Homework 1: Linear programs

Due date: 11:00pm on Friday February 2, 2017
See the course website for instructions and submission details.

1. Warm-up. Model the following problem in JuMP.

$$\begin{aligned} \underset{x_1,x_2,x_3}{\text{maximize}} \quad & 5x_1 - x_2 + 11x_3 \\ \text{subject to:} \quad & 2x_1 \geq x_2 + x_3 \\ & 0 \leq x_j \leq 3, \ j \in \{1,2,3\} \end{aligned}$$

Solve this problem using `Clp`, `ECOS`, and `SCS` solvers. Compare the answers found by each solver: which solver is more accurate? which is fastest (use the `@time` macro)? can you speculate as to why? Be sure to include your code in your solution.

2. Crop planning. Farmer Jane owns 45 acres of land. She is going to plant each with wheat or corn. Each acre planted with wheat yields $200 profit; each with corn yields $300 profit. The labor and fertilizer used for each acre are given in the table below. One hundred workers and 120 tons of fertilizer are available.

	Wheat	Corn
Labor	3 workers	2 workers
Fertilizer	2 tons	4 tons

a) How should Jane plant her crops to maximize profit? Model and solve this problem using JuMP. Include your code in your solution.

b) Code the same model once again, but this time separating the parameters from the solution as we did in class. Confirm that you obtain the same solution.

c) Solve the problem graphically by plotting the feasible set and contour lines for the objective function. Confirm that you obtain the same solution as in the previous parts.