

Code No: RT32054

R13**SET - 1****III B. Tech II Semester Regular Examinations, April - 2016****DESIGN AND ANALYSIS OF ALGORITHMS**

(Common to CSE and IT)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

PART -A

- 1 a) Distinguish between Algorithm and Psuedocode. [3M]
b) Describe the Algorithm Analysis of Binary Search. [4M]
c) State the Job – Sequencing Deadline Problem. [4M]
d) Define i) Principles of optimality ii) Feasible solution iii) Optimal solution. [3M]
e) Write the Control Abstraction of iterative Backtracking method. [4M]
f) Distinguish between fixed – tuple sized and variable tuple sized state space tree organization. [4M]

PART -B

- 2 a) Explain the properties of an algorithm with an example. [4M]
b) Give the algorithm for matrix multiplication and find the time complexity of the algorithm using step – count method. [8M]
c) Differentiate between Bigoh and omega notation with example. [4M]
- 3 a) What is meant by Divide – and – Conquer approach? [3M]
b) Write Divide – And – Conquer recursive Merge sort algorithm and derive the time complexity of this algorithm. [8M]
c) Write the General method of Divide – And – Conquer approach. [5M]
- 4 a) State the Greedy Knapsack? Find an optimal solution to the Knapsack instance $n=3, m=20, (P_1, P_2, P_3) = (25, 24, 15)$ and $(W_1, W_2, W_3) = (18, 15, 10)$. [8M]
b) What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example. [8M]
- 5 a) Draw an Optimal Binary Search Tree for $n=4$ identifiers $(a_1, a_2, a_3, a_4) = (\text{do}, \text{if}, \text{read}, \text{while})$ $P(1:4)=(3,3,1,1)$ and $Q(0:4)=(2,3,1,1,1)$. [9M]
b) Explain how Matrix – chain Multiplication problem can be solved using dynamic programming with suitable example. [7M]
- 6 a) What is a Hamiltonian Cycle? Explain how to find Hamiltonian path and cycle using backtracking algorithm. [8M]
b) Discuss the 4 – queen's problem. Draw the portion of the state space tree for $n = 4$ queens using backtracking algorithm. [8M]
- 7 a) Give the 0/1 Knapsack LCB algorithm. Explain how to find optimal solution using variable – tuple sized approach. [9M]
b) Distinguish between backtracking and branch – and bound techniques. [7M]

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3. Answer any **THREE** Questions from **Part-B**

PART -A

- 1 a) Define i) Profiling ii) Time Complexity iii) Space Complexity. [3M]
b) State the Greedy Knapsack Problem. [4M]
c) Distinguish between Prim's and Kruskal's Spanning tree algorithm. [4M]
d) Draw all possible binary search trees for the identifier set (do, if, stop). [4M]
e) Define Chromatic number & Give the state space tree for 4 – coloring problem. [4M]
f) Define Bounding Function? Give the statement of 0/1 Knapsack FIFO BB. [3M]

PART -B

- 2 a) What are the different mathematical notations used for algorithm analysis. [4M]
b) Give the algorithm for transpose of a matrix $m \times n$ and determine the time complexity of the algorithm by frequency – count method. [8M]
c) Discuss the Amortized analysis with an example. [4M]
- 3 a) What are the advantages and disadvantages of Divide – And – Conquer? [3M]
b) Write Divide – And – Conquer recursive Quick sort algorithm and analyze the algorithm for average time complexity. [8M]
c) Derive the time complexity of Quick sort algorithm for worst case. [5M]
- 4 a) State the Job – Sequencing with deadlines problem. Find an optimal sequence to the $n=5$ Jobs where profits $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$ and deadlines $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$. [8M]
b) What is a Minimum Cost Spanning tree? Explain Kruskal's Minimum cost spanning tree algorithm with suitable example. [8M]
- 5 a) Explain Reliability Design Problem with suitable example. [7M]
b) Describe the Dynamic 0/1 Knapsack Problem. Find an optimal solution for the dynamic programming 0/1 knapsack instance for $n=3$, $m=6$, profits are $(p_1, p_2, p_3) = (1, 2, 5)$, weights are $(w_1, w_2, w_3) = (2, 3, 4)$. [9M]
- 6 a) Write an algorithm for N – queen's problem. Give time and space complexity for 8 – queen's problem. [8M]
b) Give the statement of sum –of subsets problem. Find all sum of subsets for $n=4$, $(w_1, w_2, w_3, w_4) = (11, 13, 24, 7)$ and $M=31$. Draw the portion of the state space tree using fixed – tuple sized approach. [8M]

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SET - 2

- 7 a) What is LC – Search? Discuss LC – Search algorithm. [7M]
- b) Explain Travelling sales person problem LCBP procedure with the following instance and draw the portion of the state space tree and find an optimal tour. [9M]

∞	20	30	10	11
15	∞	16	4	2
3	5	∞	2	4
19	6	18	∞	3
16	4	7	16	∞

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PART -A

- 1 a) Describe & Define any three Asymptotic Notations. [3M]
- b) Write Control Abstraction of Divide – and – Conquer. [4M]
- c) 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). [4M]
- d) Distinguish between Dynamic Programming and Greedy method. [4M]
- e) What is a Backtracking and give the 4 – Queens's solution. [4M]
- f) Define : i) LC – Search ii) Branch and Bound (BB) iii) FIFO – BB. [3M]

PART -B

- 2 a) Explain the performance Analysis. [4M]
- b) Give the algorithm for matrix additions and determine the time complexity of this algorithm by frequency – count method. [8M]
- c) Discuss the Pseudo code conventions for expressing algorithms. [4M]
- 3 a) Distinguish between Merge sort and quick sort. [3M]
- b) Explain Recursive Binary search algorithm with suitable examples. [8M]
- c) Discuss the time complexity of Binary search algorithm for best and worst case. [5M]
- 4 a) Find an optimal solution to the knapsack instance n=7 objects and the capacity of knapsack m=15. The profits and weights of the objects are (P1,P2,P3, P4, P5, P6, P7)=(10, 5,15,7,6,18,3) (W1,W2,W3,W4,W5,W6,W7)=(2,3,5,7,1,4,1) [8M]
- b) Discuss the single – source shortest paths algorithm with suitable example. [8M]
- 5 a) What is All – Pair Shortest Path problem (APSP)? Discuss the Floyd's APSP algorithm and discuss the analysis of this algorithm. [9M]
- b) What is principle's of optimality? Explain how travelling sales person problem uses the dynamic programming technique with example. [7M]
- 6 a) Write control abstraction for backtracking. [7M]
- b) Explain the Graph – coloring problem. And draw the state space tree for m= 3 colors n=4 vertices graph. Discuss the time and space complexity. [9M]
- 7 a) Write Control Abstraction of Least – Cost(LC) Search. [7M]
- b) 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. [9M]

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R13**SET - 4**

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

PART -A

- 1 a) Describe Different characteristics of an algorithm. [3M]
- b) Distinguish between Divide and conquer and Greedy method. [4M]
- c) Write Control Abstraction of Greedy method. [4M]
- d) Give the statement of Reliability design problem. [4M]
- e) Define : i) State Space tree ii) E – Node and iii) Dead Node. [3M]
- f) Write the Control Abstraction of Least – Cost Branch and Bound. [4M]

PART -B

- 2 a) Explain recursive functions algorithm analysis with an example. [4M]
- b) Explain the method of determining the complexity of procedure by the step count approach. Illustrate with an example. [8M]
- c) Give the Big – O notation definition and briefly discuss with suitable example. [4M]
- 3 a) What is stable sorting method? Is Merge sort a stable sorting method? [3M]
- b) Explain partition exchange sort algorithm and trace this algorithm for n =8 elements: 24,12, 35, 23,45,34,20,48 [8M]
- c) Write non – recursive binary search algorithm? [5M]
- 4 a) Explain differences between Prim's and Kruskal's Minimum spanning Tree algorithm. Derive the time complexity of Kruskal's algorithm. [8M]
- b) Discuss the Dijkstra's single source shortest path algorithm and derive the time complexity of this algorithm. [8M]
- 5 a) Construct an optimal travelling sales person tour using Dynamic Programming. [9M]
$$\begin{pmatrix} 0 & 10 & 9 & 3 \\ 5 & 0 & 6 & 2 \\ 9 & 6 & 0 & 7 \\ 7 & 3 & 5 & 0 \end{pmatrix}$$
- b) Discuss the time and space complexity of Dynamic Programming traveling sales person algorithm. [7M]
- 6 a) What is a backtracking? Give the explicit and implicit constraints in 8 queen's problem. [8M]
- b) Draw the portion of state space tree for 4 queen's problem using variable – tuple sized approach. [8M]

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R13**SET - 4**

- 7 a) Draw the portion of state space tree generated by FIFOBB for the job sequencing with deadlines instance $n=5$, $(p_1, p_2, \dots, p_5) = (6, 3, 4, 8, 5)$, $(t_1, t_2, \dots, t_5) = (2, 1, 2, 1, 1)$ and $(d_1, d_2, \dots, d_5) = (3, 1, 4, 2, 4)$. What is the penalty corresponding to an optimal solution. [8M]
- b) Draw the portion of state space tree generated by LCBB for the 0/1 Knapsack instance: $n = 5$, $(p_1, p_2, \dots, p_5) = (10, 15, 6, 8, 4)$, $(w_1, w_2, \dots, w_5) = (4, 6, 3, 4, 2)$ and $m=12$. Find an optimal solution using fixed – tuple sized approach. [8M]
