LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **NOVEMBER 2018**

16/17/17PMT1MC04 – COMPUTER ALGORITHMS

Date: 01-11-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Answer ALL the Questions:

1. a) State a procedure to receive n numbers and print the average of n numbers. Find the number of steps per execution of the statements. (5)

OR

b) Define a stack. State Algorithm Add(*item*) for inserting elements into stack. (5)

c) Explain a Binary Search Tree with an example. Write an algorithm to insert an element with key x into a Binary Search Tree. (15)

OR

d) Write algorithm HeapSort. Simulate it on A(1 : 5) = (12, 23, 62, 56, 34). (15)

2. a) Give the procedure to find the k^{th} smallest element. (5)

OR

b) If the time for merging operations in Algorithm MergeSort is proportional to n, then find the computing time when $n = 2^k$. (5)

c) State algorithm BinSearch. Simulate it on $A(1 : 9)$ = (14, 25, 37, 62, 71, 83, 87, 90, 101) to locate x when $x = 40$, $x = 25$, $x = 90$. Draw the binary decision tree when $n = 9$. (15)

OR

d) Write algorithm QUICKSORT. Simulate it on $A(1 : 8)$ = (46, 84, 3, 95, 10, 65, 73, 44). (15)

3. a) Give the greedy method control abstraction for subset paradigm. (5)

OR

b) Let J be a set of k jobs and $\sigma = i_1 i_2 \dots i_k$ a permutation of jobs in J such that $d_{i_1} \leq d_{i_1} \leq \cdots \leq d_{i_k}$. Prove that J is a feasible solution if and only if the jobs in J can be processed in the order σ without violating the deadline. (5)

c) State procedure GREEDY-KNAPSACK and prove its correctness. Simulate Greedy-Knapsack on $(p_1, p_2 \dots p_5)$ = (24, 25, 15, 8, 18), $(w_1, w_2 \dots w_5)$ = (4, 7, 6, 5, 3) when $n = 5$ and $m = 15$. (15)

OR

d) Explain the problem 'Optimal Merge Pattern' with an example. Give procedure Tree(n). Simulate it on 10 files of length 45, 12, 61, 35, 84, 20, 17, 27, 52, 90. (15)

4. a) Give the recursive formulation of inorder, preorder and postorder traversals. (5)

OR

b) State Algorithm Backtrack(k). (5)

c) Explain n-queens problem. Give an algorithm to find the solution to n-queens problem. (15)

OR

d) State algorithm SumOfSub. Simulate it on $w = \{2, 5, 6, 8, 10, 12\}$ and $m = 20$. Also draw the portion of state space tree generated by SumOfSub. (15)

5. a) Define the terms: *P*, *NP*, polynomial complexity, polynomially equivalent. (5)

OR

b) Give a nondeterministic algorithm to check whether a propositional formula is satisfiable. (5)

c) Explain clique decision problem. Prove that clique decision problem is NP-complete. (15)

OR

d) (i) State Cook's theorem.
(ii) Define a node cover for a graph G . Give an example.
(iii) Prove that the clique decision problem reduces to the node cover decision. (3 + 3 + 9)

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