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Reg. No. : .....

Name : .....

**Fourth Semester B.Tech. Degree Examination, July 2015  
(2008 Scheme)**

**08.405 : DATA STRUCTURES AND ALGORITHMS (RF)**

Time : 3 Hours

Max. Marks : 100

**PART – A**

Answer **all** questions. **Each** question carries 4 marks.

1. Write an algorithm to solve the Towers of Hanoi Problem.
2. What is a stable sort ? Give examples.
3. Show that the average case time complexity for insertion sort is  $O(n^2)$ .
4. Select a suitable representation for a sparse matrix so as to save space. Write an algorithm to efficiently transpose such a matrix.
5. Why is it not possible to solve the Bridges of Konigsberg problem ?
6. Define the notations for time complexity of algorithms.
7. Write an iterative algorithm for inorder traversal of a binary tree.
8. Write the Fibonacci search algorithm. When is it superior to the Binary Search ?
9. Modify the BFS algorithm to generate a spanning tree.
10. Show that in a non-empty binary tree, if  $n_0$  is the number of leaves and  $n_2$  is the number of nodes of degree 2, then  $n_0 = n_2 + 1$ .

**PART – B**

Answer **any one** question from **each** module. **Each** question carries 20 marks.

**Module – I**

11. a) Why are exponential-time algorithms considered practically infeasible ? **4**
- b) Write an algorithm to multiply two polynomials represented using linked lists. **10**
- c) Implement a deque. Write procedure for inserting and deleting at either end. **6**

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12. a) What are the advantages provided by prefix and postfix notations ? 4  
 b) Write an algorithm which converts an infix expression to postfix and then evaluates the postfix expression. 10  
 c) Give an example of a real-life problem whose obvious solution is an exponential-time algorithm. 6

### Module – II

13. a) How does the Boundary Tag Method solve the problems associated with free space management ? 12  
 b) The following is the output of traversals done on a binary tree.  
**Preorder** : 20 12 6 5 28 26 28 11 12 5  
**Inorder** : 26 12 28 5 6 20 12 11 5 28  
 Generate the tree and perform a postorder traversal of the above tree. 8
14. a) Show that for the complete graph with  $n$  vertices, the number of spanning trees is  $2^{n-1} - 1$ . 6  
 b) Write an algorithm for a singly linked circular list to reverse the direction of the links. 7  
 c) Write an algorithm that takes an arbitrary non-recursive list  $L$  with no shared sublists and inverts it and all of its sublists. That is, if  $L = (a, (b, c))$  then the output should be  $((c, b), a)$ . 7

### Module – III

15. a) Write algorithms for heap sort and merge sort. 6  
 b) Derive the expressions for time complexity of heap sort and merge sort. 8  
 c) How is polyphase merging done using multiple input tapes ? 6
16. a) Show that in external sorting with disks by  $k$ -way merging using a selection tree, the internal processing time is independent of  $K$ . How is the performance affected when the selection tree is replaced by a Tree of Losers ? 14  
 b) What are the worst-case scenarios for quick sort ? How can they be avoided ? 6