

Math 521, HW b  
 9/19/2016, due 9/26/2016

1.

## Post Office Problem

Union rules state that each full-time employee must work 5 consecutive days and then receive 2 days off.

### Variation 2: Maximizing Weekends!

- Post office has 25 full-time employees. Cannot hire or fire.
- Formulate an LP to schedule employees to maximize the number of weekend days off
- (Assume solution will be integral)

Day	Number of full-time employees required
1=Monday	17
2=Tuesday	13
3=Wednesday	15
4=Thursday	19
5=Friday	14
6=Saturday	16
7=Sunday	11

## 2. ~~4~~ Making paper

A paper production company uses a combination of different kinds of raw wood fibers to produce paper. Each type of wood fiber has a purity rating, and are available in different amounts and at different costs:

Wood Fiber	Purity	Quantity available (kg)	Cost \$/kg
residue	40	6000	0.05
recycled fiber	80	4000	0.40
round wood	100	1000	0.60

By using different combinations of the three raw materials, the company is able to make three types of paper, where the grade of paper is the weighted average of the purities of the wood fibers that it is composed of. The papers are sold at the following prices:

Paper	Minimum Paper Grade	Selling price \$/kg
Premium photo	90	1.00
Photocopy	70	0.50
Wrapping	45	0.25

1. Define the sets, parameters, and variables relevant to the problem.
2. Formulate a generalized *linear programming* model to find the production plan that maximizes the company's profit. Your formulation should be correct for any possible input values for the parameters and not just the ones given. You may wish to write a few sentences to explain parts of your model that aren't straightforward.

3. Solve the following LPs using the simplex method.  
Also, sketch the feasible region and draw the path of feasible solutions.

a. Maximize  $Z = x_1 + 2x_2$

Subject to 
$$\begin{cases} 3x_1 + x_2 \leq 24 \\ x_1 + x_2 \leq 14 \\ x_i \geq 0 \end{cases}$$

b. Maximize  $Z = 4x_1 + 2x_2$

Subject to 
$$\begin{cases} x_1 - x_2 \leq 1 \\ -x_1 + x_2 \leq 3 \\ x_1 + x_2 \leq 5 \\ x_i \geq 0 \end{cases}$$