Methods:

The first step in solving my diet cost minimization problem was to identify five foods that are consistent components of my diet but also possess distinct nutritional values. After gathering these five foods, I recorded their nutritional values in a spreadsheet to keep track and broke down the labeled values into serving sizes. I quickly realized that some of my chosen foods had significantly higher nutritional values than others, potentially affecting the variety within my solution. To determine the price of each food item, I divided the item's price by its serving sizes in the package. With the nutritional values known, I multiplied the daily minimums and maximum requirements by 7 to establish the weekly constraints for these 7 requirements. Then I went into VS Code and put in my total cost function, nutritional constraints, and my decision variables. After this, I ran the code to give the optimal solution.

Part 2: Linear Programming Problem in Standard Form

The linear programming problem I solved is represented as follows: Total cost = 0.15 * x1 + 0.21 * x2 + 1.33 * x3 + 0.59 * x4 + 2.29 * x5. The goal was to minimize the cost function while meeting dietary requirements. Decision variables (x1, x2, x3, x4, x5) were constrained to be above zero because it would have been impossible to eat a negative amount of food. Nutritional constraints were set based on gathered values, ensuring the necessary minimums were met while staying under the daily maximums. The constraints were written as follows:

```
model += 0 * x1 + 170 * x2 + 0 * x3 + 470 * x4 + 340 * x5 <= 35000, "Sodium"
model += 200 * x1 + 80 * x2 + 70 * x3 + 270 * x4 + 200 * x5 >= 14000, "Calories"
model += 7 * x1 + 3 * x2 + 1 * x3 + 14 * x4 + 22 * x5 >= 350, "Protein"
```

```
model += 0 * x1 + 0 * x2 + 0 * x3 + 0 * x4 + 3 * x5 >= 140, "Vitamin_D"
model += 0 * x1 + 30 * x2 + 25.6 * x3 + 0 * x4 + 358.4 * x5 >= 9100, "Calcium"
model += 2 * x1 + 0.9 * x2 + 0.4 * x3 + 0 * x4 + 1.6 * x5 >= 126, "Iron"
model += 118 * x1 + 27 * x2 + 210 * x3 + 130 * x4 + 306 * x5 >= 32900, "Potassium"
```

After all of these steps were laid out in the program I had python solve the linear programming problem, giving me an optimal solution.

Part 4: Solution to the Linear Programming Problem

The optimal solution involved using 157.79 servings of pasta, 46.667 servings of sardines, and no servings of chicken nuggets, mixed fruit, and bread. The minimum cost for this solution was $130.54, approximately $0.8 less than the grocery store cost for these foods for the week.

Part 5: Revised Linear Programming Problem

Introducing constraints to include at least one serving of each food item or meal during the week, the revised solution maintained only one serving of nuggets, fruit, and bread. However, it increased the meal cost by $1.7, providing a bit more variety in meals.