No. of Printed Pages : 4

MMTE-002

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

Term-End Examination

00382

December, 2018

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

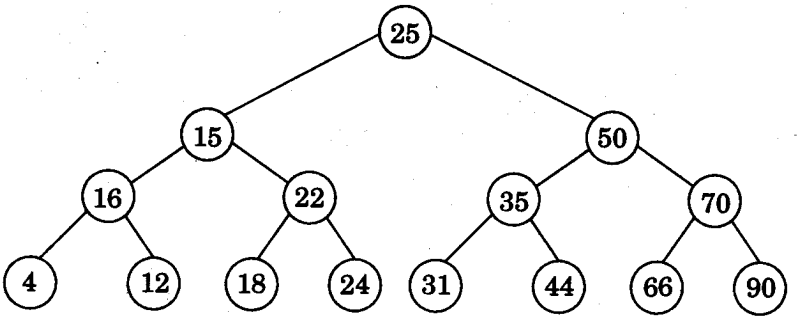
Time : 2 hours *Maximum Marks : 50*

Note : *Question no.* ***6*** *is* ***compulsory****. Answer any* ***four*** *questions from questions no. 1 to 5. Calculators are* ***not*** *allowed.*

1. (a) Sort the following numbers using the Quicksort technique : 5

35, 22, 11, 45, 26, 71, 82

(b) Write the steps to search the numbers 18 and 45 in binary search method. 5



2. (a) Show the results of inserting the keys below in order into an empty B-tree with minimum degree 2. *5*

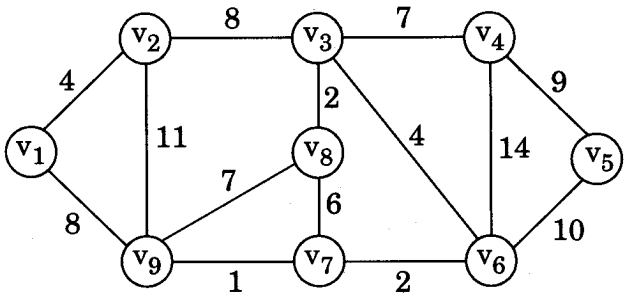
2, 5, 4, 3, 6, 9, 8, 7, 1, 2

(b) Determine an LCS of (1, 1, 1, 1, 1, 0, 0, 1, 1, 1) and (1, 0, 1, 0, 0, 1, 1, 0, 1, 0) using Dynamic programming approach, showing all the steps. *5*

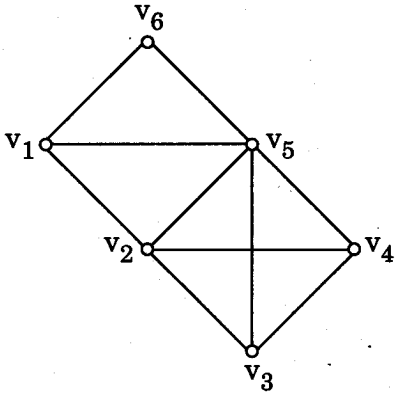
3. (a) Solve the following Huffman code problem using greedy approach : *5*

Symbol	A	B	C	D	E	F	G
Frequency	24	12	10	8	8	6	4

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



4. (a) Apply the breadth first search algorithm to the graph below with v_1 as the source vertex :



For each stage of the algorithm, give :

(i) d(v), π(v) for each vertex where d(v) is the distance from the source vertex to vertex v, π(v) is the predecessor vertex of v.

(ii) White and gray vertices in the form of sets.

(iii) Vertices in the queue.

Also give the breadth first tree. *7*

(b) What are the shortest-path and travelling salesperson problems ? Also give one difference between them. *3*

5. (a) Use the Extended-Euclidean algorithm, with a = 991 and b = 53, to find their gcd. Show all the steps of the algorithm. *7*

(b) Analyse the following algorithm and express the run time in Θ-notation. *3*

```
Algo(n)
sum = 0
For i ← 0 to n
      For j ← i to n
         sum = sum + 1
return (sum).
```

6. Which of the following statements are *True* and which are *False* ? Give reasons for your answers in the form of a short proof or a counter-example. *10*

(a) $3^n = O(2^n)$.

(b) The worst case running time for the Quicksort algorithm is O(n log n).

(c) Every min-heap is a binary search tree.

(d) The minimum spanning tree of any graph is unique.

(e) An optimal solution to the Activity-Selection problem can be obtained by using a Greedy algorithm which successively selects a compatible activity of the shortest duration.
