

A6-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 $A/B-C+D \cdot E-A \cdot C$	C.	Identity Matrix
3.4	Matrix in which many of the entries are zero	D.	$\log \log n$
3.5	Binary tree with nodes having either empty left sub-tree or empty right sub-tree	E.	- + - / $ABC \cdot DE \cdot AC$
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)**