550.400: Mathematical Modeling and Consulting

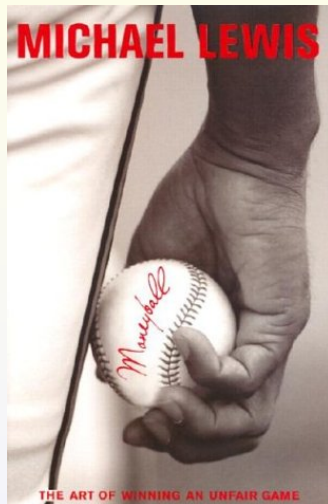## Lecture Notes

Instructor:
Dr. N. H. Lee

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Outline

Syllabus

- Grade Policy

- Attendance

- *Tentative* Schedule

- Blackboard

- Misc.

What is Mathematical Modeling?

Money Ball

What is Mathematical Modeling?

Trillion Dollar Bet

What is Mathematical Modeling?
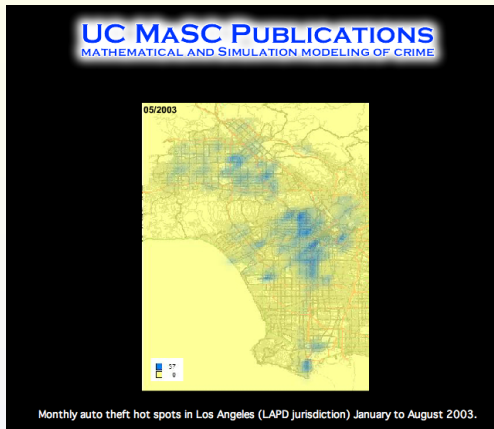
LAPD Fighting Crime with Math

What is Mathematical Modeling?
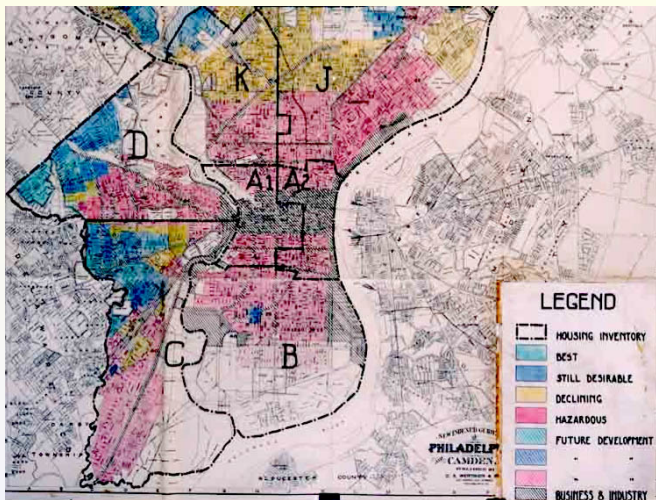
Insurance Redlining

Example: Insurance Redlining

Insurance Redlining
Insurance redlining refers to the practice of refusing to issue insurance to certain types of people or within some geographic area.

FAIR
The FAIR plan was offered by the city of Chicago as a default policy to homeowner who had been rejected by the voluntary market.

Example: Insurance Redlining

Sponsor
The U.S. Commission on Civil Rights examined charges by several Chicago community organizations that insurance companies were redlining their neighborhoods.

Data
The number of FAIR plan policies written and renewed in Chicago by zip code for the number of months of December 1977 through May 1978.

Example: Insurance Redlining

Variables to consider:

race Racial composition in percentage of minority,

fire Fire per 100 housing units,

theft Theft per 100 housing units,

age Theft per 1000 population,

involact New FAIR plan policies and renewal per 100 housing units,

income Median family income in thousands of dollars,

side North or South side of Chicago.

Example: Insurance Redlining

Frequently Recurring Elements of doing a Project in Industry:

1. Work Statement,

2. Midterm Presentation,

3. Progress Report,

4. Final Presentation,

5. Final Report.

What is Work Statement?

- The written proposal and definition of the project

- Your consulting team's "contract" with the sponsor

- It is ultimately given to the sponsor for review and signature

What is Work Statement?

It sets forth:

- the nature of the project,

- the specific objectives of the project,

- the result expected,

- the "deliverable" for the project.

What is Work Statement?

- The scope of the project must be within the time table for the course

- The deliverables are reasonable and appropriate

What is Work Statement?

- Given the nature of research, it should not include promises that your consulting team cannot be certain to achieve

- It may be necessary after discussion and agreements among various parties to modify and renegotiate the work statement as the project progresses
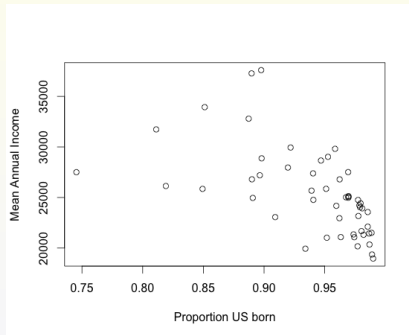
Programmings in this class

- R:
  - `tikzDevice`
  - `lm`
- LaTeX :
  - `moderncv`
  - `beamer`
  - `report`
  - `tikz`
- Git
  - `git gui`

Demo: R

```
install.packages(faraway)
require(farway)
data(eco)
plot(income ~ usborn,
    data=eco,
    xlab='Proportion US born'
    ylab='Mean Annual Income'
    )
```
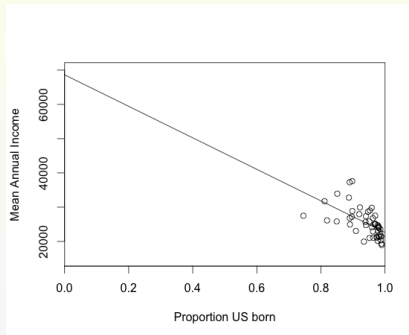
Demo: R

```
g <- lm(income ~ usborn, eco)
summary(g)
plot(income ~ usborn,
    data = eco,
    xlab='Proportion US born',
    ylab='Mean Annual Income',
    xlim=c(0,1),
    ylim=c(15000,70000),
    xaxs='i')
abline(coef(g))
```

Tutorial: LaTeX

LaTeX is a computer language for writing a scholarly paper:

	HTML	LaTeX

Code	`<html>`
	`. . .`
	`</html>`
		`\begin{document}`
		`. . .`
		`\end{document}`

Complier	Firefox and etc.	pdflatex and etc.
Output	Webpage	PDF file

Table: HTML vs LaTeX

Tutorial: LaTeX

- Demo on preparing a resume using LaTeX `moderncv` package:
  - Install LaTeX (MikTex in Windows and MacTex in OSX),
  - Download `moderncv` package files from the course folder,
  - Change file names to reflect you,
  - Edit the tex file,
  - Compile using your favorite LaTeX editor,
  - Look at the resulting PDF file.

Tutorial: Git

```
sudo apt-get install git
```


An alternative: `git gui`

Tutorial: Git

```
cd ~/
git clone http://cis.jhu.edu/~nhlee/550400.git
```
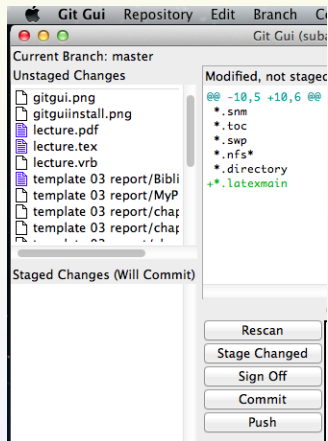

An alternative: `git gui`

Tutorial: Git

```
cd ~/550400.git
git reset --hard HEAD
git pull origin master
```


An alternative: `git gui`

Tutorial: Git

- Demo I: build a *personal* Git folder
  - Create some files
  - Stage the files
  - Commit the files
- Demo II: build the *course* Git folder

Seven Basic Principles

1. Set the context
2. Choose effective examples and analogies
3. Choose vocabulary to suit your readers
4. Decide whether to present #s in text, tables, or figures
5. Report and interpret #s in the text
6. Specify the direction *and* size of an association between variables
7. For many #s, summarize overall pattern

Creating Effective Tables

Example: Cost of Packaging

Example: The Nuclear Mission Arms Race

Example: Maintaining Inventory