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 f(n) is of the order of g(n) if there exist positive integers "a" and "b" such that
A) f(n) <= a * g(n) for all n >= b
B) f(n) <= a * g(n) for all n <= b
C) g(n) <= a * f(n) for all n >= b
D) None of the above

1.2 Adjacency matrix for a digraph is
A) unit matrix
B) symmetric
C) asymmetric matrix
D) none of the above

1.3 Which of the following data structure may give overflow error, even though the current number of elements in it, is less than its size
A) simple queue
B) circular queue
C) stack
D) none of the above

1.4 Which of the following types of expressions does not require precedence rules for evaluation?
A) Fully parenthesized infix expression
B) Partially parenthesized infix expression
C) Both A) and B)
D) Prefix expression

1.5 If j=2, m=1, x=3, y=4. What is the value of the expression j++ = = m = = y * x
A) 0
B) 1

C) 2
D) 3

1.6 The time complexity of the Depth First Search algorithm to traverse a graph of “n” vertices and “e” edges is:

A) O (n) if the graph is represented by adjacency matrix.
B) O (n) if the graph is represented by adjacency list.
C) O (e) if the graph is represented by adjacency list.
D) None of the above

1.7 The smallest number of keys that will force a B- tree of order 3 have a height 3 is:

A) 12
B) 10
C) 7
D) None of the above

1.8 Which of the following expressions accesses the (i,j) th entry of a matrix stored in column major form?

A) n*(i-1) + j
B) m*(j-1) + i
C) m*(n-j) + j
D) n*(m-i) + j

1.9 Given 2 sorted lists of size “m” and “n” respectively. The number of comparisons needed in the worst case by merge sort will be

A) m*n
B) Max (m, n)
C) Min (m, n)
D) m + n –1

1.10 A complete binary tree with 10 leaves

A) cannot have more than 19 nodes
B) has exactly19 nodes
C) has exactly 17 nodes
D) cannot have more than 17 nodes

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 Heap sort is more efficient for small size of file.
2.2 The space requirement for the quick sort method depends on the number of nested recursive calls or the size of the stack.
2.3 One of the major drawbacks of the B-Tree is the difficulty of traversing the keys sequentially.
2.4 Breadth-first search algorithm can only be used for undirected graph.
2.5 Any general tree can be converted to a binary tree.
2.6 The method of interpreting a bit pattern is called a data type.
2.7 "Linear probing" as a collection resolution technique in hashing usually leads to clustering of data.
2.8 'Insertion in' and 'deletion from' an array does not involve physical movement of elements of the arrays.
2.9 It is advantageous to implement a stack using a doubly connected linked list instead of using a singly connected linked list.
2.10 Insertion of a new element in a priority queue always occurs at the rear of the queue, irrespective of its priority.

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	Forest	**A.**	Ordered set of elements
3.2	Used in sparse matrix	**B.**	Dynamic allocation
3.3	Vertex with no incident edges	**C.**	Binary search
3.4	Threaded	**D.**	Queue
3.5	Division of array	**E.**	Circular list
3.6	Height Balanced Trees	**F.**	Ordered set of ordered trees
3.7	Graph Representation	**G.**	Tree
3.8	Open addressing	**H.**	Isolated vertex
3.9	Pattern Matching	**I.**	Sequential search
3.10	First in last out	**J.**	Adjacency Multi-list
		K.	Binary Tree
		L.	AVL Trees
		M.	Stack
		N.	Dynamic environment
		O.	Efficient Search
		P.	Finite Automata

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.	Ordered set	**B.**	Folding	**C.**	Insertion
D.	Linked list	**E.**	n + 2 * e	**F.**	n + e
G.	array	**H.**	2 * n	**I.**	10
J.	BFS	**K.**	FIFO	**L.**	12
M.	32	**N.**	One-to-many	**O.**	Many-to-many
P.	Doubly-linked list	**Q.**	0	**R.**	Abstract data type

4.1 A graph represents _____ relationship between nodes.

4.2 _____ data structure is used to implement dynamic storage management.

4.3 If x=2.5, y=0.1, m=1, n=-1. The value of the expression x > y && m < n is _____.

4.4 A B-tree of order 24 contains at least _____ keys in non-root node.

4.5 _____ can be used to find the shortest distance between given two nodes in a graph.

4.6 Given int r = 10;

Int *q = &r;

The value of *q is _____.

4.7 The _____ data structure uses direct access method for retrieval of the data.

4.8 Total number of nodes required to represent an undirected graph with "n" nodes and "e" edges using adjacency list representation is _____.

4.9 List is a(n) _____ of elements.

4.10 Linked list is preferred over an array for _____ operation.

PART TWO

(Answer any **FOUR** questions)

5.

a) Write the different operations that can be done in a stack of elements of type T as well as in a queue of elements of type T.

b) Illustrate with the help of an example how an arithmetic expression can be evaluated by using a stack.

c) Give array implementation of stack and queue.

(4+5+6)

6.

a) Define a binary tree. What do you mean by tree traversal? Give the different traversal algorithms.

b) Can we represent a general tree as a binary tree? If yes, give an example otherwise justify your answers.

c) Construct an AVL tree with the following key arriving in the given order:

k, t, v, a, e,

(6+4+5)

7.

a) Write the structure of a node for linked implementation of a polynomial. Write a function in 'C' to create a linked list for a polynomial.

b) What do you mean by circular queues? Give the array implementation of it. Write an algorithm for insertion and deletion of elements from the circular queue.

(7+8)

8.

a) What is a directed graph? What is a subgraph? What is a Hamiltonian path?

b) Explain how existence of a cycle in an undirected graph may be detected by traversing the graph in the depth first manner.

c) Show that the number of vertices of odd degree in a finite graph is even.

(3+6+6)

9.

a) Show the steps of sorting a set of numbers using quick sort.

b) Insert the following keys into a B-Tree of order 3.

10 , 24 , 23 , 11 , 31 , 16 , 26 , 35 , 29 , 20 , 46 , 28

(7+8)