GT Introduction to Analytics Modeling - Week 7 HW

As directed in the assignment, we'll use the Pulp library to create a linear program to optimize the diet. We'll also use other data manipulation libraries to help load the spreadsheet and prepare the data. Note that some manual manipulation of the spreadsheet was performed outside of this notebook. For example, a numeric column was created for serving size.

We'll first load the libraries we'll be using.

In [2]:
```python
import pulp as pp
import pandas as pd
```

We'll use pandas to load our spreadsheet. Note that I manually saved it as a CSV file.

In [4]:
```python
data = pd.read_csv("diet.csv")
data.head()
```

Out[4]:

	Foods	Price Per Serving	Serving Size	Service Size 2	Calories	Cholesterol mg	Total Fat g	Sodium mg
0	Frozen Broccoli	$0.16	10 Oz Pkg	10.0	73.8	0.0	0.8	68.2
1	Carrots,Raw	$0.07	1/2 Cup Shredded	0.5	23.7	0.0	0.1	19.2
2	Celery, Raw	$0.04	1 Stalk	1.0	6.4	0.0	0.1	34.8
3	Frozen Corn	$0.18	1/2 Cup	0.5	72.2	0.0	0.6	2.5
4	Lettuce,Iceberg,Raw	$0.02	1 Leaf	1.0	2.6	0.0	0.0	1.8

Constraints

Our constraints are as follows:

1. Minimum daily intake 1500 30 20 800 130 125 60 1000 400 700 10
2. Maximum daily intake 2500 240 70 2000 450 250 100 10000 5000 1500 40
3. If a food is selected, then a minimum of 1/10 serving must be chosen.
4. Many people dislike celery and frozen broccoli. So at most one, but not both, can be selected.
5. To get day-to-day variety in protein, at least 3 kinds of meat/poultry/fish/eggs must be selected.

Variables

We'll need a binary variable for each food to indicate whether or not we select that food in our model. We'll also need a numeric variable for each food to indicate the serving size. These will be used to solve the constraints as follows:

1. The cumulative sum of the product of each food's binary variable, the serving size and attribute must be greater than or equal to the constraint.
2. The cumulative sum of the product of each food's binary variable, the serving size and attribute must be less than or equal to the constraint.
3. The variable representing the serving size of a food must be greather than 1/10 * the binary variable for the food.
4. The sum of the binary variable for celery and frozen broccoli must be less than or equal to 1.
5. The sum of the binary variables that correspond to meat/poultry/fish/eggs must be greater than or equal to 3.

Objective Function

The objective function is to minimize the cumulative sum of the product of each food's binary variable, serving size, and cost.