Mathematics 235
Robert Gross
Homework 2
Due February 4 2011

Note: For this week's assignment, you will need to solve linear programming problems using *Excel*. Please put all of your solutions on separate sheets on one file, which you should name `HW2.xls`. Please put your name in cell `A1` of each sheet, and in cell `A2` please put the words "MT235: Homework 2" and the problem number. *If you do not follow these instructions, you will have points deducted.*

You should e-mail, as an attachment, the single *Excel* file containing all of the spreadsheet solutions to `gross@bc.edu` by 2 PM on Friday, February 4. You should bring to class and submit printed versions of each spreadsheet, stapled together. You should print two versions of your solution to each problem. **Both should be formatted so that grid lines and row and column labels print.** One version should print the numerical contents of the cells. The other version should print the formulas that are in each cell.

In addition, you must write by hand the solution to the problem in words, *e.g.*, "Buy 12 regular gloves and 13 catcher's mitts."

1. Consider the following linear programming problem:
   Maximize $2x + 3y$ subject to:

$$\begin{aligned} x &\leq 15 \\ 2x + 5y &\leq 50 \\ x + y &\leq 15 \\ 3x + y &\leq 35 \\ x, y &\geq 0 \end{aligned}$$

   (a) Using *Excel* and Solver, find the optimal solution and the value of the objective function for that optimal solution.
   (b) Determine the amount of slack or surplus for each constraint. Write out this part of the solution in sentences.

2. Consider the following linear programming problem:
   Minimize $4x + 5y$ subject to:

$$\begin{aligned} 2x + 3y &\geq 30 \\ x + 5y &\geq 20 \\ 2x - y &\geq 0 \\ x, y &\geq 0 \end{aligned}$$

   (a) Using *Excel* and Solver, find the optimal solution and the value of the objective function for that optimal solution.
   (b) Determine the amount of slack or surplus for each constraint. Write out this part of the solution in sentences.

3. **Ralph** loves steak and potatoes so much that he has decided to consume only those two foods for the rest of his life. (Ralph is a stubborn teen-ager.) He is aware that this is not the healthiest possible choice of diet, so he wants to satisfy least some key nutritional requirements. He has obtained this nutrition and cost information:

Grams of Ingredient per Serving			
Ingredient	**Steak**	**Potatoes**	**Daily Requirement (grams)**
Carbohydrate	5	15	≥ 50
Protein	20	5	≥ 40
Fat	15	2	≤ 60
Cost per serving	\$4	\$2	

Ralph wishes to find the number of servings of each food (possibly fractional) to satisfy these three dietary requirements at minimal cost.

(a) Formulate a mathematical model for this problem.
(b) Find the optimal solution using *Excel* and Solver. How many servings of steak and how many servings of potatoes should Ralph eat each day?

4. **Peabody Manufacturing** has 2 production lines to make tents. Production line A has a capacity of 25 tents/hour, and production line B has a capacity of 40 tents/hour. Production line A uses 40 yards of cotton/hour and production line B uses 50 yards of cotton/hour. Each tent can be sold for \$18. Production line A is available for no more than 15 hours and production line B is available for at most 10 hours; moreover, each production line must be used for a minimum of 5 hours. There are 1000 yards of cotton available for use, at a cost of \$6/yard. In addition to the cost of the cotton, the cost of operating production line A is \$50/hour, and the cost of operating production line B is \$75/hour.

(a) Formulate a mathematical model that maximizes *profit*, meaning revenue minus all costs.
(b) Find the optimal solution using *Excel* and *Solver*. Be sure to write your solution in full sentences.