Indian Institute of Technology Mandi
February-June 2017 Semester

CS202: Data Structure and Algorithms

Programming Assignment 7 Problem Statements

Last date of submission of code: 15th May, 2017

Implement one of the following problems using C++ programing language.
Note:

1. Implement **Prim's algorithm** to find minimum spanning tree (MST). Use Prims's algorithm as a member function in undirected and directed graphs (which you already written for assignment 7). Use adjacent list representation for implementing this algorithm for finding MST.
2. Kruskal's algorithm must be implemented using **minimum priority queue** data structure (MinPriorityQueue.hpp), implemented in Assignment 6**.**
3. Write a separate main programs to evaluate the functions (including Prim's algorithm for MST) in undirected and directed graphs represented using both the representations. DFS, BFS and MST using Kruskal's and Prim's algorithm should be there only when the representation is adjacency list.
4. Each main program can take the input either from keyboard or from a file. A sample file format for an input is given in the moodle. The graph data in the input file is in the form of an adjacency matrix. Your program must be general enough to take input from a file for any graph by providing the file-name along with its path.
5. These main programs must display the resulting graphs or subgraphs in an effective manner one edge at a time. (Use your programming skill for this. Also this display is not the part of any graph class).
6. Write a separate main programs to simulate the problem given below which is an application of MST.

Problem:

The solution to the problem given below is to construct the MST for each test case and check if the edge in the ***i***-th query is a part of MST or not.

Now that Bhallaladeva has been defeated, Katappa wants to retire. King Mahendra Baahubali has promised to give him a palace anywhere in the kingdom, provided he continues to mentor the Mahasena. Katappa can't refuse, but he also wants to live in peace, so he comes up with an idea.

The city guards are stationed at ***n*** strategic locations in the city. So, they can watch over the whole city just by moving between some of these stations - ***m***, to be precise. Also, if Katappa gives any guard a message, it will be carried to the Senapati who sits in these stations, different every day. Sensible as he is, Katappa asks Baahubali to deploy one extra guard on some of these ***m*** roads to carry his message, so that the security arrangement is not disturbed. But every extra guard will cost some gold coins to the mighty kingdom of Maahishmati, and Katappa wants to keep this cost as low as possible. So, he will ask for a palace on a street where he is assured to be able to transport the message without going anywhere.

Baahubali is going to ask Katappa if he wants to live in a particular street or not. Get a record of Katappa's answers and help Baahubali decide where to grant him a palace.

The input contains several test cases. Each case begins with two integers ***n*** and ***m***, the number of stations and the number of patrol-routes. Next, ***m*** lines contain three integers ***x***, ***y***, ***c*** - denoting the cost ***c*** of an extra guard on the patrol-route (***x***, ***y***). The next line contains a single integer ***q***, denoting the number of questions Baahubali will ask. Next ***q*** lines will contain two integers ***x***', ***y***', asking if Katappa wants a palace in the street (***x***',***y***').

Output a single line for each test case - the number of "yes" answers given by Katappa for that test-

case.