Homework 5

CS201: Data Structures and Algorithms, Fall 2021
Due: 17/1/2022, 11:59pm

Topic: Graph algorithms.

Problem 0:

Given an adjacency matrix A that represents a graph G. Implement the following:

1. Depth First Search

2. Breadth First Search

Problem 1:

Assume you have a maze that is represented by a 2D array `M` of $n \times n$ where

- `M[i][j] = 1` if you can **step** on location i, j

- `M[i][j] = 0` if you can **not step** on location i, j

- `M[0][0] = 1`

- `M[n-1][n-1] = 1`

Design an algorithm to find a path from `M[0][0]` to `M[n-1][n-1]` of length $2n + 3$ where $n \geq 5$. You algorithm shall print a path in the below format

```
(0,0) -> ....  -> (n-1, n-1)
```

if found otherwise print `NO SOLUTION`.

Problem 2:

Given an adjacency matrix `M` that represents a graph `G` with $n \leq 1$ nodes. Design an algorithm to check if G is a complete graph.

Problem 3:

Given an adjacency matrix `M` that represents a weighted graph `G` with $n \leq 1$ nodes. Design an algorithm to find and print a list of shortest paths from node i to all other nodes in G. You algorithm shall take `M` and starting node i as an input (if you are using C++ you add n to the input list.)

Problem 4:

Implement Prim's Minimum Spanning Tree algorithm where the input is an adjacency list `M` that represents a weighted graph G.

Deliverables:

- Add comments that explains your code. *If I can't understand ... I can't grade*

- Calculate **the time complexity** for each function in your files.

- Use only one programming Language. Either `C++,` `Java,` or `Python`

- **NOTE:** You might be selected to present your solution to the TA.

Hints and Advice:

- Start working on the homework ASAP.

- Ask questions if you feel you are lost.