Reg. No.																

Question Paper Code	13979

B.E. /B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Computer Science and Business Systems

20CBPC502 - DESIGN AND ANALYSIS OF ALGORITHMS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following represents the *best-case* time complexity? (a) Ω (Omega) (b) O (Big O) (c) Θ (Theta) (d) o (Little o)	1	K1	CO1
2.	Which of the following best describes time complexity? (a) The total number of operations executed (b) The time taken to execute the algorithm on specific hardware (c) The relationship between input size and the number of operations (d) The memory used by the algorithm	1	K1	CO1
3.	Which of the following is NOT a step in the substitution method? (a) Verify the guessed solution (b) Guess the form of the solution (c) Substitute the solution back into the recurrence (d) Apply dynamic programming	1	K1	CO2
4.	The Master Theorem is applicable to recurrences of the form: (a) $T(n) = aT(n/b) + f(n)$ (b) $T(n) = T(n-1) + n$ (c) $T(n) = aT(bn) + f(n)$ (d) $T(n) = nT(n-1) + a$	1	K1	CO2
5.	The *Bin Packing Problem* is usually solved using which of the following approaches? (a) Greedy heuristics like First-Fit or Best-Fit (b) Dynamic Programming only (c) Branch and Bound always (d) Backtracking only	1	K1	CO3
6.	Which of the following problems can be solved using Dynamic Programming? (a) Fractional Knapsack (b) Travelling Salesman Problem (c) First-Fit Bin Packing (d) N-Queens	1	K1	CO3
7.	In a directed graph, if there is a directed edge from vertex A to vertex B, what does it signify? (a)There is a bidirectional connection between A and B. (b)There is a one-way connection from A to B. (c) There is a weighted connection between A and B. (d) There is no connection between A and B.	1	K1	CO4
8.	The *Maximum Flow Problem* in a network is solved using: (a) Kruskal's Algorithm (b) Ford-Fulkerson Algorithm (c) Dijkstra's Algorithm (d) Bellman-Ford Algorithm	1	K1	CO4
9.	Which of the following is TRUE about the relationship between P, NP, and PSPACE? (a) $P \subset NP \subset PSPACE$ (b) $PSPACE \subset NP \subset P$ (c) $NP \subset P \subset PSPACE$ (d) $P = NP = PSPACE$	1	K1	CO5
10.	The *Quantum bit (qubit)* differs from a classical bit because: (a) It can only be 0 or 1 (b) It can exist in a superposition of 0 and 1 (c) It is always deterministic (d) It cannot be measured	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Define algorithm.	2	K1	CO1
12.	What is time-space trade-off in algorithms?	2	K1	CO1
13.	Summarize the meaning of order of growth in algorithms.	2	K2	CO2
14.	List the cases of Master's Theorem for decreasing function.	2	K1	CO2
15.	List the characteristics of brute force approach.	2	K1	CO3
16.	What is minimum cost spanning tree?	2	K1	CO3

17.	List down the steps involved in DFS.	2	K1	CO4
18.	Define Graph.	2	K1	CO4
19.	Compare class P and class NP.	2	K2	CO5
20.	Name two NP-complete problems.	2	K1	CO5
21.	What is PSPACE?	2	K1	CO6
22.	What do you understand from Quantum algorithm?	2	K1	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Explain the roles of Big O, Omega, and Theta in algorithm analysis. For finding the maximum in an array, explain how input affects best, worst, and average case complexities using asymptotic expressions.	11	K2	CO1
		OR			
	b)	Explain the primary stages in the algorithmic problem-solving process, and how does each contribute to finding a solution?	11	K2	CO1
24.	a)	Solve the recursive algorithms through recurrence relations using Master's Theorem for decreasing function.	11	K3	CO2
		OR			
	b)	Apply Substitution Method and solve using forward and backward substitution for T(n)=T(n-1) +n with initial condition T (0) =0.	11	K3	CO2
25.	a)	Identify how backtracking eliminates invalid placements while solving the 4×4 Queen problem.	11	K3	CO3
		OR			
	b)	Solve the following knapsack Problem using exhaustive search approach assuming the capacity of the knapsack as 10	11	K3	CO3

Item	Weight	Value
1	7	$42
2	3	$12
3	4	$40
4	5	$25

26.	a)	Apply the working principles of Depth First Search (DFS) and Breadth First Search (BFS) algorithms with suitable examples.	11	K3	CO4
		OR			
	b)	Construct Prim's and Kruskal's Algorithm with suitable Example.	11	K3	CO4
27.	a) (i)	Explain in detail about Cook's Theorem with examples.	6	K2	CO5
	(ii)	Explain the concepts of computability of algorithms.	5	K2	CO5
		OR			
	b)	Compare the difference between P, NP, NP-Complete, and NP-Hard problems with Examples.	11	K2	CO5
28.	a)	Solve the Vector Cover Randomized algorithms and compare the performance with deterministic ones.	11	K3	CO6
		OR			
	b)	Apply the basic principles of quantum algorithms and explain how quantum features influence their performance.	11	K3	CO6