TP3 – `PuLP` implementation training

The optimal parking problem

On Dantzig Street cars can be parked on both sides of the street. Mr. Edmonds, who lives at number 1, is organizing a party for around 30 people, who will arrive in 15 cars. The length of the i-th car is λ_i, expressed in meters as follows:

i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
λ_i	4	4.5	3	4.1	2.4	4.2	3.7	3.5	3.2	4.5	2.3	3.3	3.8	4.6	3

Table 1: The data corresponding to Mr. Edmonds' problem

In order to avoid bothering the neighbours, Mr. Edmonds would like to arrange the parking on both sides of the street so that the length of the street occupied by his friends' cars should be minimum.

Question 1.

Implemenent Mr. Edmonds' problem in `Python` thanks to `PuLP` and solve it. What is the solution?

Question 2.

Add the following constraints:

(a) The sum of cars' length parked on the left side should be less than 20 meters.

(b) Cars are allowed to occupy more or equal to 16m on no more than one of the street sides.

(c) Cars longer than 4 m should be parked on left side.

(d) If the length of the left side is bigger than 10 meters, the length of the right side should be less than 13 meters.

Question 3.

Describe the solution

Reminder:

I. Write the model with maths:

   i. What are the data?

   ii. What are the variables?

    iii. What is the objective function?

    iv. What are the constraints? Can I use several constraints to answer a more complex one?

II. Instantiate the model in `PuLP`:

    i. What `Python` (resp. `PuLP`) objects should I use for data (resp. variables)?

    ii. Optimization: at the end, can I re-use some loops or re-organise them for time / memory optimization?