TP Routing Algorithms

Report

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M1 IoT

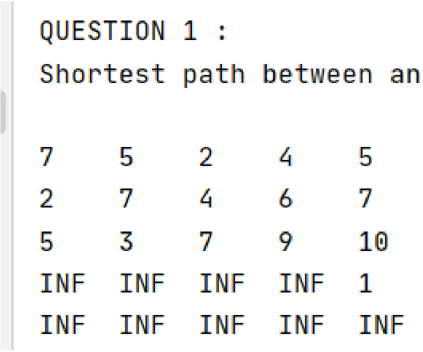
This project aims to model a computer network with a directed graph. The binary matrix shows weather or not there's at least a link between each data center.

Question 1:

In this question, we want to create a routing table for each data center. Its purpose is to determine which communication costs are the lowest to transmit data between two data centers. For the shortest path problem, we can either use Dijkstra or Floyd Warshall's algorithm. But in this case, we will use **Floyd-Warshall** because it finds the shortest path between all vertices as oppose to Dijkstra that only finds the shortest path between a single vertex and all other vertices.

Time Complexity: O(V^3)

Output:



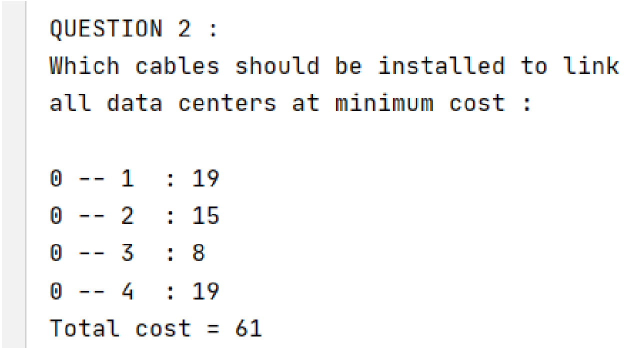
```
QUESTION 1 :
Shortest path between any pairs of vertices

7    5    2    4    5
2    7    4    6    7
5    3    7    9    10
INF  INF  INF  INF  1
INF  INF  INF  INF  INF
```

Question 2:

In this question, we consider the installation cost of cables between pairs of vertices. We want to apply an algorithm to find the best solution to connect all data centers with the minimum cost. Therefore, we will apply **Kruskal's** Minimum Spanning Tree to: sort all the edges in order of their weight and pick the smallest edge, check each time if it forms a cycle with the spanning tree formed. If not, include the edge.

Time Complexity: O (E log V)

Output:



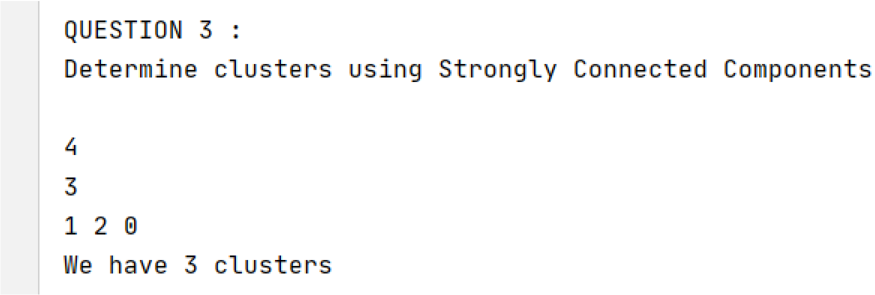
```
QUESTION 2 :
Which cables should be installed to link
all data centers at minimum cost :

0 -- 1  : 19
0 -- 2  : 15
0 -- 3  : 8
0 -- 4  : 19
Total cost = 61
```

Question 3:

In this question, we must identify clusters of data centers. In each cluster, any data providing by a data center is routed to another data center inside the same cluster. We will use **Tarjan's** algorithm to detect Strongly Connected Components for the directed graph.

Time Complexity: O(N+M)

Output:



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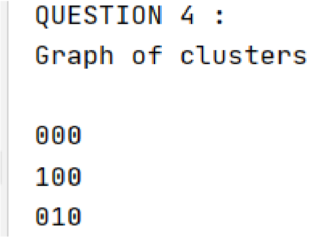
QUESTION 3 :
Determine clusters using Strongly Connected Components

4
3
1 2 0
We have 3 clusters
```

Question 4:

In this question, we want to obtain a weighted directed acyclic graph of clusters where the weight on each link represents the numbers of possible passageway between clusters. Therefore, we will go through every node in a cluster and see if there's links between other nodes in other clusters.

Output:



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QUESTION 4 :
Graph of clusters

000
100
010
```