No. of Printed Pages : 4

MMTE-002

M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE) (MACS)
M.Sc. (MACS)

00789

Term-End Examination

December, 2011

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 hours *Maximum Marks : 50*

Note : *Answer **any five** questions. Calculators are **not** allowed.*

1. (a) Does the array 5

3	6	2	5	2	8	2	1	4	1

represent a max heap ? Justify your answer. If it doesn't, show how this can be converted into a max heap using MAX-HEAPIFY algorithm. Represent the max heap as a binary tree.

(b) Let T (n) be a function satisfying the recurrence 3

$$T(n) = T\left(\left\lceil \frac{n}{2} \right\rceil\right) + T\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + 1, T(1) = 1.$$

Prove by induction that T(n) satisfies a bound of the form $T(n) \leq (n - b)$ for appropriately chosen values of c and b. Also find appropriate values of b and c.

(c) For carrying out certain task, there are two algorithms, A and B. Algorithm A takes n^2+1000 operations to complete the task and algorithm B takes 65n operations to complete the task , where n is the size of the input. Find a no ϵ N such that for any input of size greater than no, algorithm B performs better than algorithm A. 2

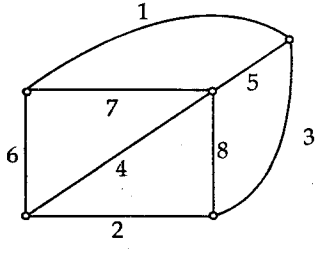
2. (a) Find an optimal parenthesisation of a matrix chain product whose sequence of dimensions is given by {4, 6, 30, 8, 9}. 5

(b) Illustrate all steps of Robin - Karp - Miller string matching algorithm for P = 1035, T = 140610216. and Q = 7. 5

3. (a) Explain the algorithm design divide and conquer approach using merge sort. 2

(b) Illustrate MERGE procedure of MERGE SORT using the array {1, 4, 6, 7} and {2, 5, 8, 9, 11}. 3

(c) Explain the Prim's algorithm using pseudo code for finding the minimal spanning tree in a graph. Use it to find the minimal spanning tree in the following graph. 5



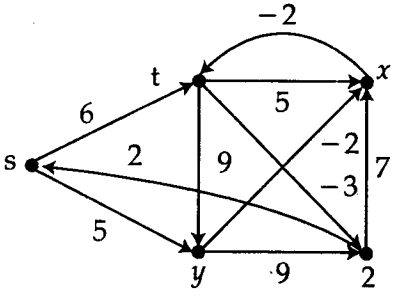
4. (a) Illustrate the procedure PARTITION, used in quick sort, using the array. 4

$A = \{3, 5, 2, 7, 1, 4\}$

(b) Explain with the help of an example that greedy strategy does not always yield optimal solution for optimisation problems. 4

(c) Compute the DFT of the vector $(2, 2, -1, 1)$ 2

5. (a) Explain why there is no solution for the shortest path problem in a weighted directed graph if it contains a cycle of negative weight. Explain the Bellman - Ford algorithm with the help of the following graph with r as the source vertex. 6



(b) Explain the counting sort algorithm using the array 4

$A = \{1, 3, 2, 1, 5, 2, 6\}$

6. (a) Explain the INORDER - TREE - WALK (x) procedure with pseudo code. Show that, if x is the roof of an n - mode sub tree, then the call INORDER - TREE - WALK (x) takes (H) (n) times. 6

(b) Find 7^{562} (mod 563) using modular exponentiation algorithm. 4