Mathematics 235
Robert Gross
Homework 5
Due March 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 `HW5.xls`. Please put your name in cell `A1` of each sheet, and in cell `A2` please put the words "MT235: Homework 5" 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, March 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."

Fractional answers are permissible in all of these problems.

1. **Bronco Lawn Mowers** manufactures a gasoline and an electric model. Demand for April, May, and June, along with maximum production for each month, are:

	Demand			Capacity		
	April	May	June	April	May	June
Gasoline	680	720	900	800	800	800
Electric	500	600	700	650	650	650

All demand must be met. The monthly cost of storing a mower in inventory is \$15. Changing total production from month to month costs \$20 for each additional mower manufactured, and \$10 for each unit decrease. The production levels in March are 600 gasoline mowers and 700 electric mowers. No mowers are currently in inventory, and none need to be in inventory at the end of June.

(*a*) Formulate a linear program to help Bronco minimize the costs detailed above. You may assume that all other costs are fixed.

(*b*) Use *Excel* and *Solver* to find the optimal solution. Be sure to state your solution in full sentences, including the minimum cost.

2. **Luigi's Soups** comes in three varieties: tomato, minestrone, and chicken. Each soup needs to be cooked, cooled, and canned, according to the following table:

	Tomato	Minestrone	Chicken	Minutes available
Cooking	12	14	18	2500
Cooling	4	3	4	2000
Canning	2	1	1	1200

The profits on a can of each soup are \$0.80, \$0.74, and \$0.31, respectively.

(*a*) Formulate a linear program to help Luigi maximize his profit.

(*b*) Use *Excel* and *Solver* to find the optimal solution. Be sure to state your solution in full sentences, including the minimum cost.

(*c*) The optimal solution does not call for manufacturing all three types of soup. Use the sensitivity report to decide at what price(s) it might be worthwhile producing the soup(s) that are not part of the optimal solution.

Luigi notices that he has time available in one or more departments, and negotiates with his workers. For an additional fee of \$3/hr, he can transfer time from any department to any department.

(*d*) Add decision variables as needed and alter the objective function as needed to formulate a new linear program for the modified problem.

(*e*) Use *Excel* and *Solver* to find the optimal solution. Be sure to state your solution in full sentences, including the minimum cost.

3. **Omaha Coffee** blends four types of beans to make two different house blends. The four types are light-roasted arabica, dark-roasted arabica, light-roasted robusta, and dark-roasted robusta, and the two different house blends are Mellow-Glow and Espresso. Mellow-Glow can be no more than 50% dark roast, and no more than 20% robusta. Espresso must be at least 80% dark roast, and no more than 30% robusta. The costs and maximum availability of each of the 4 types of beans are

	Cost/lb	Pounds available
Light-roast arabica	\$1.10	2300
Dark-roast arabica	\$1.30	2500
Light-roast robusta	\$0.82	4400
Dark-roast robusta	\$0.88	2300

A pound of Mellow-Glow sells for \$12, and a pound of Espresso sells for \$14.

(*a*) Formulate a linear program to help Omaha Coffee maximize profit.

(*b*) Use *Excel* and *Solver* to find the optimal solution. Be sure to state your solution in full sentences, including the minimum cost.

(*c*) Suppose that an additional 100lb of light-roast arabica were available at a cost of \$5/lb. Is this a wise purchase?

(*d*) Omaha is contemplating adding a new blend, to consist of equal parts of light-roast and dark-roast arabica. The anticipated sales price of the new blend is \$15/lb. Using only the sensitivity report, can you determine if this product should be considered further?