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 To make a queue empty, elements can be deleted, till
A) Front = rear+1
B) Front = rear-1
C) Front = rear
D) None of the above.

1.2 A tree is known as BST if
A) each node is greater than every node to its left subtree.
B) each node is greater than every node to its right subtree.
C) each node is less than every node to its left subtree.
D) none of the above

1.3 If there are total n nodes, then memory compaction requires
A) O ($\log_2$ n) steps
B) O (n) steps
C) O (n^2) steps
D) None of the above

1.4 Merge sort is worse than heap sort
A) from time point of view
B) from storage point of view.
C) from time as well as storage point of view.
D) none of the above

1.5 If the file contains data (61, 41, 91, 11) then the most suitable sorting technique is–
A) Quick sort
B) Radix sort
C) Insertion sort
D) None of the above

1.6 To achieve storage utilization in hashing.

A) More number of buckets are used

B) Utilize overflow buckets

C) Change hashing function

D) None of the above

1.7 For any non empty binary tree T, if n_0 is the no of terminal nodes and n_2 the no of nodes of degree 2, the relation between n_2 & n_0 is

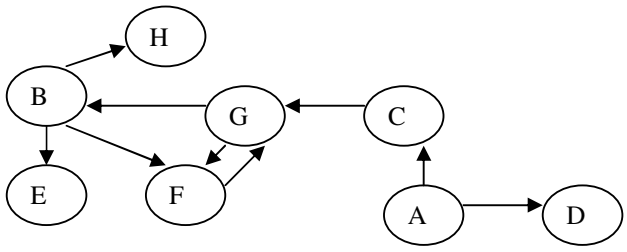
A) $n_2 = n_0 + 1$

B) $n_0 = n_2 + 1$

C) $n_0 = n_2$

D) None of the above

1.8 In the following graph the depth first traversal is



A) ACGBEFH

B) BEFGHCAD

C) Both A & B

D) None of the above

1.9 An array A[15][20] is stored in memory. Each element is of integer type. If the base address is 600 determine the address of A[8][13] when the array is stored as row major wise

A) 746

B) 946

C) 1146

D) None of the above

1.10 Consider a circular queue of characters, implemented as an array of 6 memory cells and front=2, rear=3, array cq: __, H,L,__,__,__
where ___ denotes an empty space.
What will be the status of the queue separately after adding elements P & Q and deleting elements H & L?

A) __,H,L,P, Q ,__ & __,__,__,P, Q,__
FRONT REAR FRONT REAR

B) __, H, L, P, Q, __ & __, P, Q, __,__,__
FRONT REAR FRONT REAR

C) P, Q, H, L,__,__ & P, Q,__, __,__,__
FRONT REAR FRONT REAR

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 In a linked list, we can use binary search efficiently to search an element in the list.

2.2 The algorithm to convert an infix expression into postfix takes time proportional to n^2 where n is the no. of symbols in the expression.

2.3 Recursions are slow as compare to iterations.

2.4 In a binary search tree the value of the node n is greater than every node to it's left subtree.

2.5 A stack is data structure having a fixed size.

2.6 Passing argument by value in a function is useful when the function does not need to modify the original variable in the calling program.

2.7 Quick sort is always better than merge sort.

2.8 Interpolation search requires $\log_2 n \log_2 n$ to search an element from a list having n data elements.

2.9 If in hashing all the n element of a list are clustered in the same bucket, the searching time of any element will be O(1).

2.10 Dangling pointer is a pointer is a pointer in which a pointer variable contains the address of a variable that has already been allocated.

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 Tree with n leaves requires array of size	**A.**	Direct recursion
3.2	Large integers beyond machine representation can be represented by	**B.**	Largest integer <= $\log_2 n$
3.3	Depth of a binary tree with n elements	**C.**	Long integer
3.4	A calls B and B calls A	**D.**	1.44 $\log_2 n$
3.5	In a binary tree number of ancestors for a node at level n is	**E.**	N
3.6	Dynamic memory implementation requires more	**F.**	O(n)
3.7	In heap sort, insertion can be done in	**G.**	Effectiveness
3.8	Maximum height of a balanced binary search tree is	**H.**	2^n-1
3.9	Algorithm	**I.**	Time
3.10	External sorting	**J.**	Bubble sort
		K.	Smallest integer >= $\log_2 n$
		L.	2^{n-1}-1
		M.	$\log_2 n$
		N.	2n-1
		O.	O($\log_2 n$)
		P.	Circular list
		Q.	Indirect recursion
		R.	Space
		S.	k-way merging

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.	lower	**B.**	left to right	**C.**	inorder
D.	worse	**E.**	right to left	**F.**	higher
G.	flags	**H.**	predecessor	**I.**	after
J.	ancestor	**K.**	successor	**L.**	first
M.	null	**N.**	preorder	**O.**	second
P.	better	**Q.**	before	**R.**	symmetric
S.	negative value				

4.1 Root of a binary tree is a(n) _____ of every node in tree except itself.

4.2 Pure radix sort is _____ than other sorting techniques if sizes of the number are large.

4.3 Index sequential search can be made by putting _____.

4.4 The worst case time of interpolation search is _____ than that of binary search.

4.5 In doubly linked list the traversing comes to a halt at _____.

4.6 Conversion of an expression from infix notation to prefix notation involves scanning from _____.

4.7 A sorted array can be produced from a binary search tree by traversing the tree _____.

4.8 If in a graph n is adjacent to m, n is called a(n) _____ of m.

4.9 Deletion of a node in linked list involves keeping track of address of node which comes immediately _____ the node that is to be deleted.

4.10 Adjacency matrices of a digraph is _____ matrices.

PART TWO

(Answer any **FOUR** questions)

5.

a) What are the advantages and disadvantages of array representation of stack and queues over linked list representation?

b) Write down the major problem of linear list. How can we solve the problem? Why do we use Doubly Linked List.?

(6+9)

6.

a) Which data structure is used to represent an arithmetic expression? Give an example. What is the implication of this representation?

b) Draw the binary tree for the set of numbers which are to be sorted
14,10,5,9,8,20,3,15,24,10,6

(10+5)

7.

a) Write an algorithm to sort an array in descending order using selection sort.

b) Write down the intermediate steps of sorting the following array of elements using Bubble sort.
A=40, 50, 30, 85, 70, 65, 90

(7+8)

8.

a) Define a graph? When a graph is said to be directed? Differentiate between a strongly connected and weakly connected graph? Give an example in each case.

b) What are the different methods for representation of graph? Explain each with example.

(8+7)

9.

a) Write Kruskal's algorithm for finding shortest path in a graph.

b) Define height balanced tree. How can we convert a non balanced tree into height balanced tree?

(7+8)