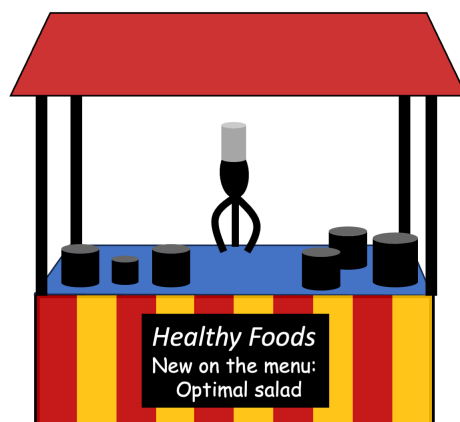


There are 1 questions for a total of 10 points.



- (10) 1. *The optimal salad problem:* You are the chef of *Healthy Foods*, and you have to create a healthy salad, minimising the calorie count but ensuring that the salad provides a minimum amount of Fat, Protein, Carbs, and Fiber. The available ingredients, along with the calorie chart. Write the problem requirement as an LP. Use an LP solver (https://developers.google.com/optimization/lp/lp_example) available freely on the web to find the optimal quantities of the ingredients.

<i>Item (per 100g)</i>	<i>Calorie</i>	<i>Fat</i>	<i>Protein</i>	<i>Carbs</i>	<i>Fiber</i>
Pecan	690	72g	10g	15g	10g
Walnuts	655	65g	15g	15g	7g
Almonds	575	50g	20g	22g	12g
Avocado	160	15g	2g	9g	7g
Corn	86	1g	3g	20g	3g
Peas	80	0g	5g	14g	5g
Carrots	41	0g	1g	10g	3g
Broccoli	34	0g	3g	7g	3g
Spinach	23	0g	3g	4g	2g
Tomatoes	18	0g	1g	4g	1g
Cucumbers	15	0g	1g	4g	0g
Lettuce	15	0g	1g	3g	1g

Your Python program should take input from a file named `input.txt` and should write the output in a file named `output.txt`. Your programs should produce an output within 1 minutes for this assignment. The format for input and output files is as follows.

INPUT: The input file contains a single line. This line contains a comma-separated sequence of the minimum quantities of Fat, Protein, Carbs, and Fiber required. Below is an example of an input file.

40.0, 50.0, 130.0, 8.0

OUTPUT: The output should contain a single line. This line should contain the minimum calorie in the optimal salad rounded to the nearest integer (e.g., *print using* `print(f"{value:0.0f}")`). For example, consider the output file corresponding to the input file above:

896

Note: There are **no** whitespaces or newline characters at the end of the output file. Having such whitespaces might lead to the autograder marking the output as incorrect.

SUBMISSION INSTRUCTIONS: All your program files should be in a directory `lecture_1_prog`. You will be asked to create a zip of this directory and submit this zip file. Your Python program should be in a file named `optimalsalad.py`. This, when executed, should read the input file (`input.txt`) and write the answer in the output file (`output.txt`).

Additional comment: Due to the simplistic way in which we have modelled the problem (i.e., minimizing calories subject to a minimum requirements of Fat, Protein, Carbs, and Fiber), you may find that the optimal salad may not be very appetising. For example, it may turn out that a mostly pecan-spinach-cucumber salad is the optimal salad! At this point, you can fine-tune your LP by adding more flavour-oriented constraints, such as the amount of lettuce should be at least 100g, cucumbers should be at most 20g, etc. Linear programming turns out to be immensely useful for such day-to-day optimisation tasks.