Assignment -3

Section - A

1. Advantages of Variable length coding over Fixed length coding?

ans Variable length coding (VLC) assigns shorter codes to frequent symbols and longer codes to infrequent ones, resulting in better compression and reduced average code length compared to fixed length coding.

2. Define knapsack Problem. How to Solve it?

ans. The knapsack problem involves selecting items with given weights and values to maximize value without exceeding a weight limit.

Solution: Use Dynamic Programming to build a table that tracks the maximum value achievable for subproblems.

3. What is Dynamic Programming?

ans Dynamic Programming is a method for solving complex problems by breaking them into overlapping subproblems and solving each only once, storing the results for future use.

4. What is Network flow Problem and what are its properties?

ans A Network flow problem involves determining the optimal way to route flow through a network from source to sink.

Properties: Capacity constraints, flow conservation and flow must not exceed edge capacities.

Sec-B

1. What is LCS Problem? Find LCS of <1,0,0,1,0,1,0,1> and <0,1,0,1,1,0,1,1,0>

ans

LCS (Longest Common Subsequence) is the longest sequence that appears in both sequence in the same order, but not necessarily contiguously.

To find it, we use Dynamic Programming to build a table comparing both sequences element by element.

Given sequences:

$X = \langle 1,0,0,1,0,1,0,1 \rangle$

$Y = \langle 0,1,0,1,1,0,1,0 \rangle$

One LCS is: $\langle 0,0,1,0,1,0 \rangle$

Length: 6

2. What is MST (minimum Spanning Tree)? Write Prim's algorithm to find MST of an undirected graph.

ans: A minimum Spanning Tree (MST) is a subset of edges that connects all vertices in a graph with the minimum total weight and no cycles.

Prim's Algorithm:

1. Start from any node.

2. Use a Priority queue to pick the minimum weight edge connecting a visited and unvisited node.

3. Add that edge and node to the MST.

4. Repeat until all nodes are included.

It ensures the growing tree remains connected and minimal at each step.

Time Complexity: O (E log V) using a min-heap.

Sec - C

1. matrix Chain multiplication Problem:

It's about finding the most efficient way to multiply a chain of matrices. The order of multiplication affects computation cost.

Given Dimensions: <10, 5, 4, 8, 6, 10, 8>

let matrices be A1 (10x5), A2(5x4), A3(4x8), A4 (8x6), A5 (6x10), A6 (10x8)

Use dynamic Programming to find the optimal Parenthesization with minimum scalar multiplications.

2. Floyd - Warshall Algorithm and Solve Given graph:

ans Floyd - Warshall finds shortest paths between all pairs of vertices in a weighted graph

steps: Initialize distance matrix with edge weights (use INF for no direct edge).

- Update distance using:
  dist[i][j] = min(dist[i][j],
  dist[i][k] + dist[k][j])
- Repeat for all intermediate nodes k.