FIT2004: Lab questions for week 11

Objectives: This prac provides a platform for you to practise through implementation various graph algorithms introduced in weeks 9 & 10 lectures.

This prac is **NOT** assessed. Implement these questions using Python programming language.

1. Implement Dijkstra's algorithm to find the single-source shortest path in an undirected graph with non-negative weights. Your implementation should use a Priority Queue to maintain the set 'Remaining' as introduced in the lecture on this topic. Run your program on random graph instances with varying number of vertices and edges. Also, randomly assign non-negative weights to the edges in each of the randomly generated graph.

2. Prim's algorithm to solve the minimum spanning tree problem shares many similarities with Dijkstra's algorithm for finding shortest paths in an undirected weighted graph. Implement Prim's algorithm using a Priority Queue to maintain the cut/partition set $V - C$, as introduced in the lecture on this topic. Test your implementation on random graph instances. However, do NOT constraint the weights to be non-negative. Does Prim's algorithm works on undirected graphs containing negative weights? Justify your answer.

3. Implement the Union-Find data structure on disjoint sets introduced in lecture 10.2 as a building block for solving Kruskal's algorithm for Minimum Spanning Tree (MST) problem.

4. Solve the problem described at this link: http://projecteuler.net/problem=107.
[1]

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[1]For those unfamiliar with Project Euler, read this `http://en.wikipedia.org/wiki/Project_Euler`