No. of Printed Pages : **3**

MMTE-002

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

M.Sc. (MACS)

00170

Term-End Examination

December, 2012

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 hours *Maximum Marks : 50*

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*Note : Attempt **any five** questions. Use of Calculator is **not** allowed.*

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1. (a) Explain the concept of input size of an algorithm. 2

   (b) Write the pseudo code for heap sort. Derive its running time. 5

   (c) Rank the following functions order of growth by finding an ordering f_1, f_2, f_3, f_4 of the functions satisfying $f_1 = o(f_2)$, $f_2 = o(f_3)$, $f_3 = o(f_4)$. The functions are $n!$, 3^n, e^n, $n^{lg\,lg\,n}$. 3

2. (a) Write an algorithm to delete an internal node from a binary search tree. 5

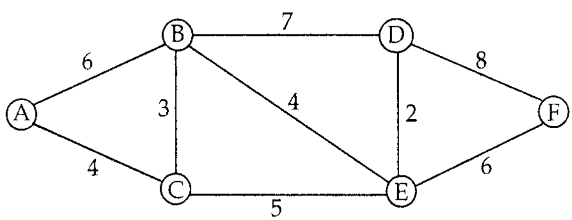
   (b) Derive the recurrence relation for number of operations in merge sort. 5

3. (a) Give examples of the following : 5

(i) A problem for which the Dynamic Programming technique outperforms greedy approach.

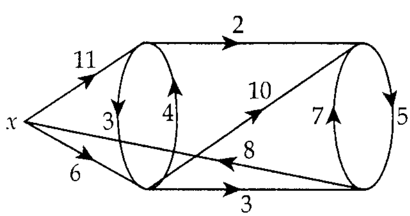
(ii) A problem for which Greedy approach outperforms Dynamic Programming technique.

(b) Obtain the minimum spanning tree using Kruskal's algorithm, showing all the steps. 5



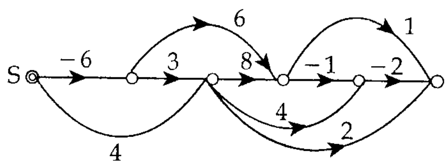
4. (a) Give an optimal parenthesisation of matrix chain product whose sequence of dimensions is (5, 10, 3, 12, 5). Show the steps in the Dynamic programming algorithm. 5

(b) Use Dijkstra's algorithm on the directed graph given below using the vertex x as the source vertex. 5



5. (a) Write the "Raising to powers with repeated squaring" algorithm. Show all the steps for computing $a^b \pmod{n}$ where a = 7, b = 67, n = 41. 5

(b) Show all the steps of the directed acyclic graph shortest path algorithm on the directed graph given below : 5



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

(b) Draw a binary search tree for the following set of keys : 2

15, 5, 16, 12, 3, 20, 10, 13, 6, 7

(c) Define a flow network and a flow. Show that, if f_1 and f_2 are flows, then $\alpha f_1 + (1 - \alpha) f_2$ is also a flow, where $0 \leq \alpha \leq 1$. 3
