UniTime 4.2: Instructor Scheduling

Tomáš Müller

June 2017
Agenda

• Short introduction of UniTime
• State of the project
• New features of UniTime 4.2
  • Instructor scheduling
  • Other features
• Next release (UniTime 4.3) & long term

This presentation is available at www.unitime.org/present/apereo17-instructors.pdf
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
Releases / Achievements

- UniTime 4.2 to be released in June 2017
  - Following a steady schedule of one release every 15 months
- UniTime 4.3 is being spected out
  - Planned release Q3 2018
- 76 institutions from 42 countries filled our voluntary registration form during the last 12 months
- 55 institutions indicated that they use UniTime in production
- Steady increase in interest and adoption from literally around the world
  - USA, Czech Republic, Pakistan, Croatia, Poland, Turkey, Peru, Kuwait, Canada, Malaysia, Spain, UAE, Palestine, Zambia, Kenya,…
    … but still very little outside contributions
- Both sides of the interface with Ellucian Banner are now available
New Release: UniTime 4.2

UniTime 4.2

- To be released in June 2017
- Brand new Instructor Scheduling component
- Mobile-friendly user interface
- Improved ability to keep students of a particular group together
- Point in time reports
- Many other improvements across the whole application

See https://goo.gl/4gIXQV (UniTime 4.2 Release Docs) for more details.
Instructor Scheduling

Instructors
- Attributes: skills, qualifications, seniority, certifications, etc.
- Maximal teaching load
- Availability and preferences (on time and courses)
- Other: hiring cost, back-to-back / same day / same room preferences, …

Courses
- Teaching requests (classes that need an instructor)
- Teaching load
- Number of instructors needed
- Requirements and preferences (instructor and attributes)
- Other: same course, same lecture preferences

Goal: assign instructors to classes in a way that maximizes satisfaction while all the constraints are met
Problem Description

• Assignment of instructors to classes
  • Automatic (using the solver)
  • Interactive (with conflict checking and suggestions)
• Respecting various constraints
  • Instructor availability, teaching load, required skill, no overlaps, etc.
• Optimization problem
  • Preferences on time, attributes, courses, instructors, etc.
  • Maximize original assignment (in MPP mode)
  • Minimize unused instructor load, etc.
• Instructors are assigned after the timetabling and student scheduling is done
  • Making use of student availability (for teaching assistants)
• Much like examination timetabling or (batch) student scheduling
  • Instructor assignments are committed (made visible, etc.) when done

See https://goo.gl/Zb2aES for the Instructor Scheduling manual.
Teaching Assistants for Chemistry

• Each course has
  • One or more lectures (*already assigned to a professor*)
  • Many labs and practices (*forming pairs and related to a particular lecture*)
• Each teaching assistant should teach one or two pairs of a lab and a practice
  • Full time TAs get two assignments, half-time TAs get just one
  • A TA can only teach one course (*both pairs must be of the same course*)
  • Preferably of the same lecture (*same professor*)
  • Must be available for the classes and the lecture
    (*he/she cannot be enrolled in an overlapping class as a student*)
• Each course may have a different set of skills and qualifications needed
  • Some (higher level courses) may require particular TAs
• Each course also needs one or two teaching assistant supervisors
  • These get assigned as course coordinators (do not show up for classes)
  • TA supervisors should be available for most of the lectures
### Instructor Scheduling Example

#### Timetable

<table>
<thead>
<tr>
<th>CHM 11100</th>
<th>Limit</th>
<th>Time Pattern</th>
<th>Time</th>
<th>Room</th>
<th>Room Cap</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>240</td>
<td>2 x 50</td>
<td>TTh 10:30a-11:20a</td>
<td>WTHR 200</td>
<td>480</td>
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<tr>
<td>Practice Study Observation</td>
<td>240</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Laboratory</td>
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<td>1 x 150</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lec 1</td>
<td>120</td>
<td>2 x 50</td>
<td>TTh 10:30a-11:20a</td>
<td>WTHR 200</td>
<td>480</td>
</tr>
<tr>
<td>Pso 1</td>
<td>24</td>
<td>1 x 50</td>
<td>T 8:30a-9:20a</td>
<td>BRWN 3100</td>
<td>30</td>
</tr>
<tr>
<td>Lab 1</td>
<td>24</td>
<td>1 x 150</td>
<td>W 11:30a-2:20p</td>
<td>BRWN 1164</td>
<td>24</td>
</tr>
<tr>
<td>Pso 2</td>
<td>24</td>
<td>1 x 50</td>
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<td>24</td>
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<tr>
<td>Pso 3</td>
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<td>M 1:30p-2:20p</td>
<td>BRWN 3104</td>
<td>30</td>
</tr>
<tr>
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<td>24</td>
<td>1 x 150</td>
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<td>24</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<td>24</td>
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<td>1 x 150</td>
<td>W 2:50p-3:40p</td>
<td>BRWN 1124</td>
<td>24</td>
</tr>
</tbody>
</table>

- 2 Lectures
- 10 Pso-Lab pairs
- 5 full time TAs
- ITA supervisor
## 1. Teaching Request

### Teaching Load:

### Scheduling Subpart:

<table>
<thead>
<tr>
<th>Class</th>
<th>External Id</th>
<th>Enrollment</th>
<th>Limit</th>
<th>Time</th>
<th>Data</th>
<th>Room</th>
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<td>CHM 11100 Lab 6</td>
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<td>24</td>
<td>W 2:50p - 5:40p</td>
<td>Full Term</td>
<td>BRWN 1135</td>
</tr>
</tbody>
</table>

### Include Subparts

- CHM 11100 Lec (1 parent class)
- CHM 11100 Pso (1 parent class)
- CHM 11100 Lab

### Same Course Preference:

- Required

### Same Common Part:

- Preferred

### Qualification Preferences:

- CHM 11100

### Role Preferences:

- TA

### Skill Preferences

- Select...

### Instructor Preferences

- Select...
Common: two assignment can share *(typically the lecture)*
TA Supervisor gets assigned as course coordinator
Instructor Scheduling Solver

• Just like any other solver in UniTime
• Using the same constraint-based solver framework and algorithms, just a different constraint model
• Fully automated or interactive

• Variable: teaching request (one or more classes that need an instructor)
• Value: teaching assignment (assignment of an instructor to a teaching request)
More Features…

- Teaching conflicts reporting
- Data exchange and roll forward
- Teaching assignments in Scheduling Assistant

You have made some changes in your schedule. Please click the Submit Schedule button to update your registration.
Other Features in UniTime 4.2

Mobile-friendly user interface

- All GWT-based pages are made responsive (*this cover all pages accessible by students and instructors*)
- Same look and content
- Only a few new components (*like the menu or notifications*)
- Some improvements to older (Struts-based) pages too
Other Features in UniTime 4.2

Student Group Scheduling

- Students of a group or a curriculum are kept together
- Additional criterion measuring probability of two students (of a group) attending the same class
- More powerful student sectioning algorithm (in course timetabling)
- Student preferences for instructional methods and individual sections

Point In Time Reports

- Snapshot of current state of students and their registration, class limits, etc.
- Using the Data Exchange page
- Multiple snapshots can be imported
- Full set of reports (weekly class hours, room utilizations, etc.)
- Roll forward

See https://goo.gl/4gIXQV (UniTime 4.2 Release Docs) for more details.
UniTime 4.3

- Planned release: Q3 2018

- Student Scheduling
  - Interfaces, student schedule quality / fairness, …

- Event Management
  - Event approval workflow, …

- Continue the effort of making the user interface look & feel more modern, mobile friendly, and better localizable
Conclusion

Long Term

- Constraint Solver: instructor and student scheduling, team building
- UI: moving from Struts to GWT, localization, documentation, mobile
- Interfaces: IMS Course Planning & Scheduling, more APIs and XMLs

For more details, please see us at the conference

- UniTime: Best Practices (Sunday, 1:30pm - 4:30pm in Flower)
- Case Study: UniTime at Masaryk University (Monday, Showcase Reception)
- UniTime 4.2: Instructor Scheduling (Tuesday, 10:15am - 11:00am in Flower)
- Course Timetabling Around the World (Tuesday, 2:30pm - 3:15pm in Flower)

- Or visit www.unitime.org

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