:
A) binary search is always better than sequential search.
B) binary search is better than sequential search when number of elements is small.
C) binary search is better than sequential search when number of elements is very large.
D) binary search is always inferior to sequential search.

1.9 In an 16-bit computer, 30 digit integer can be stored in
A) an integer variable
B) floating point variable
C) a circular list
D) none of the above

1.10 A stack can be used to
A) allocate resources by the operating system
B) to schedule jobs on round-robin basis
C) process procedure call in a program
D) none of the above

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 For a binary search tree with n-nodes, External Path Length = Internal Path Length + $\log_2 n$.

2.2 Implementation of priority queue using list is advantageous than that using array.

2.3 In a Circular linked list one can traverse the list backward.

2.4 For an ordered data set, partition exchange sort is better than bubble sort.

2.5 If the hash table is maintained in external storage on a disk, time is the critical factor for hashing.

2.6 Queues can be created by setting up an ordinary contiguous array to hold the items.

2.7 In an expression tree, leaves at the last level are either operands or operators.

2.8 Recursive algorithms always terminate without any condition.

2.9 In-fix expression can be converted to post-fix expression using a data structure called stack.

2.10 Automatic variables can be declared within any block and remain in existence until the block is terminated.

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	Interpolation search	**A.**	* - * + - / ABCDEAC
3.2	Stack	**B.**	Expression Evaluation
3.3	Prefix notation of A/B-C+D*E-A*C	**C.**	Identity Matrix
3.4	Matrix in which many of the entries are zero	**D.**	log logn
3.5	Binary tree with nodes having either empty left sub-tree or empty right sub-tree	**E.**	- + - / ABC * DE * AC
3.6	Heaps	**F.**	Iterative procedure
3.7	LRV(L=Left sub-tree, R=right sub-tree, V=roots)	**G.**	calloc
3.8	Adjacency matrix	**H.**	1 –ary tree
3.9	Stable sorting function	**I.**	Sparse Matrix
3.10	Dynamic memory allocation	**J.**	Priority Queue
		K.	Skewed Binary tree
		L.	In-order traversal
		M.	Post-order traversal
		N.	Merge Sort
		O.	Bubble Sort
		P.	realloc
		Q.	log n
		R.	directed 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.	Degree	**H.**	front=0, rear= n-1	**O.**	n+1
B.	n log n	**I.**	n	**P.**	Dangling pointer
C.	1	**J.**	2	**Q.**	Maximum
D.	n^2	**K.**	Call by reference	**R.**	Call by value
E.	3	**L.**	Free space	**S.**	minimum
F.	front= rear = 0	**M.**	-1		
G.	level	**N.**	2e		

4.1 During initial creation of heap, root contains _____ element.

4.2 The number of sub-tree of a node is called its _____.

4.3 In hashing, collision and overflow occurs simultaneously when the bucket size is _____.

4.4 In a circular queue, initial condition given is _____.

4.5 If unsorted file contains n numbers line between 100–999, then the number of passes required to sort the file using radix sort is _____.

4.6 Passing a structure to a function can be performed by _____.

4.7 Suppose in the following union definition

```
union
 {
    int a;
    char b;
}item;
```

int requires 2 bytes and char requires 1 byte. Number of bytes allocated to item will be _____.

4.8 If p is a pointer and if free(p) is executed, p will create _____.

4.9 For a connected, undirected graph G with n vertices and e edges, the sum of degrees of vertices is _____.

4.10 Empty queue is represented by the queue in which rear = _____.

PART TWO

(Answer any **FOUR** questions**)**

5.

a) What do you mean by Performance analysis? What are the other criteria for judging programs?

b) Suppose you have an array of number denoted by num[ ]. Write the iterative and recursive procedure to find the sum of 1000 elements. What is the space requirement in both the cases?

(7+8)

6.

a) What is a circular list? Write an algorithm for inserting a node at the front.

b) Suppose you are given 2 polynomials. Represent the polynomial in a suitable data structure and write an algorithm/ function to add 2 polynomials.

(6+9)

7.

a) What is a binary tree? Write down different properties of a binary tree.

b) Write down the iterative algorithm for in-order traversal of a binary tree. What will be the performance analysis of the algorithm?

(6+9)

8.

a) Write the algorithm of sorting a set of numbers in descending order using Straight selection sort. Analyze the algorithm.

b) Show the steps of sorting the following sequence.

25 57 48 37 12 92 86 33

in ascending order using quick sort method.

(6+9)

9.

a) What is hashing? Give the characteristics of hash function. Name different hash functions.

b) What are the different methods of handling overflow in hashing?

(8+7)