Graham Lovell

01/17/2025

MSDS 460, Decision Analytics

Assignment 1 – The Diet Problem

Assignment 1 was an individual assignment where we were able to be introduced to linear programming through the famous "Diet Problem". For this assignment, I needed to construct a personalized diet using current recommended dietary allowances from the U.S. Food and Drug Administration. This diet was to be limited to five foods in which I had in my household thus I chose bananas, chicken breast, cheerios, string cheese, and green peas. The goal of this assignment was to use linear programming to find the combination of these five foods that leads to satisfying all nutritional constraints at the lowest possible cost.

To complete this assignment, I chose Python as the language I would use and Jupyter Notebooks as the environment. I chose Jupyter Notebook because the cell-based approach makes debugging easy and once I was happy with my code I just condensed it all into one cell and saved as a .py file. Additionally, I chose Pulp as the model that I used to complete this linear programming task. I chose Pulp because I have previous experience with the library and it is fairly straight forward. Once I had chosen the five foods I would use for this assignment all I needed to do was collect nutritional and price information before starting. I declared my variables as the five foods I had chosen and I set eight constraints. The constraints specified seven minimum nutritional values for sodium, energy, protein, vitamin D, calcium, iron, and potassium. Additionally, I set a maximum for calories so that I would not receive a recommendation that would cause me to gain a lot of weight. I used the daily values recommended by the FDA and multiplied them by 7 to get the weekly values. Thus, this problem is telling me how many servings of each food I need to consume for a week. Lastly, I set the objective function equal to the cost of the amount of each food eaten multiplied by the cost per serving of that given food.

The first time I ran the code for my version of the diet problem, I allowed for partial servings to be recommended and did not require that each food had to be eaten at least once. The optimal solution cost a total of $104.73 and had me eating 33.76 servings of banana, 69.26 servings of dry cheerios, zero chicken breast, 84.14 servings of green peas, and 14.73 servings of string cheese. The second time I ran the code I altered the conditions so that partial servings were still allowed, but all foods must be eaten at least once. The optimal solution cost $1.56 more than the previous answer at a total of $106.29 and had me eating 32.8 servings of banana, 69.26 servings of dry cheerios, 1 chicken breast, 83.98 servings of green peas, and 14.72 servings of string cheese. The third, and last, time I ran

the code I altered the conditions so that servings had to be a whole number and all foods must be eaten once. The optimal solution cost $0.18 more than the previous answer at a total of $106.47 and had me eating 34 servings of banana, 69 servings of dry cheerios, 1 chicken breast, 77 servings of green peas, and 26 servings of string cheese.