School of Computer Science

QUESTION BANK

Course Title: DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: DS3102PC

Regulation :NR21

Course Objectives:

- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate;
- Describes how to evaluate and compare different algorithms using worst-, average-, and best- case analysis.
- Explains the difference between tractable and intractable problems, and introduces the problems that are P, NP and NP complete.

Course Outcomes:

- Ability to analyze the performance of algorithms
- Ability to choose appropriate data structures and algorithm design methods for aspecified application
- Ability to understand how the choice of data structures and the algorithm designmethods impact the performance of programs

UNIT-I

S.No	Questions	BT	CO
1	Define the term algorithm and state the criteria the algorithm	L1	CO1
2	Define order of an algorithm and the need to analyze the algorithm.	L4	CO1
3	Define asymptotic notations: big 'Oh', omega and theta?	L3	CO1
4	Distinguish between Algorithm and Pseudocode.	L2	CO2
5	State the best case and worst case analysis for binary search	L1	CO1
6	State the best case analysis of quick sort.	L4	CO2
7	Give the recurrence equation for the worst case behavior of merge sort	L1	CO3
8	Compute the average case time complexity of quick sort	L1	CO2
9	How the performance can be analyzed? Explain with the example.	L1	CO1
10	Describe best case, average case and worst case efficiency of an algorithm?	L2	CO2

Part–B(Long Answer Questions)

11	a)	Discuss various the asymptotic notations used for best case average case and worst case analysis of algorithms.	L4	CO2
	b)	Define i)Time Complexity ii)Space Complexity	L5	CO2
12	a)	Discuss binary search algorithm and analyze its time complexity	L6	CO1
	b)	Explain the algorithm of quick sort with example and find the time complexity	L3	CO2
13	a)	Explain binary search algorithm	L1	CO3
	b)	Explain the algorithm of Merge sort with example and find the time complexity.	L2	CO2
14	a)	Give the algorithm for Stassen's matrix multiplication and find the Time complexity.	L3	CO3
	b)	Explain the properties/ characteristics of an algorithm with an example.	L2	CO1
15	a)	Write a java program to implement Quick sort algorithm for sorting a list of integers in ascending order.	L3	CO2
	b)	Sort the list of numbers using mergesort:78,32,42,62,98,12,34, 83,10	L4	CO1
16	a)	Discuss binary search algorithm and analyze its time complexity	L1	CO3
	b)	Discuss various the asymptotic notations used for best case average case and worst case analysis of algorithms	L2	CO4

UNIT-II

S.No		Questions	BT	CO
1		Describe union operation on sets	L3	CO1
2		Describe find operation on sets	L1	CO2
3		Define a spanning tree and minimal spanning tree	L2	CO3
4		Define Graph in DAA?	L3	CO1
5		Define Tree in DAA ?	L4	CO2
6		Differentiate Graph and Tree	L5	CO2
7		What is set? Write different types of set operation?	L3	CO3
8		Explain different types UNION and FIND algorithm with example?	L1	CO1
9		What is Disjoint set? Give an example.	L3	CO1
10		Define a connected and bi-connected component	L2	CO2
		Part–B(Long Answer Questions)		
11	a)	What is a Backtracking and givethe4–Queens'ssolution. Draw the Portion of the state space tree for n=4 queens using backtracking algorithm	L3	CO1
	b)	What is a Hamiltonian Cycle? Explain how to find Hamiltonian path and cycle using backtracking algorithm.	L2	CO2
12	a)	Give the statement of sum–of subsets problem. Find all sum of subsets for n=4, (w1, w2, w3, w4) = (11, 13, 24, 7) and M=31.Draw the portion of the state space tree using fixed–Tuple sized approach.	L4	CO1
	b)	Define: i) State Space tree ii)E–Node iii)Dead Node	L3	CO2
13	a)	Define Chromatic number & Give the state space tree for 4–Coloring problem.	L1	CO1
	b)	Explain the Graph–coloring problem. And draw the state space tree for m= 3colors n=4 vertices graph. Discuss the time and space complexity.	L2	CO3
14	a)	Differentiate divide and conquer and greedy method	L2	CO2
	b)	Write an algorithm for N–queen's problem. Give time and space complexity for8–queen'sproblem.	L3	CO1
15	a)	Distinguish between Dynamic Programming and Greedy method.	L4	CO2
	b)	What is Graph in DAA? Give an example	L1	CO3
16	a)	Explain waiting rule for finding UNION of sets and collapsing Rule	L2	CO2
	b)	Explain with examples find() and Union() algorithms	L3	CO2

UNIT-III

S.No		Questions	BT	CO
1		Define greedy method	L2	CO1
2		Define job sequencing with deadlines problem	L3	CO2
3		Define minimum cost spanning tree	L2	CO3
4		Define Knapsack problem?	L3	CO3
5		Define Prim's algorithm	L2	CO1
6		Define Kruskal's algorithm	L1	CO2
7		Define single source shortest path problem	L3	CO4
8		Define dynamic programming	L1	CO5
9		List the features of dynamic programming	L2	CO3
10		Distinguish greedy method and dynamic programming	L1	CO2
		Part–B(Long Answer Questions)		
11	a)	What is a principle of optimality? Explain how travelling sales person problem uses the dynamic programming technique with example and also find space and time complexity.	L3	CO3
	b)	Explain single source shortest path problem with example	L1	CO1
12	a)	Give the statement of Reliability design problem and explain with suitable example.	L2	CO2
	b)	Explain prims algorithm with example	L3	CO3
13	a)	Explain Kruskal's algorithm with example	L1	CO1
	b)	What is Reliability design with example	L2	CO3
14	a)	Explain optimal binary search tree algorithm with example	L3	CO4
	b)	Explain 0/1 knapsack problem with example	L1	CO3
15	a)	What is All– Pair Shortest Path problem (APSP)? Discuss the Floyd's APSP algorithm and discuss the analysis of this algorithm.	L2	CO1
	b)	Describe the travelling sales man problem and discus show to solve it using dynamic programming?	L4	CO2
16	a)	Explain Kruskal's algorithm with example	L1	CO3
	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 (p1, p2, p3) = (1,2,5),weights are(w1,w2,w3)=(2,3,4).	L1	CO1

UNIT-IV

S.No		Questions	BT	CO
1		Define i) Feasible solution ii)Optimal solution.	L1	CO2
2		Define Greedy Method?	L2	CO3
3		What is spanning tree? Give example	L3	CO2
4		What is job sequence with deadline?	L1	CO1
5		What is minimum spanning tree?	L4	CO2
6		What is single source shortest path?	L4	CO1
7		What is time complexity of job sequence with deadline?	L4	CO3
8		What is time complexity of spanning tree?	L4	CO1
9		What is time complexity of single source shortest path?	L1	CO2
10		Distinguish between Prim's and Kruskal's spanning tree algorithm.	L1	CO3
		Part–B(Long Answer Questions)		
11	a)	Find an optimal solution to the knapsack instance n=7objects 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).	L1	CO1
	b)	State the Job– Sequencing Dead line Problem	L1	CO2
12	a)	Discuss the single–source shortest paths (i.e.Dijkstra's) algorithm with suitable example and also find the time complexity.	L2	CO2
	b)	What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example and also find the time complexity.	L3	CO1
13	a)	Find an optimal sequence to the n=5 Jobs where profits(P1,P2,P3,P4,P5)=(20,15,10,5,1)anddeadlines(d1,d2,d3 ,d4,d5) =(2,2,1,3,3).	L1	CO2
	b)	What is a Minimum Cost Spanning tree? Explain Kruskal's Minimum cost spanning tree algorithm with suitable example and also find the time complexity	L4	CO3
14	a)	State the Greedy Knapsack?Write the algorithm for Greedy knapsack and also compute the time complexity	L1	CO1
	b)	Write an algorithm for job sequence with deadlines.	L1	CO2
15	a)	Write an algorithm for Kruskal's algorithm.	L1	CO2
	b)	Write an algorithm for Prim's algorithm.	L1	CO1
16	a)	Write an algorithm for Dijkstra's algorithm.	L3	CO2
	b)	Write Application of Greedy Method.	L3	CO3

UNIT-V

S.No		Questions	BT	CO
1		Define class P?	L4	CO1
2		Compare NP-hard and NP-completeness	L4	CO2
3		Define NP-hard problem	L4	CO3
4		Define NP-complete problem	L4	CO1
5		Define deterministic problem?	L4	CO2
6		Define non-deterministic problem	L4	CO1
7		Define i) LC–Search ii)Branch and Bound(BB)iii) FIFO–BB.	L4	CO3
8		Explain optimization problem	L1	CO2
9		Define Bounding Function?	L1	CO3
10		Define Cook's theorem?	L1	CO1
11	a)	Draw the portion of state space tree generated by FIFOBB for the job sequencing with dead lines instance n=5,(p1,p2,..,p5)=(6,3,4,8,5),(t1,t2,..t5)=(2,1,2,1,1)and(d1,d2,..,d5)=(3,1,4,2,4).What is the penalty corresponding to an optimal solution	L2	CO2
	b)	Explain deterministic and non-deterministic algorithms	L1	CO3
12	a)	Write non deterministic algorithm for sorting and searching	L4	CO1
	b)	Write a non-deterministic knapsack algorithm	L1	CO3
13	a)	Explain P and NP problems are related	L1	CO3
	b)	Distinguish NP-hard and NP-complete problems	L3	CO4
14	a)	Define Bounding Function? Give the statement of 0/1Knapsack FIBB and explain the 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).	L1	CO2
	b)	Distinguish between back tracking and branch–and bound techniques.	L1	CO3
15	a)	Explain the strategy to prove that a problem is NP-hard	L1	CO1
	b)	Explain travelling sales person problem LCBB procedure with the following instance and draw the portion of the state space tree and find an optimal solution $\begin{pmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{pmatrix}$	L1	CO3
16	a)	State and prove cook's theorem	L2	CO1
	b)	Draw the portion of state space tree generated by LCBB for the0/1Knapsackinstance: n=5,(p1,p2,…,p5)=(10,15,6,8,4),(w1,w2,..,w5)=(4,6,3,4,2)andm=12.Find an optimal solution Using fixed–tuple sized approach.	L4	CO2