

# Math 377: Operations Research First Lecture

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[http://www.williams.edu/Mathematics/sjmillier/public\\_html/377Fa16](http://www.williams.edu/Mathematics/sjmillier/public_html/377Fa16)

Williams College

## Introduction and Objectives

## Introduction / Objectives

Main Topic: Optimization: Linear Programming.

### Objectives

- Obviously learn linear programming.
- Emphasize techniques / asking the right questions.
- Model problems and analyze model.
- Elegant solutions vs brute force.
- Apply to real world problems.
- Writing textbook for AMS.

Board of Trustees of Former Students (with jobs!)

## Types of Problems

- Diet problem.
- Banking (asset allocation).
- Scheduling (movies, airlines, TSP, MLB).
- Elimination numbers.
- Sphere packing....

## My (applied) experiences

- Marketing: parameters for linear programming (SilverScreener).
- Data integrity: detecting fraud with Benford's Law (IRS, Iranian elections).
- Sabermetrics: Pythagorean Won-Loss Theorem, court case.
- Wall Street consulting.

## Course Mechanics

## Grading / Administrative

- HW: 15%. Class Participation 5%. Midterm 40%. Project 40%. May change a bit. A large portion of work/grade from a group project: you'll give a talk, prepare a well-crafted manuscript, and respectfully listen to reports of others.
- Pre-reqs: linear algebra (analysis, stats, programming a plus).

### Office hours / feedback

- TBD and when I'm in my office (schedule online).
- Feedback [ephsmath@gmail.com](mailto:ephsmath@gmail.com), password first 8 Fibonacci numbers (011235813).

## Other

- Webpage: numerous handouts, additional comments each day (mix of review and optional advanced material).
- Opportunity to help write a book.
- **PREPARE FOR CLASS!** Must do readings before each class.



## Other: Advice from Jeff Miller

- Party less than the person next to you.

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- Learn to manage your time: no one else wants to.

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Happy to do practice interviews, adjust deadlines....

Linear algebra textbooks online:

<http://joshua.smcvt.edu/linalg.html/book.pdf>

Useful links

## LaTeX and Mathematica Tutorials and Templates

[http://web.williams.edu/Mathematics/sjmiller/public\\_html/math/handouts/latex.htm](http://web.williams.edu/Mathematics/sjmiller/public_html/math/handouts/latex.htm)

Has templates for using LaTeX for papers, talks, posters, and a Mathematica tutorial.

Also videos on each.

## Examples / Jobs

## Alabama vs Auburn: 2013

<https://www.youtube.com/watch?v=sL02SmM9gPw>



## Log ruler (and WCMA)



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## Log ruler (and WCMA)

11.2014.26.62

As New England forests became depleted in the nineteenth century, lumber companies surveyed their trees more carefully to ensure profit. With this two-foot scale, a man called a "scaler" could estimate the usable output of wood. Lumberjacks distrusted the mathematically trained scaler in protection of their daily wages, which were based on individual production.

## Scheduling: Baseball Tournaments, Swim Lessons



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## Inefficiencies from Location



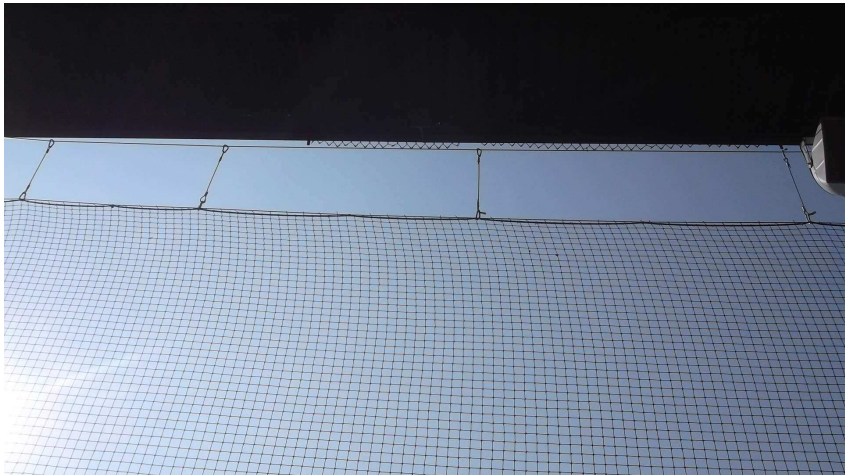


# Inefficiencies from Location





## Inefficiencies from Location



# Inefficiencies from Location



# Inefficiencies from Location

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
 1	 2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

*Alumni Fund @ Parents Fund begins*

*Mini Business Football Weekend*

*Eid al-Adha (begins at midnight) Columbus Day Reading Period begins*

*Eid al-Adha Reading Period ends*

*Eid Family Weekend*

**SEPTEMBER '13**  
S M T W T F S  
1 2 3 4 5 6 7  
8 9 10 11 12 13 14  
15 16 17 18 19 20 21  
22 23 24 25 26 27 28  
29 30

**NOVEMBER '13**  
S M T W T F S  
1 2  
3 4 5 6 7 8 9  
10 11 12 13 14 15 16  
17 18 19 20 21 22 23  
24 25 26 27 28 29 30

Halloween

# Inefficiencies from Location



## Pascal's Triangle

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### Video on Pascal's Triangle

[https://www.youtube.com/watch?v=tt4\\_4YajqRM](https://www.youtube.com/watch?v=tt4_4YajqRM)