College of Computer & Information Science
Northeastern University
CS7800: Advanced Algorithms

Fall 2014
Handout 15
3 November 2014

Problem of the Week – 11

Feasibility and optimality

Suppose you are given a *black box* algorithm that takes as input integers n, m, $m \times n$ matrix A with integer entries, and $m \times 1$ vector b with integer entries, and returns whether there exists a real $n \times 1$ vector x such that $Ax \geq b$ (i.e, the black box returns a yes or no answer).

You are faced with the following problem.

$$\text{Find } x \text{ that minimizes } c^T x \text{ subject to the constraint } A'x \geq b',$$

where c, A', and b' are $n' \times 1$ vector, $m' \times n'$ matrix, and $m' \times 1$ vector, all with integer entries, respectively. Show how to solve this problem by using the black box algorithm, where the number of calls you make is at most polynomial in n', m', and the sizes of A', b', and c.