



TEAM 2

# DSO570 FINAL PRE

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## Executive Summary



## Challenge

**4,064 students  
344 professors  
600+ courses  
44 classrooms**

## Unique Opportunities

Maximizing the professor time preference



World-class students will continue to come to Marshall



**Our final sample schedules have successfully assigned  
105 class sections to 6 classrooms.**

The average utilization rate  
of all classrooms

70%

All professors have been  
assigned to their favorite  
start times.

100%

The discrepancy of usage  
for classrooms is limited to  
be less than 15 hours.

15

No potential conflict  
between popular course  
pairs.

0



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Opportunity for Optimization



# Current Situation

**Tedious classroom assignment flow**

+

**Insufficient information from departments**

+

**Lack of timely feedback from faculty**

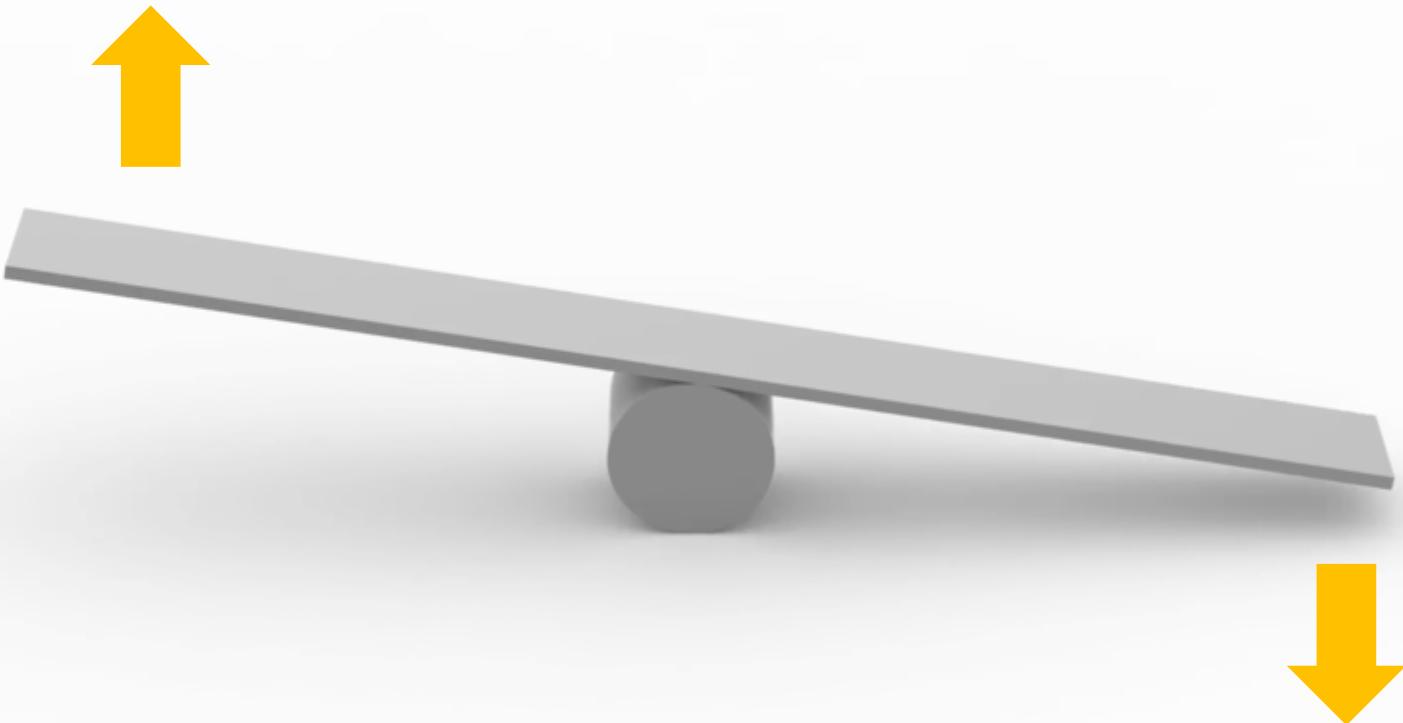


**Unnecessary resources (time, money, labor)  
to coordinate a more feasible schedule**

# A more Streamlined Course Scheduling System



Meeting needs of students and faculty



Registrar 's office workload



# Four Opportunities



## Faculty Time Preference

- simulated a preference table for 58 different instructors. (0-3)
- scheduled sections(instructors) according to their preferences and maximize the faculty aggregate preference scores



## Classroom Utilization Rate

- Utilization Rate for each class:  
$$\frac{\text{Number of students registered}}{\text{Number of available seats in the classroom}} * 100\%.$$
- focused on the overall utilization rate of all Marshall classrooms



## Classroom Usage Discrepancy

- limited the range (upper boundary minus lower boundary) of usage hours for all classrooms to be less than a certain threshold in order to avoid abuse of a particular classroom



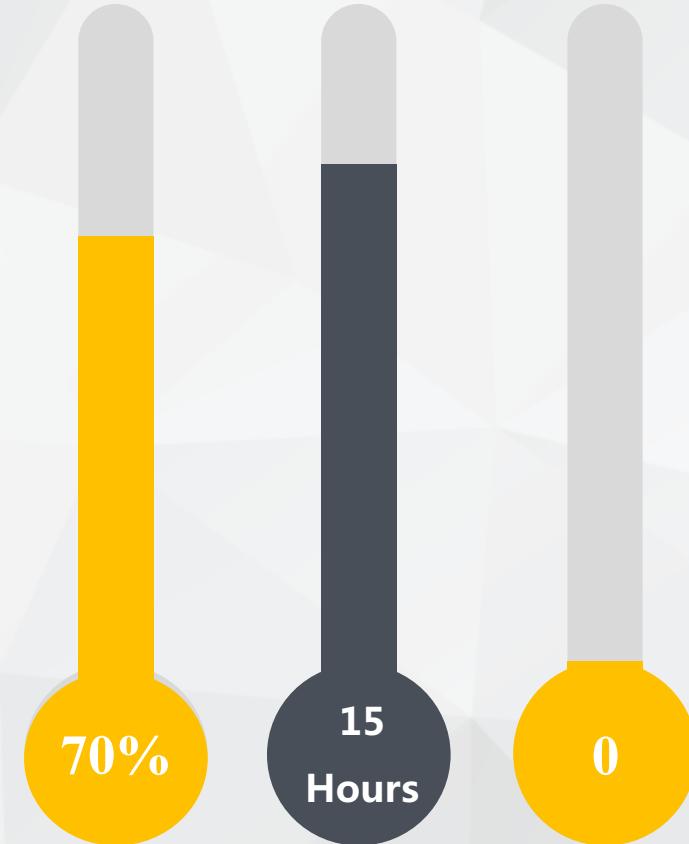
## Conflict between popular pairs

- identified 20 most popular course pairs, and our model will try to avoid conflicts between these frequently taken pairs



# Scalable and Flexible Model

The decision makers can set the specific threshold based on three aspects:



Average Utilization Rate  $\geq$  UR



Discrepancy Count  $\leq$  H



Conflicts  $\leq$  N

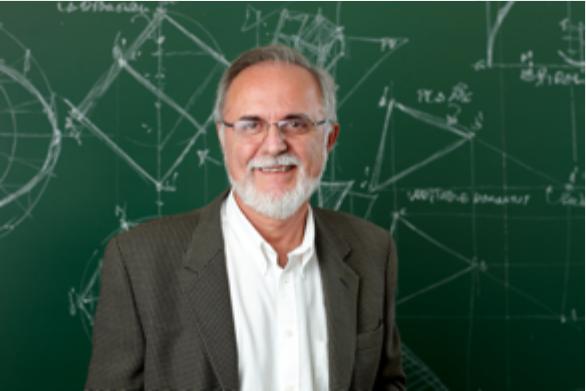
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## Methodology



# Metrics



## Faculty Preference

A vector in 3-dimensional space denoting the faculty preference for each start time across all the days.



## Classroom Usage

It is defined as the number of time slots a course occupies. A time slot is defined as the interval between two consecutive start times.



## Average classroom capacity utilization rate

It is measured as the weighted average of the course utilization rates where each weight is twice the number of course units.

*The course utilization rate is defined as the total number of students enrolled in each course per classroom size allocated to that course.*



# Modeling - Objective

## ◆ Decision Variable

$x_{ijdk}$  (Binary Variable)

Whether assign course session **i** to classroom **j**  
on start time **k** of day of week **d**

## ◆ Objective

maximize the faculty preference for start times  
and days of the course subject

$$\text{Maximize} \quad \sum_{ijdk} x_{ijdk} * P_{idk}$$

$P_{idk}$  : the instructor's preference for  
course I on day d, start time k



# Modeling – Fixed Constraints



## Allocation:

All courses must be allocated only once



## Classroom size:

The classroom must be able to accommodate all the students enrolled in the course



## Start time limit:

A 3-unit course (of total 6 timeslots) cannot start after 7 PM



**Classroom conflict:** If a course is allocated at a certain day and start time then no other courses can be allocated for the duration of that course



**Instructor conflict:** If a course is allocated at a certain day and start time then no other courses can be taught by the same instructor for the duration of that course



# Modeling – Variable Constraints

## Classroom utilization

The average capacity utilization of a classroom is no less than a threshold value.



## Popular course conflict

The number of schedule conflicts among the top popular courses is no more than a threshold value.

## Classroom usage discrepancy

The difference between the maximum classroom usage and the minimum classroom usage is no more than a threshold value.

## Instructor preference

A course cannot be allocated to a start time of the day if the instructor's preference for that start time is below a threshold value.



# Modeling – Input & Output Data

## ◆ courses, instructors and classrooms

extracted from the Marshall Course Enrollment for 1.5 and 3 units in the departments ACC, DSO and MKT for Spring 2017 and Marshall Room Capacity Chart

## ◆ top 20 popular pairs of courses

selected from the Student Course Selection in Spring 2017 which is the de-identified student level data on what courses each Marshall student chose

## ◆ preference matrix

50% of the start times - preference of 0 (Least preferred)

20% of the start times - preference of 1

15% of the start times - preference of 2

15% of the start times - preference of 3 (Most preferred)

JKP212	M	T	W	TH	F
9:00AM~9:30AM					ACCT-582-14288-Wang, Shiing-Wu
9:30AM~10:00AM		DSO-528-16274-Ansari, Arif			ACCT-582-14288-Wang, Shiing-Wu
10:00AM~10:30AM		DSO-528-16274-Ansari, Arif			ACCT-582-14288-Wang, Shiing-Wu
10:30AM~11:00AM		DSO-528-16274-Ansari, Arif	BUAD-281-14522-Jackson, Cecil, W	ACCT-582-14288-Wang, Shiing-Wu	ACCT-582-14288-Wang, Shiing-Wu
11:00AM~11:30AM	DSO-597-16316-Bassok, Yehuda	GSBA-528-15725-Kovacevich, Rex, Alan	BUAD-281-14522-Jackson, Cecil, W	ACCT-582-14288-Wang, Shiing-Wu	ACCT-582-14288-Wang, Shiing-Wu
11:30AM~12:00PM	DSO-597-16316-Bassok, Yehuda	GSBA-528-15725-Kovacevich, Rex, Alan	BUAD-281-14522-Jackson, Cecil, W	ACCT-582-14288-Wang, Shiing-Wu	ACCT-582-14288-Wang, Shiing-Wu
12:00PM~12:30PM	DSO-597-16316-Bassok, Yehuda	GSBA-528-15725-Kovacevich, Rex, Alan	BUAD-281-14522-Jackson, Cecil, W	ACCT-582-14288-Wang, Shiing-Wu	GSBA-528-15725-Kovacevich, Rex, Alan
12:30PM~12:30PM	DSO-597-16316-Bassok, Yehuda	GSBA-528-15725-Kovacevich, Rex, Alan	BUAD-281-14522-Jackson, Cecil, W		GSBA-528-15725-Kovacevich, Rex, Alan
1:00PM~1:30PM	DSO-597-16316-Bassok, Yehuda	GSBA-528-15725-Kovacevich, Rex, Alan	BUAD-281-14522-Jackson, Cecil, W	ACCT-580T-14273-Boschetto, David	GSBA-528-15725-Kovacevich, Rex, Alan



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## Results & Recommendations

# Results

**Reduces the administrative effort**

**Easy to adapt to the constant change**

**Efficiently utilizes the available space**

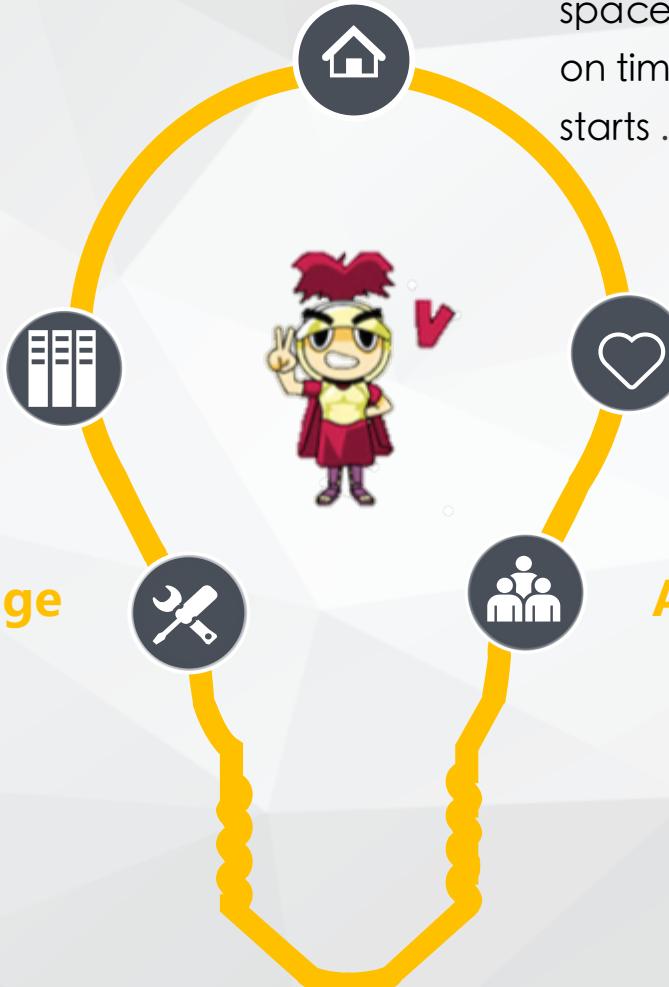
Efficiently utilizes the available space to schedule the courses on time, well before registration starts .

**Addresses the faculty preference**

by not just quantifying it but also by providing and an optimized solution which maximizes faculty preference

**Addresses the need of the students**

by successfully avoiding schedule conflicts among the popular courses and core classes offered in the same semester





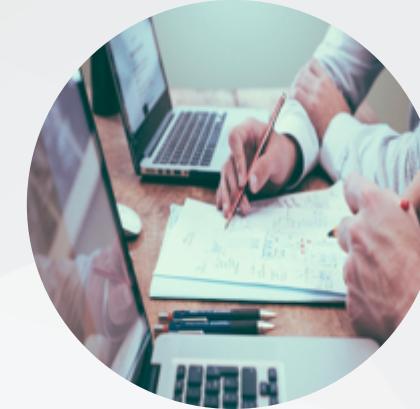
# Recommendations



The department should collect and maintain the faculty preference for the teaching times.



Popular courses can also be determined by departmental surveys.



To implement the scheduling process in one phase as it provides a feasible solution by incorporating the faculty preference.



A sunset sky with a large yellow triangle graphic and a globe silhouette.

Thank You!