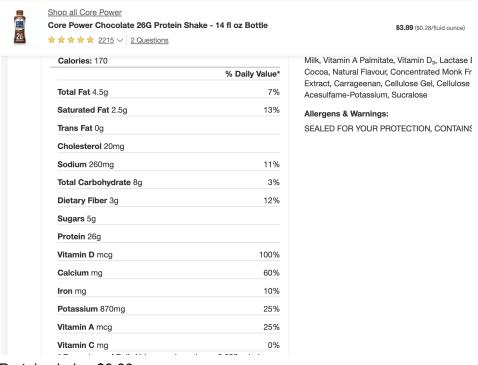
# Timmy Li MSDS460 Assignment 1

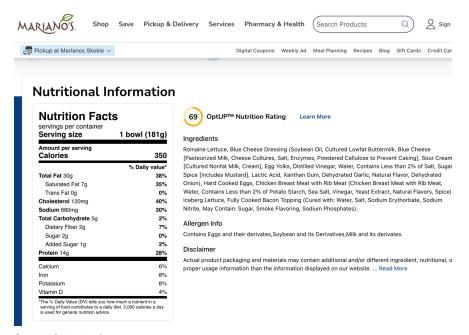
Part 1: Below are images of my selected food item's nutritional facts



### Protein shake, \$3.89



Clif bars, a box of 10 costs 15.99



### Cobb Salad, \$3.67

#### **Nutritional Information**





Water, Chicken Raised Without Antibiotics, Carrots, Enriched Noodles (Semolina Wheat Flour, Eggs, Egg Whites, Niacin, Ferrous Sulfate, Thiamine Mononitrate, Riboflavin, Folic Acid), Celery, Contains 2% or Less of: Onions, Chicken Stock, Natural Flavor, Sea Salt, Chicken Fat, Corn Starch, Garlic, Yeast Extract, Parsley, Thyme, Onion Powder, Turmeric, Acacia & Xanthan Gum, Nisin Preparation and Spices.

Contains Wheat and Their Derivatives, Eggs and their derivates.

Actual product packaging and materials may contain additional and/or different ingredient, nutritional, or proper usage information than the information displayed on our website. ... Read More

Chicken Noodle Soup, \$6.49



### Mixed Fruit Yogurt, \$1.69

We want to set up a linear programming solution for the diet problem. The problem is essentially we want to spend the least amount of money on food and still meet all the requirements that we have for nutrition. Our decision variables are the food items: Mixed fruit yogurt, chicken noodle soup, cobb salad, protein shake, Clif protein bar. The objective function is based on the costs of each food item, we will be minimizing this function because we want the least cost while satisfying the eighth nutritional constraints.

### Nutritional requirements below

Component	Max/Min	Daily Amount and measure	Weekly Amount and measure
Sodium	Maximum	5,000 milligrams (mg)	35,000 milligrams (mg)
Energy	Minimum	2,000 Calories (kilocalories, kcal)	14,000 Calories (kilocalories, kcal)
Protein	Minimum	50 grams (g)	350 grams (g)
Vitamin D	Minimum	20 micrograms	140 micrograms

		(mcg)	(mcg)
Calcium	Minimum		9,100 milligrams (mg)
Iron	Minimum	18 milligrams (mg)	126 milligrams (mg)
Potassium	Minimum	4,700 milligrams (mg)	32,900 milligrams (mg)

Sodium Constraint

65 \* x1 + 260 \* x2 + 680\*x3 + 1360\*x4 + 230\*x5 <= 5000\*7

Calorie Constraint

140\*x1 + 170\*x2 + 350\*x3 + 240\*x4 + 260\*x5 >= 2000\*7

**Protein Constraint** 

11\*x1 + 26\*x2 + 14\*x3 + 21\*x4 + 10\*x5 >= 50\*7

Vitamin D Constraint

0\*x1 + 20\*x2 + .04\*20\*x3 + 0\*x4 + 0\*x5 >= 20\*7

Calcium Constraint

.10 \* 1300\*x1 + .6\*1300\*x2 + .06\*1300\*x3 + 40\*x4 + 40\*x5 >=1300\*7

Iron Constraint

0\*x1 + .1\*18\*x2 + .08\*18\*x3 + 1.6\*x4 + 2\*x5 >= 18\*7

Potassium Constraint

.04\*4700\*x1 + 870\*x2 + .08\*4700\*x3 + 570\*x4 + 267\*x5 > = 4700\*7

• Where x1 is yogurt, x2 protein shake, x3 cobb salad, x4 chicken noodle soup, x5 clif bar We want to spend the least amount of money that we need to while still following each of these constraints. Note that sodium is a maximum of 35,000mg weekly while the rest of the constraints are minimum.

Chicken\_Noodle\_Soup = 0.0 Chobani\_Yogurt = 0.0 Clif\_Bar = 40.019057 Cobb\_Salad = 0.0 Protein\_Shake = 25.534381 OPT = 163.319214233

The optimal solution seems to be buying only two of the food items out of the five. Only purchasing clif bars and protein shakes seems to meet all of the requirements.

## Part 4

If we need to have at least one serving of each food item that I looked into. The solution is as follows

Chicken\_Noodle\_Soup = 1.0 Chobani\_Yogurt = 1.0 Clif\_Bar = 39.539781 Cobb\_Salad = 1.0 Protein\_Shake = 24.378021 I would not be spending much more, it looks like about 6 dollars more. The solution itself hasn't changed much either, only buying one of each of the items that weren't bought before a slightly less clif bars. This does feel like it still lacks variety. If I had to try and change a few things about my diet without changing the food items I selected, there may be a few things that could be changed with nutrition requirements. These requirements are based on a 2000 calorie diet and is a default for most people. Not everyone is the same so it is possible to change a few of the nutritional requirements which would in turn change the requirements for the diet. Such as changing the calorie requirement or protein requirement. We can also be looking at possibly changing from maximum to minimum and vice versa for the constraints, this may affect the output a bit as well.

#### Part 5

I'm using Google's Gemini for this part. <a href="https://gemini.google.com/app?hl=en">https://gemini.google.com/app?hl=en</a>
It pretty much did the job perfectly. The code that it outputs should work. The first solution that it suggested used a dictionary for the food items which I think should work (I did not use a dictionary). I also had it go about the solution without using a dictionary and it essentially was the same code that I had written. I would say yes if you were to use this to do this assignment you could get pretty far. The only thing it couldn't really do was actually have real food items, it made up food items for placeholders. The only two prompts were the ones below, the initial and then a follow up request.

"You are trying to solve a linear programming problem called the diet problem. The goal or objective of this problem is to find the minimum-cost diet (servings of food items) that satisfies the eight nutritional requirements. Use Python PuLP or AMPL (perhaps with its Python API). In this problem you have various nutritional requirements. You are to select 5 packaged food items and use their nutritional facts to create the constraints. You may select whichever food items you can. "

"instead of creating a dictionary for the different foods, can you define each food with a different variable and then continue the solution from there"

I would say it went very well, I was able to tailor the solution to what I was looking for, especially to compare it to my own solution.