ENGRI 1101	Engineering Applications of OR	Fall 2020	Prelab 8

LP Formulations

Name: _____

Objectives:

- Practice in formulating linear programming problems
- Introduce the idea of linear relaxation
- Demonstrate the relationship between an integer program and its linear relaxation

Brief description: In this lab we will see an example of modeling a problem as a Linear Program (LP), coding and solving it with ortools in a jupyter notebook, and start considering the question of what can be done when the desired output of a mathematical model should be integer.
Pre-lab exercise Consider the following problem: (adapted from Hillier & Lieberman) A new company is being set up to take telephone orders. The phone lines are staffed around the clock. People are hired to work in 8-hour shifts, starting at 6AM, 8AM, 12PM, 4PM, or 10PM. From survey data, the management has concluded that there are minimum staffing requirements at certain times of the day, as given in the table below.

Time period	Minimum Staff Size
6AM-8AM	48
8AM-10AM	79
10AM-Noon	65
Noon-2PM	87
2PM-4PM	64
4PM-6PM	87
6PM-8PM	64
8PM-10PM	73
10PM-Midnight	82
Midnight-6AM	43

A person is paid differently, depending on their assigned shift, where the daily salary is \$170, \$160, \$175, \$180, \$195, for the five shifts, respectively. The management would like to decide the number of people to be hired for each shift so as to minimize the total salary costs.

1. What do you think the decision variables should be?
2. How could you write the constraint that there are at least 79 people on staff from 8AM-10AM? Hint: which workers will be on staff then?
3. Your objective function is to minimize the cost incurred. How can you express this in terms of your decision variables?