Assignment #6

Due Friday, 19 October 2018, at the start of class

Please read sections 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2 of the textbook.

Please regard the Simplex Method as defined by the formulas at the bottom of page 131. You do *not* need to know how to use the "tableau" described in subsection 5.2.3 and 5.2.4. I have posted online a "template" for the Simplex Method:

bueler.github.io/M661F18/simplextemplate.pdf

DO THE FOLLOWING §4.2 EXERCISES from pages 105–106:

- Exercise 2.1
- Exercise 2.2
- Exercise 2.4

DO THE FOLLOWING §4.3 EXERCISES from pages 114–117:

- Exercise 3.1
- Exercise 3.7
- Exercise 3.12

DO THE FOLLOWING §5.2 EXERCISES from pages 141–142; for *each* of these problems print out a template and fill it in by hand:

- Exercise 2.2 (i)
- Exercise 2.2 (iii)
- Exercise 2.2 (vi)

Do *either* **P11** or **P12** below.

Problem P11. *This problem is worth 10 points. The nice thing about a pseudocode is that it does not have to run.*

Write a pseudocode for the Simplex Method. That is, take the description at the bottom of page 131 and flesh it out into an organized pseudocode. You will need to clarify/add:

- what are the inputs and outputs?
- add `for` or `while` loops to indicate the loops
- add `if` condition statements for the optimality test and other parts

Specifically, create pseudocode for the parts "Otherwise, select a variable x_t that satisfies $\hat{c}_t < 0$ as the entering variable" and "Find an index s that satisfies ..." Your answer should fit on one page.

Problem P12. *This problem is worth 12 points, i.e. 10 points plus 2 extra credit. But the code must be correct! You* must *successfully and demonstrably reproduce your results from §5.2 #2.2 (i), (iii), (iv) to get* any *credit.*

Consider problems of the form

$$\begin{aligned} \text{minimize} \quad & z = c^\top x \\ \text{subject to} \quad & Ax \leq b \\ & x \geq 0 \end{aligned}$$

where $x, c \in \mathbb{R}^n$, $A \in \mathbb{R}^{m \times n}$, and $b \in \mathbb{R}^m$ with $b \geq 0$. In this form we can add m slack variables to put the problem in standard form, and then create an initial basic feasible solution by choosing the slack variables as the basis.

(a) Write a code which implements the Simplex Method on the above problems:

```
function [x,z] = mysimplex(c,A,b)
```

For readability (and grade-ability) you should make a reasonable effort to use the same variable names as used in section 5.2 and on the template. Add a few comments at key places.

(b) The three assigned problems from §5.2, namely #2.2 (i), (iii), (iv), are in this form. Use your code to confirm the results you computed by hand.

Again, the code must be debugged and run correctly to get any credit. Please show the code and *show enough for me to understand your confirmation in part* (b).