1 Introduction and Objective

In this tutorial, we will continue our discussion on Graph problems, specifically the Minimum Spanning Tree (MST) problem.

We will heavily use http://visualgo.net/mst.html during our discussion.

Get ready to be transformed by the discussions in this tut06, especially on Question 2-3-4 :). We recommend that you read the questions and think for a while first before attending this tutorial as such questions will be the one that will appear in Written Quiz 2 and Final Exam. You need to be able to grasp the thinking process, not just to record down the solutions form your tutor...
2 Tutorial 06 Questions

Basic Stuffs about MST Algorithms

Q1. In Lecture 07, you are presented with two MST algorithms: Prim’s and Kruskal’s. First, the tutor will (re-)demonstrate the executions of Prim’s and Kruskal’s on a small connected weighted undirected graph using [http://visualgo.net/mst.html](http://visualgo.net/mst.html). The tutor may invite some students to do this live demonstration together. Then, the tutor will ask you to list down as many similarities and as many differences that you can find out of these two MST algorithms!

Not-So-Standard MST Question

Q2. Given a graph \( G \) with \( V \) vertices and \( E \) edges and the MST of \( G \), produce the best algorithm to update the MST if a new edge \((A, B)\) is to be inserted into \( G \).

MST Application 1: Clearly Has MST Flavor

Q3. An ambitious cable company has obtained a contract to wire up the government offices in the city with high speed fiber optics to create a high speed intra-net linking up all the different governmental departments. In the beginning they were confident that the minimum cost of connecting all the offices will be within budget. However, they later found they made a miscalculation, and the minimum cost is in fact too costly. In desperation, they decided to group the government offices into \( K \) groups and link up the offices in each group, but not offices between groups to save on the cost. This effectively creates \( K \) intra-nets instead of one big intra-net.

Given \( V \) government offices, the cost of linking \( E \) pairs of government offices, and a budget \( B \), help the company design a program which will tell them what is the smallest value of \( K \) (so as to minimize the number of intra-nets). The program also needs to output the government offices in each of the \( K \) groups and how they should be linked such that the total cost of all selected links is within budget \( B \).

The program should model the problem as a graph. It should also run in \( O(E \log V) \) time. Where \( E \) and \( V \) are the number of vertices (government offices) and edges (possible links between those government offices), respectively.

MST Application 2: The MST Problem is Not Obvious


Problem Set 4

Q5. Finally, the tutor will quickly discuss another trivial idea for PS4 Subtask A.