Reg. No.																

Question Paper Code	13163

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fourth Semester

Information Technology

(Common to Artificial Intelligence and Data Science, Computer Science and Engineering, Computer Science and Engineering (AIML) & Computer Science and Engineering (IoT))

20ITPC401 - DESIGN AND ANALYSIS OF ALGORITHMS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following represents the worst-case time complexity of an algorithm? (a) O(n) (b) Ω(n) (c) θ(n) (d) φ(n)	1	K1	CO1
2.	What is the primary goal of algorithm design? (a) To write code efficiently (b) To solve a problem in the best way possible (c) To minimize the number of lines of code (d) To maximize the use of memory	1	K1	CO1
3.	The best-case complexity of an algorithm refers to: (a) The longest running time (b) The average running time (c) The shortest running time (d) The time complexity on the largest input	1	K1	CO1
4.	What is the average case running time of an insertion sort algorithm? (a) O(N) (b) O(N log N) (c) O(log N) (d) $O(N^2)$	1	K1	CO2
5.	What is a recurrence relation? (a) An equation that describes a function in terms of its previous values (b) A method for solving non-recursive algorithms (c) A technique used exclusively for iterative algorithms (d) A tool for analyzing algorithm correctness	1	K1	CO2
6.	Which of the following is an example of a divide-and-conquer algorithm? (a) Linear Search (b) Quick Sort (c) Bubble Sort (d) Binary Search	1	K1	CO2
7.	If a problem can be solved by combining optimal solutions to non-overlapping problems, the strategy is called (a) Dynamic programming (b) Greedy (c) Divide and conquer (d) Recursion	1	K1	CO3
8.	What is the primary advantage of a brute-force approach? (a) It is always the fastest method (b) It guarantees finding a solution if one exists (c) It uses the least amount of memory (d)It is the most elegant and complex approach	1	K1	CO3
9.	Backtracking is an improvement over brute-force search because it: (a) Ensures the optimal solution (b) Avoids exploring unnecessary paths (c) Uses dynamic programming principles (d) Applies heuristic techniques	1	K1	CO3
10.	What does Maximum flow problem involve? (a) finding a flow between source and sink that is maximum (b) finding a flow between source and sink that is minimum (c) finding the shortest path between source and sink (d) computing a minimum spanning tree	1	K1	CO4
11.	Floyd Warshall Algorithm is an example of _____shortest path algorithm. (a) Single-source (b) All-pairs (c) All of the mentioned (d)None of the mentioned	1	K1	CO4
12.	Which algorithm is used to solve a maximum flow problem? (a) Prim's algorithm (b) Kruskal's algorithm (c) Dijkstra's algorithm (d) Ford-Fulkerson algorithm	1	K1	CO4

13.	Which of the following problems is an example of a tractable problem? (a) Sorting an array using merge sort (b) The Traveling Salesman Problem (TSP) (c) Boolean Satisfiability (SAT) Problem (d) Hamiltonian Cycle Problem	*1*	*K1*	*CO5*
14.	What is the prime task of the stable marriage problem? (a) To provide man optimal solution (b) To provide woman optimal solution (c) To determine stability of marriage (d) To use backtracking approach	*1*	*K1*	*CO5*
15.	What is the relationship between the classes P and NP? (a) P = NP (b) P is a subset of NP (c) NP is a subset of P (d) P and NP are disjoint classes	*1*	*K1*	*CO5*
16.	Which of the following problems is related to stable marriage problem? (a) Choice of school by students (b) N-queen problem (c) Arranging data in a database (d) Knapsack problem	*1*	*K1*	*CO5*
17.	Which of the following algorithm can be used to solve the Hamiltonian path problem efficiently? (a) branch and bound (b) iterative improvement (c) divide and conquer (d) greedy algorithm	*1*	*K1*	*CO6*
18.	Which of the following is an example of a randomized algorithm? (a) Quick Sort with random pivot selection (b) Dijkstra's algorithm (c) Bellman-Ford algorithm (d) Floyd-Warshall algorithm	*1*	*K1*	*CO6*
19.	Which of the following problems is similar to that of a Hamiltonian path problem? (a) knapsack problem (b) closest pair problem (c) travelling salesman problem (d) assignment problem	*1*	*K1*	*CO6*
20.	In what time can the Hamiltonian path problem be solved using dynamic programming? (a) O(N) (b) O(N log N) (c) O(N2) (d) O(N2 2N)	*1*	*K1*	*CO6*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	Write down the concepts of asymptotic notations and its properties.	*2*	*K1*	*CO1*
22.	Define Towers of Hanoi problem.	*2*	*K1*	*CO1*
23.	State Brute force approach.	*2*	*K1*	*CO2*
24.	Define Assignment problem.	*2*	*K1*	*CO2*
25.	What is Knapsack problem?	*2*	*K1*	*CO3*
26.	State the Principle of Optimality.	*2*	*K1*	*CO3*
27.	What is the significance of single source shortest path problem?	*2*	*K1*	*CO4*
28.	What is Minimum Cost Spanning Tree?	*2*	*K1*	*CO4*
29.	List some examples of P and NP problem.	*2*	*K1*	*CO5*
30.	Define Feasible and Optimal Solution.	*2*	*K1*	*CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

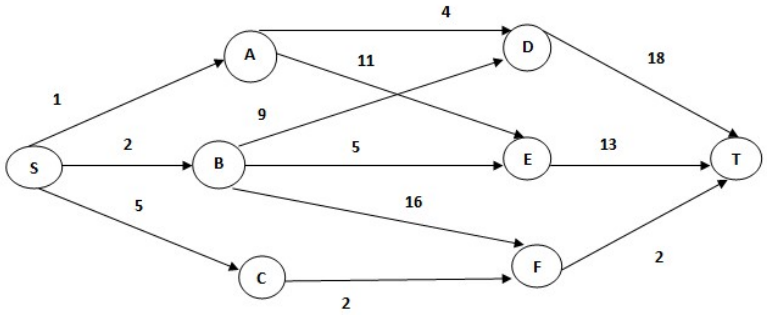
31.	a)	Describe briefly on Big oh Notation, Omega Notation and Theta Notations. Depict the same graphically and explain.	*10*	*K2*	*CO1*
		OR			
	b)	If $f(n)=2n^2+5$ and $g(n)=n^{2,}$ find the best case, worst case and average case.	*10*	*K2*	*CO1*
32.	a) (i)	Explain the concepts of Brute force string matching Algorithm.	*5*	*K2*	*CO2*
	(ii)	Closest pair problems by brute force.	*5*	*K2*	*CO2*
		OR			

b) Find the optimal solution for the following knapsack problem *10 K2 CO2*

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

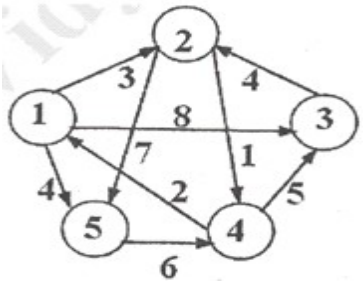
Capacity W=10.

33. a) Explain the multistage graph problem for forward and backward approach with the graph given below. *10 K2 CO3*



OR

b) Compute single source shortest path for the following graph using Floyd's method with its algorithm. *10 K2 CO3*



34. a) Maximize: *10 K2 CO4*
Z=10x1+15x2+20x3 subject to 2x1+4x2+6x3<=24 and 3x1+9x2+6x3<=30 where x1,x2,x3>=0.

OR

b) Construct a Huffmann Tree for the following data and obtain its Huffmann code. Encode the text DAB. Calculate the expected number of bits per character. *10 K2 CO4*

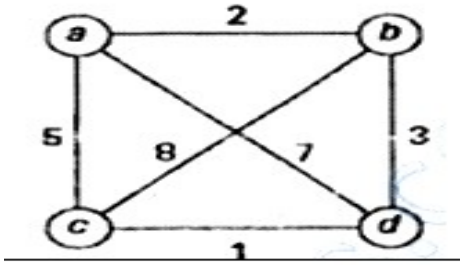
Characters	Probability
A	0.35
B	0.1
C	0.2
D	0.2
-	0.15

35. a) Explain the class of P and NP with example. *10 K2 CO5*

OR

b) Evaluate the subset sum problem with set as w= {3, 5, 6, 7, 2}and m =15.Compute all possible subset of w whose sum is equivalent to m. Draw the portion of state space tree for this problem. Derive all the subsets. *10 K2 CO5*

36. a) Apply Branch and Bound algorithm to solve the travelling salesman problem for: *10 K2 CO6*



OR

b) Explain 8-queens Problem using backtracking approach with neat example. *10 K2 CO6*