Operations Research

Homework 10

Due in class Wednesday, November 30, 2016

1. *(From HL, Exercise 13.3-5.)* Consider the following problem, which is called a linear fractional programming problem:

$$\text{Maximize } f(\mathbf{x}) = \frac{10\,x_1 + 20\,x_2 + 10}{3\,x_1 + 4\,x_2 + 20} \tag{1}$$

subject to

$$x_1 + 3\,x_2 \leq 50\,, \tag{2}$$
$$3\,x_1 + 2\,x_2 \leq 80\,, \tag{3}$$
$$x_1, x_2 \geq 0\,. \tag{4}$$

   - Transform this problem into an equivalent linear programming problem.
   - Solve the linear programming problem using Pyomo.
   - Solve the original nonlinear programming problem using Pyomo. Verify that the two solutions coincide.

   Please submit printouts of your Ipython notebooks for (b) and (c).

2. *(Variation of Homework 9, Problem 2.)* The B. J. Jensen Company specializes in the production of power saws and power drills for home use.

   B. J. Jensen, Jr., the current president of the company, is overseeing the production plans being made for the month of January. He has managed to negotiate volume discounts with one of his suppliers resulting in increased profits if more than 2 000 units of any one of his products are produced. He has obtained the following data.

	Maximum Monthly Production		**Profit per Unit Produced**	
	Regular Supply	**Discounted Supply**	**Regular Supply**	**Discounted Sup**
Power saws	2 000	1 000	\$150	\$180
Power drills	2 000	3 000	\$100	\$110

Two other factors will limit the production levels that can be achieved. One is that the company's vendor for power supply units will only be able to provide 7 000 of these units for January. Each power saw and each power drill requires one of these units. Second, the vendor who supplies a key part for the gear assemblies will only be able to provide 10 000 for January. Each power saw requires two of these parts and each power drill requires one.

Mr. Jensen now wants to determine how many power saws and how many power drills to produce in January to maximize the company's total profit.

Modify your Pyomo code from Homework 9 and solve this problem.

Hint: Note that the payoff function is now convex rather than concave. This means that you need introduce an additional binary decision variable (in Pyomo: `within=Boolean`) which tracks whether the discount threshold has been reached.