Matching problem: National Youth Service Corps (NYSC)

PWSAfrica 2018

The *National Youth Service Corps* (NYSC) is an organization set up by the Nigerian government to involve the country's graduates in the development of the country. Since 1973 graduates of universities and later polytechnics have been required to take part in the NYSC program for one year. Have you ever wondered how the allocation of corp members is being carried out by the NYSC administrative? Given the number of students that need to be allocated in each batch, can you estimate how long it will take if this allocation process is done manually, or the amount of human resources that would be expended? Obviously, a lot! To save time and resources, the Director General (DG) of NYSC has approached you as a mathematician and programmer to help design an automated system that can be used to efficiently allocate corps members to one of the 36 states in Nigeria, based on their choices.

What you will be provided

A dataset containing the following:

(i) information of corp members $\mathcal{C} = \{c_1, c_2, \ldots, c_{1000}\}$,

(ii) six list of states that each $c_i \in \mathcal{C}$ would like to be assigned to, ranked according to order of preference (that is, first choice, second choice, and so on).

You have also been told that the maximum number of corp members that can be allocated to each state is 30. Below is a screen shot of what the .txt file looks like. For clarification, each line is read as follows: Corp member 1 prefers Adamawa to Niger, and she prefers Niger to Zamfara, and so on.. Corp member 2 prefers Benue to Borno, and she prefers Borno to Katsina, and so on..

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1 Adamawa Niger Zamfara Delta Bayelsa Kwara
2 Benue Borno Katsina Anambra Abia Niger
3 Kaduna Katsina Kwara Anambra Benue Bauchi
4 Taraba Kogi Ogun Kaduna Kwara Katsina
5 Oyo Ekiti Anambra Bauchi Adamawa Ogun
6 Imo Osun Ondo Ebonyi Bayelsa Delta
7 Bauchi Delta Oyo Niger Abia Borno
8 Kogi Enugu Niger Imo Oyo Abia
9 Oyo Kebbi Yobe Ogun Benue Borno
10 Kogi Lagos Edo Benue Katsina Kwara
11 AkwaIbom Plateau Bauchi Abia Anambra Gombe
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What you are required to do

You are expected to implement a program that will

1. take the preferences of these youth corps into consideration,
2. assign each of them to only one of the states that appear on her list,
3. without exceeding the maximum capacity of the states.

First, imagine you want to solve this problem with pencil and paper, how would you go about it? Whatever set of instructions you come up with on paper is what we refer to as *algorithms*. Next, your aim is to communicate this algorithm to the computer in a language that it understands,

which is where the *Python programming language* comes in. **The goal:** Using the skills you have acquired in the past few days: (i) read in the data in Python using a most suitable data structure, (ii) implement your algorithm, (iii) run this algorithm on the data set you've just read, and finally (iv) output your solution, which will inform the DG's decision on which state to allocate each corps member. [1]

Further problems

- **Visualisation:** Use any plotting technique of your choice to produce a visualisation of (i) the proportion of assigned and unassigned corp members and (ii) the number of corps members assigned to their first choice state, second choice state, and so on.
- **New Datasets:** Do you think the way the data has been randomly generated has an effect on what you see? Can you generate another dataset with some certain properties, for example, each of the six states in the corp member's preference list must be from different geopolitical zones.[2] If you are able to generate a dataset that has this property, what inference can you draw from running the program on your newly created dataset and the original .txt file that was given to you?

[1] Given that the data was generated randomly, it might be the case that some corps members are not assigned in the final solution.

[2] I believe there are six geopolitical zones in Nigeria: North West, North East, North Central, South West, South South and South East.