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Fourth Semester B.E. Degree Examination, June/July 2023
Design & Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the algorithm design and analysis process in detail. (10 Marks)
- b. Explain the asymptotic narrations with example. (10 Marks)

OR

- 2 a. Explain the general plan of mathematical analysis of recursive algorithm with example. (10 Marks)
- b. Design an algorithm to search an element in an array using sequential search. Discuss the Best-case, worst-case and average-case efficiency of this algorithm. (10 Marks)

Module-2

- 3 a. Explain the concept of Divide and Conquer. Write the recursive algorithm to perform Binary search on the list of elements. (10 Marks)
- b. Apply Quick sort algorithm to sort the list of characters: P, R, O, G, R, A, M, M, I, N, G. Draw the tree of recursive calls made while tracing. (10 Marks)

OR

- 4 a. Develop a recursive algorithm to find the minimum and maximum element from the list. Illustrate with an example. (10 Marks)
- b. Define Topological sorting. Illustrate the topological sorting for the following graph:

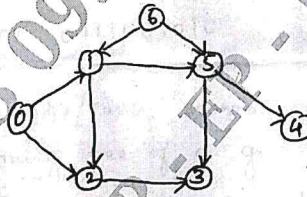


Fig. Q4 (b)

(10 Marks)

Module-3

- 5 a. Solve the following instance of greedy knapsack problem where $n = 4$, $m = 10$, $p = \{40, 42, 25, 12\}$ and $w = \{4, 7, 5, 3\}$. (10 Marks)
- b. Apply Dijkstra's algorithm to find single source shortest path for the given graph by considering 'S' as the source vertex. (10 Marks)

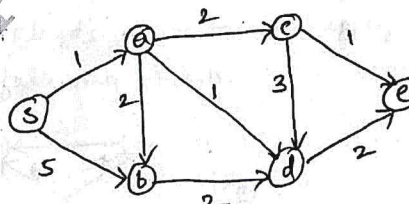


Fig. Q5 (b)

OR

- 6 a. Construct a Huffman Tree and resulting code word for the following :

| Character | A | B | C | D | - |
|-------------|-----|-----|-----|------|------|
| Probability | 0.4 | 0.1 | 0.2 | 0.15 | 0.15 |

Encode the text ABACABAD and Decode the text 100010111001010.

(10 Marks)

- b. Write a C++/Java program to find minimum cost spanning tree of a given connected graph using Kruskal's algorithm. Use Union-Find algorithm in your program. (10 Marks)

Module-4

- 7 a. Find a minimum-cost path from S to T in the given multistage graph.

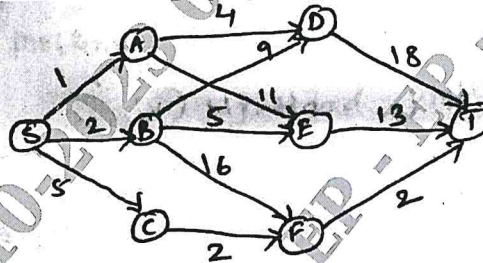


Fig. Q7 (a)

(10 Marks)

- b. Write Floyd's algorithm and apply the same to trace the following graph.

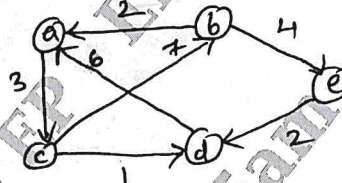


Fig. Q7 (b)

(10 Marks)

OR

- 8 a. Write Horspool's algorithm for string matching. Find the pattern BARBER. In the text : JIM SAW ME IN A BARBERSHOP. (10 Marks)
- b. Write a C++/Java program to solve 0/1 knapsack problem using Dynamic programming method. (10 Marks)

Module-5

- 9 a. Differentiate between Back tracking and Branch and Bound technique. Apply back tracking to solve the following instance of the subset-sum problem : $S = \{1, 2, 3, 6, 8\}$, $d = 9$. (10 Marks)
- b. Solve the following assignment problem using branch and bound method. (10 Marks)

| | Job 1 | Job 2 | Job 3 | Job 4 |
|----------|-------|-------|-------|-------|
| Person a | 9 | 2 | 7 | 8 |
| Person b | 6 | 4 | 3 | 7 |
| Person c | 5 | 8 | 1 | 8 |
| Person d | 7 | 6 | 9 | 4 |

OR

- 10 a. Explain the following with examples :
 (i) P problems (ii) NP problems
 (iii) NP-complete problems (iv) NP-Hard problems (10 Marks)
- b. Design and implement C++/Java program to find all Hamiltonian cycles in a connected undirected graph G of n vertices using back tracking principle. (10 Marks)
