BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO-2022)

CLASS: **IMSC** **SEMESTER: V**
BRANCH: **MATHS & COMP.** **SESSION: MO-2022**

SUBJECT: CS206 DESIGN AND ANALYSIS OF ALGORITHM

TIME: **03 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*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

Q.1(a)	Define average-case time complexity in algorithm analysis. [BT-1] [CO-1]	[2]
Q.1(b)	Prove or disprove: $10n^2 + 9 = O(n)$. [BT-3] [CO-1]	[3]
Q.1(c)	Given the recurrence F(n) = F(n-1) + F(n-2) for n > 1 and two initial conditions F(0) = 0, F(1) = 1. Derive an explicit formula for obtaining n^{th} Fibonacci number. [BT-3] [CO-1]	[5]
Q.2(a)	Specify the general nature of problems where *divide and conquer* approach is applicable. [BT-1] [CO-2]	[2]
Q.2(b)	Give an in-place variant of standard merge sort algorithm. [BT-6] [CO-4]	[3]
Q.2(c)	Derive the various time requirements of your variant (in question above). [BT-5] [CO-5]	**[5]**
Q.3(a)	Specify the key characteristics of problems which can be solved using dynamic programming approach. [BT-1] [CO-1]	[2]
Q.3(b)	Discuss, how the ***principle of optimality*** holds for the *longest common subsequence* problem. [BT-2] [CO-2]	[3]
Q.3(c)	Compare the approaches ***Memoization*** and ***Tabulation*** using a suitable example. [BT-4] [CO-3]	[5]
Q.4(a)	Specify the nature of problems solvable through greedy approach. [BT-1] [CO-2]	[2]
Q.4(b)	Give a backtracking solution to 4-queen problem. You need not specify algorithm. [BT-2] [CO-3]	[3]
Q.4(c)	Improve the original Dijkstra's algorithm for finding the shortest paths such that apart from giving length of shortest paths only it yields corresponding paths as well. [BT-6] [CO-4]	[5]
Q.5(a)	Define the classes P and NP. [BT-1] [CO-1]	[2]
Q.5(b)	How the classes NPC and NP-Hard are related to each other. Express through a suitable Venn diagram. [BT-2] [CO-1]	[3]
Q.5(c)	Propose an approximation algorithm for Travelling Salesperson Problem. Clearly specify the worst-case time complexity of your approach. [BT-6] [CO-4; CO-5]	[5]

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