

Coding Project IV

Linear Programming - 10 Points

In this assignment you will use the linprog solver from the SciPy python package to solve [DPV] 7.16:

A salad is any combination of the following ingredients: (1) tomato, (2) lettuce, (3) spinach, (4) carrot, and (5) oil. Each salad must contain: (A) at least 15 grams of protein, (B) at least 2 and at most 6 grams of fat, (C) at least 4 grams of carbohydrates, (D) at most 100 milligrams of sodium. Furthermore, (E) you do not want your salad to be more than 50 % greens by mass. The nutritional contents of these ingredients (per 100 grams) are:

ingredient	energy (kcal)	protein (grams)	fat (grams)	carbohydrate (grams)	sodium (milligrams)
tomato	21	0.85	0.33	4.64	9.00
lettuce	16	1.62	0.20	2.37	8.00
spinach	371	12.78	1.58	74.69	7.00
carrot	346	8.39	1.39	80.70	508.20
oil	884	0.00	100.00	0.00	0.00

Define and solve a linear program which makes the salad with the fewest calories under the nutritional constraints.

Restrictions

- You must complete this assignment on your own; do not share your code with anyone and do not copy code from the Internet. **You may not share any details of the LP solution – the objective function, constraints, maximum value, etc – with your fellow students.**
- You must be fully compatible with **python 3.10.x** and **SCIPY 1.11.3** using the default settings for `optimize.linprog`
- No additional libraries may be imported beyond what is provided in the assignment
- Do not modify the structure or program-flow of this assignment in any way – only add code where directed to do so by the code comments. Do not add functions, variables, or other code constructions except where told to do so.

Template Code

A template has been provided. You will complete the four functions as detailed to solve the LP. Those of you new to linear programming in Python may find the following resources helpful:

- <https://docs.scipy.org/doc/scipy/reference/generated/scipy.optimize.linprog.html>
- <https://realpython.com/linear-programming-python/>

Submission

The autograder will confirm that your submission computes a solution for the LP you define. Your final score will be based on generating the correct solution for the problem detailed above (optimal value and assignments for each variable), as well as properly defining the objective function and A & B constraint matrices. Do not submit a zip file, or any other files but **lp.py**. Late submissions will not be accepted.