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MMTE-002

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

M.Sc. (MACS)

Term-End Examination

June, 2015

00968

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 hours *Maximum Marks : 50*

Note : *Question no.* ***6*** *is* ***compulsory****. Answer any* ***four*** *questions from the remaining questions. Calculators are* ***not*** *allowed.*

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1. (a) Give an algorithm in pseudocode to find the maximum element of an array of n integers. Also, find the running time of your algorithm. *5*

(b) Sort the following numbers using Heapsort algorithm : *5*

8, 3, 2, 9, 10, 5, 6.

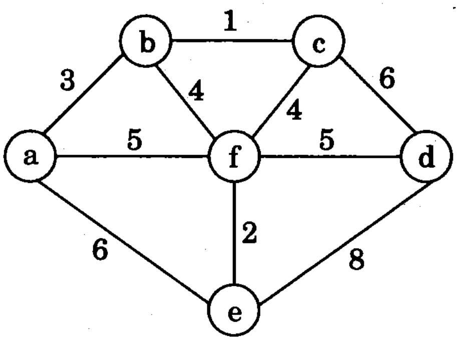
2. (a) Sort the following numbers using radix sort algorithm showing all the steps : *5*

{3567, 4098, 6804, 8573, 2784, 7348, 5740, 7642, 2430, 9248}.

(b) Write an algorithm to implement disjoint-set forest with union-by-rank heuristic. *5*

3. (a) Give an optimal parenthesisation of matrix chain product whose sequence of dimensions is {15, 10, 4, 10, 5}. Show all the steps in the Dynamic programming algorithm. 5

(b) Find the minimum cost spanning tree for the following graph using Kruskal's algorithm : 5

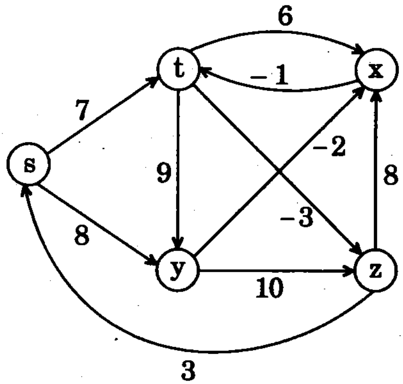


4. (a) For the polynomials $g(x) = x^2 + 5x + 2$ and $h(x) = x^2 - 3x + 1$, find the point value representation using the points [1, –1, i, –i]. Use the representation to multiply the polynomials in coefficient form. 5

(b) Find the maximum-size subset of mutually compatible activities for the following set S of activities, which is sorted in monotonically increasing order of finish time : 5

i	1	2	3	4	5	6	7	8	9
s_i	1	3	0	5	3	5	6	8	8
f_i	5	6	7	8	9	10	11	12	13

5. (a) Use the Bellman-Ford algorithm to find the shortest paths from the source vertex s to all the other vertices in the following graph : *5*



(b) Use the repeated squaring algorithm to find 5^{31}(mod 91). Show all your steps. *5*

6. (a) Rank the following functions by the order of growth : *2*

$$i_n, e^n, 2^n, n^{\log \log n}$$

(b) Is the sequence

< 23, 18, 15, 7, 14, 11, 2, 6, 8, 13 >

a max-heap ? Justify your answer. *2*

(c) For solving fractional knapsack problem, which one of the following approaches will you use ? *2*

(i) Greedy algorithm

(ii) Dynamic programming

(d) "The depth search tree of a given graph is unique." Comment on the statement with justification. *2*

(e) Give an example of a spurious hit in Rabin-Karp string matching algorithm. *2*
