

Academic Schedule Planning to meet Student Needs

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Does your institution have any of the following symptoms?



Students have difficulty enrolling in required classes

Lengthening times to graduation

Few classes on Friday, early morning, or late afternoon

Poor utilization of instructional space

Diagnosis:

All of these symptoms may result from a neglected academic planning and scheduling process



Academic Planning and Scheduling Process

Corrective Actions

Demand for more spaces
Cancellations



	Misc Per Demand Week	Limit	Manager	Date Pattern	Time Pattern	Time	Preferences Room	Distribution	Instructor
ME 263	98	98							
ME 263H									
Lecture	150	96	LLR	Full Term	3 x 50	WTHR	Computer		
Recitation	100	96	ME	Full Term	2 x 50	ME 120 ME 236	Classroom		
Laboratory	50	84-120	LAB	Even Wks	1 x 50	Windows XP			
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08:00 AM							
09:00 AM							
09:30 AM	MGMT 354 DIS-0101	MGMT 350 DIS-0101	MGMT 354 DIS-0101	MGMT 350 DIS-0101	MGMT 354 DIS-0101		
10:00 AM	KRAN Q010 09:30 - 10:20	KRAN Q010 09:30 - 10:20	KRAN Q010 09:30 - 10:20	KRAN Q010 09:30 - 10:20	KRAN Q010 09:30 - 10:20		
10:30 AM	EAS 138 SC 239 10:30 - 11:20	EAS 138 SC 239 10:30 - 11:20	EAS 138 SC 239 10:30 - 11:20	EAS 138 SC 239 10:30 - 11:20	EAS 138 SC 239 10:30 - 11:20		
11:00 AM							
11:30 AM	MGMT 482 DIS-0201	IT 226 DIS-0201	MGMT 482 DIS-0201	IT 226L DIS-0201	BIND 134 DIS-0201		
12:00 PM	RAWL 1057 12:00 - 01:15	KANDY B027 12:00 - 01:15	RAWL 1057 12:00 - 01:15	RAWL 1057 12:00 - 01:15	RAWL 1057 12:00 - 01:15		
01:00 PM							
01:30 PM	OBHR 330 DIS-0301	BRWN 1154 01:30 - 02:45	OBHR 330 DIS-0301	OBHR 330 DIS-0301	BRWN 1154 01:30 - 02:45		
02:00 PM							
02:30 PM							
03:00 PM							
04:00 PM							
04:30 PM							
05:00 PM							
06:00 PM							
08:00 PM							



Student Demand

- Number of students
- Programs of study
- Elective interests
- Eligibility for courses

Instructional Planning

- What courses to offer
- Spaces per course/class
- Instructors
- Courses taken together
- Who may take the class
- Times offered
- Room needed by class

Student Scheduling

- Can student take class?
- Do desired classes conflict?
- Time preferences
- Best assignment to classes
 - for student preferences
 - for University resources

Delivery of Instruction

- Teaching classes
- Passing/not passing student

Management/Assessment

- Faculty teaching loads
- Adequate resources?



Feedback (aka Enrollment Planning)

Key Areas of Planning to be Discussed

1. Instructional Planning and the Class Timetable
 - a. Meeting Student Needs
 - b. Tools Available
2. Class Selection (student registration/scheduling)
 - a. Class Time Availability and Conflicts
 - b. Alternative Approaches
3. Reporting and Feedback
 - a. Understanding Demand and Utilization
 - b. Planning for Change

Instructional Planning and the Timetable

Instructional planning requires the assignment of times, rooms, instructors, and students to classes. There are two traditional approaches.

Master Scheduling:

- Develop class timetable
- Schedule students to classes in timetable

Demand-driven Scheduling:

- Collect student demand for courses and times
- Develop optimized timetable and student schedules

Timetabling Comparison

Master Schedule

Pros:

- Allows extended planning time
- Predictable year to year
- Establishing schedule early facilitates student/faculty planning other activities

Cons:

- Based on projections of need
- Limits flexibility

Demand-based Schedule

Pros:

- Up to the minute demand data
- Greatest ability to optimize use of resources
- Adaptability to current needs

Cons:

- Condensed planning time
- Late completion complicates planning other activities

Which Should You Use? Either, or a Mixture



What is most important:

- Know student demand for each course, and
- Which courses need to be taken together

A good timetable requires providing both sufficient space in classes to meet student demand and providing those spaces at non-conflicting times when courses need to be taken together.

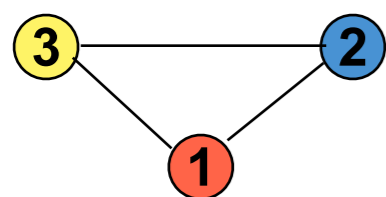
Model of Courses and Student Conflicts

Let: $\textcircled{1}$ = course 1
 \diagdown = students in common between courses

The **color** of a course node represents its period assignment

Then:

$\textcircled{3}$ $\textcircled{2}$
 $\textcircled{1}$ Courses with no students in common
 can meet in the same period

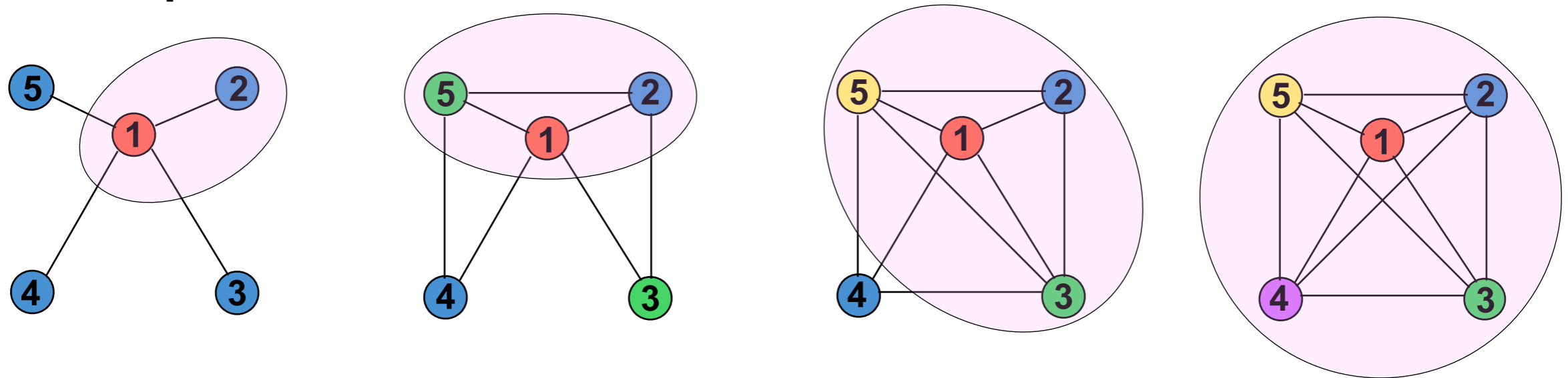


Courses sharing students between all meetings must meet in different periods

Time Conflicts and Schedule Hours

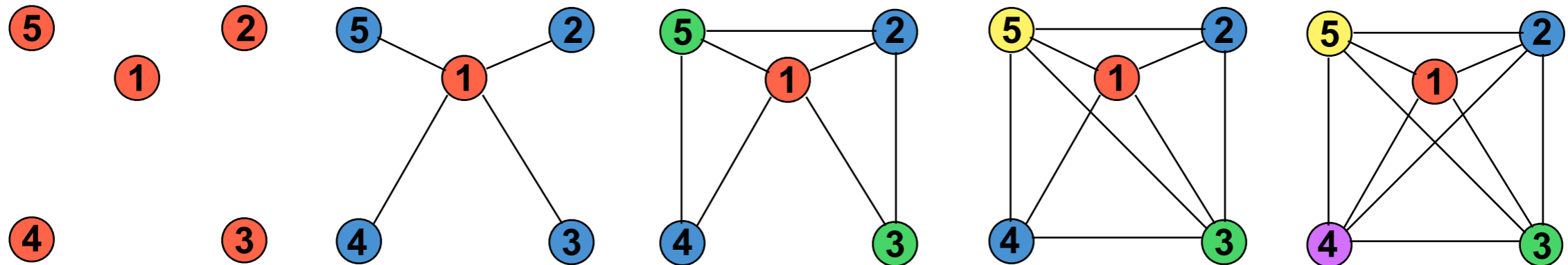
Larger clusters of courses having students in common require additional periods.

Example: 5 courses



The minimum number of scheduling periods required to avoid conflicts depends on the largest set of courses with students in all members of the set.

Scheduling and Space Utilization



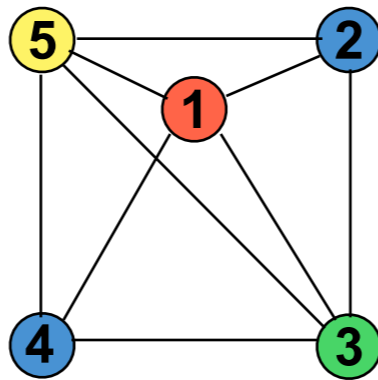
Therefore:

Providing students with more options of courses that can be taken together requires more periods in the scheduling week.

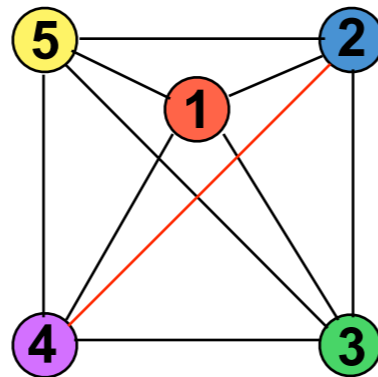
More periods also allows better utilization, but the goal is putting classes at the right times for student needs.

Room and Instructor Requirements

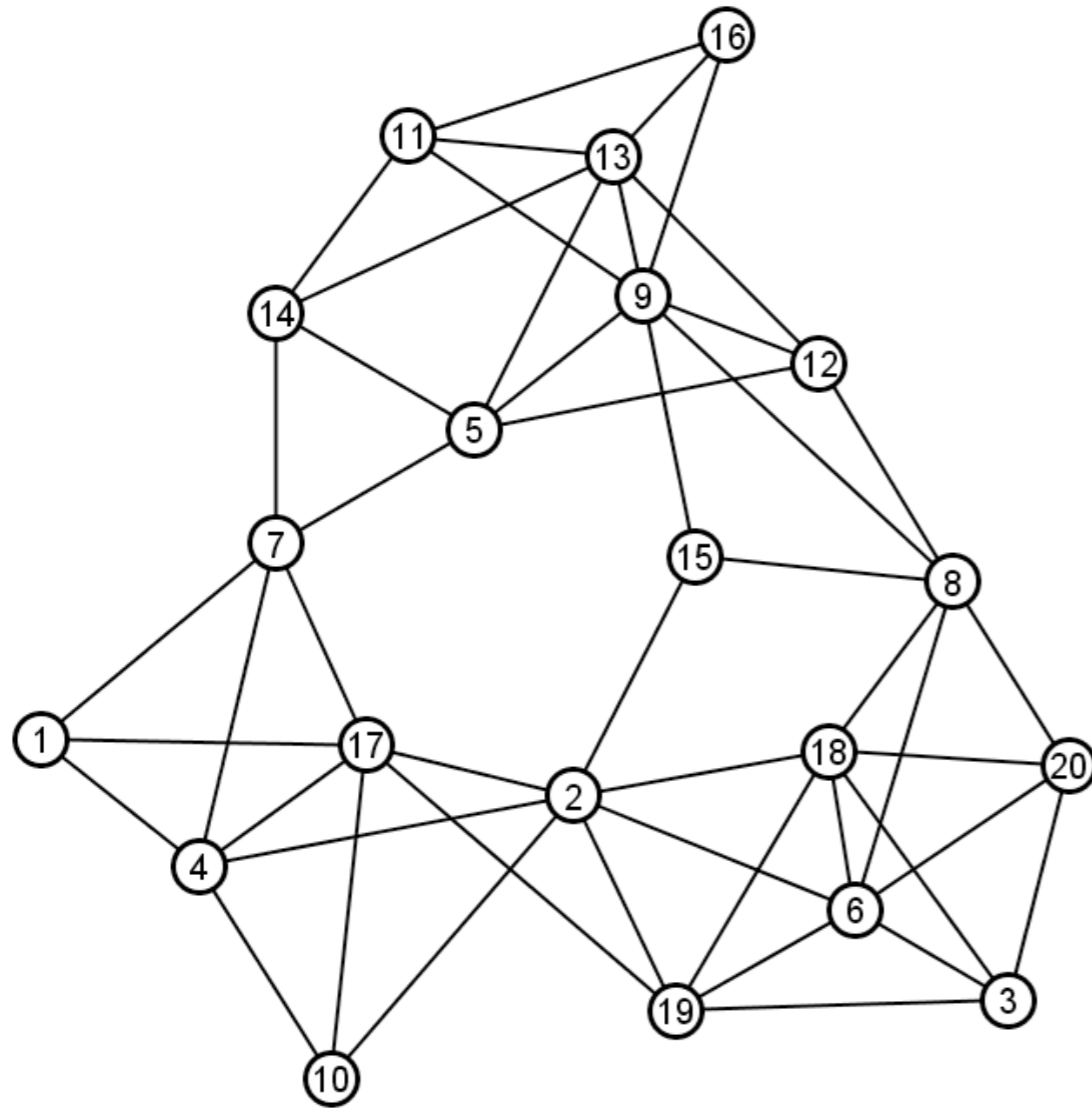
Other factors can also create a need for more periods.



If two courses with no students in common require the same resource (e.g., room, teacher) an additional period may also be required to avoid conflicts.



Creating a Good Timetable for Your College



Providing more choice to students requires a sufficient number of periods in the scheduling week, but how do you assign courses to times and rooms to avoid conflicts?

Automating the Timetabling Process

Research on course timetabling has become important in many areas of the world due to expanding university enrollments but constrained resources. Some resulting tools are:

Infosilem (Canada)

Lantiv Timetabler (Israel)

Mimosa (Finland)

O! Timetabling (South Africa)

Scientia Syllabus Plus (United Kingdom)

UniTime (United States)

Untis (Austria)

More complete list at: <http://www.asap.cs.nott.ac.uk/watt/resources/university.html>

Automating the Timetabling Process

Timetabling Demonstration

Importance of a Good Timetable



UK Higher Education Space Management Project

“Statistical analysis found that there is a clear correlation between HEIs that centrally timetable all their teaching space (both general purpose and specialist) and space performance. On average, and allowing for a range of external drivers affecting institutional size, HEIs with 100 per cent of teaching space centrally timetabled have 17 per cent less space than those which do not.”

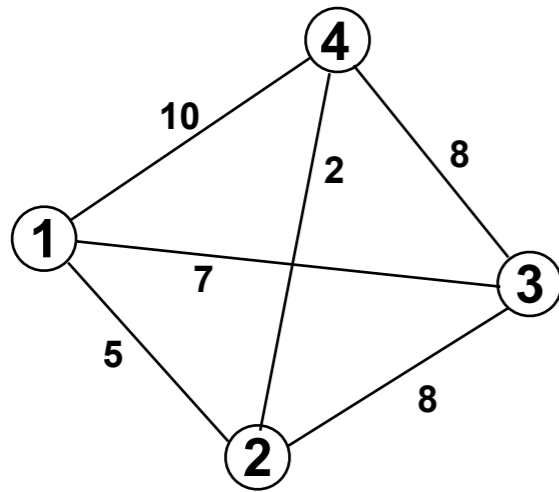
Student Sectioning

Student sectioning is the assignment of individual students to classes when there is more than one section of a course.

- In demand-driven scheduling, sectioning is done at the same time that timetable is created.
- With master scheduling, sectioning done later as as students enroll. This can both solve problems left by the timetable and create new ones.

Sectioning – Benefits and Challenges

Example:



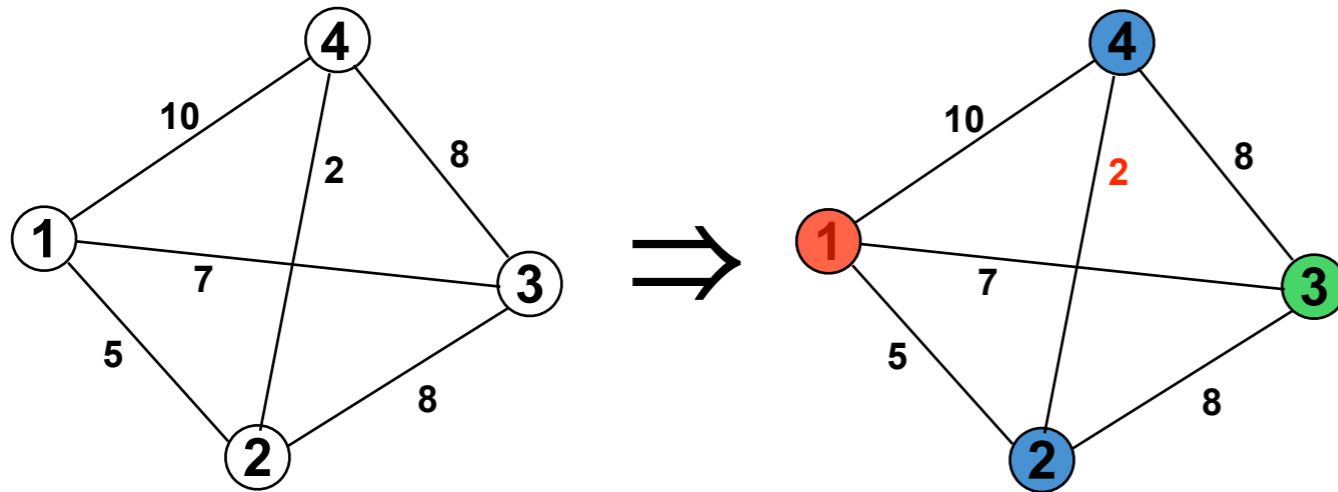
Note: number of students in common shown as labels on arcs

4 courses with 3 periods and 2 available rooms

Room 102	<input type="text"/>	<input type="text"/>	<input type="text"/>
Room 101	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Period A	Period B	Period C
Conflicts	0	0	0

Sectioning – Benefits and Challenges

Best timetable has 2 conflicts:



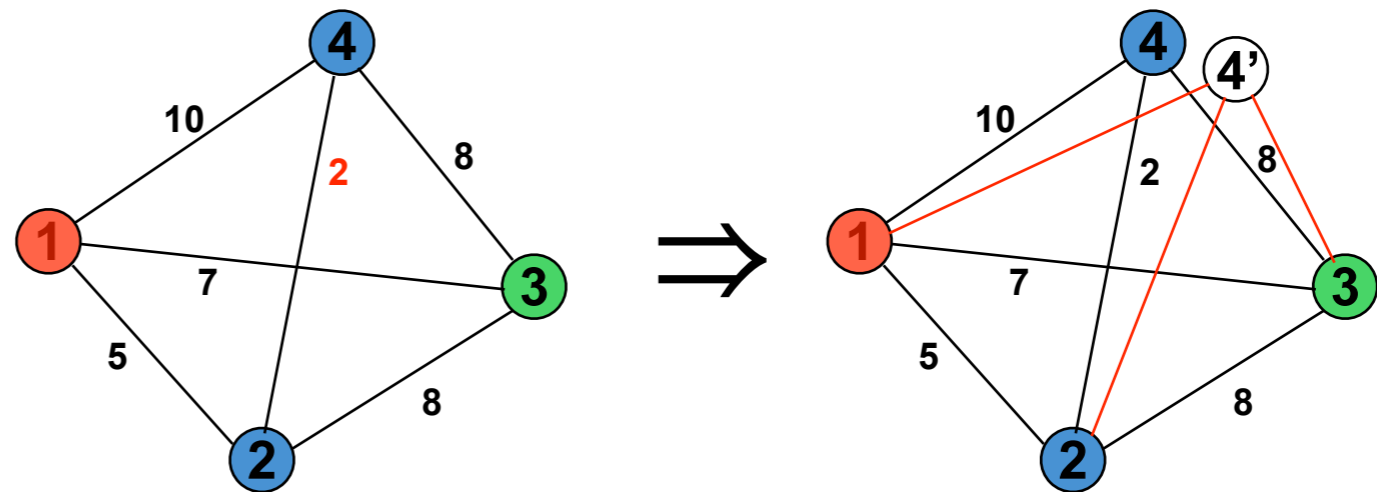
Note: 4 periods are required to avoid all student conflicts

Courses 2 and 4 have two students in common

Room 102		Course 4	
Room 101	Course 1	Course 2	Course 3
	Period A	Period B	Period C
Conflicts	0	2	0

Sectioning – Benefits and Challenges

Sectioning may resolve conflicts

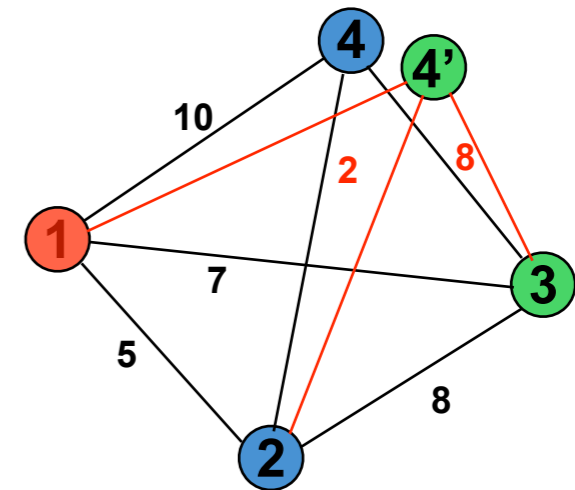


May be possible to schedule 2 conflicting students during added time period.

Room 102		Course 4	Course 4'
Room 101	Course 1	Course 2	Course 3
	Period A	Period B	Period C
Conflicts	0	0	0

Sectioning – Benefits and Challenges

However:



Total conflicts may increase if care not taken with how students are assigned to sections.

Room 102		Course 4	Course 4'
Room 101	Course 1	Course 2	Course 3
	Period A	Period B	Period C
Conflicts	0	2	8

Sectioning – Benefits and Challenges

When multiple sections are created, the scheduling system must maintain sufficient available spaces in non-conflicting sections of courses with students in common.

Otherwise,

- students unable to enroll in all required courses
- lower satisfaction
- longer time to graduation

Are You Still Operating in the 13th Century?

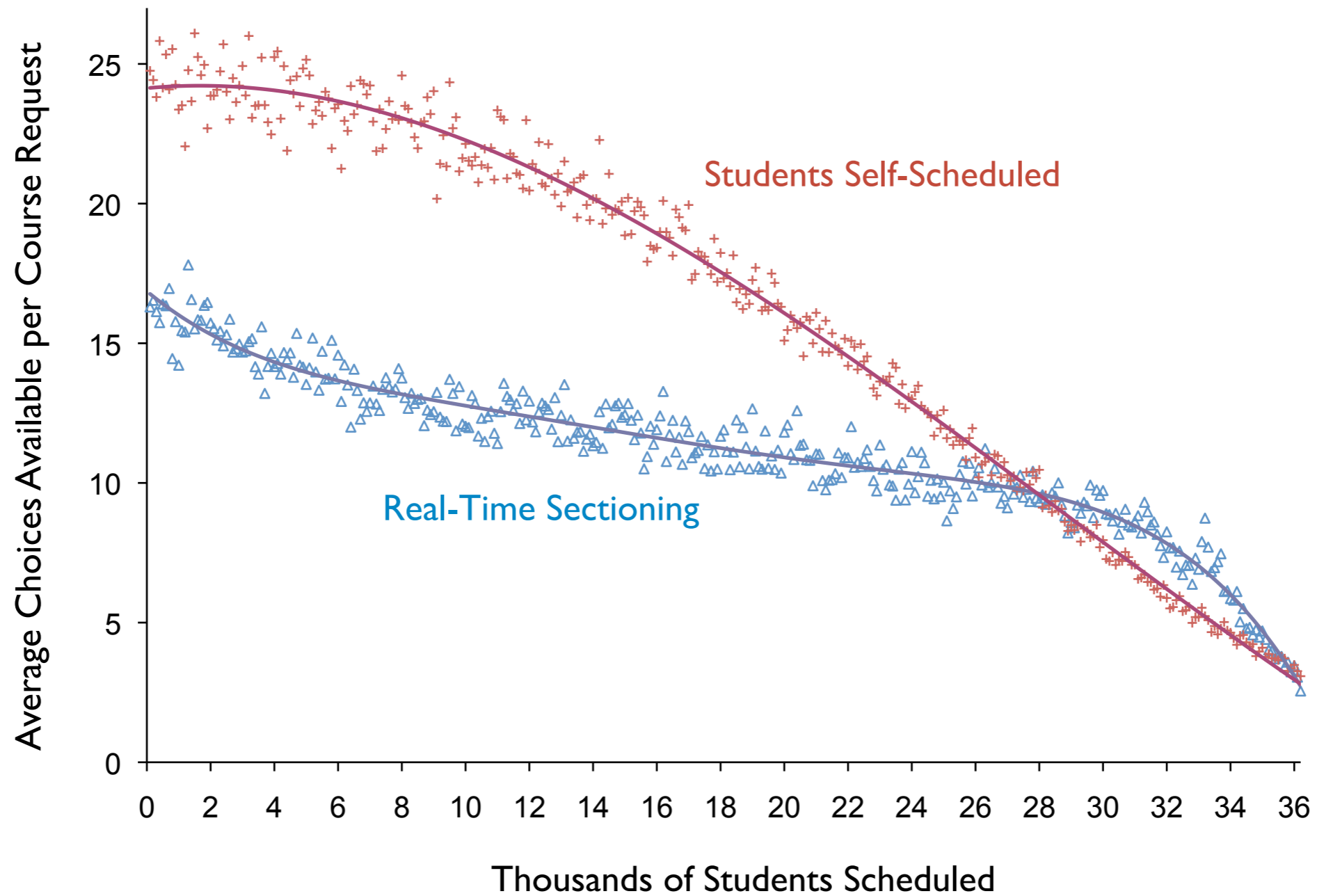
Traditional student scheduling approaches used by most colleges and universities do not maintain space in courses at required times. They have remained essentially the same since the middle ages — some with the addition of a web interface.

- Tally kept of spaces left in each class.
- Queueing order determines odds of success.

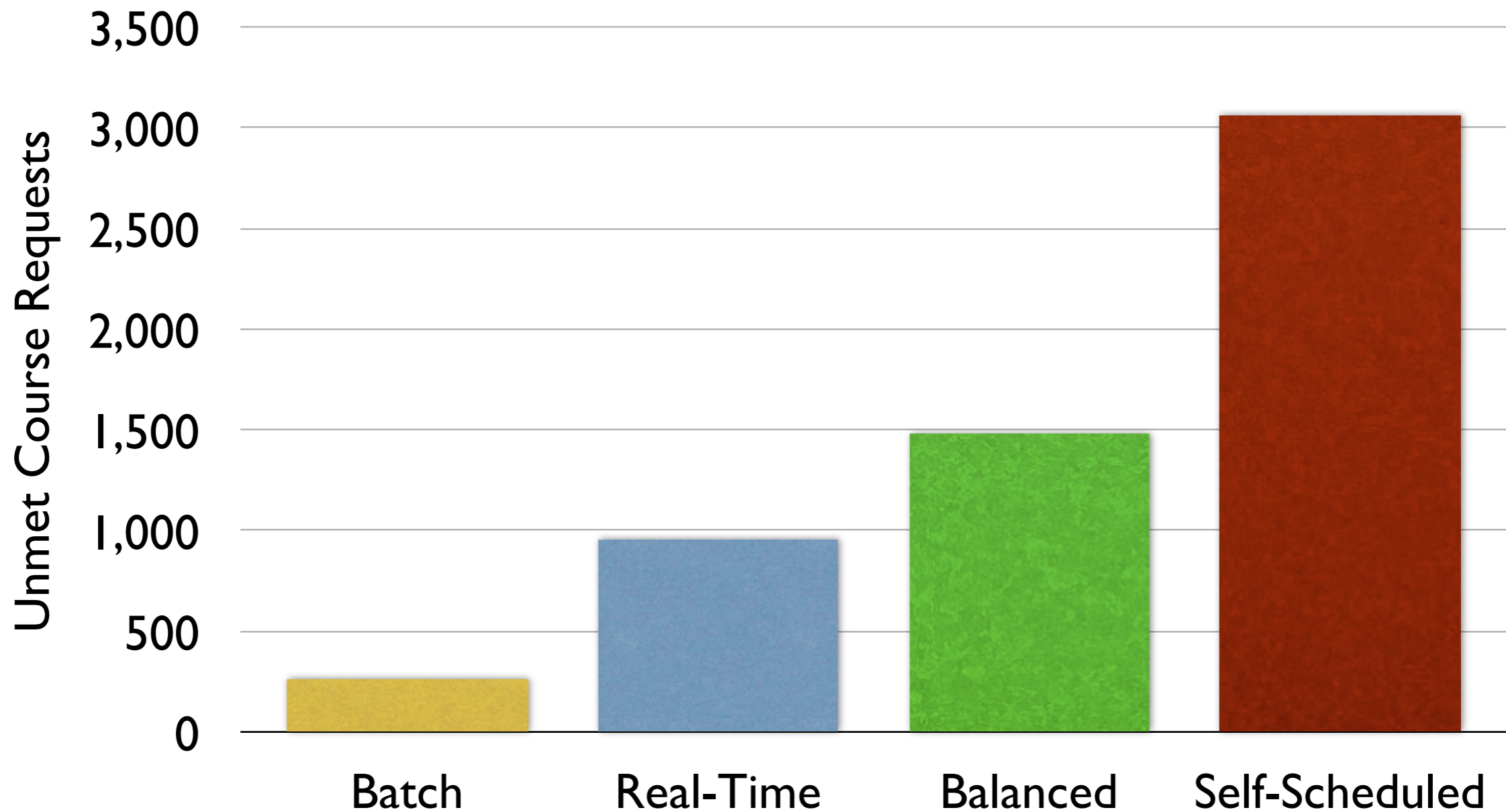
Possible Approaches for the 21st Century

Real-Time Sectioning Demonstration

Experimental Results



Experimental Results



Unmet Course Requests for Different Sectioning Methods

Purdue University, Fall 2007 - Average of 14 Runs

Reporting/Feedback

Understanding student course and time demand allows for better academic planning and scheduling.

How well course needs are met during scheduling determines your capacity to serve students.

Information from effective scheduling tools can:

- Help better refine admissions targets
- Determine where resources best used to meet student needs

Important Data

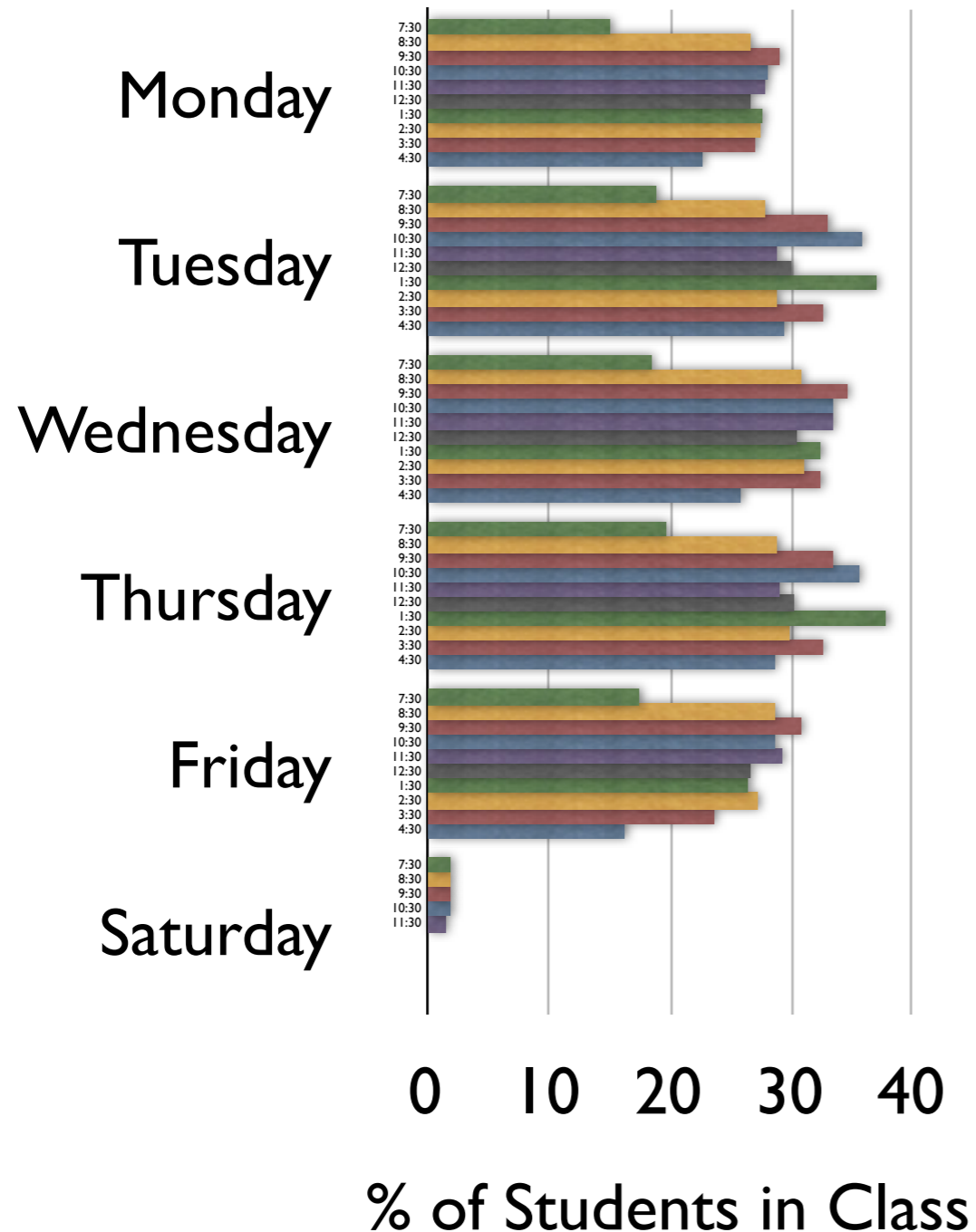
- Student Course Demand
 - Enrollment Projections by Curricular Area
 - Curriculum Course Requirement Changes
 - Student Plans of Study

- Course Joint Demand

	ENGL 106	COM 114	MA 153	MA 161	MA 165	SPAN 201	CHM 115	HIST 103	PHIL 110
ENGL106	563	22	37	12		3	26	17	
COM 114	22	492	7				46		30
MA 153	37	7	213			9		2	1
MA 161	12			284		1	279	4	2
MA 165					87		71	1	
SPAN 201	3		9	1	3	166	4	13	3
CHM 115	26	46		279	71	4	359	7	2
HIST 103	17		2	4	1	13	7	87	
PHIL 110		30	1	2		3	2		56

- Course Wait Lists (Unmet Demand)

Reporting - When Students are in Class?



Collect and Report Data on How Planning and Scheduling Process is Affecting Distribution of Student Class Hours, not just room utilization

Think You Have Space Utilization Problems?

The major Bottleneck is
Time

A timetable and student
scheduling process that do
not meet student course
needs will require
additional resources



Scenarios

The timetabling tools demonstrated can be used to run “what if” scenarios:

- Effect of Curriculum Changes
 - Required Adjustments to Course Times?
 - Adequate Amount and Types of Space?
- Effect of Removing Rooms on Class Schedule
 - Does Adequate Space Remain?
 - Make Necessary Schedule Adjustments
- Disaster Recovery

Planning Ahead for Change

Difficulty understanding how change will affect the class schedule often makes universities reluctant to make beneficial changes.

Having tools that simplify adaptation to change can make universities more responsive student needs.

Planning Ahead for Change



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05:30 PM							
06:00 PM							



Developing an academic planning and scheduling process that closely ties how and when courses are offered to student needs can improve both student satisfaction and the bottom line.

Questions?