



LINEAR PROGRAMMING

Lab 1: the Post Office

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Csci 628

Anke van Zuylen

In this lab, you will help the post office's human resources manager to determine an optimal hiring plan. You will set up and solve linear programs for four different scenarios.

Base scenario

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

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

Formulate an IP to minimize the number of fulltime employees who must be hired, implement the IP in AMPL, and solve it to find the optimal solution.

Some pointers:

- The right decision variables are key for this problem. They should allow you to figure out who is working on a given day, and how many people have their day off..
- Start by completely writing out all constraints of your LP on paper (writing out your summations). We'll discuss some AMPL syntax that will allow you to then program it more concisely in AMPL.

Variation 1: Forced overtime

- Post office can force employees to work a 6th day each week at a higher pay rate.
- The pay is \$100 for a regular day, \$130 for the overtime day.
- Adapt your IP so that it minimizes cost of meeting weekly labor requirements.

Variation 2: Maximizing weekends

- Post office has 25 fulltime employees.
- Cannot hire or fire.
- Adapt your (original) IP to schedule employees in order to maximize the number of weekend days off received by the employees.

Variation 3: Part-time employees

- Now allowed to hire parttime employees
- Full-time: 8 hours a day, 5 consecutive days (2 days off). Cost \$15/hour.
- Part-time: 4 hours a day, 5 consecutive days (2 days off). Cost \$10/hour.
- Part-time limited by union to 25% of weekly labor (in terms of working hours).
- Adapt your (original) IP to minimize the post offices weekly labor costs.

Day	Number of full-time employees required
1=Monday	$8 \cdot 17 = 136$ hrs
2=Tuesday	$8 \cdot 13 = 104$ hrs
3=Wednesday	$8 \cdot 15 = 120$ hrs
4=Thursday	$8 \cdot 19 = 152$ hrs
5=Friday	$8 \cdot 14 = 112$ hrs
6=Saturday	$8 \cdot 16 = 128$ hrs
7=Sunday	$8 \cdot 11 = 88$ hrs