

No. of Printed Pages : 7

MMTE-002

**M. SC. (MATHEMATICS WITH
APPLICATIONS IN COMPUTER
SCIENCE)**

[M. SC. (MACS)]

Term-End Examination

December, 2025

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

Time : 2 Hours

Maximum Marks : 50

Note: (i) *Attempt any **four** questions from
question nos. 1 to 6.*

(ii) *Question No. 7 is compulsory.*

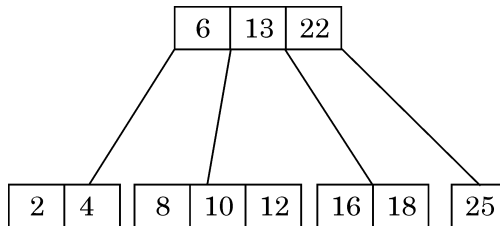
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P. T. O.

1. (a) Sort the following numbers using the merge sort algorithm, showing all the steps you use in the process : 5

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

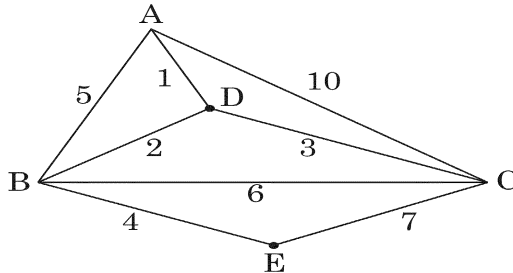
- (b) Explain the process of inserting a new element 11 in the following (2, 4) tree : 5



2. (a) Construct a Huffman code for the following data, explaining all the steps : 5

Character	Frequency
<i>a</i>	50
<i>b</i>	20
<i>c</i>	10
<i>d</i>	5
<i>e</i>	30

- (b) Find the minimum weight spanning tree of the following graph G using Kruskal's Algorithm : 5



3. (a) Find the longest common subsequence of the sequences $X = \langle 1, 2, 3, 2, 5, 2 \rangle$ and $Y = \langle 2, 4, 1, 3, 1, 2 \rangle$ using dynamic programming. 5
- (b) Show that subset sum problem is an NP-complete problem. 5
4. (a) Show that there is a polynomial time reduction from independent set problem to set cover problem. 5

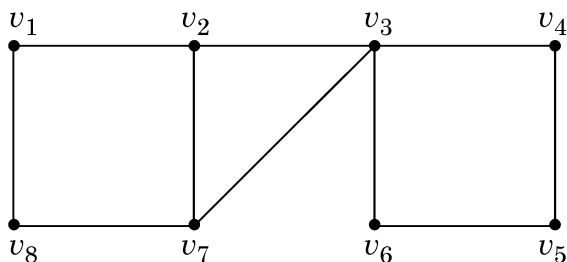
- (b) Write the algorithm for coin changing problem by using dynamic programming technique and explain each of the steps used in it. Do not write any pseudo-code. 5
5. (a) A thief enters a house for robbing it. He can carry a maximal weight of 60 kg into his bag. There are 5 items in the house with the following weights and values. What items should the thief take if he can even take the fraction of any item with him ? 5

Item	Weight	Value
1	5	30
2	10	40
3	15	45
4	22	77
5	25	90

- (b) Explain with the help of an example that Greedy strategy does not always yield optimal solution for optimisation problems. 5

6. (a) Show that the n th Fibonacci number F_n satisfies the inequality $F_n \geq (\sqrt{2})^n$ for all $n \geq 6$. 4

- (b) Apply DFS algorithm to find a spanning tree of the following graph. Also find all the fundamental cycles of the spanning tree : 6



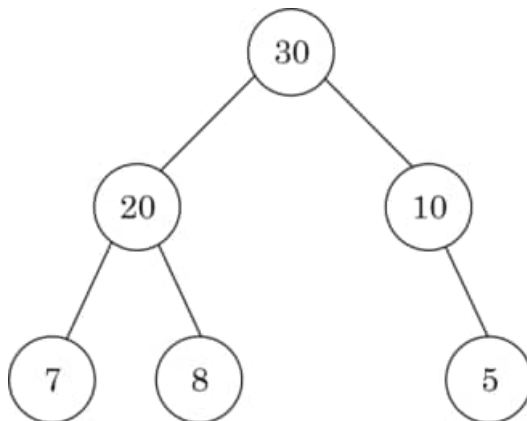
7. Which of the following statements are true and which are false ? Justify your answer with short proof or a counter-example :

$$5 \times 2 = 10$$

(a) $2^n = O((2.5)^n)$

(b) Quick sort is always faster than counting sort when applied on any array of numbers.

(c) The following is an example of max. heap :



- (d) Every binary heap is a binary search tree.
- (e) Dijkstra's algorithm solves the "all pairs shortest path problem".

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