

|         |  |
|---------|--|
| PRN No. |  |
|---------|--|

|            |                |
|------------|----------------|
| PAPER CODE | U314-212 (ESE) |
|------------|----------------|

**(AY: 2024-25) December 2024 (ENDSEM) EXAM**  
**TY (SEMESTER - I)**

**COURSE NAME: Design & Analysis of Algorithm**

**Branch: AI&DS**

**COURSE CODE: ADUA31202**

**(T.Y PATTERN 2020 R1)**

**Time: [1Hr 30 Min]**

**[Max. Marks: 40]**

**(\*) Instructions to candidates:**

- 1) **Figures to the right indicate full marks. Use of scientific calculator is allowed**
- 2) **Use suitable data wherever required**
- 3) **All questions are compulsory. Solve any two sub question each from Questions 1 and 2**
- 4) **Solve any one sub question (2 marks) from Questions 3 ,4 ,5 and 6 and sub question of 4 marks is compulsory from questions 3,4,5,and 6**

| Q. No. | Question Description  | Max. Marks | CO mapped | BT Level       |
|--------|---|------------|-----------|----------------|
| Q.1    | a) Explain different means of improving efficiency of Algorithm.  | [4]        | CO1       | L1(Remember)   |
|        | b) How algorithm can be used as a problem solving method with example.  | [4]        | CO1       | L2(Understand) |
|        | c) What are asymptotic notations? Explain Big-O, Theta, and Omega notations with examples.  | [4]        | CO1       | L2(Understand) |
| Q2     | a) What is divide and conquer strategy. Name few problems that can be solved using divide and conquer.  | [4]        | CO2       | L1(Remember)   |
|        | b) Explain analysis of Merge sort & Quick Sort with respect to Worst, Best and average case complexities.   | [4]        | CO2       | L3(Apply)      |
|        | c) Consider the following instances of Job Scheduling problem for $n = 5$ , Profit (P1, P2, P3, P4, P5): (20,15,10,5,1), and Deadline (D1, D2, D3, D4, D5): (2,2,1,3,3), Find the optimal solution using Greedy approach? | [4]        | CO2       | L3(Apply)      |
| Q3     | a) Explain dynamic programming strategy? Enlist few applications which can be solved by using dynamic programming.  | [2]        | CO3       | L1(Remember)   |
|        | OR  |            |           |                |
|        | b) Define Dynamic Programming. How does it differ from Greedy Method?   | [2]        | CO3       | L1(Remember)   |
|        | c) Solve the 0/1 Knapsack Problem using Dynamic Programming. The weights are [10,20,30] and the profits are [60,100,120]. The knapsack capacity is 50.  | [4]        | CO3       | L3(Apply)      |
| Q4     | a) What is the backtracking method? Provide an example where backtracking is used to solve a problem.   | [2]        | CO4       | L2(Understand) |

|      | <p style="text-align: center;">OR</p> <p>b) Explain the N-Queen problem. How is backtracking used to solve it? Give stepwise solution</p> <p>c) Solve the Hamiltonian Cycle problem using the backtracking approach (Draw State Space Tree). Explain with help of an example</p>  | [2]    | CO4    | L3(Apply)      |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
|------|---|--------|--------|----------------|---|---|----|---|---|---|---|---|----|---|---|---|-----|-----|--------------|
|      |   | [4]    | CO4    | L3(Apply)      |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| Q.5  | <p>a) What is the Branch and Bound method? Provide an example.</p> <p style="text-align: center;">OR</p> <p>b) Explain the difference between LC Branch and Bound and FIFO Branch and Bound.</p> <p>c) Solve the 0/1 Knapsack problem using the LC Branch and Bound approach<br/>Consider M=8</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>Weight</th> <th>Profit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> <td>10</td> </tr> <tr> <td>2</td> <td>3</td> <td>5</td> </tr> <tr> <td>3</td> <td>4</td> <td>15</td> </tr> <tr> <td>4</td> <td>5</td> <td>7</td> </tr> </tbody> </table> | Item   | Weight | Profit         | 1 | 2 | 10 | 2 | 3 | 5 | 3 | 4 | 15 | 4 | 5 | 7 | [2] | CO5 | L1(Remember) |
| Item | Weight  | Profit |        |                |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| 1    | 2   | 10     |        |                |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| 2    | 3   | 5      |        |                |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| 3    | 4   | 15     |        |                |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| 4    | 5   | 7      |        |                |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
|      |   | [2]    | CO5    | L1(Remember)   |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
|      |   | [4]    | CO5    | L3(Apply)      |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
| Q.6  | <p>a) Define P, NP, NP-complete, and NP-hard problems.</p> <p style="text-align: center;">OR</p> <p>b) Explain the Clique Problem and show how it can be reduced to an NP-complete problem.</p> <p>c) Prove that the Vertex Cover Problem is NP-complete using polynomial-time reduction.</p>   | [2]    | CO6    | L1(Remember)   |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
|      |   | [2]    | CO6    | L1(Remember)   |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |
|      |   | [4]    | CO6    | L2(Understand) |   |   |    |   |   |   |   |   |    |   |   |   |     |     |              |