CSE 6331 – Algorithms – Spring, 2015 – Prof. Supowit

Homework 9 – Due: Friday, April 10

1. In lecture we discussed the following version of the LP problem:

Problem *A*: Given a matrix $A \in \Re^{m \times n}$ and vectors $\mathbf{b} \in \Re^m$ and $\mathbf{c} \in \Re^n$, find a vector $\mathbf{x} \in \Re^n$ that maximizes $\mathbf{c}^T\mathbf{x}$ subject to $A\mathbf{x} \geq \mathbf{b}$.

Now consider

Problem *B*: Given a matrix $A \in \Re^{m \times n}$ and a vector $\mathbf{b} \in \Re^m$, find a vector $\mathbf{x} \in \Re^n$ such that $A\mathbf{x} \geq \mathbf{b}$.

Assuming that you have a subroutine that efficiently solves problem *B*, how could you efficiently solve problem *A*?

2. Describe a way to solve the following problem using linear programming:

Input: a weighted digraph $G = (V, E, dist)$, where $dist : E \rightarrow \Re^+$ and some $s \in V$.

Output: for each $v \in V$, the number

d_v = the length of a shortest path from *s* to *v*.

Your LP should have $O(|E|)$ constraints.