BRAC University (Department of Computer Science and Engineering)

CSE 221 (Algorithms) for Fall 2024 Semester

Quiz 3

Set A

Student ID:

Section: **Full Marks: 20**

Name: **Duration: 30 minutes**

---

1. The cities in Italy are connected in such a way that their adjacency list representation looks as follows-

Rome: Milan, Venice, Florence
Milan: Rome, Florence, Bologna, Venice
Florence: Milan, Naples, Rome, Bologna, Venice
Venice: Rome, Milan, Florence
Naples: Florence, Bologna, Genoa
Turin: Genoa
Bologna: Naples, Genoa, Milan, Florence
Genoa: Turin, Bologna, Naples
Palermo:Catania, Syracuse
Catania: Palermo, Syracuse
Syracuse: Catania, Palermo

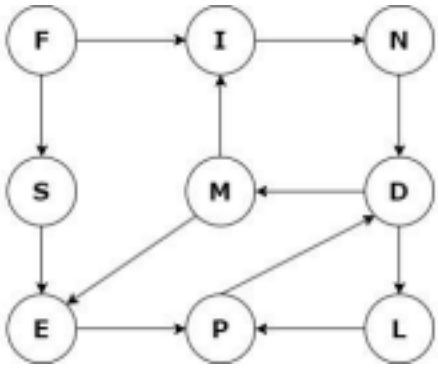
Suppose Rome suddenly gets affected with covid-19. The rest of the cities are non-affected. You are asked to find out the time steps the covid virus will take to affect all the non-affected cities if it takes one time step to travel from one city to another. So, one affected city will affect all of its neighbors in one time step.

a) Draw the graph and create the adjacency matrix for the graph. 4

b) Mention the name of the graph traversal algorithm you think is suitable for solving the problem. 1

c) Simulate the suitable algorithm to find the time steps needed for each non affected city to be affected. Choose the smallest (in alphabetical order) vertex when there is a choice. 5

2. Sherlock Holmes found himself in a dire situation where James Moriarty imprisoned his assistant Watson in a maze. The maze is made of 9 different rooms. Each room has a part of the key with an alphabet written on it. Moriarty tells Sherlock that only if he can attach all the key chain parts in exactly this order: **"F-I-N-D-M-E-P-L-S"**, then he can unlock the room with that key where Watson is kept. The map of the maze is given below:



a) Now you know something about a graph traversal algorithm that travels from the source to as far as possible along each branch. Simulate/Draw the traversal. **Keep in mind, wherever you have to choose between different neighbors to explore, follow the sequence that will make the key chain parts in the sequence that Sherlock needs.** 5

b) When Sherlock tries to save his friend, water suddenly fills the rooms. He needs to find a way to contain the water somehow so that the water doesn't overflow from one place to another. So, he created different isolated closed groups of rooms where he can travel anywhere in that particular group. A group can contain 1 to N number of rooms where N is the total number of vertices, and no two groups can share the same room.

i) **Mention** the name of a suitable algorithm for this task. 1

ii) **Show** simulation for the graph given above. 4

You can reuse your answer from question (a) to reduce work.