UniTime

Student Scheduling
in UniTime

November 2016

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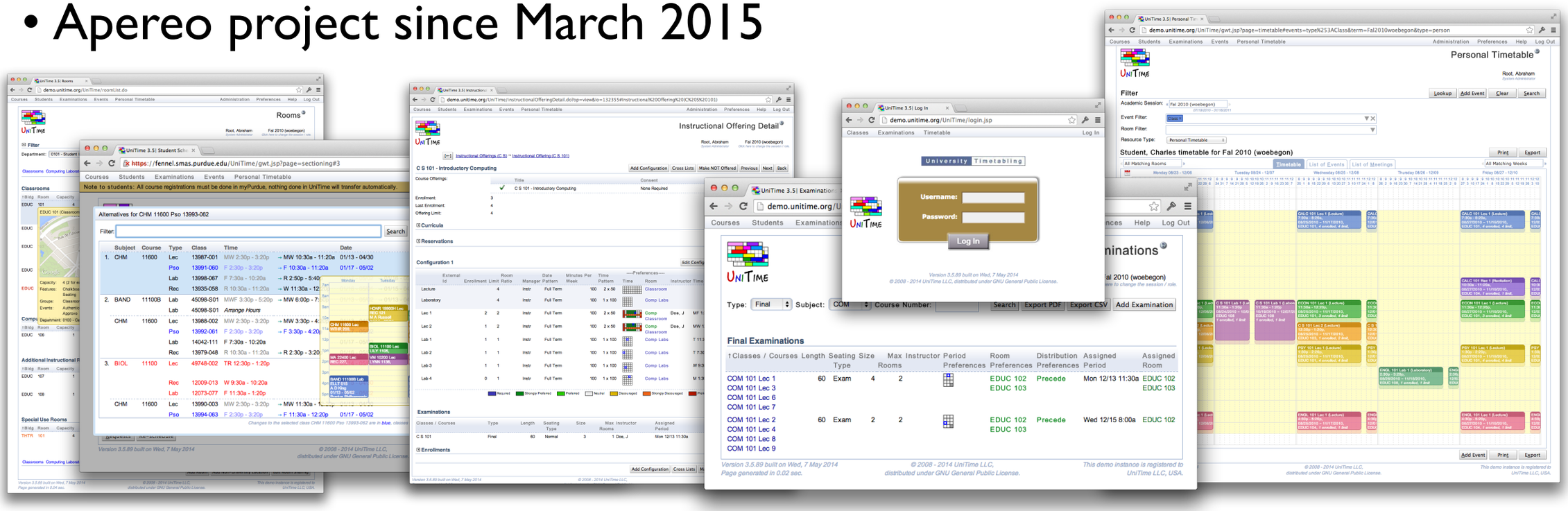
Introduction

What is UniTime?

- Comprehensive academic scheduling solution
- Four components: course timetabling, examination timetabling, student scheduling and event management
- Open source, web-based, written in Java using modern technologies
- Using state-of-the-art optimization algorithms
- Distributed data entry and timetabling in multi-user environments
- Apereo project since March 2015



Student Scheduling

What is Student Scheduling?

- Enrollment of students into classes in a way that maximizes the ability for students to get the courses they need

Why needed?

- To ensure that students will be able to get the courses they need in a multi-section environment
- Students who come early may block later students from being able to get the courses they need
- Getting a workable schedule can be a tedious process for a student

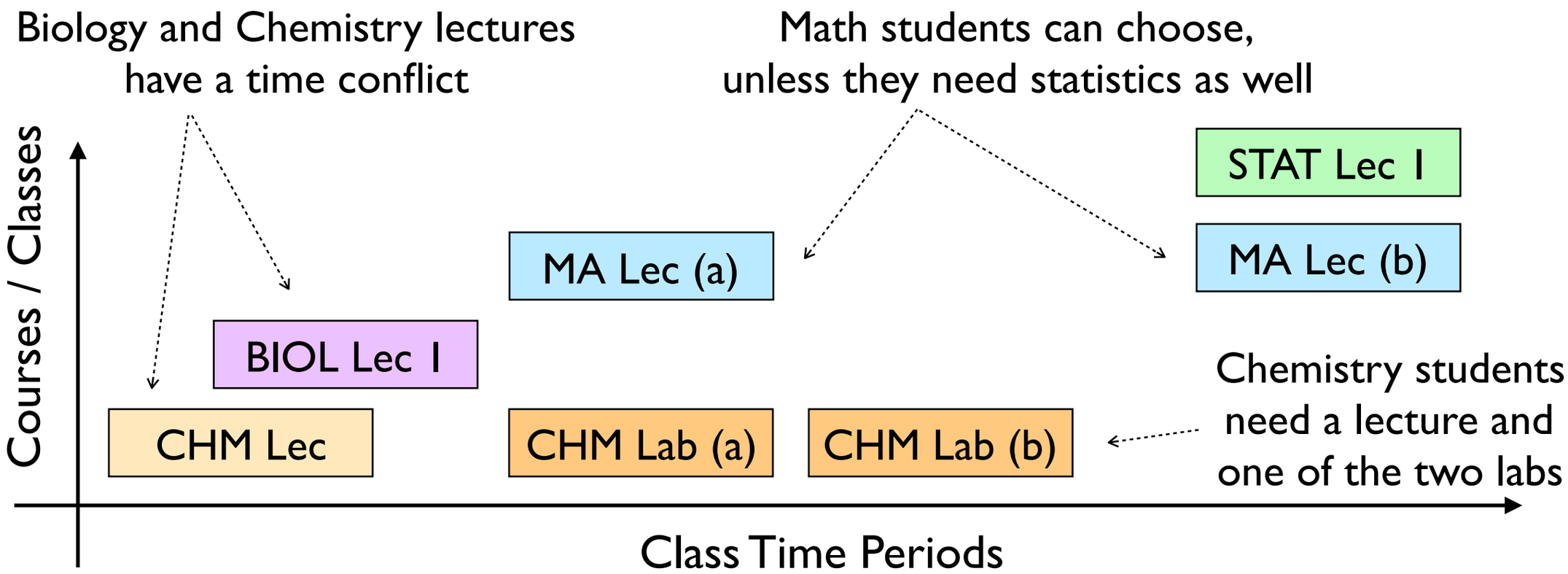
Goal

- Student fills in course requests, including alternatives, free times, etc.
- System provides a schedule that meets student needs
- Students have the ability to modify their schedule

Why needed?

A student cannot take a combination of courses

- Because there is a (time) conflict
  - *Classes are offered at overlapping times or one after the other in rooms that are too far apart*
- Or, there is not enough space in a non-conflicting combination of classes



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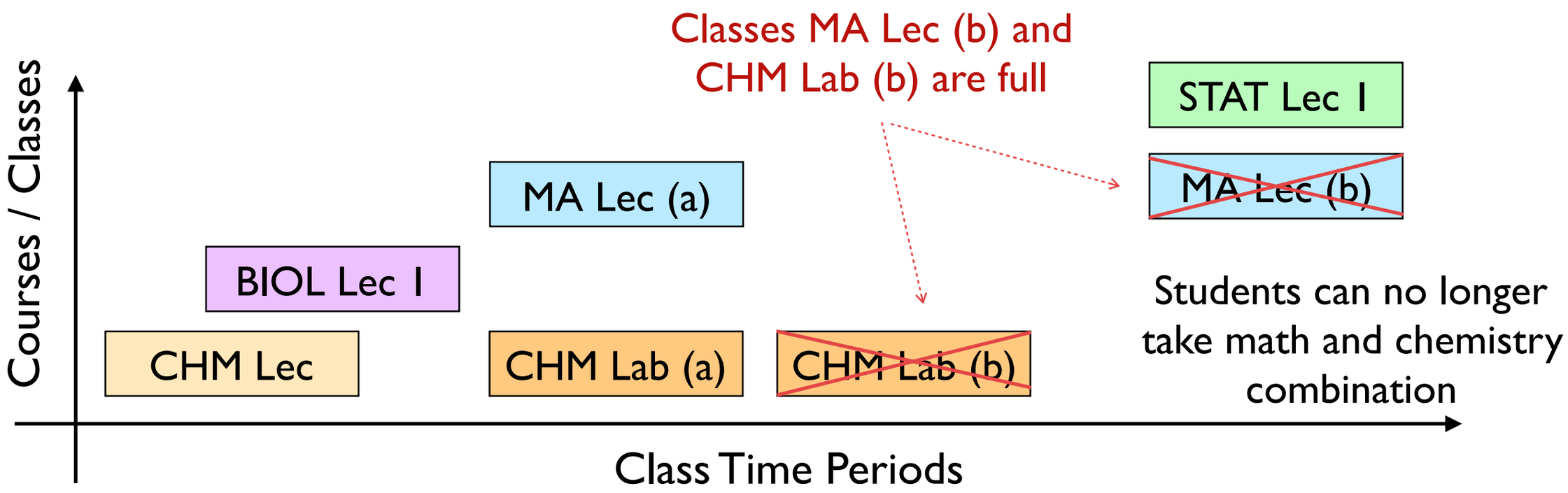
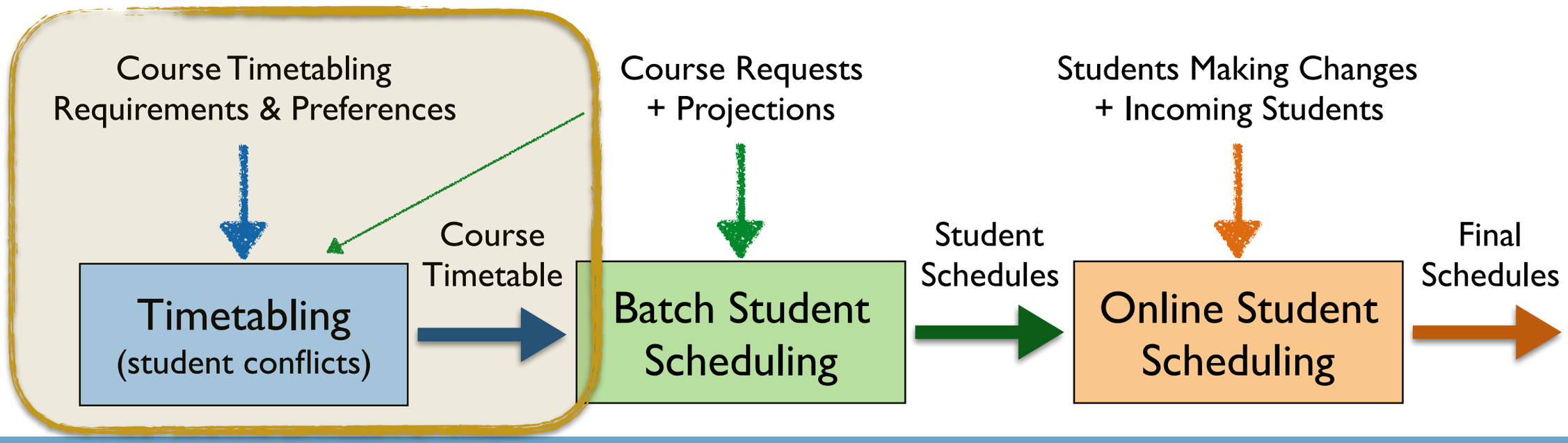


Student Scheduling Process

Step 1: Course Timetabling

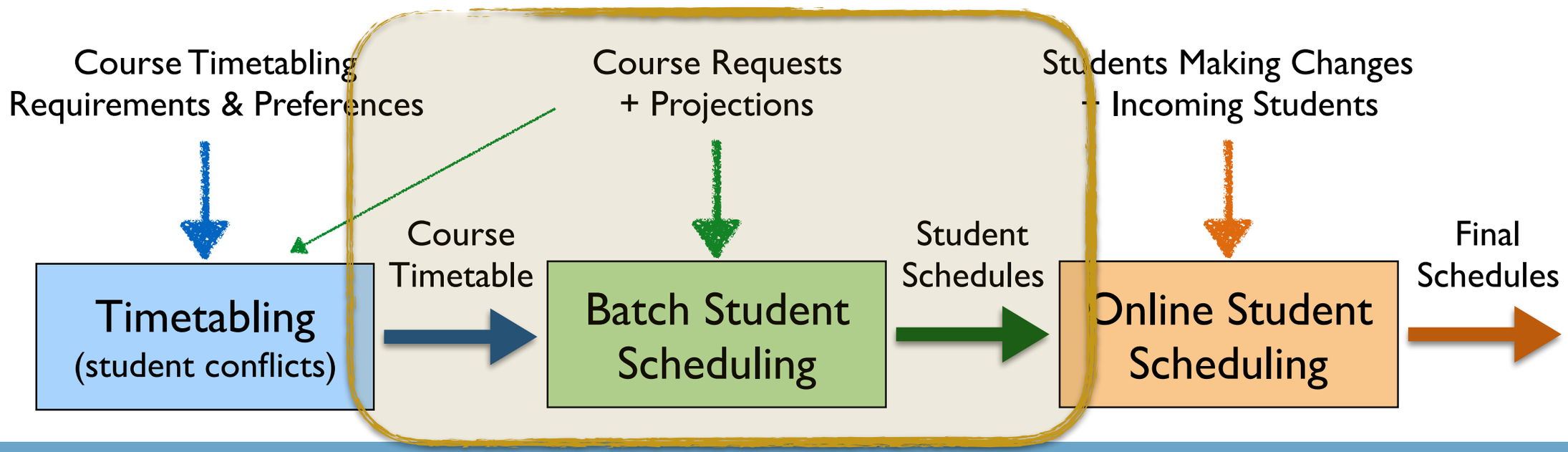
- Minimizing student conflicts together with faculty preferences
  - Last-like student course enrollments
  - Curricula *(e.g., list of courses for each program and year)*
  - Courses Requests (pre-registration)
  - A combination of these



Student Scheduling Process

Step 2: Batch Student Scheduling

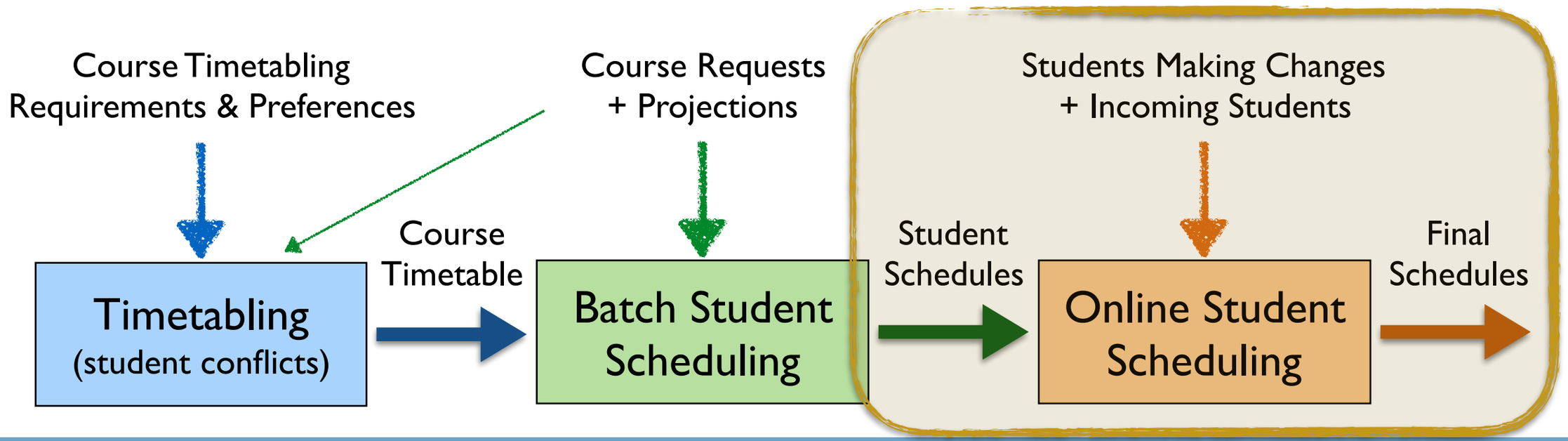
- After a timetable is produced
- Using pre-registrations and student course demand projections
- To provide students with initial schedules
- An optimization process, using the (student scheduling) solver
- It is possible to iterate
  - With the ability to keep already enrolled students unchanged or to minimize changes



Student Scheduling Process

Step 3: Online Student Scheduling

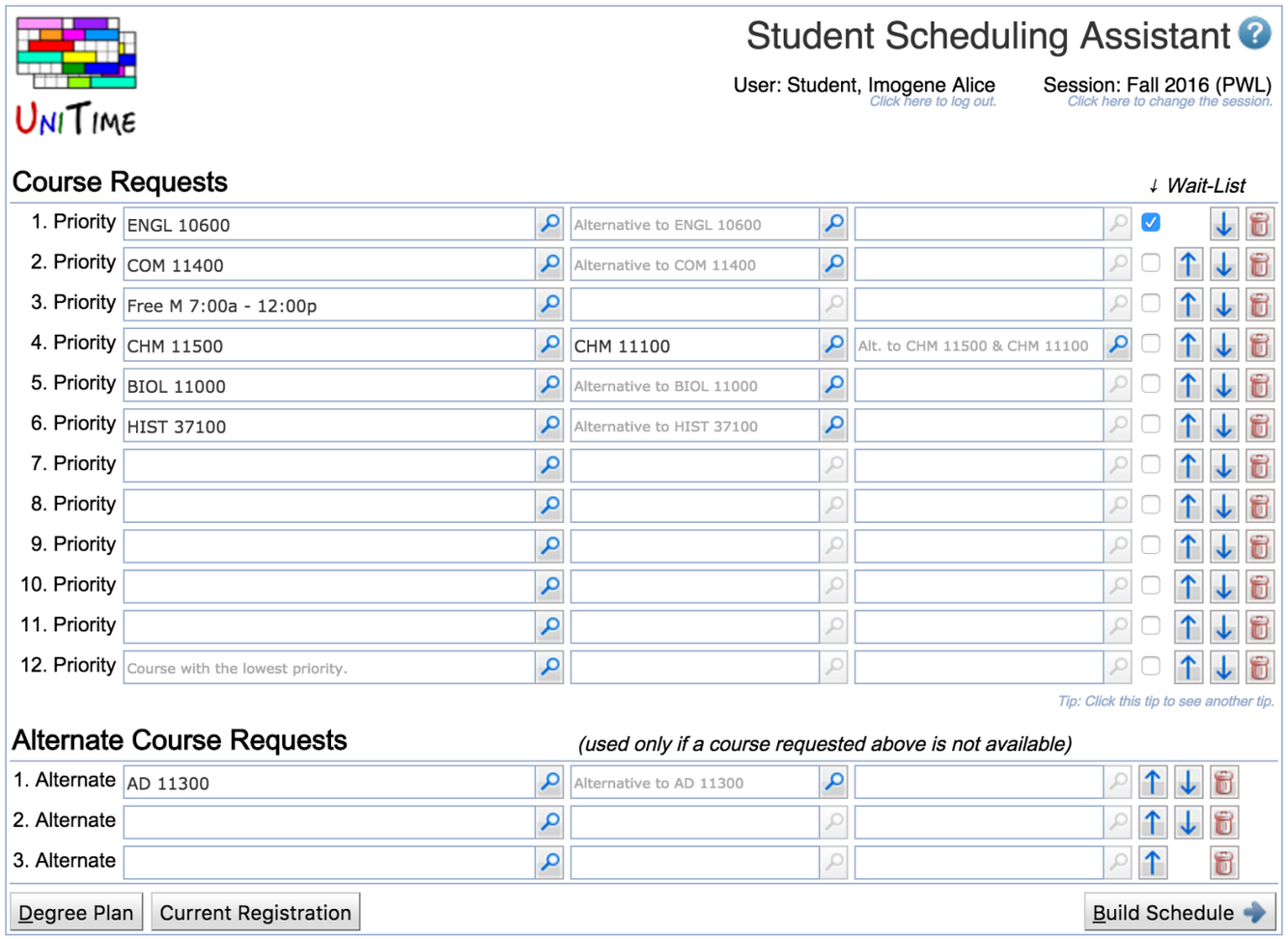
- Students without pre-registration can enroll online
  (incoming freshmen and students that did not register)
- All students can make adjustments to their schedules
- Automatically reserve space in sections based on projections
- Solver provides suggestions
  - Ordered by their quality, with the ability to filter through



Course Requests

Course Requests

- Each requested course can have up to two alternatives (or it can be wait-listed)
- There can also be additional alternate course requests to get the desired number of courses
- There can be free time requests in the list



Course Requests

UniTime

Student Scheduling Assistant

User: Student, Imogene Alice
Click here to log out.

Session: Fall 2016 (PWL)
Click here to change the session.

Course Requests

↓ *Wait-List*

1. Priority	ENGL 10600	Alternative to ENGL 10600		☑	
2. Priority	COM 11400	Alternative to COM 11400		☐	
3. Priority	Free M 7:00a - 12:00p			☐	
4. Priority	CHM 11500	CHM 11100	Alt. to CHM 11500 & CHM 11100	☐	
5. Priority	BIOL 11000	Alternative to BIOL 11000		☐	
6. Priority	HIST 37100	Alternative to HIST 37100		☐	
7. Priority				☐	
8. Priority				☐	
9. Priority				☐	
10. Priority				☐	
11. Priority				☐	
12. Priority	Course with the lowest priority.			☐	

Tip: Click this tip to see another tip.

Alternate Course Requests

(used only if a course requested above is not available)

1. Alternate	AD 11300	Alternative to AD 11300	
2. Alternate			
3. Alternate			

Degree Plan | Current Registration | Build Schedule

Course Structure

Classes are organized in a course structure

- Intuitive data entry and display of classes and their requirements
- Helps to define a way how students can enroll into the course
- Additional relations can be derived from the structure
- Used to build a class timetable

	Limit	Date Pattern	Minutes per Week	Time Pattern	Time	Room	----Preferences---- Distribution	Instructor
MA 170	50	Statistics I						
STAT 170		Introductory Statistics						
Configuration 1	40							
Lecture	40	Full Term	50	1 x 50		Classroom		
Laboratory	40	Full Term	150	3 x 50		EDUC CompPr	Same Room	
Recitation	40	Full Term	100	1 x 100		THTR		
Lec 1	20	Full Term	50	1 x 50		ThtrSeat Classroom		Newman, George
Lab 1	10	Full Term	150	3 x 50		EDUC CompPr	Same Room	Smith, John William
Lab 2	10	Full Term	150	3 x 50		EDUC CompPr	Same Room	Smith, John William
Lec 2	20	Full Term	50	1 x 50		ThtrSeat Classroom		Newman, George
Lab 3	10	Full Term	150	3 x 50		EDUC Comp CompPr	Same Room	Doe, Joe
Lab 4	10	Full Term	150	3 x 50		EDUC Comp CompPr	Same Room	Doe, Joe
Rec 1	40	Every Other Week	100	1 x 100		THTR ThtrSeat		Newman, George
Configuration 2 (DO)	10							
Distance Learning	10	Full Term	250					
Dist 1	10	Full Term	250	Arr 5 Hrs		*N/A*		Newman, George

Student Enrollment

Student enrollment into the course

- One class of each instructional type (subpart) of a configuration
- Follow the nesting relations, if defined
- No time and limit conflicts, respecting reservations

	Limit	Date Pattern	Time Pattern	Instructor	Time	Room
MA 170	50	Statistics I				
STAT 170		Introductory Statistics				
Configuration 1	40					
Lecture	40	Full Term	1 x 50			
Laboratory	40	Full Term	3 x 50			
Recitation	40	Full Term	1 x 100			
Lec 1	20	Full Term	1 x 50	Newman, George	T 12:30p-1:20p	EDUC 103
Lab 1	10	Full Term	3 x 50	Smith, John William	MWF 2:30p-3:20p	EDUC 102
Lab 2	10	Full Term	3 x 50	Smith, John William	MWF 11:30a-12:20p	EDUC 102
Lec 2	20	Full Term	1 x 50	Newman, George	T 1:30p-2:20p	EDUC 101
Lab 3	10	Full Term	3 x 50	Doe, Joe	MWF 3:30p-4:20p	EDUC 102
Lab 4	10	Full Term	3 x 50	Doe, Joe	MWF 1:30p-2:20p	EDUC 102
Rec 1	40	Odd Wks	1 x 100	Newman, George	Th 9:30a-11:20a	THTR 101
Configuration 2 (DO)	10					
Distance Learning	10	Full Term				
Dist 1	10	Full Term	Arr 5 Hrs	Newman, George		

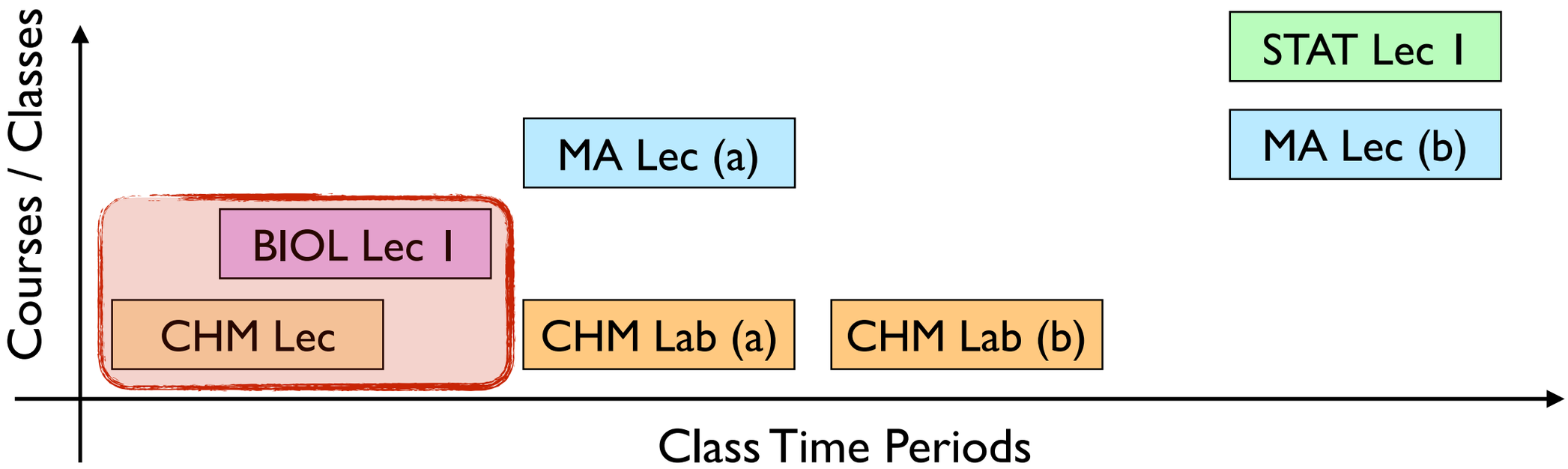
- Lec 1, Lab 1, Rec 1
- Lec 1, Lab 2, Rec 1
- Lec 2, Lab 3, Rec 1
- Lec 2, Lab 4, Rec 1
- Dist 1

\+ Reservations
\+ Other Constraints

Student Constraints

Time Conflicts

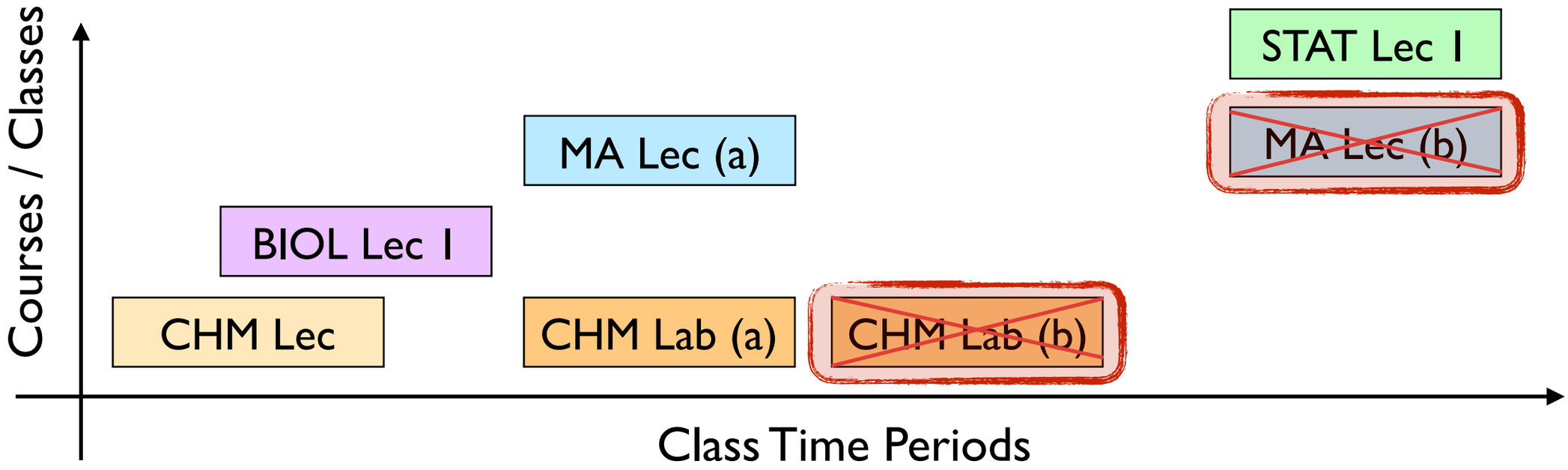
- Student time conflicts are in general not allowed
- There are, however, a few exceptions
  1. Some parts of a course may allow for time overlaps
  2. Certain class combinations may ignore student conflicts
  3. A student may be given an individual reservation
- If allowed, the solver tries to minimize the overlapping time in this case
- Online: If a class moves in time, conflicting students are rescheduled



Student Constraints

Limits

- There are class limits, configuration limits, and reservation limits
- A class may be disabled for student scheduling *(acts as zero limit)*
- If a limit is decreased, the existing students are left in the class
- Online: If a class is cancelled, enrolled students may be automatically rescheduled



Reservations

Reservations

- Reservations can be used to restrict certain parts of an offering to a certain group of students
- Type: Individual, Student Group, Curriculum, Course
- A reservation has a limit (can be unlimited) and may have a deadline

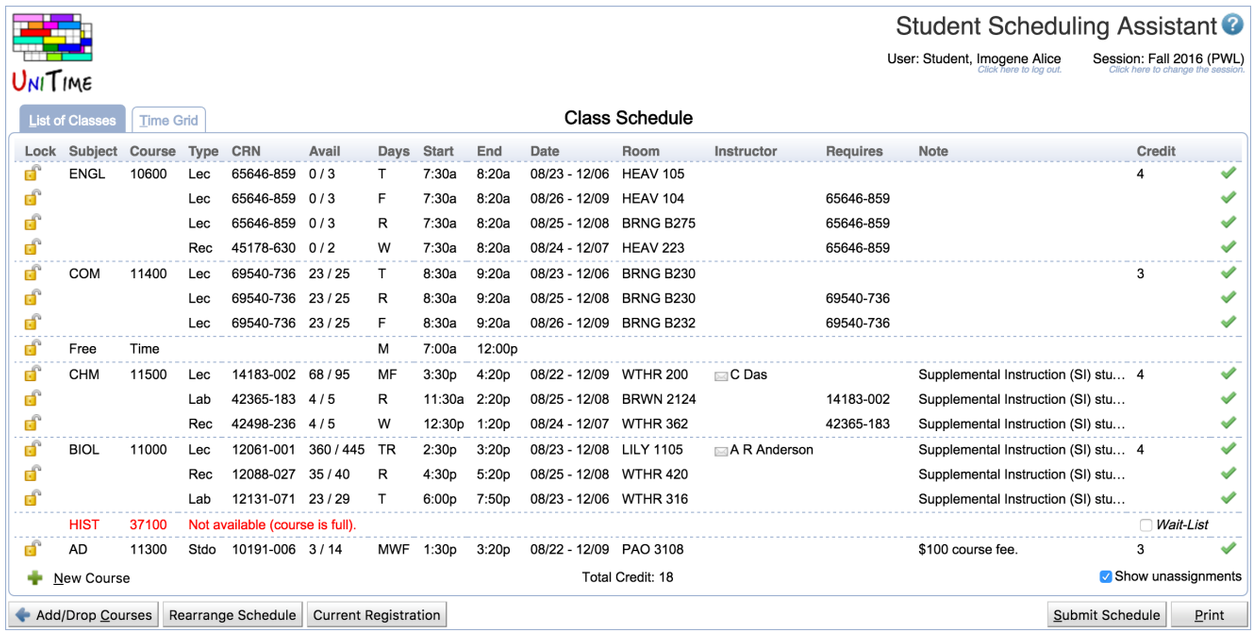
Additional Properties

- Reservation priority: individual before student group, etc; if same type more restrictive first
- Some reservations must be used (individual, student group), even when there is some unreserved space in the course
- Individual reservations allow for signing up over the limit and for a time conflict (with other course)
- A course may require reservations (even if there would be unreserved space available otherwise)

Student Schedule

Student Schedule

- As complete as possible
  (alternatives are used when a course is not available)
- Priorities are used to resolve conflicts
- The amount of overlapping time is minimized (where allowed)
- Distance conflicts are minimized (consequent classes too far)



Student Schedule

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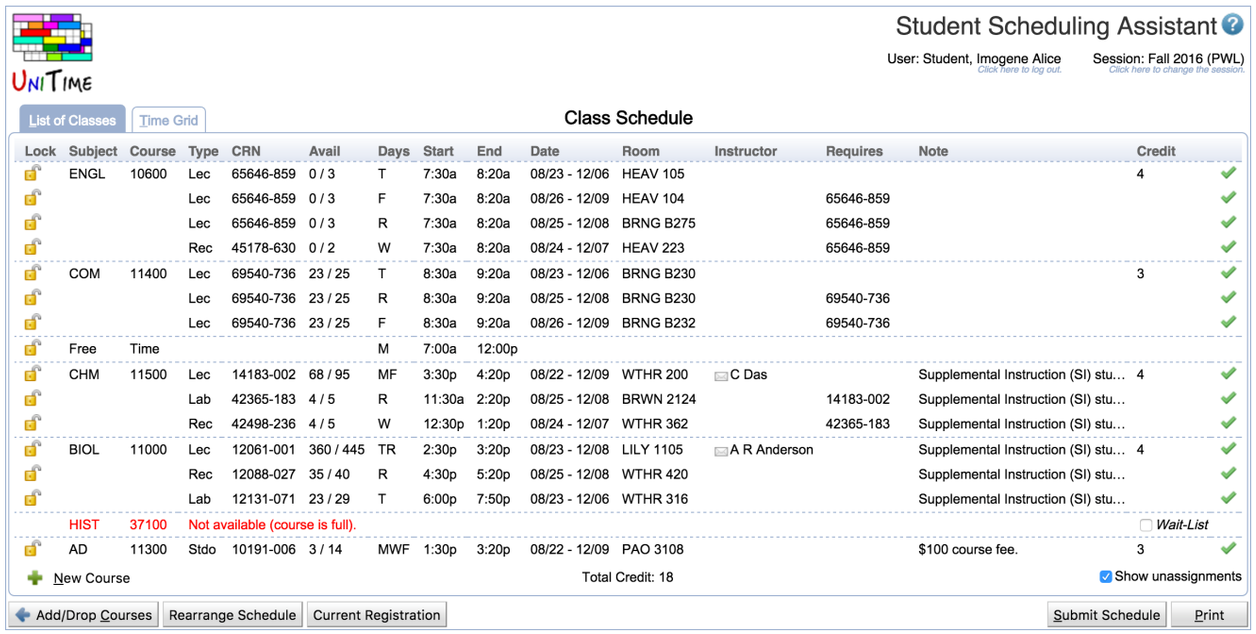
- Priorities are used to resolve conflicts
- The amount of overlapping time is minimized (where allowed)
- Distance conflicts are minimized (consequent classes too far)

Additional Criteria

- Avoid over-expected classes
- Keep previous schedule
- Section balancing
- Avoid arrange hour classes
- Keep students of the same group together (batch)



Online: Expectations

Expectations

- During batch sectioning, we can use projected demands to
  1. Fill in the remaining space (requested vs. projected)
  2. Keep students off the class combinations that will be needed later
  3. Use this information to track the expectations for each class during online scheduling
- Expectations are like reservations, except fully automatic
- Typical Example: 1st year students are not around for the batch run

During Online Student Scheduling

- Students are diverted from classes that are over-expected (expected + enrolled ≥ limit)
- Expectations are kept up to date as the new students are coming in

Online: Automated Wait-Listing

Wait-Lists

- Wait-lists are defined on the offering level (for the whole course)
- Getting on the list:
  - When entering course demands: student can choose between providing an alternative or getting on a wait-list
  - If a student is dropped from a course due to a course change
- Deadlines also apply to wait-lists

Wait-List Processing

- Order based on time stamp, reservation priority, the reason for getting on the list, etc.
- Wait-Lists are automatically processed:
  1. When there is a new space in the course (e.g., a class opens up)
  2. When there is a course change
- UniTime is not allowed to change other courses of a student

Online: Course Locking

Course Management During Online Scheduling

- An offering must be locked before an operator can make a change
- When an offering is locked, no enrollment changes are allowed
  (students can drop the course, but any other change will put them on a wait-list)
- Once the course is updated, it can be unlocked
  1. All existing enrollments of the offering are validated
  2. Students with a change that does not break any constraint are notified
  3. Students with a conflict are removed and put on the top of the wait-list
  4. Wait-list is processed and the affected students are notified
     (it tries to minimize changes for students from the previous step)
- The Class Assignment page (that is used to move a class) shows how many students will have a conflict with a new time placement

Other Features

Enrollment Deadlines (Online)

- Online student scheduling allows for add, drop, and change deadlines
- Defined in the number of weeks after the class starts
- Defaults are set on the academic session (for the whole term), but can be overridden on a particular course

Distribution Constraints

- Linked Sections: Certain classes (of different courses) may be linked together
  - If a student is taking both courses, taking one class in a link means that he must take the other class of the link
- Ignore Student Conflicts: Certain classes (of different courses) may allow to ignore student time conflicts
  - Useful, e.g., when two courses share a lecture
  - The overlapping time is minimized in this case (if possible)

Other Features

Email Notifications

- Students are automatically notified when they have a change in their schedule

Consents

- Some courses may need a consent (of a department or an instructor)
- UniTime lets the student in, consent is either given or the enrollment is rejected

Monitoring

- Scheduling Dashboard page shows how the courses are filling up as well as how the students are progressing
- There is also extensive logging that can be used for tracking issues and showing enrollment history of a student
- There are also various reports that can be very handy
  (showing student time and availability conflicts, class balancing, etc.)

Other Features

More Features

- Departmental, Instructor, and Advisor roles
  (to give consent and to make changes on behalf of a student)
- Student Status
- Mass Cancel
- Ability to Customize
  - Student eligibility check and enrollment (Ellucian Banner XE)
  - Retrieve degree plan (Ellucian DegreeWorks)
  - Email template, retrieve course details, etc.
- Ability to run batch solver for subsets of students
- …

Purdue University

Current State

- Batch student scheduling is only used for a few groups of students (Management, Learning Communities, etc.)
- Students are using the Scheduling Assistant to get a schedule
- At the moment they can choose whether to use Banner or UniTime
  - No automated waitlisting and no expectations
  - Students have time windows and limits are manually updated instead
- We are using the Banner XE Student API to synchronize the changes
  - Banner does all the necessary eligibility checking
- We have added recently an integration with degree planning tool (DegreeWorks)

Vision

- Build the course timetable based on the individual student degree plans
- Use the batch solver to provide all students with an initial schedule
- Still debating how to deal with incoming freshmen

New in UniTime 4.2

Already Implemented

- Responsive design
- Ability to provide more than two alternative courses
- Preferences on instructional methods and/or individual sections
- Keep students of a group together (batch)

Work in Progress

- Avoid times when a student is teaching (for Teaching Assistants)
- …

Short Demo

Of the Student Scheduling Assistant…

Conclusion

Student Scheduling in UniTime

- Maximize ability for the students to get the courses they need
- Offers a lot of functionality
- Can be used in many different ways (batch, online, or a combination)

For more details

- Visit www.unitime.org
- Email us at support@unitime.org

An online demo is available at https://demo.unitime.org