



# UniTime 3.1 University Timetabling Application

## Examination Timetabling Capabilities

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- Build on modern technologies
  - Enterprise Java Application
  - Relational database (Oracle, MySQL, ...)
- Publically available
  - Open source (GNU GPL license)
  - Web: [www.unitime.org](http://www.unitime.org)
    - 1200+ downloads, online documentation, support
- State of the art
  - Modern constraint based solver with wide scope of applicability
  - Well accepted by the research community
    - Published papers, citations, etc.
    - International Timetabling Competition 2007



## UniTime 3.1: Design Goals

- Examinations are fully integrated with course timetabling
  - Exams are visible (and can be defined) on courses and classes
    - By schedule deputies (which may have limited rights)
    - By examination timetabling managers
  - Student class enrollments are considered
  - Class assignments may be considered
    - Final exams for evening classes, room assignment of a class, etc.
  
- Consistent look and feel
  - Preferences
    - Same room preferences (different set of rooms)
    - Period versus time preferences
  - Etc.



## UniTime 3.1: Examination Model

- Examination Periods
  - Not overlapping, of various length and preferences
- Examination Rooms
  - Coordinates, seating capacity, examination seating capacity
  - Problem (final / evening examination)
  - Period preferences
- Examination
  - Problem (final / evening examination), Length, Instructor(s)
  - Relation with courses
    - A set of classes, configuration, offerings, or courses
  - Period and room preferences
- Distribution Preferences
  - Same/different period, room, precedence



## UniTime 3.1: Period Preferences

- Consistent range of preferences
  - Prohibited, strongly discouraged, ... required
- Can be set on various levels
  - Preferences set directly on a period
    - Prohibited period cannot be used,
    - otherwise acts as a default for period preferences that are set on an exam
  - Period preferences on rooms
    - Prohibited: cannot be used
    - Strongly discouraged: cannot be used, unless specified on an exam
    - Discouraged: usage of a room should be minimized
  - Period preferences on an exam

# UniTime 3.1: Period Preferences

- Final examination period preferences

	from: 8:00a	10:20a	1:00p	3:20p	7:00p
	to: 10:00a	12:20p	3:00p	5:20p	9:00p
Mon 04/28	Preferred	Preferred	Preferred	Preferred	Preferred
Tue 04/29	Neutral	Neutral	Neutral	Neutral	Neutral
Wed 04/30	Neutral	Neutral	Neutral	Neutral	Neutral
Thu 05/01	Neutral	Neutral	Neutral	Neutral	Neutral
Fri 05/02	Neutral	Neutral	Neutral	Neutral	Neutral
Sat 05/03	Neutral	Neutral	Neutral	Neutral	Neutral

- Required
- Strongly Preferred
- Preferred
- Neutral
- Discouraged
- Strongly Discouraged
- Prohibited

- Evening examination period preferences

- If the same two periods are defined for each day

- Both Periods
- Late Period (8:30PM - 10:30PM)
- Early Period (7:00PM - 8:00PM)
- Not Available
- No Period

January 2008

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1			1	2	3	4	5
2	6	7	8	9	10	11	12
3	13	14	15	16	17	18	19
4	20	21	22	23	24	25	26
5	27	28	29	30	31		

February 2008

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
5						1	2
6	3	4	5	6	7	8	9
7	10	11	12	13	14	15	16
8	17	18	19	20	21	22	23
9	24	25	26	27	28	29	

March 2008

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
9							1
10	2	3	4	5	6	7	8
11	9	10	11	12	13	14	15
12	16	17	18	19	20	21	22
13	23	24	25	26	27	28	29
14	30	31					

April 2008

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
14			1	2	3	4	5
15	6	7	8	9	10	11	12
16	13	14	15	16	17	18	19
17	20	21	22	23	24	25	26
18	27	28	29	30			



## UniTime 3.1: Examination solver

- Goal
  - Same solver (as for course timetabling)
  - Different model (same for both evening and final exams though)
  - Similar/consistent user interface
- Different modes
  - Batch (Initial problem, Minimal perturbation problem)
  - Interactive (Suggestions are provided to the user)
  - Instant (An exam can be rescheduled without loading into the solver)
- Only one solution exists in the database
  - Solver still works with current, initial and best solutions
- Visible solution (reports, exams, etc.)
  - Current solution of the solver (if loaded)
  - Saved solution



## UniTime 3.1: Reporting Capabilities

- Similar as on course timetabling
  - Assigned, not assigned exams
  - Examination timetable (grid)
    - For a room, an instructor, or a subject area
    - In row, per week, per day
    - Various backgrounds and orderings
- Additional reports
  - Directly accessible from the application
    - Current (loaded) solution, saved solution
  - PDF and CSV export
  - Filtering (by a subject area, and/or expression)
- Other reports
  - PDF (legacy-like) reports



# UniTime 3.1: Preliminary Results

- Fall 2007 Final Examinations

Solution property	Fall 07 Schedule	UniTime 3.1	UniTime 3.1 (no rotation)
Direct student conflicts	156	79	68
More than 2 exams a day	1,129	557	593
Back-to-Back conflicts	6,119	6,695	6,149
Room splits	79	21	18
Period penalty	591	654	656
Room size penalty	84,620	47,827	53,142
Rotation penalty	37,423	39,116	322,720
Not-original room penalty	473	506	506

Rotation penalty:  $P_{index} \cdot P_{avg}$



## UniTime 3.1: Additional features

- Non-standard examinations
  - Using event management capabilities
- Interfaces with Banner, Astra
  - Course structure including course timetable
  - Student class enrollments
  - Room availabilities
- Roll forward
- Individual student/instructor examination schedules
  - Either PDF, or a web interface