CSE548/AMS542 Fall 2007 Analysis of Algorithms

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Due in class on Wednesday, Oct. 10th. Each problem (including the extra credit problem) has a maximum of 10 points. (i) You write down the solution clearly. If we can not recognize your writing then you may lose points. (ii) Avoid too many details. A succinct and clean proof is the best. You may use the algorithms we covered in class without referring to the details. (iii) If you discuss some of the problems with other fellow students (at most 3 students per group), write down their names and the problems. If you consult any books/webpages, cite them.

Homework 3

1. Textbook (Kleinberg & Tardos), page 189, problem 2, 9, 10, 21, 26, 27.

   Hint to problem 26: First prove that if the ordering of the edges in terms of their lengthes is the same, then the minimum spanning tree has the same combinatorial topology (i.e., chooses to use the same set of edges). Then think about how many different topologies can the MST ever have when x ranges from $-\infty$ to ∞.

2. Let $G = (V, E)$ be a graph with nonnegative edge costs, S, the *senders* and R, the *receivers*, are disjoint subsets of V. The problem is to find a minimum cost subgraph of G that has a path connecting each receiver to a sender (any sender suffices). Partition the instances into two cases, $S \cup R = V$ and $S \cup R \neq V$. Show that these two cases are in P and NP-hard, respectively. For the second case, give a factor 2 approximation algorithm.

3. (Extra credit) Textbook (Kleinberg & Tardos), page 189, problem 29.

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