# MSCI 435 – Progress Report

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## Problem Definition:

This problem requires us to allocate a group of professors to specific course at specific times of the week. Two main solution methodologies were considered. The first solution aimed to model this as a Set Covering problem. This methodology however would require the generation of large and complex sets. The second option was to model the problem as an assignment problem for scheduling, which due to its easier to manage number of variables and constraints was chosen.

Assuming 2 cohorts of students, each studying 5 days in a week, each week with 8 times slots, we must generate a schedule that will minimize the “Penalties”. Those penalties are any and all the characteristics of a schedule that can negatively impact the students, the professors or the department. The objective function will be further discussed below.

## Indices:

## Parameters:

## Variables:

## Objective Function:

For this problem we are optimizing for 3 different groups: Students, Professors and the Department. Each group has their own definition of what makes a good schedule. The objective function aims to minimize the average dissatisfaction of the 3 groups. The following factor must be addressed for each group:

* Students:
  + Lunch Break: Students prefer to have a break between the times of 12:00 and 13:00. Classes assigned during that period will incur a penalty.
  + Morning Classes: In a similar manner, morning classes should be avoided (Classes between 9:00 and 10:00).
  + Breaks: Small breaks during the day (1 hour) are to be avoided.
* Professors:
  + Number of Classes Assigned: Professors prefer to be assigned the least number of courses possible.
  + Days Off: Minimize number of days a professor is required to teach.
  + Longer Weekends: Avoid Mondays and Fridays.
  + No Evening Classes (16:00 to 17:00)
* Department:
  + Minimize Number of Professors: A lesser number of professor assigned to teaching courses means better use of university resources.
  + Minimize Seasonal Professor: Use the least number of seasonal professors as they require additional funding.

## Constraints:

1. All courses should be scheduled.
2. Each professor can teach at most two courses. These two courses must be for different cohorts.
3. Professors can’t teach two courses during the same timeslot
4. Courses cannot have overlaps if it’s for the same cohort.
5. Courses from the same cohort cannot start at the same time.
6. For courses that are for both cohorts, cohort 2 cannot have classes when these courses are offered. (This constraint is for courses of 2 hours)
7. For courses that are for both cohorts, cohort 2 cannot have classes when these courses are offered. (This constraint is for courses of 3 hours)
8. For courses that are for both cohorts, cohort 2 cannot start another course at the same time.
9. Professors cannot start teaching two courses at the same time.
10. A course can only be assigned to one professor.
11. We need a constraint to relate variable Yik with Xijtdc.
12. We need a constraint to relate variable Zid with Xijtdc.
13. We need a constraint to relate variable Wij with Xijtdc.
14. Professors only teaches courses they can teach.
15. If one part of the course is taught by a course, both part of the course is taught by the prof.
16. A given prof can only start teaching a given course at one given time.
17. Can’t start at last hour of the day if it’s a two hour class
18. Can’t start at last two out of the day if it’s a 3 hour class
19. Can’t have two parts of the same class within the same day.
20. A class can only belong to a cohort if it’s intended for the given cohort.