

# CBCS SCHEME



17CS43

## Fourth Semester B.E. Degree Examination, Jan./Feb. 2023 Design and Analysis of Algorithms

Max. Marks: 100

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

### Module-1

- 1 a. Discuss the sequential search algorithm along with its best, average and worst case efficiency. (08 Marks)
- b. Write an algorithm to check whether all the elements in a given array are distinct. Discuss its worst case efficiency. (06 Marks)
- c. Discuss the following:
  - i) Connected graph and connected component. (06 Marks)
  - ii) Adjacency list and adjacency matrix representation of a graph. (06 Marks)

OR

- 2 a. Discuss any three types of Asymptotic notations with suitable example. (08 Marks)
- b. Give the algorithm to solve towers of Hanoi problem. Solve the recurrence relation to find the numbers of moves. (06 Marks)
- c. What is an Algorithm? What are the five criteria that all algorithms must satisfy? (06 Marks)

### Module-2

- 3 a. Give recursive algorithm for binary search. Discuss its complexity. (06 Marks)
- b. Write an algorithm to sort 'n' numbers using Quick sort. Discuss the best, average and worst case time complexity. (08 Marks)
- c. Discuss how to multiply two matrices using Strassen's matrix multiplication. How this algorithm is better than Brute force matrix multiplication? (06 Marks)

OR

- 4 a. Write recursive algorithm to find maximum and minimum element in an array. Discuss its complexity. (06 Marks)
- b. Write an algorithm to sort 'n' numbers using merge sort. Trace the algorithm for the input 15, 45, 30, 10, 20, 25, 18, 60. (08 Marks)
- c. Apply DFS based algorithm and source removal algorithm to solve the following topological sorting problem. (06 Marks)

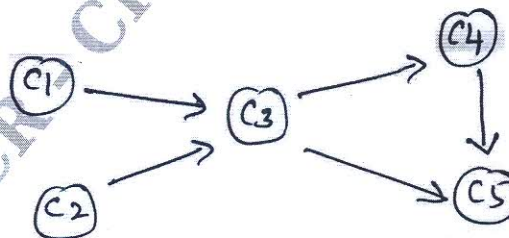


Fig.Q.4(c)

**Module-3**

- 5 a. Discuss the control abstraction for greedy method along with coin change problem as an example. (06 Marks)  
 b. Give the Dijkstra's algorithm. Apply the algorithm to find shortest path by considering 'a' as source vertex. (08 Marks)

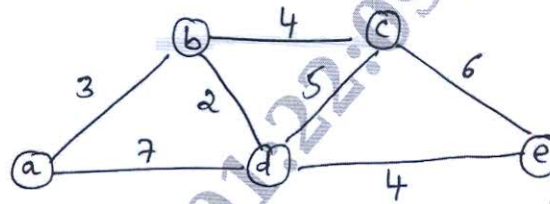


Fig.Q.5(b)

- c. Construct Huffman tree for the following data and obtain its Huffman code.

Characters	A	B	C	D	E
Probability	0.1	0.1	0.2	0.2	0.4

(06 Marks)

**OR**

- 6 a. Apply Prim's algorithm to find minimum cost spanning tree for the following graph. (06 Marks)

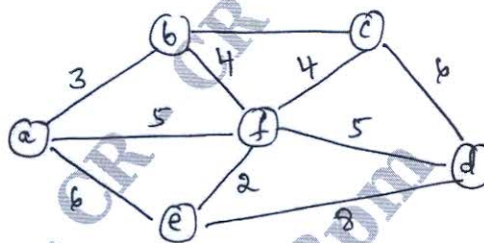


Fig.Q.6(a)

- b. Write an algorithm for Greedy Knapsack problem. Consider the following instances of the Knapsack problem.  
 $N = 3, m = 20, (P_1, P_2, P_3) = (25, 24, 15)$  and  $(W_1, W_2, W_3) = (18, 15, 10)$ . Apply greedy method to find optimal solution. (08 Marks)  
 c. Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive key insertions. (06 Marks)

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**Module-4**

- 7 a. What are multistage graphs? Write a pseudocode for forward approach corresponding to multistage graph. (06 Marks)  
 b. Write Bellman and Ford algorithm to compute shortest path. Apply the algorithm for the following graph.

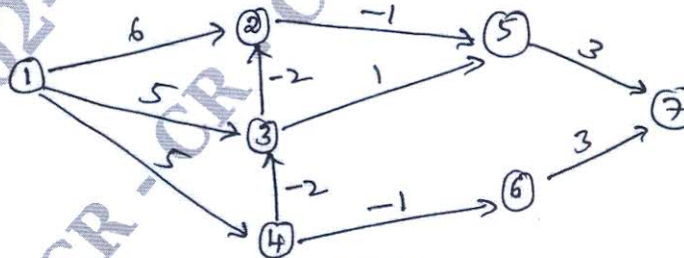


Fig.Q.7(b)

Consider ① as source vertex.

(08 Marks)

c. Consider the following graph and the matrix showing the edge length.

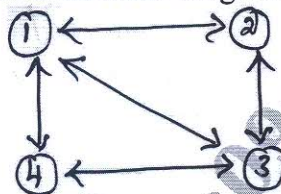


Fig.Q.7(e)

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

Find the optimal Tour for the salesperson.

(06 Marks)

OR

8 a. Solve the following Knapsack problem using memory function algorithm capacity  $W = 5$ .

Item	1	2	3	4
Weight	2	1	3	2
Value	12	10	20	15

(06 Marks)

b. Write the Floyd's algorithm. Apply the algorithm for the following graph and obtain the resultant matrix:

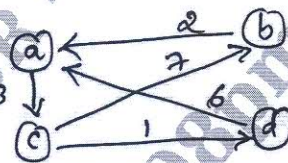


Fig.Q.8(b)

(08 Marks)

c. What is transitive closure? Give Warshall's algorithm and obtain the complexity.

(06 Marks)

**Module-5**

9 a. Discuss the backtracking technique along with N-Queens problem as an example. (06 Marks)  
 b. Solve the following assignment problem using branch and bound method.

$$C = \begin{bmatrix} \text{Job1} & \text{Job2} & \text{Job3} & \text{Job4} \\ 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \begin{matrix} \text{person a} \\ \text{person b} \\ \text{person c} \\ \text{person d} \end{matrix}$$

(08 Marks)

c. Write a note on non deterministic algorithm.

(06 Marks)

OR

10 a. Construct state space tree of the backtracking algorithm applied to the instance  $S = \{3, 5, 6, 7\}$  and  $d = 15$  of the subset sum problem. (06 Marks)  
 b. Define NP-complete problem. Discuss with an example. (08 Marks)  
 c. What is Hamiltonian cycle? How to find Hamiltonian cycle using Backtracking? Explain with an example. (06 Marks)

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