Total No. of Questions: 23

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

IT3CO34 Design & Analysis of Algorithms

Programme	:	B.Tech.	**Branch/Specialisation**	:	IT
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

Marks CO BL

Q1. What is the worst-case time complexity of Insertion Sort? **1 1 1**

Rubric	Marks
c) $O(n^2)$	1

- ○ O(n)
- ○ O(n log n)
- ◉ $O(n^2)$
- ○ O(1)

Q2. Which asymptotic notation is the tightest bound on the growth rate of an algorithm? **1 1 1**

Rubric	Marks
c) Theta (Θ)	1

- ○ Big-O
- ○ Omega (Ω)
- ◉ Theta (Θ)
- ○ Small-o

Q3. The best-case time complexity of Quick Sort occurs when- **1 1 1**

Rubric	Marks
b) The partitioning is always balanced	1

- ○ The pivot is always the smallest element
- ◉ The partitioning is always balanced
- ○ The pivot is always the largest element
- ○ The array is already sorted

Q4. Strassen's algorithm is used for- **1 1 1**

Rubric	Marks
c) Matrix Multiplication	1

- ○ Graph Traversal
- ○ Sorting
- ◉ Matrix Multiplication
- ○ Shortest Path Calculation

Q5. Which algorithm is used to find the shortest path from a single source to all other vertices in a weighted graph? **1 5 1**

Rubric	Marks
b) Dijkstra's Algorithm	1

- ○ Bellman-Ford Algorithm
- ◉ Dijkstra's Algorithm
- ○ Kruskal's Algorithm
- ○ Floyd-Warshall Algorithm

Q6. The Huffman coding algorithm is used for- 1 2 1

Rubric	Marks
b) Data compression	1

- ○ Sorting numbers
- ◉ Data compression
- ○ Finding the shortest path
- ○ Graph coloring

Q7. Which of the following is **not** solved using dynamic programming? 1 2 1

Rubric	Marks
c) Job Sequencing with Deadlines	1

- ○ Longest Common Subsequence
- ○ Floyd-Warshall Algorithm
- ◉ Job Sequencing with Deadlines
- ○ 0/1 Knapsack Problem

Q8. The Bellman-Ford Algorithm is used for- 1 2 1

Rubric	Marks
b) Finding Shortest Path in a Graph with Negative Weights	1

- ○ Finding Minimum Spanning Tree
- ◉ Finding Shortest Path in a Graph with Negative Weights
- ○ Sorting elements
- ○ Finding Strongly Connected Components

Q9. The Branch and Bound method is mainly used for solving- 1 3 1

Rubric	Marks
b) Optimization Problems	1

- ○ Sorting Problems
- ◉ Optimization Problems
- ○ String Matching Problems
- ○ Searching Problems

Q10. In the N-Queens problem, what is the objective? 1 4 1

Rubric	Marks
b) To place N queens on an NxN chessboard such that no two queens attack each other	1

- ○ To find the shortest path
- ◉ To place N queens on an NxN chessboard such that no two queens attack each other
- ○ To determine the minimum spanning tree
- ○ To find the longest common subsequence

Section 2 (Answer all question(s))

Marks CO BL

Q11. Define asymptotic notations with the help of examples? 2 1 2

Rubric	Marks
Definition of asymptotic notations, examples	2

Q12. Solve the recurrence relation: $T(n) = 2T(n/2) + O(n)$. 3 2 3

Rubric	Marks
solution	3

Q13. (a) Explain the working of the Bubble Sort algorithm with an example. **5 4 3**

Rubric	Marks
Definition and explanation of Bubble Sort algorithm with example	5

(OR)

(b) Compare Selection Sort and Insertion Sort in terms of time complexity.

Rubric	Marks
comparision with time complexity	5

Section 3 (Answer all question(s))

Marks CO BL

Q14. What is the main idea behind the Divide and Conquer approach? **2 3 2**

Rubric	Marks
Definition of Divide and Conquer approach	2

Q15. What is the advantage of using Heap Sort over Merge Sort? **3 2 2**

Rubric	Marks
explanation with advantage	3

Q16. (a) Explain Strassen's Matrix Multiplication Algorithm with an example. **5 2 2**

Rubric	Marks
Explanation of the divide-and-conquer approach with example	5

(OR)

(b) Compare Radix Sort and Bucket Sort in terms of time complexity and working principles.

Rubric	Marks
• Comparison and working based on time complexity and use cases	5

Section 4 (Answer all question(s))

Marks CO BL

Q17. What is Huffman Coding? Give an example to create Huffman coding tree. **3 4 3**

Rubric	Marks
Definition and Example of Huffman Coding	3

Q18. (a) Explain Kruskal's Algorithm for finding the Minimum Spanning Tree with an example. **7 4 4**

Rubric	Marks
Definition and purpose of Kruskal's Algorithm	4
Example with proper step-by-step execution	3

(OR)

(b) Describe the Knapsack Problem using Greedy Algorithm and analyze its complexity.

Rubric	Marks
Explanation of the Fractional Knapsack Problem	4
Complexity analysis	3

Section 5 (Answer all question(s))

Marks CO BL

Q19. Explain the Floyd-Warshall algorithm with an example. Explain Process of matrix updation. 4 3 2

Rubric	Marks
Explanation of Floyd-Warshall algorithm with example	4

Q20. (a) Explain the 0/1 Knapsack problem using Dynamic Programming with an example. 6 5 4

Rubric	Marks
explanation of 0/1 Knapsack problem with example	6

(OR)

(b) Describe the Multistage Graph problem and solve it using Dynamic Programming.

Rubric	Marks
Eexplanation of the Multistage Graph problem with Example	6

Section 6 (Answer any 2 question(s))

Marks CO BL

Q21. Explain the N-Queens problem using the backtracking approach. 5 4 3

Rubric	Marks
Explanation of the N-Queens problem	5

Q22. How does the Hamiltonian Cycle problem work using backtracking? 5 4 4

Rubric	Marks
Working of the Hamiltonian Cycle problem	5

Q23. Explain the concept of NP, NP-Complete, and NP-Hard problems with examples. 5 5 1

Rubric	Marks
Explanation with example of all 3	5

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