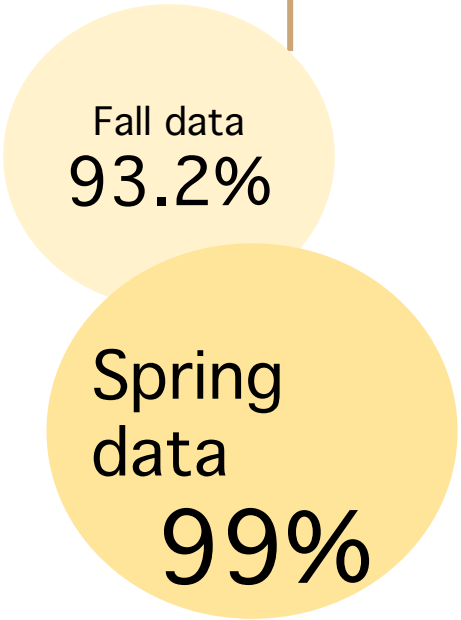
The Registrar's Problem

-based on conflicts number



Nov 11, 2019
Yichun Cao,
Chen Fan

Algorithm

Conflict-driven Algorithm

Create Lists

- Room, Courses, time, student lists
- Conflict list (Combination[Ca][Cb][conflict])
- Map of slots lists to assign courses

Remove students

- Remove overlapping courses for each student
- Remove students to fit room capacity

Prioritized Lottery (Extension)

Create Objects

- Students: id, preference lists
- Courses: id, prof, length, subject, level
- Time: start, end, duration, days
- Room: id, capacity, subjects

Flexible (Extension)

Assign Times & Assign Rooms

Output schedule

Traverse course list and print everything

Extension #1(Improvement on Algorithm)

- General idea : minimize the total conflict between each course scheduled in one time slot
- combination[COURSE A, COURSE B] returns the conflicts between course A and B
- Instead of putting two courses with minimum conflict into one time slot

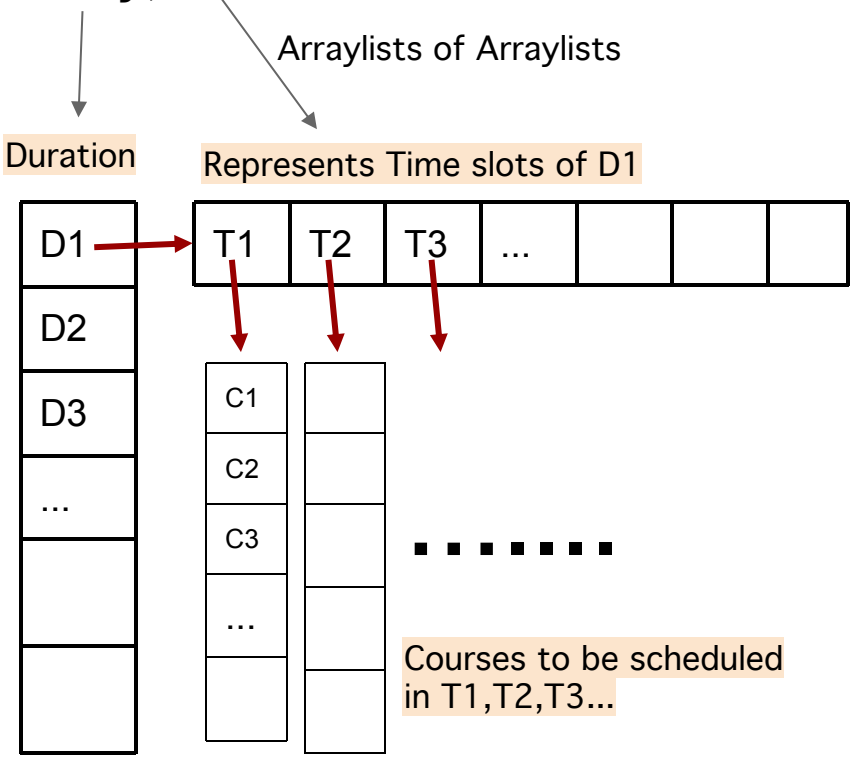
  For each time slot, we calculate total conflict number when course A is put into that slot by adding conflict number with all scheduled courses in that slot

  Put course A into the slot with minimum conflict number

- Optimal might use Dynamic Programming

Map of Arrays of ArrayList

<Key, Value>



Assign Time

- Map of Arrays of ArrayList to store courses into each time slot
- PutFirst : separate courses with high conflict number into distinct slots
- PutRest : After each time slot has at least one course, put the class with *the least number* of conflicts with all scheduled courses in the slot

Extension #2(Assign time slots by duration)

- Store duration of the class time into Course
- Map<Integer, ArrayList<ArrayList<Course>>>

  Integer: the duration

  ArrayList<ArrayList<Course>> : time slots in this duration

  ArrayList<Course>: stores the courses in one time slot

- Put each course in time slots with required duration

Assign Room

- Assign biggest room to biggest course in each time slot
- Check subject of each course and assign accordingly

Extension #3 (Assign classrooms by Subject Building)

- For each classrooms store all subjects that courses from those subjects can use this classroom
- Assign largest course to a largest unscheduled room that can hold this course based on the subject.

Update Students

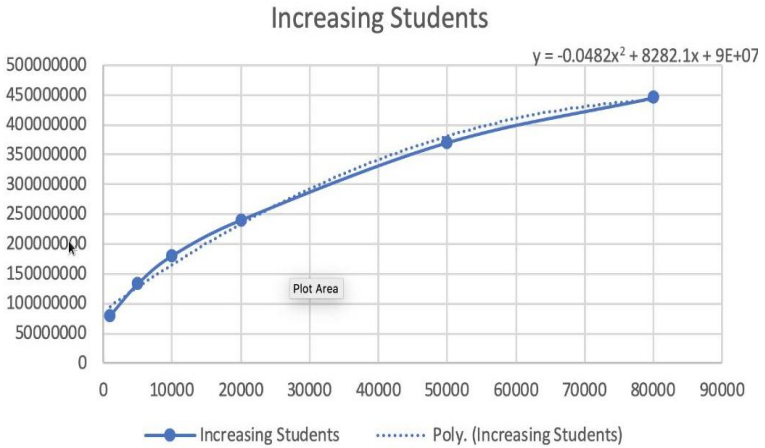
- Remove overlapping courses for each student
- Remove students to fit room capacity

Extension #4 (lottery)

- Randomly generate Class Year for each student
- For 300-level course, only lottery students that are not seniors out

Run-time Analysis

Dependency On s



Dependency On c

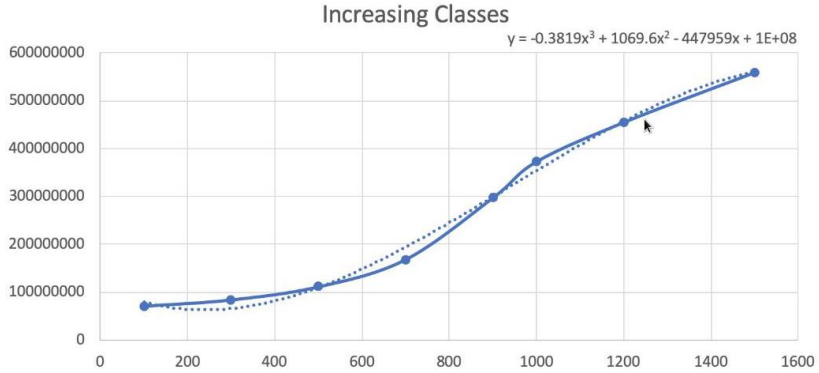
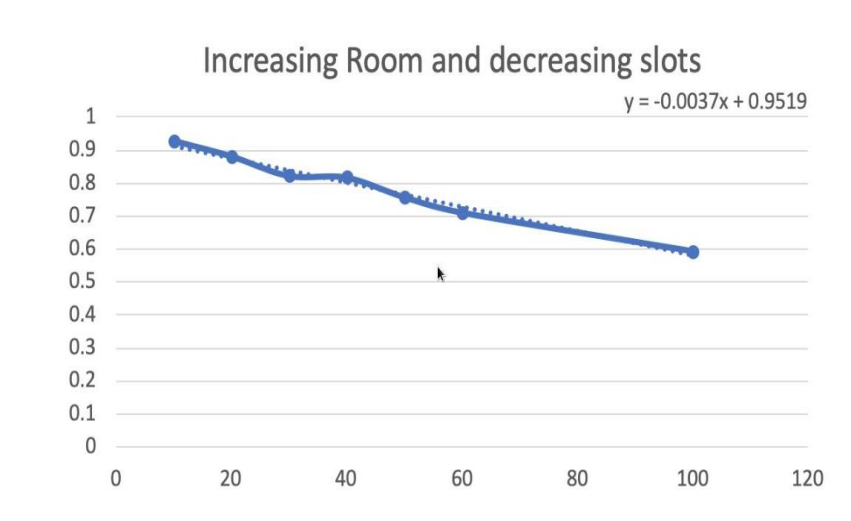


Figure 2: Run-time verses the number of classes.

$$O(c^2 log c^2 + s^2)$$

Solution Quality Analysis

On random input



On real data

Fall	0.931	0.931	0.929	0.936	Avg = 0.932
Spring	0.99	0.992	0.993	0.982	Avg = 0.99

Highest: Spring 2012(99.3%)
Lowest: Fall2004 (89.5%)

ESEM?
100 level intro?
Students tends to choose more course in Fall

Reality

100 level	MATH	11:25 AM 12:45 PM TTH	PK243
100 level	EALC	4:10 PM 5:30 PM MW	TH116
100 level	LATN	10:10 AM 11:00 AM MWF	CARP13
100 level	CHEM	10:10 AM 11:00 AM MWF	PK278
100 level	RUSS	9:10 AM 10:00 AM MWF	RCCON
100 level	PHIL	2:40 PM 4:00 PM WF	TAYE
100 level	GEOL	11:10 AM 12:00 PM MWF	PK25
100 level	SOCL	11:40 AM 1:00 PM MW	DAL119
100 level	POLS	11:40 AM 1:00 PM MW	TAYE
100 level	CITY	12:55 PM 2:15 PM TTH	DAL300
100 level	BIOL	8:10 AM 9:00 AM MWF	PK20

Linear Alebra/Multi Calc

Intro Language Classes

Intro Humanity Classes

300 level	MATH	11:40 AM 1:00 PM MW	PK338
300 level	PHIL	2:10 PM 4:00 PM M	TAYE
300 level	PHIL	7:10 PM 10:00 PM T	TAYE
300 level	POLS	7:10 PM 10:00 PM M	TAYE
300 level	LATN	7:10 PM 9:00 PM T	CARP13
300 level	PHIL	1:10 PM 3:30 PM F	TAYE
300 level	ARTD	8:25 AM 9:45 AM TTH	GOB
300 level	SPAN	4:10 PM 5:30 PM MW	TAYG
300 level	BIOL	9:55 AM 11:15 AM TTH	PK229
300 level	ARTD	7:10 PM 9:00 PM MW	GOB

Real Analysis (Allowing overlaps with 100 Math course)

Typical 300-level humanity courses (meets once a week & really late)

Typical 300-level Science courses (meets twice a week & not so late)

ESEM TIME

2014	9:55AM - 11:15 AM	TTH
2013	8:15AM - 9:45 AM	TTH
2012	9:45AM - 11:15 AM	TTH
2011	11:15AM - 12:45AM	TTH
2010	4:00 PM - 5:30 PM	TTH
2009	8:30 AM - 10:00 AM	TTH
...	...	

- Mostly on Tuesday-Thursday mornings
  - Not expected:
  - Most time slots have duration of 160
  - Reasons Speculated:
  - Data is extracted from real schedules
  - Results -> real schedule