NARASIMHAREDDYENGINEERINGCOLLEGE
(Autonomous)
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COMPUTER SCIENCE AND ENGINEERING
QUESTION BANK

Course Title : DESIGNANDANALYSISOFALGORITHMS

Course Code : DS3106PC

Regulation : NR20

Course Objectives:

- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describesmajoralgorithmictechniques(divide-and-conquer,backtracking,dynamicprogramming, greedy, branch and bound methods) and mention problems for which eachtechniqueisappropriate;
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-caseanalysis.
- Explainsthedifferencebetweentractableandintractableproblems,andintroducestheproblemsthatare P, NP and NP complete.

CourseOutcomes(CO's):

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

UNIT–I
INTRODUCTION OF ALGORITHM

S.No	Questions	BT	CO	PO
	Part –A(Short Answer Questions)			
1	Define the term algorithm and state the criteria the algorithm	L1	CO1	PO1
2	Define order of an algorithm and the need to analyze the algorithm.	L4	CO1	PO2
3	Define asymptotic notations :big' Oh', omega and theta?	L3	CO1	PO1
4	Distinguish between Algorithm and Pseudocode.	L2	CO2	PO1
5	State the best case and worst case analysis for binary search	L1	CO1	PO2
6	State the best case analysis of quick sort .	L4	CO2	PO2
7	Give the recurrence equation for the worst case behavior of merge sort	L1	CO3	PO2
8	Compute the average case time complexity of quick sort	L1	CO2	PO1
9	How the performance can be analyzed? Explain with the example.	L1	CO1	PO1
10	Describe best case, average case and worst case efficiency of an algorithm?	L2	CO2	PO1

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	PO1, 2
	b)	Define i) Time Complexity ii) Space Complexity	L5	CO2	PO2
12	a)	Discuss binary search algorithm and analyze its time complexity	L6	CO1	PO2, 3
	b)	Explain the algorithm of quick sort with example and find the time complexity	L3	CO2	PO3
13	a)	Explain binary search algorithm	L1	CO3	PO3, 4
	b)	Explain the algorithm of Merge sort with example and find the time complexity.	L2	CO2	PO4
14	a)	Give the algorithm for Stassen's matrix multiplication and find the time complexity.	L3	CO3	PO5
	b)	Explain the properties / characteristics of an algorithm with an example.	L2	CO1	PO3
15	a)	Write a java program to implement Quick sort algorithm for sorting a list of integers in ascending order.	L3	CO2	PO2
	b)	Sort the list of numbers using merge sort:78,32,42, 62, 98, 12, 34, 83,10	L4	CO1	PO4
16	a)	Discuss binary search algorithm and analyze its time complexity	L1	CO3	PO5
	b)	Discuss various the asymptotic notations used for best case average case and worst case analysis of algorithms	L2	CO4	PO4

UNIT–II

DISJOINT SET

S. No		Questions	BT	CO	PO
Part –A(Short Answer Questions)					
1		Describe union operation on sets	L3	CO1	PO2
2		Describe find operation on sets	L1	CO2	PO3
3		Define a spanning tree and minimal spanning tree	L2	CO3	PO5
4		Define Graph in DAA ?	L3	CO1	PO7
5		Define Tree in DAA ?	L4	CO2	PO1
6		Differentiate Graph and Tree	L5	CO2	PO5
7		What is set? Write different types of set operation?	L3	CO3	PO3
8		Explain different types UNION and FIND algorithm with example?	L1	CO1	PO7
9		What is Disjoint set ? Give an example.	L3	CO1	PO9
10		Define a connected and bi-connected component	L2	CO2	PO4
Part– B(Long Answer Questions)					
11	a)	What is a Backtracking and give the 4 – Queens's solution. Draw the portion of thestate space tree for n = 4 queens using backtracking algorithm	L3	CO1	PO2
	b)	What is a Hamiltonian Cycle? Explain how to find Hamiltonian path and cycle usingbacktracking algorithm.	L2	CO2	PO4
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 treeusing fixed – tuple sized approach.	L4	CO1	PO6
	b)	Define: i) State Space tree ii) E – Node iii) Dead Nod	L3	CO2	PO7
13	a)	Define Chromatic number & Give the state space tree for 4 – Coloring problem.	L1	CO1	PO5
	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	PO7

14	a)	Differentiate divide and conquer and greedy method	L2	CO2	PO5, 6
	b)	Write an algorithm for N – queen's problem. Give time and space complexity for8 – queen's problem.	L3	CO1	PO6
15	a)	Distinguish between Dynamic Programming and Greedy method.	L4	CO2	PO7
	b)	What is Graph in DAA? Give an example	L1	CO3	PO8
16	a)	Explain waiting rule for finding UNION of sets and collapsing Rule	L2	CO2	PO4
	b)	Explain with examples find() and Union() algorithms	L3	CO2	PO4

UNIT–III
DYNAMIC PROGRAMMING

S. No		Questions	BT	CO	PO
Part –A(Short Answer Questions)					
1		Define greedy method	L2	CO1	PO2
2		Define job sequencing with deadlines problem	L3	CO2	PO4
3		Define minimum cost spanning tree	L2	CO3	PO5
4		Define Knapsack problem?	L3	CO3	PO6, 7
5		Define Prim's algorithm	L2	CO1	PO8
6		Define Kruskal's algorithm	L1	CO2	PO9
7		Define single source shortest path problem	L3	CO4	PO11
8		Define dynamic programming	L1	CO5	PO10
9		List the features of dynamic programming	L2	CO3	PO8
10		Distinguish greedy method and dynamic programming	L1	CO2	PO9
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	PO10
	b)	Explain single source shortest path problem with example	L1	CO1	PO1
12	a)	Give the statement of Reliability design problem and explain with suitable example.	L2	CO2	PO1
	b)	Explain prims algorithm with example	L3	CO3	PO9
13	a)	Explain Kruskal's algorithm with example	L1	CO1	PO8
	b)	What is Reliability design with example	L2	CO3	PO5
14	a)	Explain optimal binary search tree algorithm with example	L3	CO4	PO9
	b)	Explain 0/1 knapsack problem with example	L1	CO3	PO3
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	PO6
	b)	Describe the travelling sales man problem and discuss how to solve it using dynamic programming?	L4	CO2	PO9
16	a)	Explain Kruskal's algorithm with example	L1	CO3	PO5
	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	PO3

UNIT–IV
GREEDY METHOD

S. No		Questions	BT	CO	PO
Part –A(Short Answer Questions)					
1		Define i) Feasible solution ii) Optimal solution.	L1	CO2	PO2
2		Define Greedy Method?	L2	CO3	PO4
3		What is spanning tree ? give example	L3	CO2	PO7
4		What is job sequence with dead line?	L1	CO1	PO5
5		What is minimum spanning tree?	L4	CO2	PO5
6		What is single source shortest path ?	L4	CO1	PO3
7		What is time complexity of job sequence with dead line?	L4	CO3	PO8
8		What is time complexity of spanning tree?	L4	CO1	PO6
9		What is time complexity o single source shortest path ?	L1	CO2	PO3
10		Distinguish between Prim's and Kruskal's spanning tree algorithm.	L1	CO3	PO9
Part– B(Long Answer Questions)					
11	a)	Find an optimal solution to the knapsack instance n=7 objects and the capacityof 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	PO3
	b)	State the Job – Sequencing Deadline Problem	L1	CO2	PO5
12	a)	Discuss the single – source shortest paths (i.e. Dijkstra's) algorithm with suitableexample and also find the time complexity.	L2	CO2	PO7
	b)	What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm withsuitable example and also find the time complexity.	L3	CO1	PO9
13	a)	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).	L1	CO2	PO11
	b)	What is a Minimum Cost Spanning tree? Explain Kruskal's Minimum costspanning tree algorithm with suitable example and also find the time complexity	L4	CO3	PO5, 7
14	a)	State the Greedy Knapsack? Write the algorithm for Greedy knapsack and alsocompute the time complexity	L1	CO1	PO4
	b)	Write an algorithm for job sequence with dead lines.	L1	CO2	PO7
15	a)	Write an algorithm for Kruskal's algorithm.	L1	CO2	PO1
	b)	Write an algorithm for Prim's algorithm.	L1	CO1	PO3
16	a)	Write an algorithm for Dijkstra's algorithm.	L3	CO2	PO5
	b)	Write Application of Greedy Method.	L3	CO3	PO3

UNIT–V
BRANCH AND BOUND

S. No	Questions	BT	CO	PO
Part –A(Short Answer Questions)				
1	Define class P?	L4	CO1	PO4
2	Compare NP-hard and NP-completeness	L4	CO2	PO6
3	Define NP-hard problem	L4	CO3	PO7
4	Define NP-complete problem	L4	CO1	PO7
5	Define deterministic problem?	L4	CO2	PO2
6	Define non-deterministic problem	L4	CO1	PO1
7	Define i) LC – Search ii) Branch and Bound (BB) iii) FIFO – BB.	L4	CO3	PO5
8	Explain optimization problem	L1	CO2	PO9
9	Define Bounding Function?	L1	CO3	PO2

10		Define Cook's theorem?	L1	CO1	PO3
Part– B(Long Answer Questions)					
11	a)	Draw the portion of state space tree generated by FIFOBB for the job sequencing with deadlines 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	PO8
	b)	Explain deterministic and non-deterministic algorithms	L1	CO3	PO9
12	a)	Write non deterministic algorithm for sorting and searching	L4	CO1	PO6
	b)	Write anon-deterministic knapsack algorithm	L1	CO3	PO10
13	a)	Explain P and NP problems are related	L1	CO3	PO4
	b)	Distinguish NP- hard and NP-complete problems	L3	CO4	PO2
14	a)	Define Bounding Function? Give the statement of 0/1 Knapsack FIFO BB 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	PO9
	b)	Distinguish between backtracking and branch – and bound techniques.	L1	CO3	PO1
15	a)	Explain the strategy to prove that a problem is NP-hard	L1	CO1	PO2
	b)	Explain travelling sales person person problem LCBB procedure with the followinginstance and draw the portion of the state space tree and find an optimal tour. $\begin{pmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{pmatrix}$	L1	CO3	PO9
16	a)	State and prove cook's theorem	L2	CO1	PO4
	b)	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. Find an optimal solution using fixed – tuple sized approach.	L4	CO2	PO6

***BloomsTaxonomyLevel(BT)**(L1–Remembering;L2–Understanding;L3–Applying;L4– Analyzing;L5–Evaluating;L6–Creating)

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