Optimization
Summer 2010

Homework 5

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Unlike previous and future assignments, this homework will consists of a small implementation project. For this project, you are welcome to work in small groups (no more than 3 students per group). You should email your solutions to your tutor by **May 21**.

Problem 1: Program a basic version of the simplex algorithm using Bland's rule for choosing a pivot. You are allowed to use any programming language you feel comfortable with, but we recommend that you use Matlab or Python+numpy. The input and output of your program is as follows:

1. Input (sample): Each instances consists of a matrix $\mathbf{A} \in \mathcal{R}^{m \times n}$, vectors $\mathbf{c} \in \mathcal{R}^n$ and $\mathbf{b} \in \mathcal{R}^m$, and an initial basis $B \subseteq [1, n]$. The objectives is to solve

$$\min \mathbf{c} \cdot \mathbf{x} : \mathbf{A}\mathbf{x} = \mathbf{b}, \mathbf{x} \geq \mathbf{0}.$$

   You can assume that the rows of $\mathbf{A}$ are LI and that B is a feasible basis.

2. Output (sample): On each instance, your program should output for each iteration of the simplex algorithm, the current basis B and basic feasible solution $\mathbf{x}$, the vector of reduced costs, and the value of the current solution $\mathbf{c} \cdot \mathbf{x}$.

A tar file with the instances is available from the class website [link]. Run your program on every instance and save the output on a separate file. Please include your code as well.

Problem 2: After finishing the implementation, what are your thoughts regarding the simplex algorithm? What was easier than you expected? What was more difficult? Write a short report (no more than half a page).