Code No: R1632053 **R16** SET - 1

III B. Tech II Semester Regular Examinations, April/May - 2019

DESIGN AND ANALYSIS OF ALGORITHMS

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1.	a)	What is performance measurement of an algorithm?	[2M]
	b)	Write any two differences between divide-and-conquer and greedy method.	[2M]
	c)	State the KNAPSACK problem. What is the difference between KNAPSACK and 0/1 KNAPSACK problem?	[2M]
	d)	State the principle of optimality.	[3M]
	e)	Draw the state-space tree along with answer nodes for 4-queens problem.	[3M]
	f)	Explain briefly branch and bound technique for solving problems.	[2M]

PART -B

2.	a)	Write different pseudo code conventions used to represent an algorithm.	[7M]
	b)	What is space complexity? Illustrate with an example for fixed and variable part in space complexity.	[7M]
3.	a)	Discuss the working strategy of merge sort and illustrate the process of merge sort algorithm for the given data: 43, 32, 22, 78, 63, 57, 91 and 13.	[7M]
	b)	Describe binary search in detail and provide time complexity analysis with an example.	[7M]
4.	a)	Write a greedy algorithm for sequencing unit time jobs with deadlines and profits.	[7M]
	b)	What is optimal merge pattern? Find optimal merge pattern for ten files whose record lengths are 28, 32, 12, 5, 84, 53, 91, 35, 3, and 11.	[7M]
5.	a)	Write and explain an algorithm to compute the all pairs shortest path using dynamic programming and prove that it is optimal.	[7M]
	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.	[7M]
6.	a)	What is a backtracking? Give the explicit and implicit constraints in 8 queen's problem.	[7M]
	b)	Write an algorithm to determine the Hamiltonian Cycle in a given graph using backtracking.	[7M]
7.	a)	Explain FIFO Branch and Bound solution.	[7M]
	b)	Draw the portion of the state space tree generated by LC branch and bound of knapsack problem for an instance n=4, (P1, P2, P3, P4) = (10, 10, 12, 18), (w1, w2, w3, w4)=(2, 4, 6, 9), and m=15.	[7M]

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) How to measure a time complexity of an algorithm? [2M]
   b) Describe the time complexity of Divide and Conquer in the recurrence form. [2M]
   c) Define Minimum Cost Spanning Tree and list its applications. [2M]
   d) What is meant by bottom-up dynamic programming? [3M]
   e) Why Backtracking always produces an optimal solution? Justify. [3M]
   f) What are the searching methods that are commonly used in branch and bound method? [2M]

PART -B

2. a) What is an asymptotic notation? Explain different types of asymptotic notations with examples. [7M]
   b) What do you mean by performance analysis? Give the algorithm for matrix multiplication and find the time complexity of the algorithm using step–count method. [7M]

3. a) Illustrate the tracing of quick sort algorithm for the following set of numbers: 25, 10, 72, 18, 40, 11, 64, 58, 32, 9. [7M]
   b) With a suitable algorithm, explain the problem of finding the maximum and minimum items in a set of *n* elements. [7M]

4. a) Use the greedy algorithm for sequencing unit time jobs with deadlines and profits to generate the solution when n=7, (p1, p2,…p7)=(3, 5, 20, 18, 1, 6, 30), and (d1, d2,…, d7)=(1, 3, 4, 3, 2, 1, 2). [7M]
   b) Discuss the Dijkstra's single source shortest path algorithm and derive its time complexity. [7M]

5. a) Find the all pairs shortest path solution for the graph represented by below adjacency matrix: [7M]

$$\begin{bmatrix} \infty & 6 & 5 & 4 \\ 3 & \infty & 2 & 6 \\ 18 & 6 & \infty & 7 \\ 8 & 12 & 10 & \infty \end{bmatrix}$$

   b) Define merging and purging rules in 0/1 knapsack problem and explain with an example. [7M]

6. a) State N-Queens problem and solve 8-Queens problem using backtracking. [7M]
   b) Explain the Graph–Coloring problem and draw the state space tree for m= 3 colors and n=4 vertices graph. Discuss the time and space complexity. [7M]

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7. a) State the concept of branch and bound method and also mention its applications. [7M]

   b) Generate FIFO branch and bound solution for the given knapsack problem, m = 15, n = 3, (P1, P2, P3) = (10, 6, 8) and (w1, w2, w3) = (10, 12, 3). [7M]

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2. Answer **ALL** the question in **Part-A**
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PART –A

1.	a)	Using step count method, analyse the time complexity of procedure to add two m x n matrices.	[2M]
	b)	Give the general idea of Divide & Conquer algorithms.	[2M]
	c)	Define feasible and optimal solution.	[2M]
	d)	Differentiate between divide-and-conquer and dynamic programming.	[3M]
	e)	State and explain m- colourability decision problem.	[3M]
	f)	Explain briefly branch and bound technique for solving problems.	[2M]

PART -B

2.	a)	What is an algorithm? Explain its characteristics in detail.	[7M]
	b)	What do you mean by performance analysis? Derive the run time complexity of a non-recursive Fibonacci series algorithm using tabular method.	[7M]
3.	a)	Apply Merge Sort to sort the list a[1:10]=(31,28,17,65,35,42.,86,25,45,52). Draw the tree of recursive calls of merge sort, merge functions.	[7M]
	b)	What are different approaches of writing randomized algorithm? Write randomized sort algorithms.	[7M]
4.	a)	Write a greedy algorithm for sequencing unit time jobs with deadlines and profits.	[7M]
	b)	Write and explain Prism's algorithm for finding minimum cost spanning tree of a graph with an example.	[7M]
5.	a)	Explain the methodology of Dynamic programming. Mention the applications of Dynamic programming.	[7M]
	b)	Let X = a,a,b,a,a,b,a,b,a,a and Y = b,a,b,a,a,b,a,b. Find a minimum-cost edit sequence that transforms X and Y.	[7M]
6.	a)	Write and explain recursive backtracking algorithm.	[7M]
	b)	Find all possible subsets of *w* that sum to *m*. Let w={5,7,10,12,15,18,20}and *m*=35 and draw the portion of the state space tree that is generated using backtracking.	[7M]
7.	a)	What is LC–Search? Discuss LC–Search algorithm.	[7M]
	b)	Describe the Travelling sales person problem and discuss how to solve it using branch and bound?	[7M]

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2. Answer **ALL** the question in **Part-A**
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PART –A

1.	a)	What do you mean by Amortized Complexity? Give an example.	[2M]
	b)	Write the control abstraction for divide-and-conquer algorithms.	[2M]
	c)	State the general principle of greedy algorithm.	[2M]
	d)	Write Bellman and Ford algorithm to compute shortest paths.	[3M]
	e)	Define implicit and explicit constraints of backtracking.	[3M]
	f)	Differentiate between back tracking and branch and bound.	[2M]

PART -B

2.	a)	What are the Asymptotic notations and give its properties?	[7M]
	b)	What is time complexity? Explain the different methods of finding the time complexity with examples.	[7M]
3.	a)	Write a recursive algorithm for binary search and also bring out its efficiency.	[7M]
	b)	Explain divide-and-conquer technique; write a recursive algorithm for finding the maximum and minimum element from the list.	[7M]
4.	a)	Solve the following instance of knapsack problem using greedy method. n=7(objects), m=15, profits are (P1,P2,P3,P4,P5,P6,P7)=(10,5,15,7,6,18,3) and its corresponding weights are (W1,W2,W3,W4,W5,W6,W7)=(2,3,5,7,1,4,1).	[7M]
	b)	What is a Minimum Cost Spanning tree? Explain Kruskal's Minimum cost spanning tree algorithm with a suitable example.	[7M]
5.	a)	Present the dynamic programming solution for single sources shortest path problem. Analyze its time complexity.	[7M]
	b)	Design a three stage system with device types D1, D2, D3. The costs are $30, $15, $20 respectively. The cost of the system is to be not more than $105 and the reliability of each device type is 00.9, 0.8 and 0.5 respectively.	[7M]
6.	a)	How does backtracking work on the 8 Queen problem? Explain with a suitable example.	[7M]
	b)	Write an algorithm for finding m-coloring of a graph and explain with an example.	[7M]
7.	a)	Give a comparison between different branch-and-bound approaches.	[7M]
	b)	Discuss 0/1 Knapsack problem with respect to branch and bound method.	[7M]

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