Code No: R2032423 **R20** SET -1

III B. Tech II Semester Regular Examinations, July -2023
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE(AIML),CSE(AI),CSE(DS)CSE(AIDS), AIDS,AIML)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1.	a)	Write an algorithm for linear search and analyze the algorithm for its time complexity	[7M]
	b)	Write a short notes on probabilistic analysis. Discuss its role in Algorithmic analysis.	[7M]
		(OR)	
2.	a)	Write the properties of algorithm and various fields of study in algorithms.	[7M]
	b)	Differentiate performance measurement and performance estimation of algorithms	[7M]

UNIT-II

3.	a)	Design an algorithm to sort the given list of elements using Quick Sort incorporating divide and conquer technique. Sort the following list using the same and compute its average case time efficiency: 8, 3, 0, 9, 6, 1, 3, 4.	[7M]
	b)	Consider the following instance of Knapsack problem N=3, M=20, (p1,p2,p3)=(25,24,15), (w1,w2,w3)=(18,15,10) Calculate Maximum profit, Minimum weight and Maximum profit per unit weight.	[7M]
		(OR)	
4.	a)	Explain the merge sort algorithm 310, 285, 179, 652, 351, 423, 861, 254, 450, 520. Derive the time complexity from T(n)=2T(n/2) +cn	[7M]
	b)	Explain single source shortest path Problem with example.	[7M]

UNIT-III

5.	a)	Use the function OBST to compute w(i,j), r(i,j), and c(i,j), $0 \le i < j \le 4$, for the identifier set (a1, a2, a3, a4) = (do, if, int, while) with p(1 : 4) = (3, 3, 1, 1) and q(0:4)=(2,3,1,1,1). Using the r(i,j)'s construct the optimal binary search tree	[9M]
	b)	Write and explain an algorithm to compute the all pairs shortest path using dynamic programming and prove that it is optimal.	[5M]
		(OR)	
6.	a)	Solve the following 0/1 Knapsack problem using dynamic programming P= (11, 21, 31, 33), W= (2, 11, 22, 15), C=40, n=4.	[7M]
	b)	Discuss the time and space complexity of Dynamic Programming traveling sales person algorithm.	[7M]

UNIT-IV

7.	a)	Write an algorithm for sum of subsets problem.	[7M]
	b)	Find a solution to the 8-Queens problem using backtracking strategy. Draw the solution space using necessary bounding function	[7M]
		(OR)	
8.	a)	Describe the algorithm for Hamiltonian cycles and Determine the order of magnitude of the worst-case computing time for the backtracking procedure that finds all Hamiltonian cycles.	[7M]
	b)	Write the algorithm for general iterative backtracking method and explain various factors that define the efficiency of backtracking	[7M]

UNIT-V

9.	a)	State and prove Cook's theorem	[7M]
	b)	Explain the P, NP, NP-Hard and NP- complete classes with suitable examples	[7M]
		(OR)	
10.	a)	Write about non deterministic algorithms and choice, failure and success functions with search example	[7M]
	b)	Using an example prove that, satisfiability of boolean formula in 3-Conjunctive Normal form is NP-Complete.	[7M]

Code No: R2032423 **R20** SET -2

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*****

UNIT-I

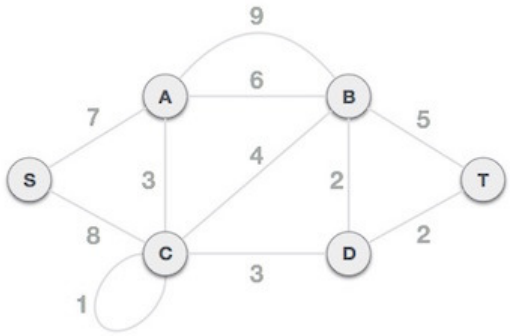
1. a) Compare Big-oh notation, Omega Ω and Little-oh notation. Illustrate with an example. [7M]
   b) Define time complexity? Explain time complexity of insertion sort in different cases. [7M]

(OR)

2. a) Write Randomized algorithm for Quick sort. Analyze its performance with quick sort algorithm without randomization. [7M]
   b) Write an algorithm for Binary search and analyze the algorithm for its time complexity [7M]

UNIT-II

3. a) Explain Defective chess board Problem with example [7M]
   b) Write Prim's algorithm to generate minimum cost spanning tree for the given graph [7M]



(OR)

4. a) Design the algorithm to find the minimum and maximum element of given array and derive its time complexity. [7M]
   b) Explain the Knapsack problem. Find an optimal solution to the Knapsack instance n=7, m=15, (p1, p2, p3, …p7)=(10,5,15,7,6,18,3) and (w1, w2, w3, …w7)=(2, 3, 5,7, 1, 4, 1). [7M]

UNIT-III

5. a) Draw an Optimal Binary Search Tree for n=4 identifiers (a1,a2,a3,a4) = (do, if, read, while) P(1:4)=(3,3,1,1) and Q(0:4)=(2,3,1,1,1). [7M]
   b) Write and explain an algorithm to compute the all pairs shortest path using dynamic programming and prove that it is optimal [7M]

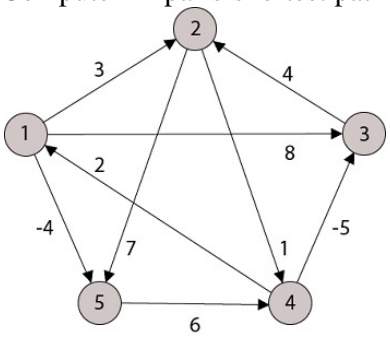
(OR)

|''|'||||''|''|||'|

6. a) Write dynamic programming solution for the traveling sales person problem for the network with the cost adjacency matrix. Assume node 1 as the home city. [7M]

0	10	15	30
4	0	9	11
5	13	0	10
7	7	8	0

b) Compute All pairs-shortest path for following graph [7M]



UNIT-IV

7. a) Find all m-colors of a graph with undirected connections v1->2, v1->v3, v1->v4, v2->v3, v2->v4, v2->v5, v3->v4, v4->v5 using backtracking technique. [7M]

b) What is sum-of-subsets problem? Write a recursive backtracking algorithm for sum of subsets problem. [7M]

(OR)

8. a) Explain the Graph – coloring problem. And draw the state space tree for m= 3colors n=4 vertices graph. Discuss the time and space complexity [7M]

b) Briefly explain n-queen problem using backtracking [7M]

UNIT-V

9. a) Explain the strategy to prove that a problem is NP hard. [7M]

b) Is Travelling salesman problem NP-hard or NP-Complete? Justify your answer. [7M]

(OR)

10. a) Show that the HAMILTONIAN_CYCLE problem on directed graphs is NP-complete [7M]

b) Relate deterministic problems, NP problems, NP hard and NP complete problems. Discuss the examples. [7M]

Code No: R2032423 **R20** SET -3

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Answer any **FIVE** Questions **ONE** Question from **Each unit**
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*****

UNIT-I

1. a) What are the different mathematical notations used for algorithm analysis [7M]
   b) Write about the program step count and frequency count methods used to estimate the performance of an algorithm with an example. [7M]

(OR)

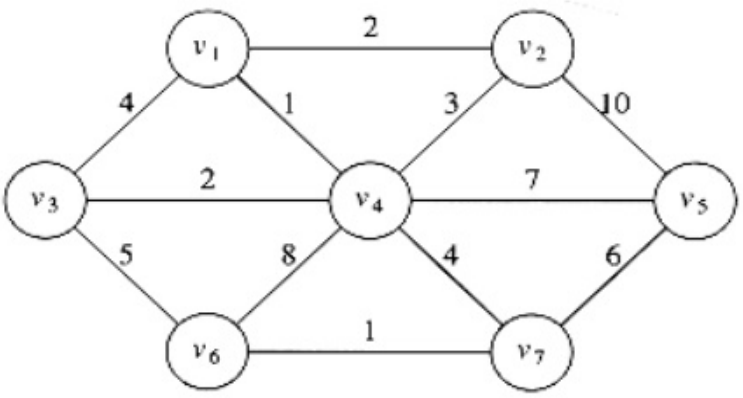
2. a) Write algorithm for calculating multiplication of matrices and derive its time complexity using step count method [7M]
   b) Give the asymptotic bounds for the equation f(n)=2n3-6n+30 and represent in terms of Θ notation. [7M]

UNIT-II

3. a) Trace the quick sort algorithm to sort the list J,N,T,U,K,U, N, I, V, E, R, S,I,T,Y in alphabetical order. And show that the average case time complexity is **$O(n \log_e n)$** [7M]
   b) Write and explain the general method of divide-and-conquer strategy .Describe binary search in detail and provide time complexity analysis with an example [7M]

(OR)

4. a) Apply the greedy method to solve Knapsack problem for given instance Where n=3, m=20, (p1,p2,p3)=(25,24,15), and weight (w1,w2,w3)=(18,15,10). [7M]
   b) Construct the minimum cost spanning tree using Krushkal algorithm for the given graph and explain the algorithm. [7M]



Code No: R2032423 **R20** SET -3

UNIT-III

5. a) Solve the following instance of 0/1 KNAPSACK problem using Dynamic programming n = 3, (W1, W2, W3) = (2, 3, 4), (P1, P2,P3) = (1, 2, 5), and m = 6. [7M]

   b) Write dynamic programming solution for the traveling sales person problem for the network with the cost adjacency matrix. Assume node 1 as the home city. [7M]

0	**10**	**15**	**30**
4	**0**	**9**	**11**
5	**13**	**0**	**10**
7	**7**	**8**	**0**

(OR)

6. a) Illustrate the working principle of dynamic programming with all pairs shortest path problem. [7M]

   b) Draw an Optimal Binary Search Tree for n=4 identifiers (a1,a2,a3,a4) = (do, if, read, while) P(1:4)=(3,3,1,1) and Q(0:4)=(2,3,1,1,1) [7M]

UNIT-IV

7. a) Write backtracking algorithm of Graph coloring problem and derive its time complexity [7M]

   b) Write backtracking algorithm of N-Queens problem and derive its time complexity [7M]

(OR)

8. a) find the solutions for the subset sum for N=7, m=35, w={5,7,10,12,15,18,20} using back tracking approach. [7M]

   b) Explain how the Hamiltonian circuit problem is solved by using the backtracking concept. [7M]

UNIT-V

9. a) State and prove Cook's theorem [7M]

   b) Explain the classes of NP-Hard and NP-Complete. [7M]

(OR)

10. a) Write a non-deterministic algorithm of sorting a list of elements in an array. [7M]

    b) Explain Nondeterministic knapsack algorithm. [7M]

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Answer any **FIVE** Questions **ONE** Question from **Each unit**
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*****

UNIT-I

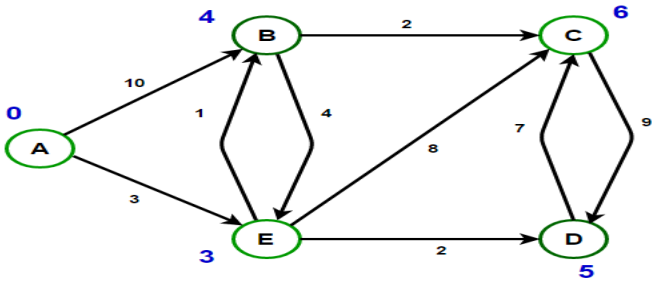
1. a) Write Randomized algorithm of Quick sort with example. Show the performance difference with out randomization. [7M]
   b) Describe asymptotic notations Big Oh (O), Omega (Ω) and Theta (Θ) notations and show their behavior using graphical representation. [7M]

(OR)

2. a) Write the algorithm for finding the factorial of given number and estimate the time complexity. [7M]
   b) What is Performance Analysis? Explain Space Complexity and Time Complexity with examples. [7M]

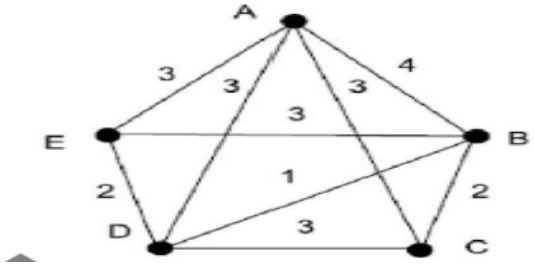
UNIT-II

3. a) Design an algorithm to sort the given list of elements using Merge Sort incorporating divide and conquer technique. Sort the following list using the same and compute its time efficiency: 4, 2, 0, 8, 7, 1, 3, 6 [7M]
   b) Generate the shortest path from single source (A) and explain the algorithm. [7M]



(OR)

4. a) Explain the concept of minimum cost spanning tree? What are the different algorithms exist for obtaining minimum cost spanning tree. Compute the minimum cost spanning tree using Prim's algorithm for the given graph. Draw the spanning tree generated at each step. [7M]



|''|'||||''|''|||'|

b) Write greedy algorithm for knapsack problem. Find the solution for the following Knapsack problem using greedy method (p1,p2,p3,p4)=(2,5,8,1), (w1,w2,w3,w4)=(10,15,6,9) and m=30 [7M]

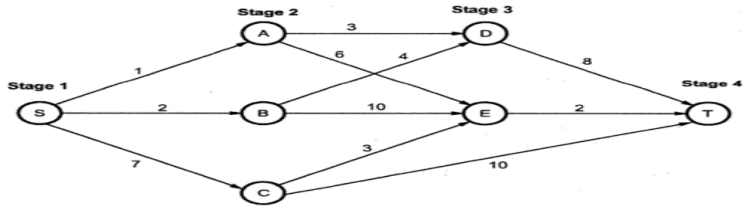
UNIT-III

5. a) Solve the following 0/1 Knapsack Problem using dynamic programming n=4, m=30, (w1,w2,w3,w4) = (10,15,6,9) and (p1, p2, p3, p4) = (2,5,8,1) [7M]

b) Use the function OBST to compute w(i,j), r(i,j), and c(i,j), $0 \leq i < j \leq 4$, for the identifier set (a1, a2, a3, a4) = (do, if, int, while) with p(1 : 4) = (3, 3, 1, 1) and q(0:4)=(2,3,1,1,1). Using the r(i,j)'s construct the optimal binary search tree [7M]

(OR)

6. a) Address the problem of multistage graph using dynamic programming. [7M]



b) Construct an optimal travelling salesperson tour using Dynamic Programming for the given data: [7M]

$$\begin{bmatrix} 0 & 10 & 9 & 3 \\ 5 & 0 & 6 & 2 \\ 9 & 6 & 0 & 7 \\ 7 & 3 & 5 & 0 \end{bmatrix}$$

UNIT-IV

7. a) Explain the key concepts of backtracking and state space tree with about 8-queens problem. [7M]

b) Explain the Graph–coloring problem. Draw the state space tree . [7M]

(OR)

8. a) Find a solution to sum of subsets problem using backtracking strategy. Draw the solution space using necessary bounding function m=12 with items (2,3,1,4,5,6,7) n=7 [7M]

b) Explain the major drawbacks of backtracking method with example. [7M]

UNIT-V

9. a) Differentiate between deterministic and non deterministic algorithm.. [7M]

b) Discuss in detail about the classes of NP-hard and NP-complete. [7M]

(OR)

10. a) Explain circuit satisfiability problem with a circuit diagram. Show that circuit satisfiability problem is NP- hard. [7M]

b) Compare NP Hard and NP Complete. [7M]