LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

FIRSTSEMESTER – NOVEMBER 2017

17/16PMT1MC04- COMPUTER ALGORITHMS

Date: 10-11-2017 Dept. No. Max. : 100 Marks
Time: 01:00-04:00

Answer ALL the Questions:

1. a) Explain the terms: Computational procedures, algorithm validation, debugging, profiling, performance analysis. (5)

OR

b) The factorial function $n!$ has value 1 when $n \leq 1$ and value $n * (n-1)!$ when $n > 1$. Write an iterative algorithm to compute $n!$. Also calculate the time complexity. (5)

c) (i) What is a priority queue? Give an example.
(ii) State a procedure to add and delete an item from a queue and stack. (3+ 12)

OR

d) Write algorithm HEAPIFY. Simulate A(1 : 7) = (15, 34, 78, 67, 79, 54, 89). (15)

2. a) Give the control abstraction for divide and conquer. (5)

OR

b) State the algorithm to find the k^{th} smallest element. (5)

c) State algorithm MergeSort. Simulate it on $A(1 : 7) = (45, 24, 37, 15, 70, 82, 12)$. Draw tree of calls of MergeSort when $n = 7$. (15)

OR

d) Write algorithm QUICKSORT. Simulate it on
$A(1 : 10) = (65, 70, 74, 47, 80, 85, 60, 55, 50, 45)$. (15)

3. a) If $p_1/w_1 \geq p_2/w_2 \geq \cdots \geq p_n/w_n$, then prove that the algorithm GreedyKnapsack generates an optimal solution to given instance of the Knapsack problem. (5)

OR

b) Explain optimal storage on tapes with an example. (5)

c) State greedy algorithm for sequencing unit jobs with deadlines and profits. Find the optimal solution when $n = 5$, $(p_1, p_2, p_3, p_4, p_5) = (20, 15, 10, 5, 1)$,
$(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$. (15)

OR

d) Explain the problem 'Optimal Merge Pattern'. State an algorithm which generates a two-way merge tree. Find binary merge tree with minimum weighted external path length for files of length 28, 32, 12, 5, 84, 53, 91, 35, 3, 11. (15)

4. a) State a recursive backtracking algorithm. (5)

OR

b) Explain inorder, preorder and postorder traversals with examples. (5)

c) Apply backtracking method, to find a solution to 4-queens problem. Give an algorithm to place the k^{th} queen in column i of a $n \times n$ chessboard and a backtracking algorithm to solve the n-queens problem. (15)

OR

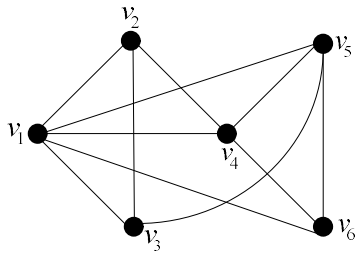
d) State algorithm SumOfSub. Let w={5,7,10,12,15,18,20} and m=35. Find all possible subsets of w that sums to $m$using SumOfSub. (15)

5. a) Explain 3-SAT problem ? State Cook's theorem. (5)

OR

b) Let $A[i]$, $1 \leq i \leq n$ be an unsorted array of positive integers. State a nondeterministic algorithm which sorts the numbers into nondeceasing order. (5)

c) Explain node cover decision problem with an example. Determine the minimum node cover for the following graph.



Prove that the node cover decision problem is NP-Complete. (15)

OR

d) Explain the maximum clique problem with an example. Prove that CNF-satisfiability reduces to clique decision problem. (15)

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