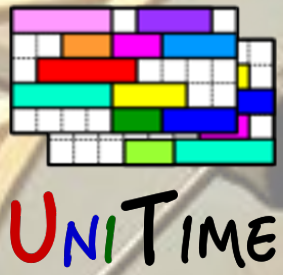


UniTime

Student Scheduling at Purdue University

Tomáš Müller

PATAT 2024



Student Scheduling

What is Student Scheduling?

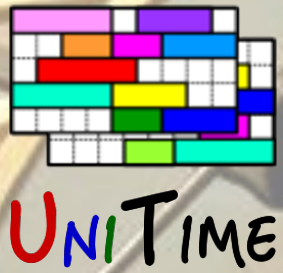
- Enrollment of students into classes
- Based on their course requirements

Why needed?

- To ensure that students will be able to get the courses they need
- Avoid students who come early from blocking later students
- 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



Student Scheduling @Purdue

Purdue University

- Large public university in West Lafayette, Indiana founded in 1869
- 13 schools and colleges, 400 programs, 5k courses, 9k organised classes, 52k students (39k undergrads)
- Pre-registration/batch student scheduling
 - The first algorithm published in 2010
 - Started in Fall 2018 for new students only (8.6k students)
 - Lots of improvements since then
 - Now all undergrads for Spring 2024
 - ~ 35k students
 - And two batches for Fall 2024
 - Continuing students in April (27.5k)
 - New students in July (11.3k)





Spring 2024 @Purdue

Spring 2024 Timeline

- Advising and pre-registration starts in September (9/5)
- Schedule of classes is published early October (10/9)
- Pre-registration ends mid-November (11/16)
- Student schedules are available late November (11/30)
- Open registration and waitlisting starts in December (12/4)
- Classes start in January (1/8)



A few numbers

- 34,998 students pre-registered
- 180,476 course requests (5.16 per std)
 - 56,356 marked as vital (31.2%)
- 4 priority groups
- 3k courses with 8.5k organized sections





Student Scheduling Process

Option 1: Batch (one time)

- All students are scheduled at one time after the timetable is produced based on student pre-registrations
- An optimization process, using the (student scheduling) solver

Option 2: Online (real-time)

- Students without pre-registrations (e.g., incoming freshmen) can enroll online
- All students can make adjustments to their schedules
- Reservations, automated waitlists, override requests, etc.

Option 3: Both

- Any combination of various batches and online scheduling

Student Scheduling Assistant ?
User: Student, Imogene Eugenia (A) Session: Fall 2019 (PWL)
[Click here to log out.](#) [Click here to change the session.](#)

Buttons: Add/Drop Courses, Rearrange Schedule, Current Registration, Submit Schedule, Print

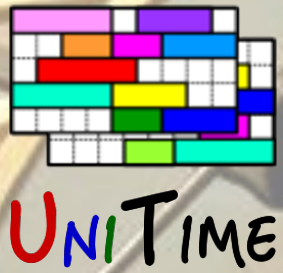
Class Schedule

Lock	Subject	Course	Type	Class	Avail	Days	Start	End	Date	Room	Instructor	Requires	Note	Credit
	ENGR	13100	Stdo	14811-005	116 / 116	T	3:30p	5:20p	08/20 - 12/03	ARMS B061				2
			Stdo	14811-005	116 / 116	R	3:30p	5:20p	08/22 - 12/05	ARMS B098		14811-005		
	MA	16500	Lec	23122-100	468 / 468	MWF	12:30p	1:20p	08/19 - 12/06	CL50 224	K Matsuki		Evening Exams Required. Prere...	4
			Rec	42955-111	39 / 39	R	12:30p	1:20p	08/22 - 12/05	EE 236		23122-100	Evening Exams Required. Prere...	
	CHM	11500	Lec	51542-001	44 / 50	MF	11:30a	12:20p	08/19 - 12/06	WTHR 200	G Schmidt		Supplemental Instruction (SI) st...	4
			Lab	51531-396	3 / 3	T	11:30a	2:20p	08/20 - 12/03	BRWN 1175			Supplemental Instruction (SI) st...	
			Rec	15631-492	3 / 3	M	4:30p	5:20p	08/19 - 12/02	BRWN 3102		51531-396	Supplemental Instruction (SI) st...	
	ENGL	10600	Lec	59218-831	1 / 3	MR	2:30p	3:20p	08/19 - 12/05	REC 108			Traditional	4
			Lec	59218-831	1 / 3	W	2:30p	3:20p	08/21 - 12/04	BRNG B274		59218-831	Traditional	
			Rec	59219-832	1 / 1	F	2:30p	3:20p	08/23 - 12/06	HEAV 223		59218-831	Traditional	
	PSY	12000	Rec (Hybrid)	10045-029	15 / 15	W	3:30p	4:20p	08/21 - 12/04	BCHM 105			Evening Exams Required on all ...	3
			Dist (Hybrid)	10062-038	168 / 225	Arrange Hours			08/19 - 12/07				Students registering for this sect...	
	Free	Time				MWF	7:30a	8:30a					Evening Exams Required on all ...	
													Students registering for this sect...	
	New Course													

Total Credit: 17 ☒ Show unassignments

Buttons: Add/Drop Courses, Rearrange Schedule, Current Registration, Submit Schedule, Print

You are not registered for any classes yet. Please click the Submit Schedule button in order to complete your registration.



Student Scheduling Process

Student Scheduling Process

1. Student meets with the advisor
 - Fill in Advisor Recommendations (using degree plan, etc.)
 - Alternative and substitute courses, section pre-assignments
 - Placeholders (e.g., foreign language 3 credits) & additional notes
2. Student fills in pre-registration
 - Pre-populated with advisor recommendations, but can make additional changes
 - Request approvals (e.g., pre-requisite overrides, departmental permissions)
 - May include free time requests and preferences
3. Schedule is built for all pre-registered students
 - Nightly test runs to detect conflicts & demand issues early
 - Vital courses have higher priority
4. Students review their schedule, make changes, additional approvals
 - Students that do not pre-register, skip steps 2 and 3
 - Can still make use of advisor recommendations (pre-populated courses)



Batch Student Scheduling

Student Scheduling Solver


- Using student course requests of all participants
- Provide students with initial schedules
- An optimization process, using the (student scheduling) solver
 - **Constraints:** course structure, time conflicts, class/course limits, reservations, ...
 - **Optimization:** request priority, overlapping time (where allowed), distance conflicts, student preferences, schedule quality, accommodations, ...
- Hybrid approach
 - Combining neighbourhood search and limited-depth search
 - Various phases, based on student and course priorities
- Test runs, reporting
- Interface with Ellucian Banner (validation, overrides, enrollment)



Online Student Scheduling

Student Scheduling Assistant

- Students can make changes to their schedule or register from scratch
 - Schedule is immediately computed based on the provided request
 - Suggestions (available changes) when a class is clicked
 - Waitlisting for courses/sections



Student Scheduling Assistant ?
User: Arnaud, Mirco Click here to log out. Session: Spring 2024 (PWL) Click here to change the session.

[Add/Drop Courses](#) [Rearrange Schedule](#) [Current Registration](#) [Submit Schedule](#) [Print](#)

[List of Classes](#) [Time Grid](#) **Class Schedule**

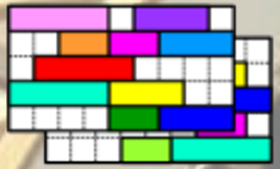
Lock	Subject	Course	Type	Class	Avail	Days	Start	End	Date	Room	Instructor	Requires	Note	Credit
	PHYS	66300	Lec	19229-001	18 / 20	TR	4:30p	5:45p	01/09 - 04/25	PHYS 331	N Lashkari			3
	PHYS	66100	Lec	25856-001	22 / 44	TR	1:30p	2:45p	01/09 - 04/25	PHYS 338	C H Greene			3
	PHYS	61700	Lec	25851-001	13 / 35	MW	12:00p	1:15p	01/08 - 04/24	PHYS 234	P Duffell			3
	PHYS	69600	Lec	16688-001	122 / 140	R	3:30p	4:20p	01/11 - 04/25	PHYS 112	G A Csathy, K P Ritchie			1
	ENGL	62000	Lec	33693-003	1 / 8	MW	9:30a	11:20a	01/17 - 04/24	KRAN G021	B A Lageveen	Consent of Department	For International grad TAs only, Admission b...	5
			Ind	25374-016	1 / 8	Arrange Hours			01/16 - 04/27	YONG 810	E S Perkins	33693-003	For International grad TAs only, Admission b...	
			Lec	58093-001	2 / 8	MW	9:30a	11:20a	01/17 - 04/24	KRAN G009	K R Swanson	Waiting for consent of department	For International grad TAs only, Admission b...	5
			Ind	25372-014	2 / 8	Arrange Hours			01/16 - 04/27	YONG 810	S Zeynalova	58093-001	For International grad TAs only, Admission b...	
	MA	59500TF	Lec	15954-005	30 / 40	MWF	3:30p	4:20p	01/08 - 04/26	SCHM 123	T J Sinclair			3
	MA	59500QGA	Lec	19741-006	26 / 40	MWF	1:30p	2:20p	01/08 - 04/26	SCHM 317	O Tsybaliuk			3
	COM	11400	Lec	11524-407	24 / 24	M	7:30a	8:20a	01/08 - 04/22	BRNG B230				3
			Lec	11524-407	24 / 24	W	7:30a	8:20a	01/10 - 04/24	BRNG B230		11524-407		
			Lec	11524-407	24 / 24	R	7:30a	8:20a	01/11 - 04/25	BRNG B238		11524-407		
New Course Total Credit: 24 <input checked="" type="checkbox"/> Show unassignments														

[Add/Drop Courses](#) [Rearrange Schedule](#) [Current Registration](#) [Submit Schedule](#) [Print](#)



Spring 2024 @Purdue

Spring 2024	All Students	Priority Students	CR100+ Students	CR60+ Students	Remaining Students
Number of Students	34,998	5,028	10,183	9,781	10,006
Complete Schedule	78.90 %	90.27 %	84.03 %	72.90 %	73.84 %
- missing one course	17.58 %	9.43 %	13.81 %	21.77 %	21.43 %
- missing two courses	3.27 %	0.60 %	2.06 %	4.82 %	4.34 %
Courses per Student	5.16	5.68	4.80	5.29	5.13
Assigned Courses	95.01 %	98.08 %	96.13 %	93.56 %	93.70 %
- 1st choice	94.01 %	95.34 %	94.64 %	93.88 %	92.76 %
- 2nd choice	4.81 %	4.00 %	4.62 %	4.80 %	5.47 %
- substitute	0.49 %	0.19 %	0.23 %	0.70 %	0.72 %
Vital courses	56,356	8,286	14,637	15,379	18,054
Assigned vital courses	99.65 %	99.79 %	99.47 %	99.54 %	99.82 %
Satisfied preferences	82.09 %	84.65 %	83.04 %	82.29 %	78.29 %
Distance conflicts	1,756	441	495	488	332
Free time conflict	280	52	43	90	95



UNITIME

Demo

Demonstration



Thank you!

More Materials

- Online Help help.unitime.org
 - Installation Instructions help.unitime.org/installation
 - Customizations help.unitime.org/customizations
 - Localization help.unitime.org/localization
 - Manuals help.unitime.org/manuals
- Research Publications www.unitime.org/publications.php
- Presentations www.unitime.org/presentations.php
- Webinars www.unitime.org/webinars.php
- GitHub github.com/UniTime
- Downloads & Nightly Builds builds.unitime.org

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