Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA- IInd SEMESTER–EXAMINATION –JUNE - 2012

Subject code: 2620001 **Date: 08/06/2012**

Subject Name: Data Structures (DS)

Time: 10:30 am – 01:00 pm **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) State weather followings are true/false. Justify it. 07

(i) Binary search takes ***O(n)*** time to execute.

(ii) Maximum number of nodes in binary tree of depth ***k*** is $2^{(k+1)} - 1$.

(iii) Hashing taken place when two or more keys maps to the same memory location.

(iv) Stack is used in a non-recursive implementation of a recursive algorithm.

(v) At most one cycle could be present in tree.

(vi) A preorder traversal technique lists the nodes of binary search tree in ascending order.

(vii) Exponential algorithms run faster than polynomial time algorithms.

(b) Answer the following questions. 07

(i) List the characteristics of spanning tree.

(ii) Define a Graph.

(iii) Give the equivalent postfix expression for the infix expression ***a / b * c – d + f / e***

(iv) Which data structure is used for Breadth First Traversal of graph?

(v) Differentiate Complete Binary Tree and Full Binary Tree.

(vi) How does a linked stack differ from a linear stack?

(vii) Obtain the address of A[i][j][k] for an 3-dimensional array $A[u_1:u_2:u_3]$ where α is the base address and each element allocates 1 word in memory.

Q.2 **(a)** Discuss the various applications of stack. **07**

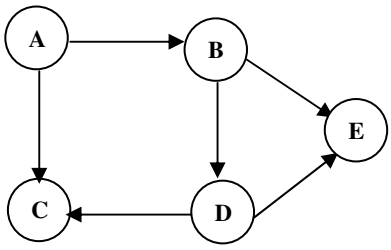
(b) **(i)** Explain how stacks are used in non-recursive implementation of recursive program by giving suitable example. **03**

(ii) Construct an expression tree for given infix expression: ***(A + B) * C – D***. State the result of preorder traversal of the tree. **04**

OR

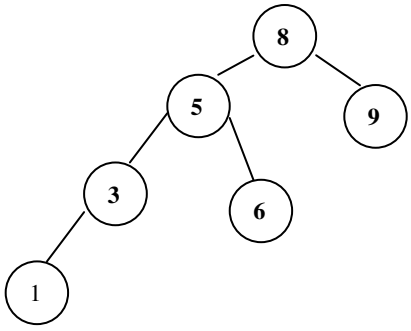
(b) **(i)** Write an algorithm to create sorted order polynomial in two variables. **03**

(ii) Write a Warshall's algorithm to find path matrix of a graph. Find the path matrix for following graph. **04**



Q.3 **(a)** Consider a hash table of size = 10. Using quadratic probing, insert the keys 72, 27, 36, 24, 63, 81 and 101 into the table. Take c_1=1 and c_2=3. **07**

(b) Write a non-recursive algorithm for preorder traversal of binary tree. Give the preorder traversal of following binary tree also show the content of stack. **07**



OR

Q.3 **(a)** Show all passes of merge sort algorithm for following data:39, 9, 89, 45, 90, 26, 71, 18. Also analyze merge sort algorithm in best case, worst case and average case. **07**

(b) What is the significance of Threaded Binary Tree? Give the node structure of it. Also explain advantages of threaded binary tree. Construct threaded binary tree for given data: 67, 34, 12, 11, 56, 89, 54, 33, 98, 17 **07**

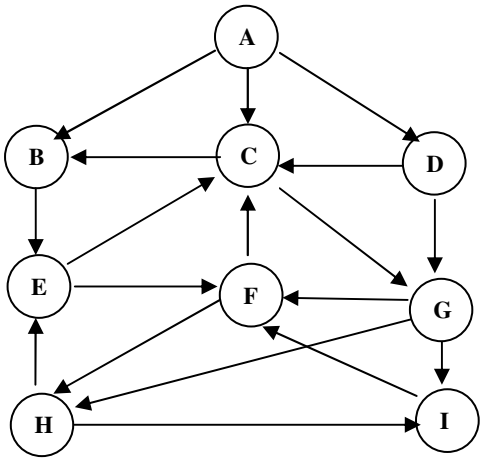
Q.4 **(a)** Define the characteristics of B-tree. Construct B-tree of order 5 by inserting the following elements: 3, 14, 7, 1, 8, 5, 11, 17, 13, 6, 23, 12, 20, 26, 4, 16, 18, 24, 25, and 19 **07**

(b) Show all passes of Heap Sort for the list: { 15,35,55,75,5,95,85,65,45,25} . **07**

OR

Q.4 **(a)** Construct an AVL tree by inserting the following elements in the given order. 63, 9, 19, 27, 18, 108, 99, 81 by applying appropriate rotation. **07**

(b) Write an algorithm for Depth First Traversal. Give the DFT traversal from vertex H for following graph and show the content of stack. **07**



Q.5 **(a)** **(i)** Explain the Trie in detail by giving suitable example. **04**

(ii) Write an algorithm to convert postfix expression to assembly code. **03**

(b) Define a recurrence relation for Tower of Hanoi problem. Also find the solution of it. **07**

OR

Q.5 **(a)** **(i)** Write an algorithm to insert element at front in queue. **04**

(ii) Define O (big oh) , Ω (omega) and θ (theta) notations of time complexity. **03**

(b) Explain the Dijkstra's algorithm by giving suitable example. **07**

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