

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

Term-End Examination

December, 2013

**MMTE-002 : DESIGN AND ANALYSIS OF
ALGORITHMS**

Time : 2 hours

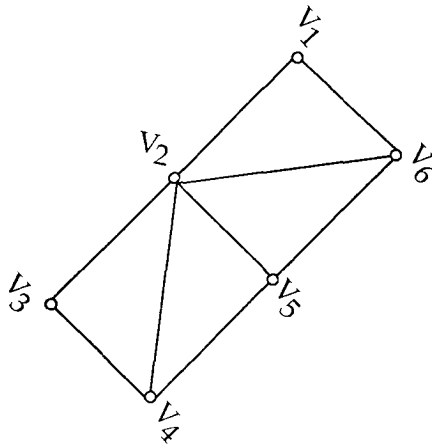
Maximum Marks : 50

Note : Answer any five questions.

(Calculators are not allowed)

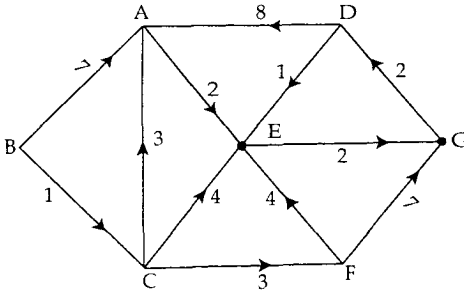
1. (a) Explain the terms with respect to running time of an algorithm. 3
(i) Asymptotic upper bound.
(ii) Asymptotic lower bound.
(iii) Asymptotic tight bound.
- (b) Define Max. heap and Min. heap. Show that an n element heap has height $\lceil \log n \rceil$ 5
- (c) On what kind of inputs the following algorithms exhibit its worst case behaviour : 2
(i) Insertion sort
(ii) Quick sort
2. (a) Use the recursion tree method to guess tight asymptotic bounds for the recurrence $T(n) = 4T(n/2) + n$. Use substitution method to prove it. 5
- (b) Write a pseudo code for a divide and conquer algorithm for finding the position of the largest element in an array of n numbers. 5

3. (a) Illustrate the procedure PARTITION, used in quick sort, using the array { 1, 6, 3, 7, 2, 5, 4 }. 5
- (b) What is the Huffman code for the following set of frequencies : 5
- | | | | | | |
|----|----|----|----|---|---|
| a | b | c | d | e | f |
| 50 | 30 | 20 | 12 | 5 | 3 |
- Show all the steps of the algorithm. Also compute the number of bits required to encode the data.
4. (a) Explain the breadth first search algorithm using the graph given below with V_1 as the source vertex 6



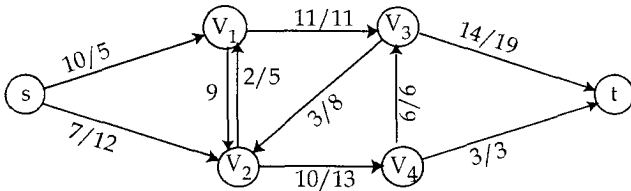
- For each stage in the algorithm, give :
- (i) The distance from the source and the predecessor for each vertex
 - (ii) Black and gray vertices in the form of sets
 - (iii) Vertices in the queue
- (b) Find the gcd of 21 and 35 using extended Euclidean algorithm showing all the steps. 4

5. (a) Find the shortest path from B to G in the following graph by using Dijkstra's algorithm 6



- (b) Construct a 3-way B-tree for the input data given in the following sequence : 4
 10, 20, 30, 50, 60, 35, 40.

6. (a) For the following network flow draw the residual network 5



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