Operations Research

Homework 10

Due in class Friday, April 29, 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

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

- 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. *(From HL, Exercise 15.8-5.)* The B. J. Jensen Company specializes in the production of power saws and power drills for home use. Sales are relatively stable throughout the year except for a jump upward during the Christmas season. Since the production work requires considerable work and experience, the company maintains a stable employment level and then uses overtime to increase production in November. The workers also welcome this opportunity to earn extra money for the holidays.

B. J. Jensen, Jr., the current president of the company, is overseeing the production plans being made for the upcoming November. He has obtained the following data.

	Maximum Monthly Production		Profit per Unit Produced	
	Regular Time	Overtime	Regular Time	Overtime
Power saws	3 000	2 000	$150	$50
Power drills	5 000	3 000	$100	$75

The values for maximum monthly production assume adequate supplies of materials from the company's vendors.

However, Mr. Jensen now has learned that, in addition to the limited number of labor hours available, two other factors will limit the production levels that can be achieved this November. One is that the company's vendor for power supply units will only be able to provide 10 000 of these units for November (2 000 more than his usual monthly shipment). 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 15 000 for November (4 000 more than for other months). 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 November to maximize the company's total profit.

Set up a model and solve the model using Pyomo, e.g. by formulating it as a separable programming problem and using a linear solver.