The food items that I picked for this first assignment was based on a meal that we make quite often since the kids enjoy it and it makes them get their fruits / vegetables in. The food is a vegetarian Poke Bowl. In our household, we usually cook larger portions since we're a family of 5, but for this assignment, I just assumed cooking for myself. The ingredients differ from a traditional Poke Bowl because my kids are still on the picky side. The initial ingredients for the Poke Bowl recipe are 1) tofu, 2) white rice, 3) mango, 4) low sodium soy sauce, 5) avocado, 6) edamame, 7) canned corn. I then used https://www.nutritionix.com site to get the Nutritional Facts and my local grocery store – Safeway (https://www.safeway.com) for the prices and price per serving.

Once these food ingredients, nutritional facts, serving size, and price per serving were entered into an excel spreadsheet, I then started creating a Python linear programming model. The first step before diving into any Python coding was determining whether to use Python PuLP or AMPL code. I decided to use Python PuLP because of the easier Python syntax vs the Python AMPL. After deciding on which method to use, I then needed to download the PuLP package. I had not used it in my prior Python assignments so I had to download it first before importing the necessary Python libraries. Once the libraries were imported, the next step was to create a dataframe based on the Excel file where all the food data is stored. After the dataframe was loaded, the next step was to use PuLP to create the problem variable. Since the assignment asks for the minimal cost solution, the code used is "LpMinimize". After creating the problem variable, I then created dictionary lists of food items, price per serving, and the nutritional facts for all food items. The last dictionary was a dictionary of food items with lower bound.

The objective function of identifying total cost for a balanced diet was then added to the problem. The assignment also called for daily constraints of several components of

nutritional items. Those included minimum or maximum. For example, the assignment called for a minimum of 2,000 calories or a maximum of 5,000 mg of sodium. If it listed a minimum component, it did not list a maximum. Since this is about diet and in ensuring a healthy lifestyle, I also added a maximum constraint or vice versa when the assignment lists the maximum constraint. For example, for calorie, the maximum daily intake recommendation is 3,000 calories from *Medical News Today,* I included a maximum constraint of 3,000. For sodium, the maximum constraint of 5,000 mg was listed so I added a minimum sodium daily intake of 500 mg based on recommendations as shown in this article from *John Hopkins Medicine*. Although it is recommended to have a minimum of 2,000 calories daily, that doesn't mean we should go significantly beyond the minimum. Going beyond significantly may not actually provide the desired results of a "diet". Another factor is overconsuming a certain nutrition can lead to health issues – for example, eating too much protein lead to higher risk of kidney stones based on article from *Harvard Health Publishing*.

Once the constraints were added, I was able to run the solver and print the problem status to determine that it was infeasible. The primary reason was I did not meet the minimum requirement of vitamin D. I went back and added 2 hard boiled eggs to the recipe to meet the requirement. After updating my dataset with the eggs and re-running the solver, the problem status became optimal instead now. With an optimal model, it was determined that the least cost balanced diet consisted of avocado, hard boiled eggs, and tofu. This resulted in a daily cost of $9.58 and on a weekly basis would be $67.06.

The last part of the assignment was attempting to have a third-party LLM model create the results. I was able to successfully use ChatGPT to create the Python script but it had different results than the model that I created.

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