Code No: R2031052 **R20** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE, IT)

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

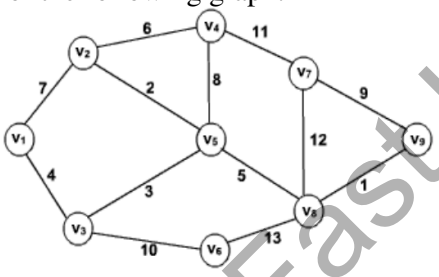
1. a) Give the algorithm for matrix additions and determine the time complexity of this algorithm by frequency-count method. [7M]
   b) Write the algorithm to find a factorial of a given number. Derive its efficiency [7M]

(OR)

2. a) Explain the general plan for analyzing the efficiency of a recursive algorithm. [7M]
   b) What is an algorithm? Write Towers of Hanoi algorithm. [7M]

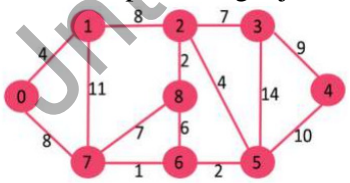
UNIT-II

3. a) Write Divide-And-Conquer recursive Merge sort algorithm and derive thetime complexity of this algorithm. [5M]
   b) Write an algorithm for prim's method and find the minimum cost spanning tree for the following graph. [9M]



(OR)

4. a) Perform binary search on list of elements to find the key element using divide and conquer, and also estimate the time complexity. [5M]
   b) Find shortest path using dijkstra's algorithm for following graph [9M]



UNIT-III

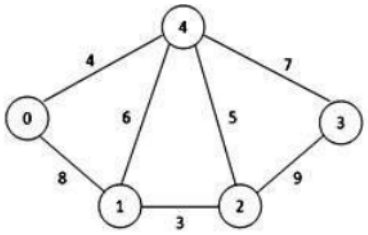
5. a) How the reliability of a system is determined using dynamic programming? Explain. [5M]
   b) Solve the following instance of 0/1 KNAPSACK problem using Dynamic programming. n = 3, (W1,W2,W3) = (2,3,4), (P1,P2,P3) = (1,2,5), and m = 6. [9M]

(OR)

6. a) Construct optimal schedule for the following jobs n=8, (p1,p2,p3,p4,p5,p6,p7,p8)=(40,100,50,30,4,7,12,11) and (d1,d2,d3,d4,d5,d6,d7,d8)=(1,4,2,3,3,2,2,1) [7M]

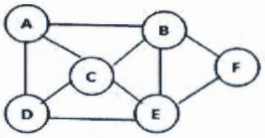
|'''|'|'|''||'''||||

b) Calculate shortest distances using All pairs shortest path algorithm [7M]



UNIT-IV

7. a) Find the Hamiltonian cycle in the following graph [7M]



b) Use Backtracking technique, solve the following instance for the Subset sum problem, s=(6,5,3,7) and d=15. [7M]

(OR)

8. a) Give the formulation of modified knapsack problem using branch and bound and find the optimal solution using Least Cost Branch and Bound (LCBB) with n=4, m=15, (p1…p4) = (15,15,17,23), (w1…w4) = (3,5,6,9) [7M]

b) Write an algorithm for N-Queens problem using Backtracking. [7M]

UNIT-V

9. a) Explain the features of nondeterministic algorithms. [7M]

b) Briefly explain about NP-hard and NP-complete problems. [7M]

(OR)

10. a) Prove or disprove: If there exists a polynomial time algorithm to convert a Boolean formula in CNF into an equivalent formula in DNF, then P=NP. [7M]

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

Code No: R2031052 **R20** SET - 2

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*****

UNIT-I

1. a) What are the features of an efficient algorithm? Explain with an example. [7M]
   b) Write an algorithm to find the maximum element in an array of n elements. Give the mathematical analysis of this non recursive algorithm. [7M]

(OR)

2. a) Differentiate between probabilistic analysis and amortized analysis. [7M]
   b) Apply the step Count method to find the time Complexity of the following algorithm. [7M]

```
for(i=n ;i>=1; i-=k)
 {
 Print" Hello";
 }
```

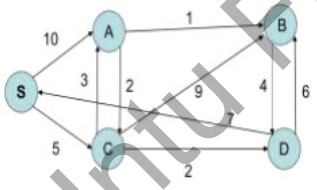
Note: here k is some constant

UNIT-II

3. a) What is Minimum cost spanning tree? Explain an algorithm for generating minimum cost spanning tree and list some applications of it. [7M]
   b) Write a greedy algorithm for sequencing unit time jobs with deadlines andprofits. [7M]

(OR)

4. a) Consider the directed edge-weighted graph shown below [9M]



Show the execution of Dijkstra's shortest path algorithm for solving the Single Source Shortest Path (SSSP) problem on this graph. Use the vertex S as the source.

   b) List out the advantages and disadvantages of divide and conquer approach. [5M]

UNIT-III

5. a) Write the algorithm to compute 0/1 Knapsack problem using dynamic programming and explain it. [6M]
   b) Write a function to compute lengths of shortest paths between all pairs of nodes for the given adjacency matrix [8M]

$$\begin{bmatrix} 0 & 6 & 13 \\ 8 & 0 & 4 \\ 5 & \infty & 0 \end{bmatrix}$$

(OR)

6. a) Describe the Matrix multiplication chains problem. Apply the recursive solution of dynamic programming to determine optimal sequence of pair wise matrix multiplications [7M]

b) Compare and contrast divide and conquer, greedy and dynamic programming problem solving strategies. [7M]

UNIT-IV

7. a) What is sum-of-subsets problem? Write a recursive backtracking algorithm for sum of subsets problem. [7M]
   b) Explain briefly about N-Queens Problem. Construct state space tree for placing 4-Queen's. [7M]

(OR)

8. a) Write the algorithm for general iterative backtracking method and explain various factors that define the efficiency of backtracking. [7M]
   b) Write an algorithm for finding all m-colorings of a graph. [7M]

UNIT-V

9. a) Describe Cook's theorem. [7M]
   b) Give the characteristics of NP-hard problems. [7M]

(OR)

10. a) Write and explain nondeterministic knapsack algorithm. [7M]
    b) Differentiate between NP-Complete and NP-hard problems. [7M]

Code No: R2031052 **R20** SET - 3

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UNIT-I

1. a) What is the time complexity of following function fun ( )? Explain. [7M]

```
int fun (int n) {
for (inti = 1; i<=n; i++)
for (int j = 1; j < n; j +=i)
Sum = Sum + i*j;
return (Sum);
}
```

b) Write an algorithm for linear search and analyze the algorithm for its time complexity. [7M]

(OR)

2. a) Give the algorithm for matrix multiplication and find the time complexity of the algorithm using step-count method. [7M]

b) What are the different mathematical notations used for algorithm analysis. Discuss the Amortized analysis with an example. [7M]

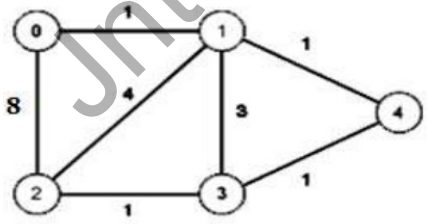
UNIT-II

3. a) Derive the Best, Worst and Average time complexities of Quick sorting technique. Show the result of running Quick sorting technique on the sequence 38,27,43,3,9,65,12,82, 10,56. [10M]

b) Write the control abstraction for divide and conquer technique. [4M]

(OR)

4. a) Construct Minimum cost spanning tree using Prim's algorithm. [9M]



b) Write the control abstraction for divide and conquer technique [5M]

UNIT-III

5. Using algorithm OBST compute W (i, j), R (i, j) and C (i, j), 0<=I < j <=4 for the identifier Set (a1,a22,a3,a4)= (end, goto, print, stop) with P(1)=1/20,P(2)=1/5, P(3)=1/10, P(4)=1/20, Q(0)=1/5,Q(1)=1/10,Q(2)=1/5,Q(2)=1/20,Q(4)=1/20. Using the R (i, i) s construct the optimal binary search tree [14M]

(OR)

6. a) Explain the Travelling Sales person problems with an example and analyze its recurrence relation [7M]

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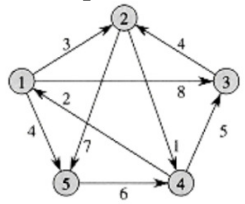
b) Find all pairs shortest paths for the following graph and write the algorithm. [7M]



UNIT-IV

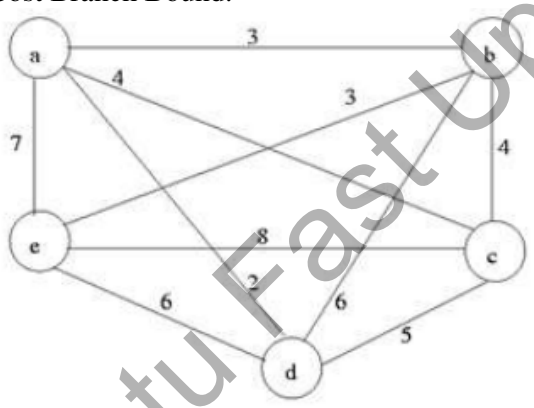
7. a) If the portion of solution space for an 8-queens problem is given as (7, 1, 4, 6), then identify the remaining portion of solution space. Use back tracking to solve the problem. [7M]

b) Solve the given instance of sum of subset problem s={3,5,6,7} and d=15. Construct a state space tree [7M]

(OR)

8. a) Consider the sum of subset problem n=4, sum=13, and w1=3, w2=4, w3=5 and w4=6. Solve the problem using backtracking. [7M]

b) Solve the following instance of travelling sales person problem using Least Cost Branch Bound. [7M]



UNIT-V

9. a) Explain in detail about P, NP and NP-complete classes. [7M]

b) List the characteristics of NP-hard problems. [7M]

(OR)

10. a) What are deterministic and non-deterministic algorithms? Distinguish between them. [7M]

b) Explain how NP-hard and NP class problems are related with examples [7M]

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UNIT-I

1. a) What are the Asymptotic notations? Explain and give its properties. [7M]
   b) Explain the process of designing an algorithm. Give characteristics of an algorithm. [7M]

(OR)

2. a) Discuss the Pseudo code conventions for expressing algorithms. [7M]
   b) Define Theta notation. Explain the terms involved in it. Give an example. [7M]

UNIT-II

3. a) Find the minimum and maximum values for the list of elements 23, 45,32,78,54,12,39,86,77,21 using divide and conquer method. [7M]
   b) Explain the working principle of Kruskal's algorithm. [7M]

(OR)

4. a) Consider the array of elements and search the element 55 using binary search 25,35,45,55,65,66,67,75,76,77,78,86,87. Derive the time complexity of binary search. [8M]
   b) Discuss Strassen's matrix multiplication with an example and derive its time complexity. [6M]

UNIT-III

5. Compute OBST w(i,j), r(i,j), c(i,j), 0<=i<=j<=4 for set(a1,a2,a3,a4)=(for, if, else, while) with p1=1, p2=4, p3=2, p4=1, qo=4, q1=2, q2=4, q3=1, q4=1 Using r(i,j) construct OBST. [14M]

(OR)

6. a) Find the shortest tour of Traveling sales person for the following cost matrix using Dynamic Programming. [7M]

$$\begin{bmatrix} \infty & 12 & 5 & 7 \\ 11 & \infty & 13 & 6 \\ 4 & 9 & \infty & 18 \\ 10 & 3 & 2 & \infty \end{bmatrix}$$

   b) Explain Principle of optimality in Dynamic Programming with suitable example. [7M]

UNIT-IV

7. a) What is travelling salesman problem? Solve the following salesman problem instance using Branch and Bound. [7M]

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 0 & 0 \end{bmatrix}$$

   b) Explain the solution to the graph coloring problem using backtracking. [7M]

(OR)

8. a) Write an algorithm to determine the Hamiltonian cycle in a given graph using backtracking. [7M]
   b) Explain the basic principle of Backtracking and list the applications of backtracking. [7M]

UNIT-V

9. a) Differentiate between NP-complete and NP-Hard [7M]
   b) Explain the satisfiability problem and write the algorithm for the same [7M]

(OR)

10. a) Explain the classes of P and NP [7M]
    b) Write the Nondeterministic sorting algorithm and analyze its complexity [7M]