

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: MCA
BRANCH: MCA**

**SEMESTER : II
SESSION : SP/2025**

SUBJECT: CA419 ANALYSIS OF ALGORITHMS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

		CO	BL																
Q.1(a) What is the significance of Asymptotic Notations in Analysis of an algorithm? Illustrate O , Ω , Θ notations in term of Time Complexity with suitable examples.	[5]	1	2																
Q.1(b) Draw a recursion tree to determine a good asymptotic upper bound on the recurrence relation $T(n)=T(n/2) + n$. Use the substitution method to verify it.	[5]	1	4																
Q.2(a) Given 5 jobs A, B, C, D and E each of them requires 1 unit of time to get completed. The deadline and profit associated with them are {2, 1, 2, 1, 3} and {100, 19, 27, 25, 15} respectively. Apply greedy approach to schedule them maximizing the profit.	[5]	3	3																
Q.2(b) A directed and weighted graph consisting of vertices A, B, C, D, E and F with edges {A,B}, {A, C}, {B,C}, {B, D}, {C, E}, {E, D}, {D, F} and {E, F}. The weights of these edges are 2, 4, 1, 7, 3, 2, 1 and 5 respectively. Apply greedy approach to find shortest path to each of the vertices from vertex A.	[5]	2	3																
Q.3(a) Given an array of n integers, write an algorithm to implement merge sort on it. Deduce a recurrence relation based on your algorithm and show the complexity of your algorithm.	[5]	5	5																
Q.3(b) If 2 large integers are to be multiplied, then how could the concept of Divide and Conquer approach help us. Illustrate the approach by multiplying 24 with 15.	[5]	3	3																
Q.4(a) Formulate a recurrence relation for finding binomial coefficient and then using dynamic programming approach, write an algorithm to compute it. Analyse your algorithm in terms of problem size n.	[5]	5	6																
Q.4(b) Consider a graph consisting of 4 vertices A, B, C and D represented by following cost adjacency matrix: <div style="margin-left: 40px;"> <table style="border-collapse: collapse;"> <tr><td>0</td><td>10</td><td>15</td><td>20</td></tr> <tr><td>5</td><td>0</td><td>9</td><td>10</td></tr> <tr><td>6</td><td>13</td><td>0</td><td>12</td></tr> <tr><td>8</td><td>8</td><td>9</td><td>0</td></tr> </table> </div> A salesperson stationed at A wish to visit B, C and D and then come back to A with minimum travelling expenditure. Apply dynamic programming to solve his problem.	0	10	15	20	5	0	9	10	6	13	0	12	8	8	9	0	[5]	3	3
0	10	15	20																
5	0	9	10																
6	13	0	12																
8	8	9	0																
Q.5(a) There are two boys and a girl, how will you allow them to sit on 3 given chairs so that the girl will never be in between boys using backtracking method of problem solving. Present your answer in terms of state space tree.	[5]	5	3																
Q.5(b) Prove that Clique Decision problem is NP-Hard problem.	[5]	4	5																