P P SAVANI UNIVERSITY

Fifth Semester of B. Tech. Examination
December 2021
SEIT3032 Design and Analysis of Algorithms

9.12.2021, Thursday   Time: 09:00 a.m. To 11:30 a.m.   Maximum Marks: 60

Instructions:
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Define the Following Terms:	[05]
(i)	What do you mean by divide and conquer approach?	
(ii)	Discuss feasible solution with an example.	
(iii)	Differentiate between greedy method and dynamic programming.	
(iv)	What is the best case complexity for merge sort?	
(v)	Find minimum-cost spanning tree using Kruskal's algorithm of the following graph.	
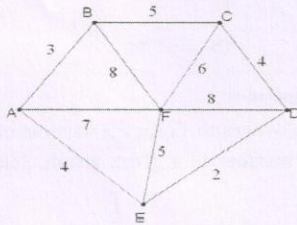
Q - 2 (a)	Trace the merge sort for data A = {310, 285, 179, 652, 351, 423, 861, 254, 450, 520}.	[05]
Q - 2 (b)	Give the algorithm for binary search method. What is the complexity of binary search method?	[05]

OR

|		
Q - 2 (a)	Write an algorithm for quick sort. Analyze quick sort algorithm for best case and worst case.	[05]
Q - 2 (b)	Write an algorithm for insertion sort. Apply the same for sorting {5, 2, 4, 6, 1, 3}.	[05]
Q - 3 (a)	How Huffman code is memory efficient compare to fixed length code? Find an optimal Huffman code for the following set of frequency. a : 45, b : 13, c : 12, d : 16, e : 9, d : 5.	[05]
Q - 3 (b)	Discuss multistage graph problem using dynamic programming.	[05]
Q - 3 (a)	Consider Knapsack capacity W=50, w=(10,20,40) and v=(60,80,100). Find the maximum profit using greedy approach. Also calculate the capacity consumed.	[05]
Q - 3 (b)	Discuss 0/1 Knapsack problem using dynamic programming method.	[05]
Q - 4	Attempt any one.	[05]
(i)	Describe in brief asymptotic notations used for algorithm analysis.	
(ii)	Discuss - Strassen's matrix multiplication along with its time complexity.	

SECTION – II

Q - 1	Discuss - Strassen's matrix multiplication along with its time complexity.	[05]
(i)	Brute force approach	
(ii)	Dynamic Approach vs Backtracking	
(iii)	State space Tree	
(iv)	Least cost Branch and Bound	
(v)	NP Hard	
Q - 2 (a)	What is the disadvantage of Naïve String matching Algorithm. How Knuth-Morris-Pratt String Matching Algorithm can solve it. Explain with suitable example.	[05]

Q - 2 (b) Consider a set of n positive integers S={1,2,3,4,5}. Find whether or not there exists any [05] subset of the given set, whose elements sum is equal to 9. Solve with Backtracking approach.

OR

Q - 2 (a) Explain Robin -Karp String Matching algorithm with suitable example. [05]

Q - 2 (b) What is Hamiltonian cycle. Consider following undirected graph. Find whether or not any [05] Hamiltonian cycle exists in graph. Solve with Backtracking approach.
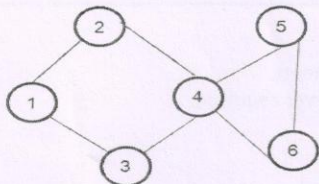
Q - 3 (a) What is 15 Puzzle problem? Transform given initial arrangement to Goal arrangement with [05] minimum movements. Solve with Branch and Bound approach.
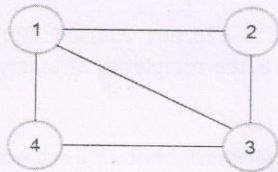
1	2	3	4
5	6		8
9	10	7	11
13	14	15	12

Initial Arrangement

1	2	3	4
5	6	7	8
9	10	11	
13	14	15	12

Goal Arrangement

Q - 3 (b) Explain Graph coloring problem in brief. Consider below graph. Color the vertices of a graph [05] with minimum number of colors. State Chromatic number of a given graph. Solve using backtracking approach.

OR

Q - 3 (a) Differentiate between Branch & Bound and Backtracking approach. State general [05] characteristics of Branch and Bound approach. Explain various branch and bound techniques.

Q - 3 (b) State general characteristics of Backtracking approach. Explain whether 2 Queen can be [05] placed on 2X2 chessboard such that no queens will be under attack? Explain whether 3 Queen can be placed on 3X3 chessboard without attacking each other?

Q - 4 Write short note on P and NP Class. [05]

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SECTION – I

|		
Q - 1	Define the following terms:	[05]
(i)	Optimization Problem	
(ii)	Asymptotic Notation	
(iii)	Dynamic Programming vs Greedy Method	
(iv)	External Sorting	
(v)	Recurrence Relation	
Q - 2 (a)	Sort the List 10,20,30,40,50 using Quick Sort Technique. Also explain the Time complexity of Quick sort algorithm. Show all Steps.	[05]
Q - 2 (b)	State methods to solve Recurrence relation. Explain Time Complexity of Binary Search.	[05]

OR

Q - 2 (a)	Explain Compression techniques with suitable example.	[05]
Q - 2 (b)	Consider following Set of Items. Each item has some Profit and Weight. Fill the Knapsack with the Items such that Profit can be maximized. Knapsack Capacity is 7. Find the Total profit earned. Apply Dynamic Programming Technique. Show all possible steps.	[05]

Items	Item-1	Item-2	Item-3	Item-4
Weight	3	2	4	5
Profit	2	1	5	6

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Q - 3 (a)	Consider the following Directed weighted graph. Find shortest paths from one node to all other nodes in a graph. Consider Node -1 is Source. Solve with Dijkstra's Algorithm.	[05]
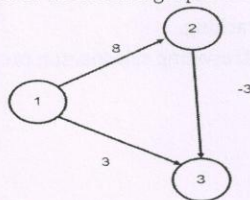
Q - 3 (b)	Explain Master's Theorem and its importance.	[05]

OR

Q - 3 (a)	Explain Prim's Algorithm with suitable example. State Time Complexity.	[05]
Q - 3 (b)	Explain Optimal Binary Search Tree with suitable example.	[05]
Q - 4	Consider the following Directed weighted graph. Find shortest path with minimum cost from Source node to destination. Node-1 is Source and Destination is 8. Apply Dynamic programming Technique. Show all Steps.	[05]
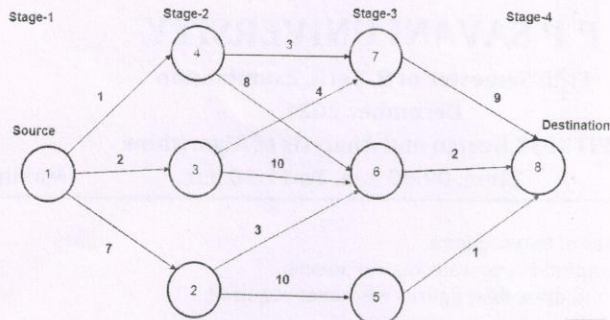
Q - 1   Answer the following: [05]
  (i)   Define - chromatic number of a graph
 (ii)   Define - answer states
(iii)   Define P-type problem.
 (iv)   State types of constraints used in backtracking.
  (v)   Define prefix function (π).

Q - 2 (a) What is N-queens Problem? Discuss 4 queens problem using backtracking method along   [05]
               with one solution.

Q - 2 (b) Discuss - 15-puzzle problem.   [05]

Q - 2 (a) Discuss graph coloring problem with the help of backtracking.   [05]
Q - 2 (b) Discuss least cost search in detail.   [05]
Q - 3 (a) Working modulo q=13, how many spurious hits and valid shifts does the Rabin-Karp   [05]
               matcher encounter in the text T=2359023141526739921 when looking for the pattern
               P=31451? Show all the calculation steps clearly.

Q - 3 (b) Discuss with examples - NP-complete and NP-Hard problems.   [05]

Q - 3 (a) Discuss the working of the naive string matching algorithm with the help of the pattern [05]
               P=0001 and the text T=000010001010001.

Q - 3 (b) What is finite automata? Explain use of finite automata for string matching with suitable [05]
               example.

Q - 4   Attempt any one.   [05]
  (i)   Discuss sum of subsets problem with the help of backtracking.
 (ii)   Explain use of branch and bound technique for solving travelling salesperson problem.

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