Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– II - EXAMINATION – WINTER 2015

Subject Code: 2620001 **Date:30/11/2015**

Subject Name: Data Structures

Time:02.30 p.m. To 05.00 p.m. **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Answer the following questions by selecting an appropriate option. **07**

(1) For any real constants a and b where b > 0, $(n + a)^b$ = _____.
(a) $\Theta(n^b)$ (b) $\Theta(a^b)$ (c) $\Theta(n + a)$ (d) $\Theta(a)$

(2) In merge sort, merge process for N numbers requires time _____.
(a) $O(N^2)$ (b) O (N) (c) O (N log N) (d) O (log N)

(3) How many comparisons are required to sort N numbers using selection sort?
(a) N (b) N^2 (c) N (N + 1) / 2 (d) N (N - 1) / 2

(4) A binary tree T has N leaf nodes then the number of nodes of degree 2 in tree T is _____.
(a) log N (b) N – 1 (c) N (d) 2^N

(5) Which queue should only be used when the queue is emptied at certain intervals?
(a) Simple Queue
(b) Circular Queue
(c) Priority Queue
(d) Double Ended Queue

(6) Which data structure is used for polynomial manipulation efficiently?
(a) Linked List
(b) Tree
(c) Stack
(d) Queue

(7) In a graph G with N vertices, if every vertex is connected with every other vertex then the total number of edges in Graph G are _____.
(a) N (b) N - 1 (c) N (N + 1) / 2 (d) N (N - 1) / 2

(b) Answer the following questions. **07**

(1) The running time of an algorithm A is at least $O(N^2)$.
Whether the above statement is True or False? Justify with reason.

(2) Which algorithm is a formal system for string manipulation that was originally developed to support theory of computation?

(3) Which data structure makes use of computed addresses to locate its elements?

(4) Define : Data Structures

(5) Write the vector representation of circularly doubly linked linear list with header node.

(6) Define : Digraph

(7) Which data structure is useful to implement any recursive process using a non-recursive code?

Q.2 **(a)** Write and analyze algorithm for Insertion sort to find out the required time in best case and worst case situations. **07**

(b) What is stack machine? Explain it with algorithm to generate the stack-machine assembly language code and trace the algorithm for expression A = B * C + A. **07**

OR

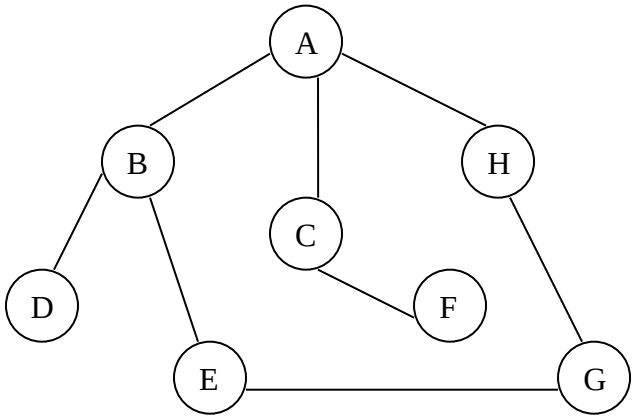
(b) Explain the address calculation formula for 1-dimensional, 2-dimensional and 3-dimensional row major array. How the polynomial $X^2 + 3XY + Y^2 + Y - X$ be represented using array? **07**

Q.3 **(a)** Generate a Trie structure for the following list of words. **07**
ARRAY, BINARY, DATA, GRAPH, INSERTION, LINEAR, LINKED, LIST, PRIMITIVE, QUEUE, SELECTION, SORT, STACK, STRUCTURE, TREE.

(b) Write algorithm to sort data in ascending order using partition-exchange sort method and sort the following set of data using it. **07**
41, 22, 73, 10, 64, 57, 93, 35, 98, 86

OR

Q.3 **(a)** Differentiate DFS Vs BFS. Give the DFS and BFS traversal for following graph starting with vertex A. **05**



(b) Write algorithm to copy one linked list to another linked list. Source list contains the field INFO to store information and LINK as pointer while destination list contains DATA to store information and PTR as pointer. **05**

(c) Write non-recursive algorithm to search an element from the list using Binary search. **04**

Q.4 **(a)** Write algorithm to copy a binary tree. **03**

(b) Write non-recursive pre-order traversing algorithm for binary tree. **04**

(c) Explain the applications of linked linear list. **07**

OR

Q.4 **(a)** Explain : garbage collection. **03**

Q.4 **(b)** Give the linked list vector representation for the following polynomials and the resultant polynomial that can be obtained through multiplying them. **04**
(1) $X^2 + XY^2 + YZ + Y$ (2) $X + XZ$

(c) What is hashing? List and explain various hashing functions with suitable example. **07**

Q.5	**(a)**	What is sparse matrix? Explain the sequential representation and multi-linked structure with suitable example.	**07**
	(b)	Explain the recursive process with flow chart. Write recursive algorithm to find out GCD of two numbers.	**07**

OR

Q.5	**(a)**	Generate a binary search tree for the following set of data. 51, 100, 39, 45, 77, 93, 14, 68, 26, 82. Generate in-order threaded binary tree of the above tree after deleting the node with value 77.	**07**
	(b)	What is a circular queue? Explain it with suitable example. Write algorithms to insert an element to and delete an element from a circular queue.	**07**

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