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1. Project Goal:

The Leeds School of Business associate dean hopes to increase academic requirements for students transferring from other University of Colorado programs into Leeds. This would decrease the number of incoming transfer students, in turn facilitating easier course enrollment planning and scheduling. To achieve this, we are going to adjust the standards for transferring to Leeds. Here we would provide suggestions based on students' GPA and grades in the given courses to decrease the number of transfer students by approximately 25% and 50%, respectively, of transfer students.

2. Materials & Methods:

The new criteria would be defined according to the records of the transfer students who had admitted to Leeds. We have the dataset that contains the information of GPA and letter grades of the selected courses (MATH 1112, ECON 2010, ECON 2020, a statistics course, and BCOR 1015) over five semesters from the transfer students in Leeds. The goal is to set up a cutoff point to reduce the number of students by 25% and 50%, respectively. Our strategy is to use the overall GPA as a main criterion with individual grades of the selected courses as an auxiliary gauge. Below is the outline of exploratory data analysis used in this project.

A. Data processing and organization:

a、*Pool datasheets*

The datasheets of the transfer students over five semesters would first be pooled together for further data processing.

b、*Fills missing values*

Check if there exist missing values in the data frame. If yes, missing values would be imputed with a string "NA".

c、*Find unique elements & transform to standard grades*

Since the letter grades used in the datasheets were not consistent, some letter grades need to be transformed to the standard letter grade format. First, we identified the unique elements representing grades in the data and transformed non-standard grades (e.g. TB+) to the standard one (e.g. B+).

d、*Exploratory data analysis*

Besides the abovementioned steps, we also calculated some summary values (e.g. total number of students) and performed visualization (e.g. histogram of course grades and GPA) to observe the data. The additional visualization could be found in the supplementary materials. Also, we found that, in the stat course, only the name of the course was recorded, so this column would not be used in our selection criteria. On the other hand, due to excess number of missing values in the course BCOR 1015, we decided to keep BCOR 1015 as the original selection criterion (that is, students need to earn a C or better in the course) and created a new one for other courses. To quantitatively compare the letter grades of the required courses (i.e. MATH 1112, ECON 2010, ECON 2020, and a statistics course), we used the CU Boulder Grading System [1] to transform the letter grade of four selected courses into numeric GPA

scale. Our approach is to average these transformed letter grade-equivalent GPA of the four mentioned courses as a representative score (namely course GPA) to select the transfer students.

B. First Approach: Calculate the cutoff point to reduce the number of students by 25% & 50% based on overall GPAs:

a、Reduce 25%:

The first goal is to reduce 25% of transfer students, so we calculated the 25th percentile based on the overall GPA in the processed datasheet. In this data, in total we have 908 transfer students. We then used the built-in function ***quantile*** in R to find the 25th percentile. Theoretically, we need to reduce the number of students by 227 and keep 681 students.

b、Reduce 50%:

The second goal is to reduce 50% of transfer students, so we calculated the 50th percentile based on the overall GPA in the processed datasheet. We used the same function to calculate the cutoff point. Theoretically, we need to reduce the number of students by 454 and keep 454 students.

C. Second Approach: Calculate the cutoff point to reduce the number of students by 25% & 50% based on letter grades of the selected courses:

a、Reduce 25%:

The first goal is to reduce 25% of transfer students, so we calculated the 25th percentile based on the course GPA in the processed datasheet. Again, in total we have 908 transfer students. We used the built-in function ***quantile*** in R to find the 25th percentile of the score. Theoretically, we need to reduce the number of students by 227 and keep 681 students.

b、Reduce 50%:

The second goal is to reduce 50% of transfer students, so we calculated the 50th percentile based on the course GPA. We used the same function to calculate the cutoff point. Theoretically, we need to reduce the number of students by 454 and keep 454 students.

3. Results:

A. First Approach- <u>Reduce the number of students based on the overall GPA</u>:

The overall GPA distribution of all transfer students was demonstrated in Figure 1. To reduce 25% students, we set a minimum overall GPA requirement at the 25th percentile. The 25th percentile of overall GPA is **3.14**. Notably, we observed that there were three students who had the same overall GPA at this percentile. To provide a practical suggestion for future student selection, we do not need to set up a tie-breaker to address this, so one of new criteria is to set overall GPA as 3.14 to achieve student reduction by 25%. On the other hand, to reduce transfer students by 50%, we calculated the median GPA, which is 3.3135. To concisely set up the new selection criteria, we rounded the number to the nearest value with two digits greater than it,

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so we chose overall GPA **3.32** as an approximated estimate. By setting the overall GPA 3.32 as the new minimum required GPA for admission, we can achieve approximately 50% decrease in the number of incoming transfer students as about half of the applicants will fall below that median mark.

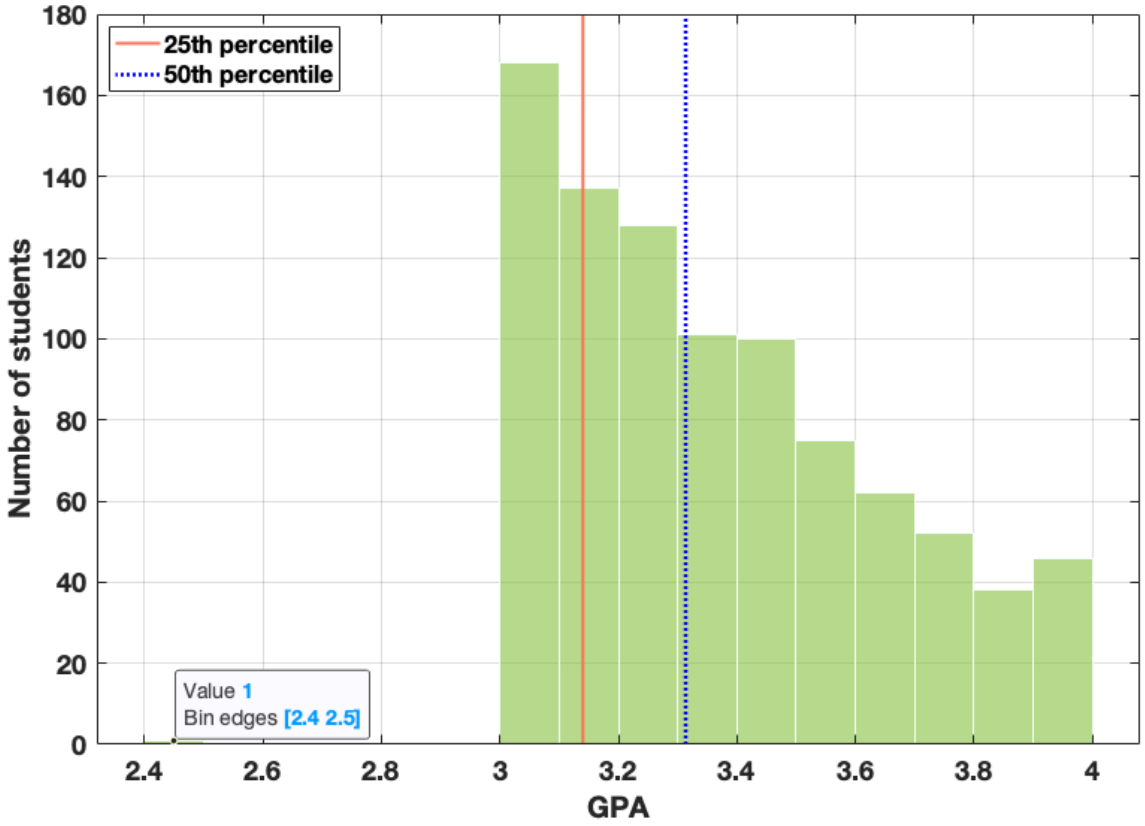

Figure 1. The overall GPA distribution of transfer students and the 25th and 50th.

B. Second Approach- <u>Reduce the number of students based on the course GPA</u>:

The course GPA distribution of all transfer students was demonstrated in Figure 2. To reduce 25% students, we set a minimum course GPA requirement (i.e. average course GPA based on MATH 1112, ECON 2010, ECON 2020, and a statistics course) at the 25th percentile. The 25th percentile of course GPA is **3.1750**. On the other hand, to reduce transfer students by 50%, we calculated the median course GPA, which is **3.4000**. By setting the course GPA as the new minimum requirement for admission, we can achieve 25% and 50% decrease in the number of incoming transfer students, respectively.

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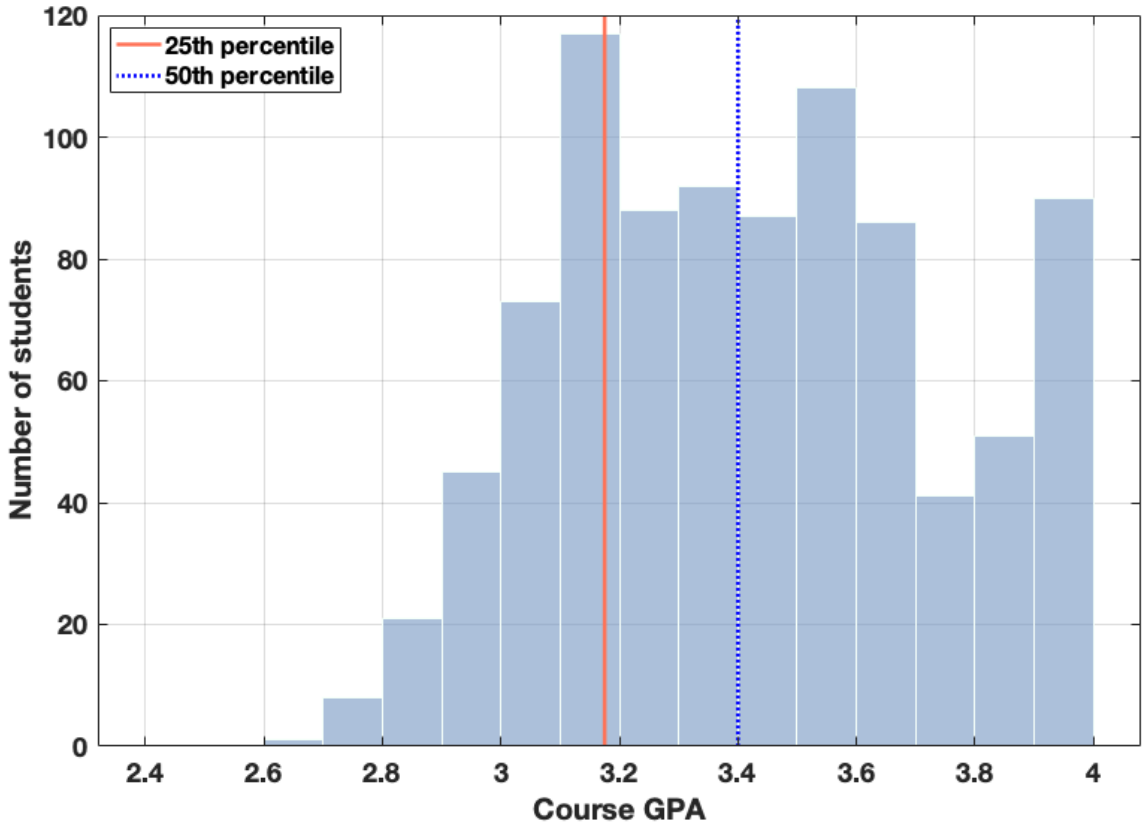

Figure 2. The course GPA distribution of transfer students and the 25th and 50th percentiles.

4. Conclusion:

In summary, based on the data of transfer students in Leeds, we have new suggestions for the associate dean to reduce the number of transfer students by 25% and 50%, respectively.

To reduce 25%, the new incoming students have to achieve the minimum requirement as follows:

Approach ONE: students need an overall GPA of **3.14** or higher and B- or better in MATH 1112, ECON 2010, ECON 2020, and a statistics course. If they had taken BCOR 1015 (a business course), they needed to earn a C or better in the course.

Approach TWO: students need an overall GPA of 3.0 or higher and B- or better in MATH 1112, ECON 2010, ECON 2020, and a statistics course. Also, their average course GPA of MATH 1112, ECON 2010, ECON 2020, and stat course has to be **3.1750** or higher. If they had taken BCOR 1015 (a business course), they needed to earn a C or better in the course.

To reduce 50%, the new incoming students have to achieve the minimum requirement as follows:

Approach ONE: students need an overall GPA of **3.32** or higher and B- or better in MATH 1112, ECON 2010, ECON 2020, and a statistics course. If they had taken BCOR 1015 (a business course), they needed to earn a C or better in the course.

Approach TWO: students need an overall GPA of 3.0 or higher and B- or better in MATH 1112, ECON 2010, ECON 2020, and a statistics course. Also, their average course GPA of MATH 1112, ECON 2010, ECON 2020, and stat course has to be **3.4000** or higher. If they had taken BCOR 1015 (a business course), they needed to earn a C or better in the course.

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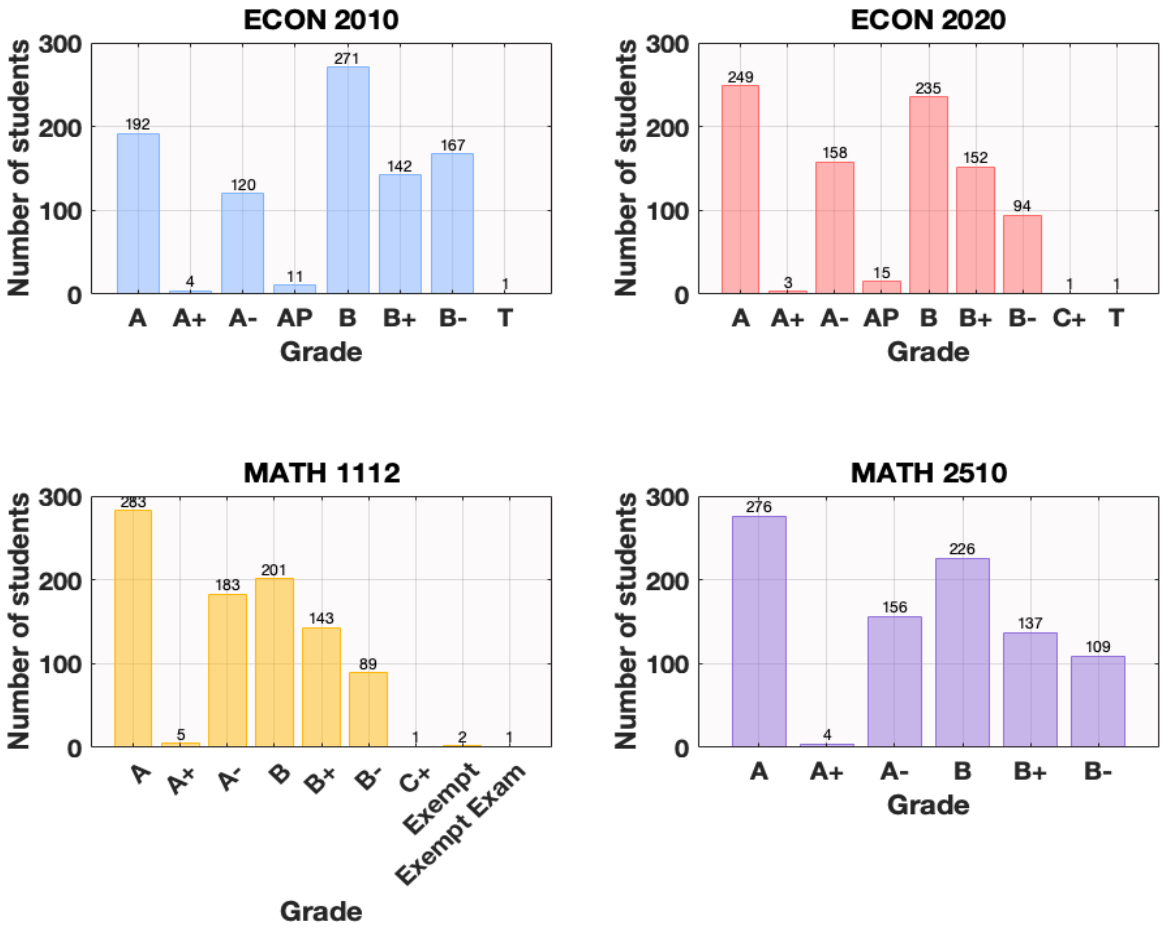
Technical appendix

5. Supplementary materials:



Supplementary Figure 1. The bar charts that visualize counts of students given the letter grades in each selected course.

6. References:

[1] CU Boulder Grading System :https://catalog.colorado.edu/graduate/credits-grading/

[2] The code is used to convert course grades.