

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BCA
BRANCH: BCA

SEMESTER: V/ADD
SESSION: MO/2025

SUBJECT: CN301 FUNDAMENTALS OF COMPUTER ALGORITHMS

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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|---|-----|-----|----|
| Q.1(a) Fill in the blanks with suitable functions: | [2] | CO | BL |
| (i) $5n^2 + 100n\log^2 n + 6 = \Omega(\text{-----})$ | | CO4 | L3 |
| (ii) $n^2\log^2 n + 100n^3 + 6 = O(\text{-----})$ | | | |
| Q.1(b) How is time complexity of an algorithm measured? | [3] | CO4 | L4 |

Estimate time complexity of the following algorithm, where N and M are two positive integers. Justify your answer.

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Step 1: a = 0
Step 2: b = 1
Step 3: for i = 1 to N do the following
        a = a + 1
Step 4: loop (b < M)
        b = b * 2
        end loop
Step 5: Terminate
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|---|-----|-----|----|
| Q.2(a) Estimate space complexity of the algorithm given in Q.1(b). | [2] | CO4 | L2 |
| Q.2(b) With a suitable example, explain the significance of the worst and the best case time complexity of an algorithm. | [3] | CO5 | L5 |
| Q.3(a) Using Master's theorem, obtain an upper bound of the function T(n) which is defined as $T(n) = 2T(n/3) + n$. | [2] | CO4 | L1 |
| Q.3(b) Mention one advantage and one disadvantage of using recursion in solving a problem. | [3] | CO3 | L1 |
| Q.4(a) What is the time complexity of Merge sort algorithm? | [2] | CO4 | L1 |
| Q.4(b) Construct an input instance of five elements suitable for showing the worst case scenario of quick sort algorithm and then explain the worst case time complexity of quick sort. | [3] | CO4 | L4 |
| Q.5(a) Mention one key feature of each of the following design paradigms:
(i) Divide and Conquer (ii) Greedy. | [2] | CO3 | L2 |
| Q.5(b) Solve the following instance of general Knapsack problem using a greedy method and hence find the maximum profit.
Capacity of the Knapsack: 16
Weight vector: <2, 3, 2, 7, 5, 4, 1> Profit Vector: <4, 5, 3, 18, 12, 16, 10> | [3] | CO3 | L3 |