**Code No: 135AF** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, August - 2022**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 Hours** **Max. Marks: 75**

**Answer any five questions**
**All questions carry equal marks**
**- - -**

1.a) Explain about the types of Randomized algorithm.
b) Write an algorithm of Quick sort and analyze performance of quick sort in worst case. [7+8]

2.a) What are asymptotic notations? Explain with examples.
b) Sort the following elements using Merge sort: [7+8]
12, 2, 16, 30, 8, 28, 4, 10, 20, 6, 18

3.a) Explain the Union algorithm with weighing rule.
b) Discuss about the general method of backtracking. [7+8]

4.a) Write an algorithm to determine Bi-connected components.
b) Describe sum of subsets problem with an example. [7+8]

5.a) Show how Prim's algorithm can be implemented using heap. What would be the time complexity of the algorithm?
b) Write the applications of Greedy method. [10+5]

6. Write the Greedy algorithm for sequencing unit time jobs with deadlines and profits. Trace the algorithm with suitable example. [15]

7.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) = (cout, float, if, while) 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(3) = 1/20, and q(4) = 1/20. Using the r(i, j)'s construct the optimal binary search tree.
b) Discuss about chained matrix multiplication in dynamic programming. [10+5]

8. Explain the following:
a) LC branch and bound
b) Cook's theorem. [8+7]

**---ooOoo---**

**Code No: 135AF** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, February - 2022**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any five questions**
**All questions carry equal marks**
**----**

1.a) Give Strassen's matrix multiplication algorithm and derive the time complexity.
b) Illustrate with an example the working of quick sort. [7+8]

2.a) Explain various asymptotic notations for algorithm analysis.
b) Derive the time complexity of binary search. [7+8]

3. Give the solution to the 8-queens problem using backtracking. [15]

4. Explain the solution to the graph coloring problem using backtracking. [15]

5. Explain the Single source shortest path problem with an example. [15]

6. What is the need for generating a spanning tree? Explain an algorithm for generating spanning tree. [15]

7. Discuss the time and space complexity of Dynamic Programming traveling sales person algorithm. [15]

8. Explain the LC branch and bound algorithm. [15]

**---ooOoo---**

**Code No: 135AF** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, January/February - 2023**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A**

**(25 Marks)**

1.a) Define Big 'Oh' notation [2]
b) Compare Quick Sort and Merge Sort. [3]
c) What is an articulation point in a graph? Give an example. [2]
d) Construct the state space tree for 4-Queens problem with bounding function. [3]
e) Write an algorithm for simple Union operation. [2]
f) What is Minimum Spanning Tree? Give an example. [3]
g) Write the difference between the Dynamic programming and the Greedy method. [2]
h) What is mean by state space tree? Give an example. [3]
i) Define cook's theorem. [2]
j) Draw the relation of P, NP, NP-Hard and NP-Complete. [3]

**PART – B**

**(50 Marks)**

2.a) Sort the following data using Quick Sort and illustrate each step with appropriate figure for each iteration. [ 20, 12, 35, 15, 11, 19, 35 ]
b) Write the Recurrence relation and derive the best case complexity for the Quick Sort. [5+5]

**OR**

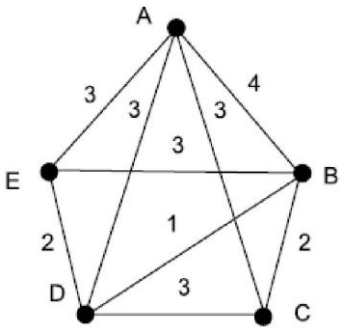
3.a) Describe asymptotic notations Big Oh (O), Omega (Ω) and Theta (Θ) notations and show their behavior using graphical representation.
b) Give the asymptotic bounds for the equation $f(n)=2n^3-6n+30$ and represent in terms of O notation. [5+5]

4. Generate the state space tree and find the solutions for the subset sum for N=7, m=35, w={5,7,10,12,15,18,20} using back tracking approach. [10]

**OR**

5. Write an algorithm for Graph Coloring problem and explain with an example. [10]

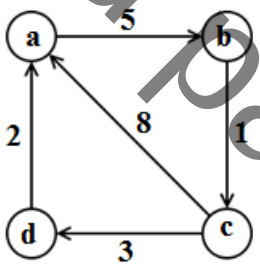
6. Explain the concept of minimum cost spanning tree? What are the different algorithms exist for obtaining minimum cost spanning tree. Compute the minimum cost spanning tree using Prim's algorithm for the given graph. Draw the spanning tree generated at each step. [10]




**OR**

7. 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. [10]

8.a) Write an algorithm for all pairs shortest path. Define its complexity.
b) Compute the shortest distance between each pair of nodes for the following graph using all pair shortest path algorithm. [5+5]




**OR**

9. Use the function OBST to compute w(i, j), r(i, j) and c(i, j), $0 \le i \le j \le 4$ 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 r(i,j)'s construct optimal binary search tree. [10]

10. Generate the state space tree using FIFO Branch and Bound and find the shortest path followed by the travelling salesperson instance defined by the cost matrix given below. [10]

$$\begin{bmatrix} \infty & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$

**OR**

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

**---ooOoo---**

**Code No: 155EV** **R18**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, January/February - 2023**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CESE, CSE(CS), CSE(AIML), CSE(DS), CSE(N))**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.



## PART – A

**(25 Marks)**

| | | |
|---|---|---|
| 1.a) | Explain amortized complexity. | [2] |
| b) | How can we measure an algorithm's running time? | [3] |
| c) | What is AND/OR graph? | [2] |
| d) | State graph coloring problem. | [3] |
| e) | Write any two characteristics of a Greedy Algorithm. | [2] |
| f) | What is the importance of knapsack algorithm in our daily life? | [3] |
| g) | What is Hamiltonian cycle? | [2] |
| h) | Define spanning tree. | [3] |
| i) | What is meant by non-deterministic algorithm? | [2] |
| j) | What is NP-hard problem? | [3] |

## PART – B

**(50 Marks)**

| | | |
|---|---|---|
| 2.a) | Sort the records with the following index values in the ascending order using quick sort algorithm. 2, 3, 8, 5, 4, 7, 6, 9, 1 | [5+5] |
| b) | What is probabilistic analysis? Give example. | |

**OR**

| | | |
|---|---|---|
| 3.a) | Give the general plan of divide and conquer algorithms. | [5+5] |
| b) | What are the different mathematical notations used for algorithm analysis. | |
| 4. | Given a set of non-negative integers {10, 7, 5, 18, 12, 20, 15}, and a value sum 35. Explain sum of subsets problem illustrating the above example. | [10] |

**OR**

| | | |
|---|---|---|
| 5.a) | What is weighting rule for Union(i, j)? How it improves the performance of union operation? | |
| b) | Give brief note on graph coloring. | [5+5] |

6.a) Discuss about all pairs shortest path problem with suitable example.
b) Discuss briefly about the minimum cost spanning tree. [5+5]

**OR**

7. State the Job – Sequencing with deadlines problem. Find an optimal sequence to the n = 5 Jobs where profits (P1, P2, P3, P4, P5) = (20, 15, 10, 5, 1) and deadlines (d1, d2, d3, d4, d5) =(2, 2, 1, 3, 3). [10]

8. Draw the portion of the state space tree generated by LCBB for the knapsack instances: n=5, (P1, P2, . . . , P5) = (12,10,5,9,3), (w1, w2, ...,w5)=(3, 5, 2, 5, 3) and M =12. [10]

**OR**

9. Explain how Matrix – chain Multiplication problem can be solved using dynamic programming with suitable example. [10]

10. Solve the Travelling Salesman problem using branch and bound algorithms. [10]

**OR**

11.a) Discuss about cook's theorem.
b) What is the satisfiability problem? Explain. [5+5]

**---ooOoo---**

**Code No: 135AF** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, March - 2021**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 Hours** **Max. Marks: 75**

**Answer any five questions**
**All questions carry equal marks**
**- - -**

1.a) Discuss Strassen's matrix multiplication as well as classical O (n^2) one. Determine when Strassen's method outperforms the classical one.
b) Define Time Complexity. Describe different notations used to represent these complexities. [8+7]

2. List and explain the applications of backtracking. [15]

3. 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). [15]

4. What is travelling salesman problem? Explain how it can be solved using Branch and Bound method. Show the steps and solution by taking any one example containing atleast 5 cities and 10 ways to travel between them. [15]

5.a) Using branch and bound technique explain the 0/1 knapsack problem.
b) Give a note on FIFO branch and bound solution. [7+8]

6. Explain the Bi-connected components in detail. [15]

7.a) Explain binary search and find its time complexity.
b) Write an algorithm for finding maximum element of an array; perform best, worst and average case complexity with appropriate order notations. [7+8]

8. State and prove the Cook's theorem. [15]

**---ooOoo---**

**R16**

**Code No: 135AF**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, May/June - 2019**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 hours** **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A**

**(25 Marks)**

1.a) In what way a time complexity differs from space complexity. [2]
b) Give the general plan of divide and conquer algorithms. . [3]
c) Write an algorithm for collapsing find. [2]
d) Define Backtracking? List the applications of Backtracking [3]
e) What is the importance of knapsack algorithm in our daily life? [2]
f) Write Control Abstraction of Greedy method. [3]
g) What you mean by dynamic programming. [2]
h) Define optimal binary search tree with an example. [3]
i) State the difference between FIFO and LC Branch and Bound algorithms. [2]
j) Write the Control Abstraction of Least – Cost Branch and Bound. [3]

**PART - B**

**(50 Marks)**

2.a) What are the different mathematical notations used for algorithm analysis.
b) Write Divide – And – Conquer recursive Quick sort algorithm and analyze the algorithm for average time complexity. [10]

**OR**

3. Write Randomized algorithm of Quicksort. [10]

4. Write an algorithm to determine the Hamiltonian cycle in a given graph using backtracking. [10]

**OR**

5. Explain the AND/OR graph problem with an example. [10]

6.a) Explain the Knapsack problem with an example.
b) Write a greedy algorithm for sequencing unit time jobs with deadlines and profits. [10]

**OR**

7. State the Job – Sequencing with deadlines problem. Find an optimal sequence to the n = 5 Jobs where profits (P1, P2, P3, P4, P5) = (20, 15, 10, 5, 1) and deadlines (d1, d2, d3, d4, d5) =(2, 2, 1, 3, 3). [10]

8. 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). [10]

**OR**

9. Explain how Matrix – chain Multiplication problem can be solved using dynamic programming with suitable example. [10]

10. Solve the Travelling Salesman problem using branch and bound algorithms. [10]

**OR**

11. Explain the FIFO BB 0/1 Knapsack problem procedure with the knapsack instance for n=4, m=15,(p1,p2,p3,p4)=(10,10,12,18), (w1,w2,w3,w4) =(2, 4, 6, 9). Draw the portion of the state space tree and find optimal solution. [10]

**---ooOoo---**

**R16**

**Code No: 135AF**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, November/December - 2018**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 hours** **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A**

**(25 Marks)**

1.a) Write an algorithm to find the number of digits in the binary representation of a positive decimal integer. [2]
b) How can we measure an algorithm's running time? [3]
c) What is a set? List the operations that can be performed on it. [2]
d) Give brief note on graph coloring. [3]
e) State the Job – Sequencing Deadline Problem. [2]
f) Find an optimal solution to the knapsack instance n=4 objects and the capacity of knapsack m=15, profits (10, 5, 7, 11) and weight are (3, 4, 3, 5). [3]
g) What is Travelling Sales Man Problem? [2]
h) Give the statement of Reliability design problem. [3]
i) State the methodology of Branch and Bound. [2]
j) Define Bounding Function? Give the statement of 0/1 Knapsack FIFO BB. [3]

**PART - B**

**(50 Marks)**

2.a) Explain Recursive Binary search algorithm with suitable examples.
b) Distinguish between Merge sort and quick sort. [5+5]

**OR**

3.a) What is stable sorting method? Is Merge sort a stable sorting method? Justify your answer.
b) Explain partition exchange sort algorithm and trace this algorithm for n =8 elements: 24,12, 35, 23,45,34,20,48. [5+5]

4. Write and explain the algorithm of Bi connected components with an example. [10]

**OR**

5. Give the solution to the 8-queens problem using backtracking. [10]

6. What is Minimum cost spanning tree? Explain an algorithm for generating minimum cost Spanning tree and list some applications of it. [10]

**OR**

7.a) Explain the greedy technique for solving the Job Sequencing problem.
b) Write with an example of Prim's algorithm. [5+5]

8.a) Discuss the time and space complexity of Dynamic Programming traveling sales person algorithm.

b) Write an algorithm of matrix chain multiplication. [5+5]

**OR**

9. With the help of suitable example explain the all pairs shortest path problem. [10]

10.a) Give the 0/1 Knapsack LCBB algorithm.

b) Differentiate between deterministic and non deterministic algorithm. [5+5]

**OR**

11. Draw the portion of state space tree generated by LCBB for the 0/1 Knapsack instance: n = 5, (p1,p2,…,p5) = (10,15,6,8,4), (w1,w2,..,w5) = (4,6,3,4,2) and m=12. And also find an optimal solution of the same. [10]

**---ooOoo---**

**R16**

**Code No: 135AF**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, October - 2020**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 2 hours** **Max. Marks: 75**

**Answer any five questions**
**All questions carry equal marks**
- - -

1.a) Explain the general method of divide and conquer with an example.
b) Write an algorithm for stressan's matrix multiplication and analyze the complexity of your algorithm. [7+8]

2.a) List the disjoint set operations and explain with examples.
b) Explain GRAPH coloring problem with example. Analyze the running time for that problem/algorithm. [7+8]

3. Differentiate between prim's algorithm and krushkars algorithm for finding the minimum cost spanning tree. [15]

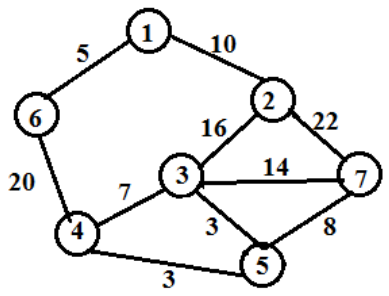
4.a) Write an algorithm of all pairs shortest path problem.
b) Solve the following 0/1 Knapsack problem using dynamic programming
P= (11, 21, 31, 33), W= (2, 12, 23, 15), C=42, n=4. [7+8]

5.a) Compare NP Hard and NP Complete.
b) Explain about 0/1 Knapsack Problem using branch and bound with example. [7+8]

6. Explain the merge sort algorithm with an example. Design an algorithm for merge sort. [15]

7.a) Explain the major drawbacks of backtracking method with example.
b) Write an algorithm for sum of subsets problem. [8+7]

8.a) Write an algorithm for Knapsack problem using Greedy method.
b) Find the optimal solution by using primis minimum cost spanning of the following graph. [7+8]




---ooOoo---

**Code No: 135AF** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, September - 2021**
**DESIGN AND ANALYSIS OF ALGORITHMS**
**(Common to CSE, IT)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any five questions**
**All questions carry equal marks**
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1. 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 best case time efficiency: 4, 2, 0, 8, 7, 1, 3, 6. [15]

2. Consider the following recurrence
   $T(n)=3T(n/3)+ n$
   Obtain asymptotic bound using substitution method. [15]

3. Using disjoint-sets find the connected components in the undirected graph G = (V, E), where the vertices V = {a, b, c, d, e, f, g, h, i, j} and edges E = {(a, c), (a ,b), (e, f), (h, i), (e, g), (a, d), (e, d) (b, d), (c, a), (h, j)}. The edges are processed in the order given. List the vertices in each connected component after each step. [15]

4. Find a solution to the 8-Queens problem using backtracking strategy. Draw the solution space using necessary bounding function. [15]

5. Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source (figure 1). In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized? [15]

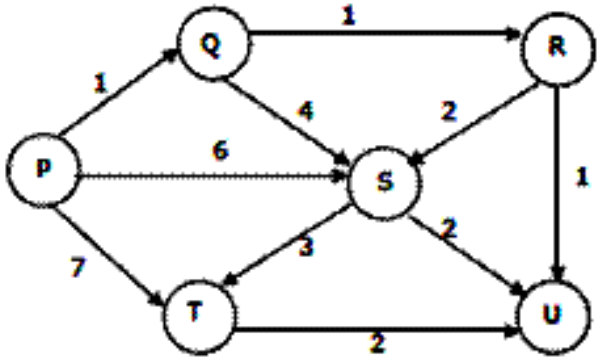


Figure 1

6. A thief enters a house for robbing it. He can carry a maximal weight of 60 kg into his bag. There are 5 items in the house with the following weights and values. What items should thief take if he can even take the fraction of any item with him? (w1, w2, w3, w4, w5) = (5, 10, 15, 22, 25), (b1, b2, b3, b4, b5) = (30, 40, 45, 77, 90). [15]

7. Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. (figure 2) [15]

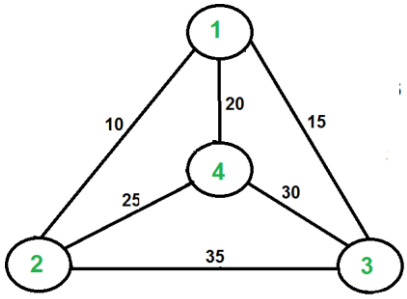


Figure 2

8. Given a set of 4 items, each with weight {2,2,4,5} and benefit {3,7,2,9}, Using LC branch and Bound determine the items to include in the knapsack so that the total weight is less than or equal to a given weight limit and the total benefit is maximized. The weight limit for this knapsack is 10? [15]

**---ooOoo---**