WMMC Problem 1

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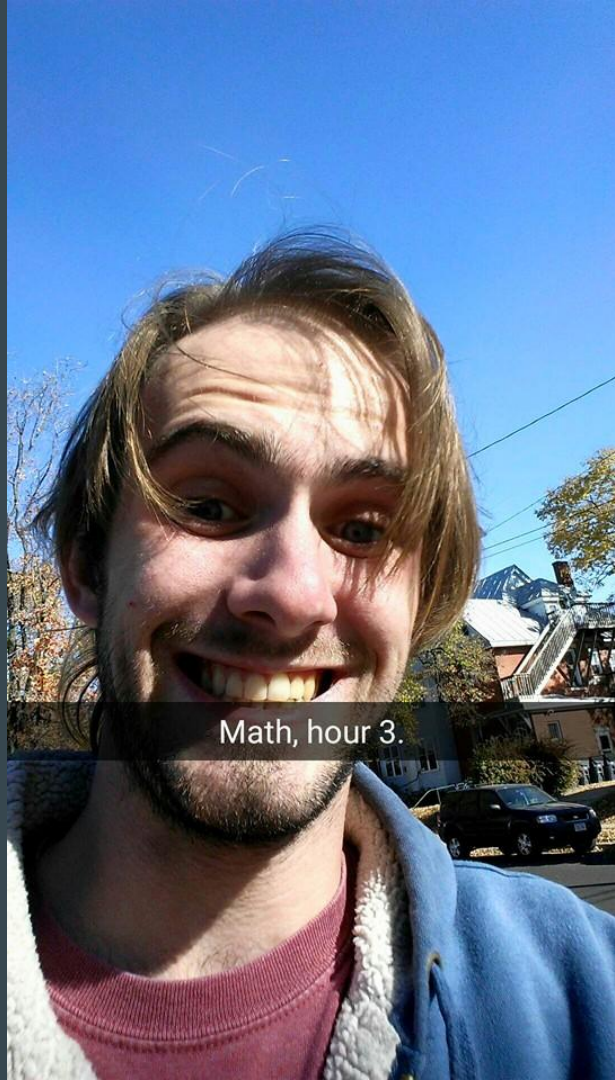
Methodology

Initially, we decided to do a depth first search of all possible schedules, and sort all the viable schedules according to how well they meet a fitness metric. We were optimistic we could implement several ways to shortcut huge sections of the search tree.



Definition of a Schedule

- For our uses we defined a schedule of a set of triples of the form:
- `(instructor, class, time)`
- We said a schedule was viable if every section of every class was present without any scheduling conflicts

Viable Class Assignments

- Our first step in creating a viable schedule was to determine all of the viable teacher-class-time triples.
- As it turns out, there are 1856 triples that work, as opposed to the 7800 possible triples.
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Size of Search Space

- From these possibilities, we needed to choose 116 of these triples. Unfortunately that means we would need to evaluate 10^[redacted] possible schedules to find one that works.
- This would take until the heat death of the universe.
- We decided that would force the possible triples to be added to our schedule in canonical order. This reduces the number of possibilities to “only” 10^187.

Pruning the Tree

- From this gigantic search tree, we pruned off any branch as soon as we discovered that they:
  - Had an instructor in two places at once
  - Had an instructor teaching too many classes
  - Had an instructor teaching 3 classes in a row.
  - Has an instructor teaching 2 group 2 classes.
  - Had an instructor teaching an unneeded section of a class
  - Had too many instructors teaching at one time
- Together, these pruned off a significant portion of the search tree.

Effectiveness of a Schedule

- Function g which calculated the effectiveness which relied on:
  - A- The professor's satisfaction of the classes they were teaching:
  - B- Reducing the prep time and workload for the teachers
  - C- The room efficiency
  - D- The teachers transition time
- Function g outputs a % (0-100) with 100 being the best efficiency.

$$g(s)= WeightA \cdot A + WeightB \cdot B + WeightC \cdot C + WeightD \cdot D$$

- The Weights are how much importance you place on each
  - All weights add to 1

$$g(s)= .25 \cdot A + .25 \cdot B + .4 \cdot C + .1 \cdot D$$

A- The Professor Satisfaction Score

- Each section can earn up to 2 points
  - 1 point if the teacher prefers to teach the course
  - Another point if the teacher likes the time
- With 116 courses there's a potential for 232 points
- Score is the percent of 232 points the schedule achieves

A= (Total points/232)= Satisfaction Percent

B- Workload Score

- A teacher would have a larger workload (and be less efficient) if he has to teach more courses.
  - It would be more efficient to teach multiple sections of the same course.]

# of courses taught	Junior	Senior	Manager
1	6	6	6
2	4	3	NA
3	2	0	NA
4	0	NA	NA

B=(Workload points)/234

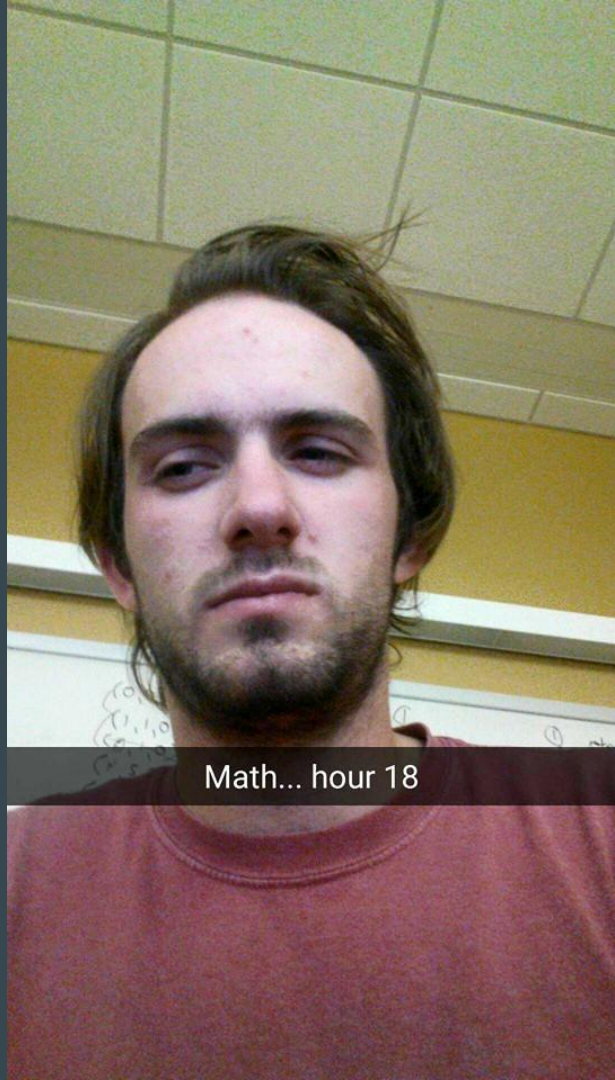
C- Room Efficiency

- We decided most “room efficient” if less rooms are used overall in schedule.
- Rooms not used at all could be repurposed
  - Offices, study/tutor rooms, research, administrative purposes, campus resources, or rented out
- With 116 classes and 8 hours in the day
  - Most efficient if 14.5 Rooms classroom used.
  - So 100% efficient if 15 rooms are used
  - 0% efficient if all (25) rooms are used

C= 100 - 10 (“Rooms used” -15)

The End

In the end after many hours of work, we did greatly reduce our search tree. However, we discovered that we severely underestimated the size of the search tree, and severely overestimates our ability to prune that search tree, and thus we couldn't produce viable schedules efficiently.



D- Transition Efficiency

- If the professor teaches 2 classes in a row:
  - It is more efficient if they stay in the same room
- For each occasion a professor teaches 2 in a row
  - 1 “transition point” if they stay in the same room
  - 0 points if they have to switch
- Efficiency is the percent of times they end up staying in the same room.

D= (Transition points)/(# of times professor teaches 2 in a row)

Exponential Growth is a B**ch

-Ancient Proverb