Team Members:
Alyssa Fermin
Ayah Elwan
Mehek Palrecha
Hoangcamt Nguyen

Dorm Room Assignment Matching Evaluation

Our Approach:

We decided to create our dorm room matchings with our version of serial dictatorship. We are optimizing to make students happy and deciding on order depending on a series of constraints and then we will assign rooms by seniority. We will then evaluate and compare our results with the serial dictatorship policy that is on canvas. We will use the evaluation method provided on canvas with a few changes to match our matching method. While we were creating our matching algorithm, we kept track of how well our matching algorithm was performing by using the evaluation on every iteration of our program which will be discussed more in our analysis.

Assignment Policy:

Our assignment policy will meet the following criteria that we decided on:

1. Students who need an accessible room will be matched to an accessible room if available
2. Students will only be matched to a room that is less than or equal to their maximum price
3. Graduate students will only be matched to a graduated room
4. Freshmen housing will be prioritized in the matching

The sorting of the students will be in the following order:

1. Freshmens will be placed at the top
    - This will guarantee that freshmen get placed into a room
2. Graduate students
    - Within the graduate students, the ones who need an accessible room will go first
3. Undergraduate students
    - Within the undergraduate students, the ones who need an accessible room will go first
4. All of the groups will be ordered by budget to ensure that low-income students will get a room they can afford
    - Students will be placed in order from the smallest max price to the largest
    - If students have the same budget, then they will be placed depending on seniority (with Freshmens being an exception and allowed to be placed at the top)

Justification:

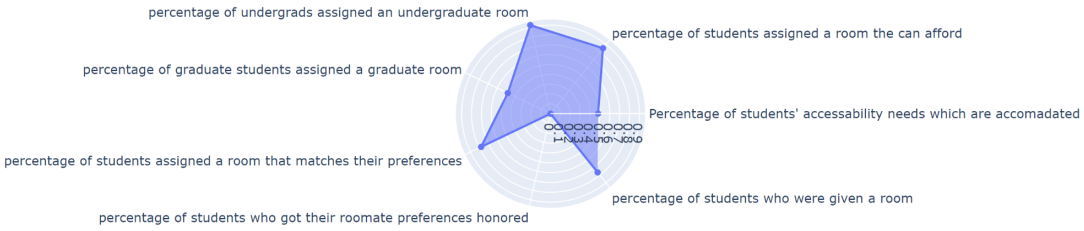
In the algorithm, it was important that students got an accessible room if needed and a room that matched their pricing constraints. This meant that students that needed accessibility accommodations and students who were low-income were prioritized in the algorithm. This seemed to be the fairest approach to use because if students that did not get assigned to an accessible room and they needed one then they would not be able to access their room, which would not be fair. Low-income students were also prioritized because it would not make sense to assign them to a room out of their budget when there were rooms that they could afford. This guarantees that students who need an accessible room should only be assigned to a room that is accessible and students will only be assigned to a room they can afford.

Next, freshmen get priority to their preferences because as first-year students we thought it would be best to prioritize their preferred halls to help build a sense of community and belonging as this would be their first year at their university. Graduate students will be matched next and they could only be matched to a graduate hall since this would also cause them to be in a community with other graduate students. By placing graduate students at the top, they would be getting first pick at graduate rooms. Finally, the rest of the list will be sorted depending on seniority since we thought it would be most fair for the students who have the most credits and been at the university the longest should get first pick.

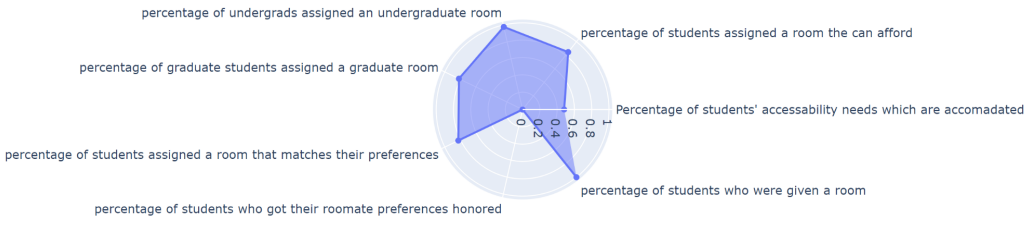
Analysis:

A representation of how our algorithm did in the matching after each iteration (this is evaluated on Dataset A):

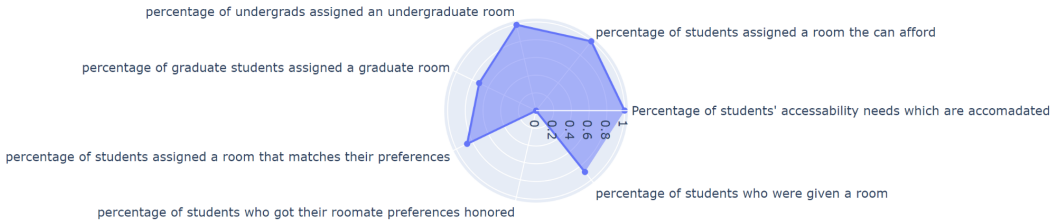
Version 1: Sorted by student's preferences of price and accessibility



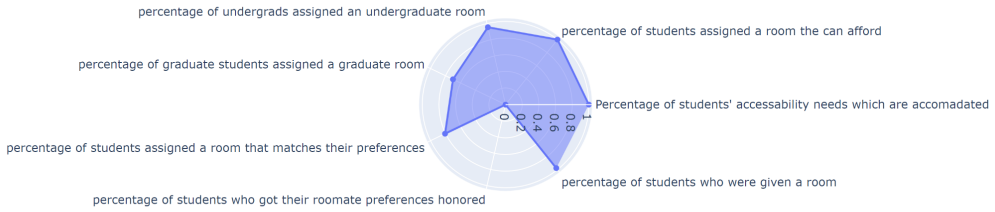
Version 2: Sorted by student's preferences of price, accessibility, and grad status



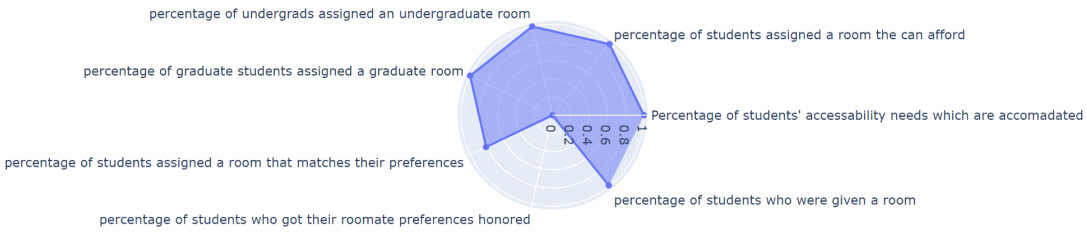
Version 3: Matches first by price preference and accessibility need, then assign a random room that fits other preferences



Version 4: Changed the filtering of price by ‘low_income’, instead filtered price by max_price

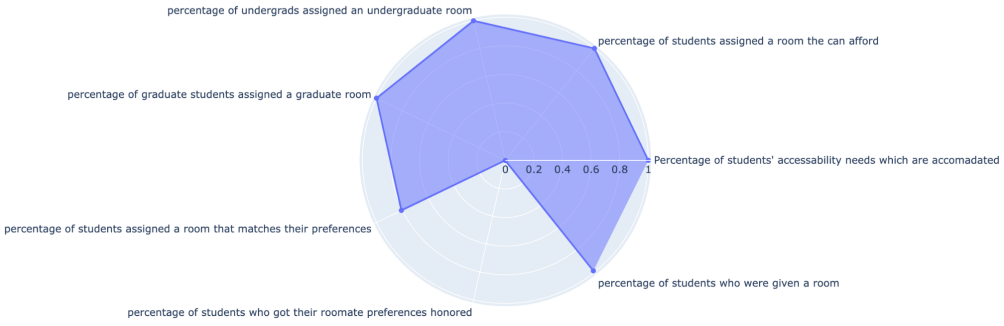


Final Version:



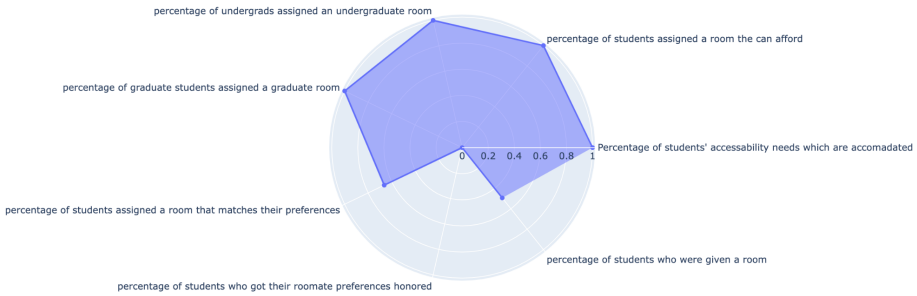
Evaluation of all datasets:

Dataset A:



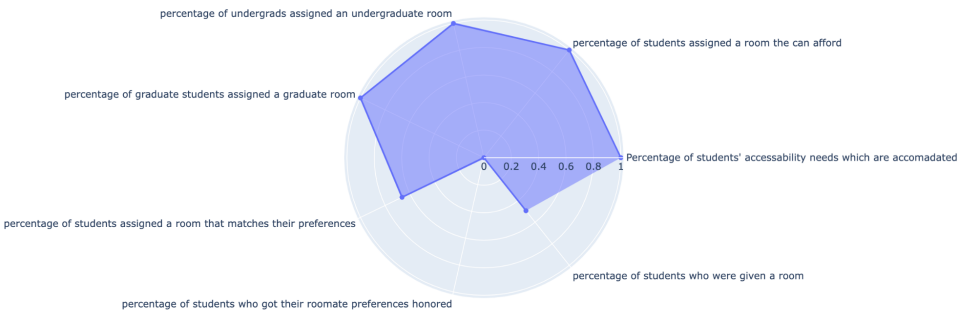
- In dataset A, 98 percent of students were assigned to a room. This is because the algorithm would only match a student to a room that meets their accessibility needs and price range. The 67 students who were not matched needed accessible rooms and had a budget of $7000, however there was no room that fit that criteria. The algorithm also does not take into consideration roommate preferences, however, it does attempt to match students to a room that matches their preferences. About 80 percent of students got matched to a room that matches their preferences. All students got assigned to the following rooms: graduate students to graduate rooms, undergraduate students to undergraduate rooms, a room that they can afford, and a room that meets their accessibility needs.

Dataset B:



- In dataset B, only about 50 percent of students got matched to a room which makes sense since there are twice as many students as rooms. However, of the students that were matched, all students got assigned to the following rooms: graduate students to graduate rooms, undergraduate students to undergraduate rooms, a room that they can afford, and a room that meets their accessibility needs. Additionally, of the students who got matched about 66 percent got assigned to a room that matched their preferences.

Dataset C:



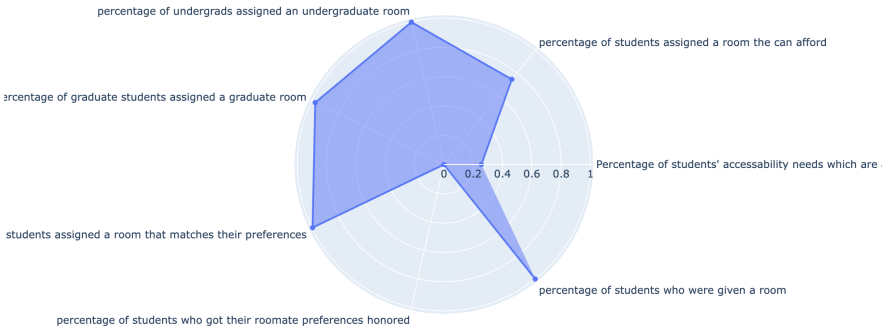
- Similar to dataset B, in dataset C, only about 50 percent of students got matched to a room however this is because of the two constraints of only assigning students to a room they can afford and to an accessible room, if needed. However, of the students that were matched, all students got assigned to the following rooms: graduate students to graduate rooms, undergraduate students to undergraduate rooms, a room that they can afford, and a room that meets their accessibility needs. Also similar to dataset B, of the students who got matched about 66 percent got assigned to a room that matched their preferences.

Analysis of the Algorithm:

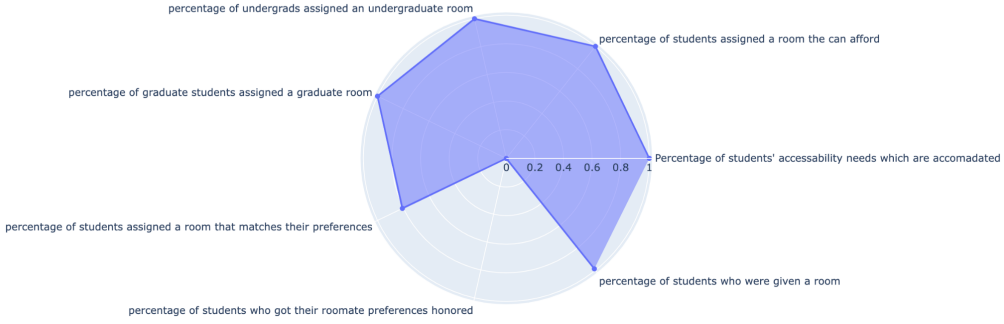
Overall, although our algorithm did not match all the students in ⅔ of the datasets, over 50 percent of students got assigned to a room that matches their preferences and everyone got assigned to the following rooms: graduate students to graduate rooms, undergraduate students to undergraduate rooms, a room that they can afford, and a room that meets their accessibility needs. This is a tradeoff when considering roommate preferences as well since we did not optimize our algorithm to match students with their preferred roommate. However, overall our algorithm performs well when it comes to our priorities of assigning rooms that are affordable, accessible, and graduate halls to graduate students and undergraduates to undergraduate halls.

Comparison with serial dictatorship by RUID (on dataset A):

Serial Dictatorship by RUID:



Serial Dictatorship by our algorithm:



- The serial dictatorship by RUID performs poorly when matching students to an accessible room if needed, in contrast our algorithm prioritizes that and performs very well. Serial dictatorship by RUID does fairly well to match a student to a room they can afford and our algorithm assigns everyone to a room they can afford. A tradeoff that we had to have is matching students to a room that matches their preferences. The serial dictatorship by RUID matches everyone to their preferences, however, ours does not because it is more important to us that we match students to a room they can afford and that is accessible if needed. Overall, our algorithm performs better than a straight serial dictatorship since we the ordering of our students placed an emphasis on affordability, accessibility, and matching students to the correct hall.