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General Seat Allocation

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Object Oriented Programming Lab - Project Report

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Declaration

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Chapter 1

Introduction

Seat Allocation is a general problem faced worldwide in different circumstances eg. college seats, railway bookings(defence quota, army quota, etc), etc. Here we have discussed a similar problem i.e seat allocation to students through an exam ranking, there are different colleges with different courses(eg. Computer Science Engineering, Electronics Engineering, etc). The solution is explained further after the reference algorithm.

1.1 Aims and Objectives

The main aim or objective of this problem is to solve the problem for a large no of students as inputs and to give the best output possible that will give all the students maximum satisfaction, reservation of the seats are to be involved i.e there is a particular amount of reservation for caste students, these students can even be given a general seat provided that they get a better allotment but no caste seats can be given to general or different caste.

1.2 Problem Statement

Allocate seats to the given students according to their rank, preference of a student, caste of the student and maximum seats of a branch in a college.The ratio of seats being 50% for general ,25% for OBC category and 25% for SC/ST category students.Note that no General student can take a category seats even if it remains empty and a category students can take general seat if they are getting a better preference.

Chapter 2

Gale-Shapley Algorithm

Imagine a group of N boys and another group of N girls. Everyone wants to be matched with (one) member of the opposite sex. The problem is how to do it. If people didnt care who their partner is then it is not hard to come up with a matching. For example, you could arrange the boys and girls in order of age and pair the oldest boy with the oldest girl, the second oldest boy with the second oldest girl, and so on. As long as no two members of the same sex have exactly the same birthday, this procedure assigns one (and only one) girl to every boy and one (and only one) boy to every girl. Of course, you could order people by their names, the length of their hair, their grade point average, or their wealth and also come up with matches.

One trouble with these approaches (the trouble that these notes will focus on) is that they ignore the fact that people have preferences. Boys like some girls better than others. Girls also care who they are matched with. One would like to tailor the matches so that they are somehow consistent with individual preferences. In this section, I am going to explain a way to do this that has nice properties.

I need to be precise about several things before I start. First, a matching is just an assignment of one (and only one) boy to each girl. When there are equal numbers of boys and girls, there are a lot (N!) of different assignments. I will say that a pair is mated if they are matched together. I will talk about a boy and girl being mated and so on.

Second, I must describe what preferences are. Here I assume that every individual has a preference ordering over the members of the opposite sex. That is if I denote the boys by B1, B2, . . . , BN and the girls G1, G2, . . . , GN, then the preferences of each individual are represented by an ordered list of members of the opposite sex. For example, B1s preferences may be G1 ¿ G2 ¿....¿GN, meaning that the first boy likes G1 better than any other girl, likes G2 second best, and so on. I will assume that everyones preferences are strict (so that if you ask a girl: Who do you prefer: Bi or Bj ? Shell give you a definite answer.

She wont say: I dont care.), but otherwise, I will make no other assumption.If there is a universally accepted notion of attractiveness, then all of the boys will have the same preferences. I allow this possibility, but I do not require it.

Finally, I must come up with some condition that describes what it means to have a good match. Some ideas have superficial appeal, but clearly are too much to ask for. For example, you could say that a match is good if everyone is matched to his or her favorite choice. It should be clear that in general this is not possible. Even if there are only two boys and

two girls, if both boys favor the same girl, then one of them will be disappointed. Another possibility is to say that a match is good if someone is happy. This condition rules out silly matches (for example, matching everyone to his or her least favorite, if that is possible), but in some sense is asking too little. Here is the condition, called stability, that I propose. A match between boys and girls is stable if there does not exist a boy-girl pair (all them Ben and Jen) such that:
1. Ben is not paired with Jen.
2. Ben prefers Jen to his mate.
3. Jen prefers Ben to her mate.
Suppose that you could find a pair that satisfied the three properties. The matching is unstable in the following sense. Ben can approach Jen and suggest that she dump her current partner in favor of him. Ben hopes Jen will accept (because he likes her better than his current partner). Jen will accept (because she likes Ben better than her current partner). So, if a matching isnt stable, you will expect divorces. Notice that stability does not prevent someone from being stuck with his least preferred choice: Suppose that I am every girls least favorite boy. If I am matched to my least favorite girl, then the first two conditions above hold between me and any girl Im not matched with, but the third condition fails. When I request that someone break up with their mate to hook up with me, shell turn me down. With this introduction, the questions that I want to ask are: Do stable matchings exist? How do I find them?

2.1 Solution

Here we allocate all the caste students in order of their rank and their choice into their seats ie reserved seats.Then further we allocate all students if there is condition that a student is better of ie a caste student gets a higher college preference then he is allotted that seat This is where the stability of the answer reaches maximum then further again we allocate the caste students due to vacancy created.

Chapter 3

Procedure

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3.1 Requirements

The required inputs are the list of colleges with their branch and maximum seats in every branch, students ranking in genera and all the castes.

3.2 Analysis

This will take a maximum of preference list * no of students since it is summation if seats are vacant, So therefore this algorithm takes O(N * C) where N is no of students and c is no of colleges.

3.3 Implementation

Gale-shapley algorithms tag line remains the basis of this solution i.e make maximum possible stable state.

Chapter 4

References

Gale-Shapley algorithm is taken from the given URL

https://www.cs.princeton.edu/ wayne/kleinberg-tardos/pdf/01StableMatching.pdf