Due: Friday, March 15th (in class)

The final exam will be on Monday, April 22nd at noon in SRYC 2750.

1. Problem 4-1 from the AMPL book.

2. Problem 4-3 from the AMPL book. Please group all the submission files for this assignment into a single e-mail.

3. Is the dual of the auxiliary primal problem considered in Phase 1 of the simplex method always feasible?

4. Consider a linear program in standard equality form which is infeasible, but which has an optimal solution upon the removal of a single constraint. Show that the dual of the original (infeasible) problem is feasible, and that the optimal cost is infinite.

5. Let P and Q be two polyhedra in $\mathbb{R}^d$ given in terms of their linear inequality constraints. Devise an algorithm that decides whether P is a subset of Q.

6. Repeat question 5 with P and Q are given in terms of their extreme points.

7. For this question, we'll return to your personal linear program (from Problem 3) of the previous coefficient.

a. For what range of values of the objective co-efficient of x_1 (here $c_1 = 1$) does your optimal solution remain optimal?

b. For what range of the right hand side of the first equation does your optimal solution remain optimal?

c. What is the shadow price of the right hand side of the first equation?

Note that you can check these calculations using Excel or other software, but the objective is to walk through the calculations by hand.

8. & 9. Questions 4.16 and 4.17 in the attached Supplemental Exercises (from K.R. Baker, *Optimization Modeling with Spreadsheets*, 3rd ed.). The "qualitative patterns" mentioned are business terminology for identifying basic and non-basic variables, and which equations are slack and tight. Give a clear mathematical formulation of the problem (typeset or handwritten), but use software to extract the solutions.

10. Show that for the pattern-based formulation of the cutting stock problem (discussed in class), that given an optimal solution to the linear program (i.e. ignoring integrality constraints), we can construct an integer feasible solution whose cost differs from the optimal cost by no more than m.

The research paper presentations will take on April 5th, 10th and 12th, with two presentations per class on the latter two dates. Please sign up for a presentation slot (first come, first served).