**SVKM’s NMIMS**

**Mukesh Patel School of Technology Management & Engineering**

**Computer Engineering Department**

Program: B.Tech / MBA Tech Sem V

**Course: Design and Analysis of Algorithms**

w.e.f. 12th July 2021

**Faculty:** Radhika Chapaneri

LAB Manual

PART A

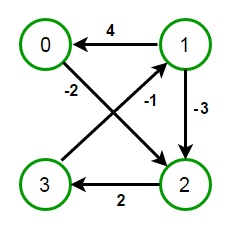
(PART A : TO BE REFFERED BY STUDENTS)

**Experiment No.08**

**A.1 Aim:**  **Implement Dynamic Approach Design paradigm.**

**Task 1:**

**Find all pair shortest path for the given graph**



**Task 2:**

**Mr. Abhishek works as a tourist guide. His current assignment is to take some tourists from one city to**

**another. For each pair of neighboring cities there is a bus service that runs only between those two cities**

**and uses the road that directly connects them. Mr. Abhishek has a map showing the cities and the roads**

**connecting them. He also has the information regarding each bus service. He understands that it may not**

**always be possible for him to take all the tourists to the destination city in a single trip.**

**The edges connecting the cities represent the roads and the number written on each edge indicates the**

**distance between cities. By using programming knowledge can you help Abhishek to find the shortest**

**distance between each pair of cities.**

**Task 3: Comment on the time complexity of the algorithm.**

**A.2 Prerequisite:**

1. Concepts of Dynamic Programming Technique of algorithm design.

2. Knowledge of Matrix Handling.

3. Knowledge of different operations performed on Graph data structure.

**A.3 Outcome:**

**After successful completion of this experiment students will be able to**

1. Implement Graph data structure to solve the given problem
2. Implement Floyd’s Warshall algorithm
3. Enlist the applications of finding all pair shortest path data structure.

**A.4 Theory:**

A graph is a pictorial representation of a set of objects where some pairs of objects are connected by links. The interconnected objects are represented by points termed as **vertices**, and the links that connect the vertices are called **edges**.

Formally, a graph is a pair of sets **(V, E)**, where **V** is the set of vertices and **E**is the set of edges, connecting the pairs of vertices. Take a look at the following graph −



In the above graph,

V = {a, b, c, d, e}

E = {ab, ac, bd, cd, de}

Floyd’s algorithm is applicable to both directed and undirected graphs provided that they do not contain a cycle. It is convenient to record the lengths of shortest path in an n- by- n matrix D called the distance matrix. The element dij in the ith row and jth column of matrix indicates the shortest path from the ith vertex to jth vertex (1<=i, j<=n). The element in the ith row and jth column of the current matrix D(k-1) is replaced by the sum of elements in the same row i and kth column and in the same column j and the kth column if and only if the latter sum is smaller than its current value.

**A.5 Procedure/Algorithm:**

Algorithm:- Algorithm Floyd(W[1..n,1..n])

//Implements Floyd’s algorithm for the all-pairs shortest paths problem

//Input: The weight matrix W of a graph

//Output: The distance matrix of shortest paths length

{ D ← W

for k←1 to n do

{ for i ← 1 to n do

{ for j ← 1 to n do

{ D[i,j] ← min (D[i, j], D[i, k]+D[k, j] ) } }

return D }

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PART B

(PART B : TO BE COMPLETED BY STUDENTS)

***(Students must submit the soft copy as per following segments within two hours of the practical.***

***The soft copy must be uploaded on the Portal.)***

|  |  |
| --- | --- |
| Program:Btech CS | Sem: V |
| Roll No.B032 | Name:Ayush mundra |
| Division:B | Batch :B1 |
| Date of Experiment: | Date of Submission: |
| Grade : |  |

**B.1 Software Code written by student:**

***(Paste your code completed during the 2 hours of practical in the lab here)***

***A screenshot of a computer

Description automatically generated***

***A piece of paper with writing on it

Description automatically generated with medium confidence***

***Task 3***

The Floyd-Warshall algorithm is a graph-analysis algorithm that calculates shortest paths between all pairs of nodes in a graph. It is a dynamic programming algorithm with **O(|V|3)** time complexity and O(|V|2) space complexity.

**B.2 Input and Output:**

***(Paste your commented program input and output in following format, If there is error then paste***

***the specific error in the output part. In case of error with due permission of the faculty extension***

***can be given to submit the error free code with output in due course of time.)***

**B.3 Observations and learning:**

***(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)***

**B.4 Conclusion:**

*(****Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)***

**B.5 Question of Curiosity**

***(To be answered by student based on the practical performed and learning/observations)***

Can you find one interview question based on dynamic programming and state your approach to solve it?

Coin change-making problem

The change-making problem addresses the question of finding the minimum number of coins (of certain denominations) that add up to a **given amount of money**.

Selecting the highest possible coin: The subproblem is about making the amount (Sum - the coin we added) with the same set of coins. Ignoring the highest possible coin: In this case, the subproblem is making the same sum with the original set of coins, minus the highest possible coin. Choosing the better option in this problem equates to choosing the smaller of the two options. If the highest coin does not exceed the required sum, then we take the minimum of the two. Otherwise, we choose the second option and ignore the highest coin. Since that coin cannot be used in our solution, we act as if it doesn’t exist.

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