LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRSTSEMESTER – APRIL 2018

17PMT1MC04- COMPUTER ALGORITHMS

Date: 30-04-2018 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

Answer ALL the questions. Each question carries equal marks.

1. a) If S is a set of n elements, the *powerset* of S is the set of all possible subsets of S. Write a recursive algorithm to compute the power set of S. (5)

OR

b) Give procedure SEARCH to search for an element x in an array $A(1 : n)$ and return t if $a(t) = x$ and zero otherwise. (5)

c) Describe a Binary Search Tree. Write an algorithm to search an element with key x by recursive search method in a Binary Search Tree. (15)

OR

d) Give HEAPSORT to sort numbers in an array. Simulate it on $A(1 : 6) = (14, 17, 25, 12, 13, 17)$. (15)

2. a) Calculate the time complexity of divide and conquer algorithm for $a = 1$, $b = 2$, $f(n) = cn$ using recurrence relation. (5)

OR

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

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

OR

d) Give procedure BINSRCH and simulate it on A(1: 10) = (21, 36, 45, 70, 75, 82, 90, 95, 100, 110) when $x = 46$ and $x = 82$. Draw the binary decision tree when $n = 10$. (15)

3. a) Give an algorithm to generate a 2-way merge tree. (5)

OR

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

c) State procedure GREEDY-KNAPSACK. Find an optimal solution to the knapsack problem instance: $n = 7$, $m = 15$, $(p_1, p_2 \ldots p_7) = (10, 5, 15, 7, 6, 18, 3)$, $(w_1, w_2 \ldots w_7) = (2, 3, 5, 7, 1, 4, 1)$. (15)

OR

d) Write algorithm JS. What is the solution generated by the function JS when $n = 5$, $(p_1, p_2 \ldots p_5) = (20, 15, 10, 5, 1)$, $(d_1, d_2 \ldots d_5) = (2, 2, 1, 3, 3)$. (15)

4. a) Apply backtracking method, to find a solution to 4-queens problem. (5)

OR

b) Explain depth first search traversal with an example. (5)

c) Give the procedure for general iterative and recursive backtracking method. (15)

OR

d) State algorithm SumOfSub. Let $n = 6$, $m = 30$, simulate SumOfSub on the data $w = \{5, 10, 12, 13, 15, 18\}$. (15)

5. a) Describe a satisfiabilityproblem. (5)

OR

b) Write a nondeterministic sorting algorithm. Also calculate the time complexity. (5)

c) Explain node cover decision problem with an example. Also prove that the node cover decision problem is NP-Complete. (15)

OR

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

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