Ma421 - Operations Research
IPSA Paris
2019 - 2020

Practical Work 2

Member in United States Electoral College: Study of the Representation of Population

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1. Install **PuLP** and read the documentation from the link: *https://pythonhosted.org/PuLP/*

2. Solve the following LP problems in $\mathbb{R}$ and $\mathbb{N}$ with **PuLP** :

$$min\ \{-8x_1 - 5x_2 \mid x_1 + x_2 \leq 6,\ 9x_1 + 5x_2 \leq 45,\ x_i \geq 0\}$$

$$min\ \{2x_1 + 7x_2 + 2x_3 \mid x_1 + 4x_2 + x_3 \geq 10,\ 4x_1 + 2x_2 + 2x_3 \geq 13,\ x_1 + x_2 - x_3 \geq 0,\ x_i \geq 0\}$$

3. Watch the video from the link: https://youtu.be/7yZ5xxdkTb8

4. Read, understand and execute the two examples "Deciding Where to Go on Vacation" and "Creating a Reading List" from the link: https://github.com/AnnaNican/optimizers/tree/master/.ipynb_checkpoints

5. Let be $x = (x_1, \ldots, x_p)$. Each coordinate of x represents the population of the state i and N the number of members at the US Electoral College. Justify that minimizing the representativity gap is to solve the following integer LP problem:

$$min\ \{u - v \mid v \leq \frac{\alpha_i}{x_i} \leq u,\ \sum_{1 \leq i \leq p} \alpha_i = N\}$$

where α_i represents the number of members in US Electoral College for the state i.

6. Give the number of members for each state in 2016 with the criteria of representativity of the question 5.

7. Analyse the results of the 2016 United States presidential election.

One report for a staff of two students but each student will send the report.
The report will be presented on **one page recto-verso in two-column layout + US map**.
You will only present the answers from question 5 to question 7.