Project 2 - Minimum Cost Diet LP

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1 Setup

Using data from the United States Department of Agriculture, I downloaded nutritional information for five food items, and stored them in *.csv* format in the /Data section of my project directory. The food items are avocado, beans, rice, cheese, and spinach. I imported the *.csv* files using Python in /Code/parse_data.py, and organized the nutritional information according to certain nutritional properties: Protien, Calories, Vitamin C, Vitamin D, Sodium, and Saturated Fat. In the /Code/script.py file, I imported the organized data, in addition to the PulP library to manage the details of the linear program. From there I set up the various food items as variables, added an objective function of the costs associated with the different variables, and specified that I wanted to minimize the objective function. The nutritional information was added as contraints in the linear program.

To run the program, unzip the file and run the following commands:

```
cd Code/
pip install pulp
python script.py
```

1.1 Nutritional Information

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	Cheese	Rice	Beans	Avocado	Spinach
Serving Size (g)	28.0	42.0	130.0	136.0	340.0
Protein	7.0	3.0	10.0	2.67	9.72
Calories	110.0	150.0	150.0	227.0	78.0
Sodium	180.0	0.0	341.0	11.0	269.0
Vitamin A	589.0	0.0	0.0	200.0	31882.0
Vitamin C	0.0	0.0	0.0	12.0	95.5
Saturated Fat	5.001	0.0	0.0	2.891	0.214

(a) Nutritional Information

Food	Dollar cost per pound
Cheese	7.71
Rice	1.00
Beans	1.00
Avocado	1.25
Spinach	7.00

(b) Food Costs

Figure 1.1: Nutritional information and cost of food items

1.2 Variables

The individual food items were set up as real-valued variables in the linear program.

1.3 Objective Function

The objective function was generated by mapping the variables to their corresponding costs. The cost first had to be converted from cost per pound, to cost per gram, and then scaled to the serving size of the food item in the nutritional information. The conversion amount used was 453.5924 grams per 1 pound.

1.4 Constraints

Six contraints were added to the linear program - one for each nutritional property. For each nutritional property (e.g. Protien, Calories, ... etc.), the variables were matched with the corresponding food item's nutritional information (e.g. variable 'cheese' was associated with the amount of protein in cheese). The sum of the variable-coefficient pairs was then compared to the daily value of each nutritional property. The daily nutritional values are given in (1.1) below, and an example of the 'Calories' constraint is in (1.2).

$$\begin{aligned} Calories &= 2000 \\ Protein &\leq 56 \\ Sodium &\leq 2400 \\ VitaminC &\geq 90 \\ VitaminA &\geq 700 \\ SaturatedFat &\leq 20 \end{aligned} \tag{1.1}$$

$$2400 = (110 \cdot Cheese) + (150 \cdot Rice) + (150 \cdot Beans) + (227 \cdot Avocado) + (78 \cdot Spinach) \tag{1.2}$$

2 Results

3 Menu

1. First item in a list
2. Second item in a list
3. Third item in a list

4 Resources

- United States Department of agriculture - `https://ndb.nal.usda.gov/ndb/`
- Cost Cheese - `http://www.wisconline.com/cgi-bin/aaw_catalog.pl?start=109&end=117&t=ven&ven=125`
- Cost Spinach - `https://www.howmuchisit.org/how-much-does-spinach-cost/`
- Cost Beans - `https://www.amazon.com/365-Everyday-Value-Organic-Black/dp/B074MFZ1NS/ref=sr_1_3_a_it/146-5585447-2072360?ie=UTF8&qid=1523249746&sr=8-3&keywords=organic+black+beans`
- Cost Rice - `https://www.answers.com/Q/How_much_does_one_pound_of_rice_cost`
- Cost Avocado - `https://www.hassavocadoboard.com/retail/volume-and-price-data`
- Average Avocado Size - `https://www.answers.com/Q/What_is_the_weight_of_an_average-sized_avocado`