Optimizing the Addition of Class Sections in the College of Arts and Sciences

The Power of AND | University of Wisconsin Eau Claire

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Introduction

With a large number of course options at UW-Eau Claire, finding the optimal time for offering a new course section can be difficult because of the large possibility of conflict. We analyzed the sections of the 74 most popular courses at UWEC for incoming first-year students, to determine the optimal time to open a new course section for a given course. Courses fill up quickly in a small amount of time for these incoming first-year students, who often have conflicting course times, so it is important for the University Administration to accurately determine which courses need new sections, and when those sections should be scheduled. We created an agent-based model using linear programming elements in MATLAB to simulate this registration period and optimize the addition and scheduling of course sections based on the highest demand of the incoming first-years. The final results of our simulation will help determine when a new section of a course should be opened with the least amount of conflicts.

Process

The MATLAB code takes an input that includes a course name and a range of times for which the new course section should be scheduled within.

```
>> final_fxn('GEOG 178',8,16)
```

The code reads in spreadsheets that are implemented using Microsoft Excel and stores the information into various matrices. The code determines the other courses students will be taking based on their degree plan, and implements these into a matrix where the course can be scheduled according to the lowest number of course conflicts between the students.

```
The best time to schedule the class is 3 pm with 1 conflicting student schedule.
>>
```

Background

In order to find a solution, we employed a program known as MATLAB, a powerful computing environment that is great for running multiple simulations of complex situations. One of the many functions MATLAB is excellent at is working with matrices, which are rectangular grids of numbers. In this complex problem, organization of coursetimes and students and conflicts between courses is very important, and creating matrices is a great way to keep information organized.

$$\begin{bmatrix} a_{1,1} & \cdots & a_{1,m} \\ \vdots & \ddots & \vdots \\ a_{n,1} & \cdots & a_{n,m} \end{bmatrix}$$

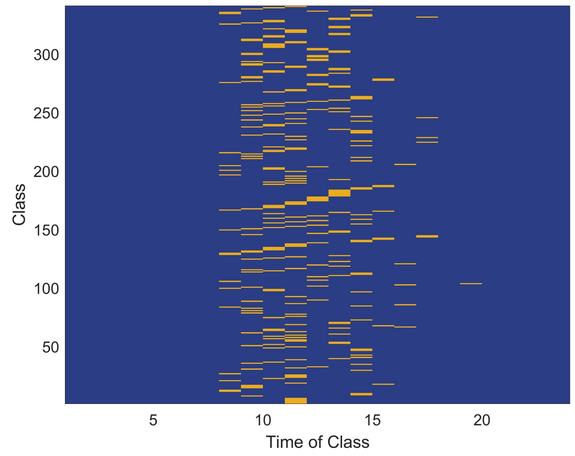
Example of what a matrix in MATLAB looks like. Each element of the matrix is represented by an “a” with n being the row number and m being the column number that the element is located at. Matrices in MATLAB can store various types of information such as strings (words), cells (words and numbers together), or simply numbers.

Assumptions

In order to greatly reduce the complexity of the problem at hand, and increase how general the code can be, we made the following assumptions:

- Only the most popular courses taken at UWEC will be analyzed
- Any capstone courses or independent study courses will not be analyzed, as these courses are not regularly scheduled courses
- Students will only take the courses on their degree plans, if there is not a seat available for the course, then they will take one less course that semester
- Interchangeability of courses is not considered

Explanation of Resulting Times Graph



The graph on the left shows the scheduled times for the 74 most popular courses at UW-Eau Claire. The x-axis represents the time that each course is conducted and each yellow line scaling the y-axis represents a course taking place.

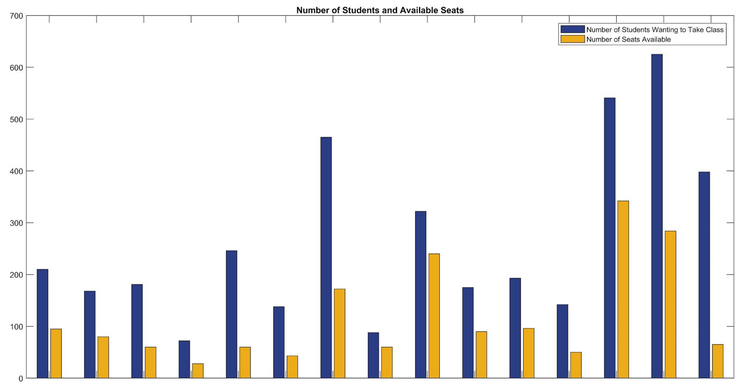
With a large amount of courses taking place this makes it difficult to identify the optimal time to schedule a new section.

This graph helps to identify when the best time (or the slots with fewest other lines) to schedule a new course section will be.

The graph to the right represents the number of students wanting to take the course compared to how many seats the course has.

This illustrates that many of the most popular courses UW-Eau Claire offers would benefit from additional course sections.

Our code will then look at the ratio of the two bars from one course to determine when the ideal time to schedule would be, based on the graph above.



General Process

Read Files → Elimination → Compare Availabilities

- Takes information from a list of courses
- Takes student information paired with desired courses

- Deletes irrelevant courses, ie missing data or not part of the most popular 74 courses

- Analyze the top 74 courses, availability, and seat count
- Determines least conflicting times for the new sections

Final Results & Next Steps

RESULTS

We found that there is a need to create new sections for a majority the 74 most popular courses that are taken in the College of Arts and Sciences. Of course, not every student will obtain a seat in a desired course, but most of the courses we analyzed have at least a 2:1 ratio for the number of students wanting to take a course to the number of seats available. We found that we can schedule a new course section with very few course conflicts between students using our MATLAB code.

NEXT STEPS

This code can continue to be developed in order to deal with interchangeable courses, and the next steps would be to determine if there is a need for more than one course section to be created, and assign days and times to each of the new courses. This code can be adapted to be used with other colleges on campus and the courses analyzed can be modified by changing the excel file that the code reads in.

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