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**M 6169**

M.E. DEGREE EXAMINATION, MAY/JUNE 2009.

First Semester

Computer Science and Engineering

CS 1602 — DATA STRUCTURES AND ALGORITHMS

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the significance of function templates?
2. Order the following function by growth rate :  
 $N$ ,  $N \log N$ ,  $N \log^2 N$ ,  $2^N$ ,  $3^7$ ,  $N^{1.5}$
3. Write a simple routine to pop from a stack (array implementation).
4. Show the result of inserting 3, 1, 4, 6, 9, 2, 5, 7 into an initially empty binary search tree.
5. Give the pseudo code for simple topological sort.
6. Show the following regarding maximum item in the heap :  
"It must be at one of the leaves".
7. Find the buddy of a block of size  $2^i$  if it begins at some even or odd multiple of its block size.
8. Give examples for the four memory management strategies.
9. What is the running time of insertion sort if all the elements are equal?
10. Illustrate with an example that the greedy algorithm to minimize the mean completion time for multiprocessor job scheduling works.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Given two sorted lists L1 and L2, write a procedure to compute  $L1 \cap L2$  using only the basic list operations. (8)
- (ii) Write a recursive function that returns the number of 1's in the binary representation of N. (8)

Or

- (b) (i) Design a class template ,OrderedSet, that stores a collection of items (in an array), along with the current size of the collection. Provide public functions isEmpty, makeEmpty, insert, and remove on the collection. (10)
- (ii) Write an alternative gcd algorithm based on the following observation (arrange so that  $a > b$ )
- $$\text{gcd}(a, b) = \text{gcd}(a/2, b) \text{ if } a \text{ is even and } b \text{ is odd.} \quad (6)$$
12. (a) (i) Develop an algorithm for findMin and findMax using recursion in binary search trees. (10)
- (ii) Illustrate that the infix to postfix conversion takes  $O(N)$  time. (6)

Or

- (b) Explain the concepts in AVL trees and illustrate single rotation with an example. (16)
13. (a) Develop an algorithm for obtaining spanning tree for a given graph and a starting node of a tree. (16)

Or

- (b) Develop an algorithm to take N elements and insert them into a heap one by one. Calculate the running time of the algorithm for sorted and random inputs. (16)
14. (a) Describe the garbage collection algorithm for equal sized blocks. (16)

Or

- (b) (i) Explain the storage compaction process and the methods for computing forwarding addresses. (10)
- (ii) Describe the issues in memory management. (6)
15. (a) Explain the procedure for heapsort with an example and illustrate the deleteMax procedure. (16)

Or

- (b) Explain the backtracking method to find an optimal solution for tic-tac-toe. (16)