550.400: Mathematical Modeling and Consulting

Lecture Notes

Instructor:
Dr. N. H. Lee

JHU AMS 2012 FALL

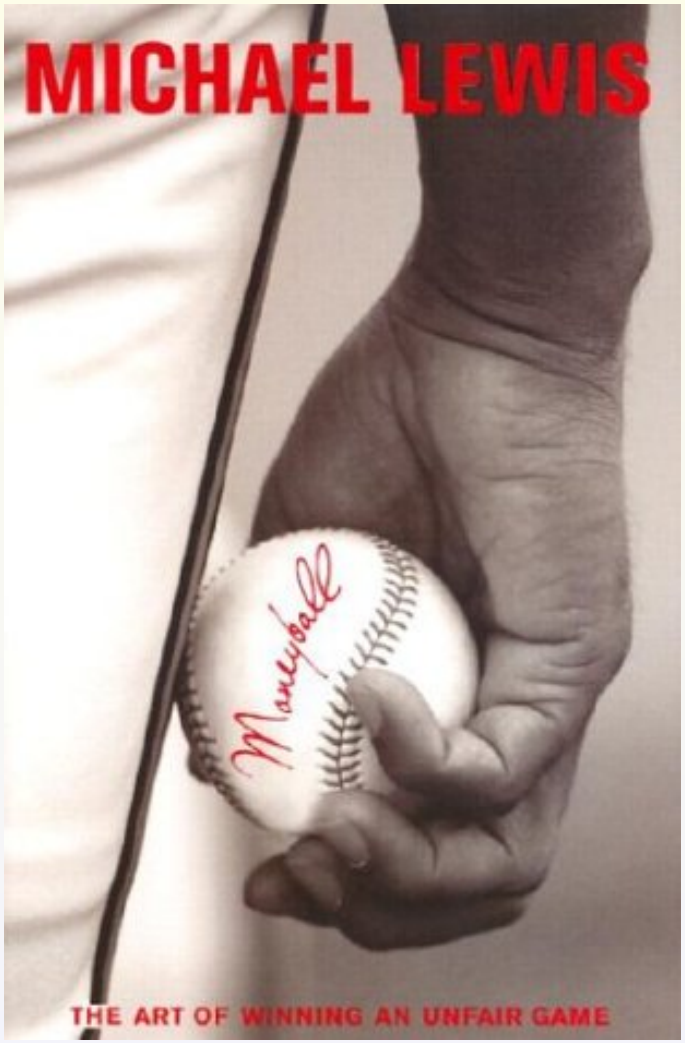
Last Compiled on September 5, 2012

Outline

Syllabus

- Grade Policy
- Attendance
- *Tentative* Schedule
- Blackboard
- Misc.

What is Mathematical Modeling?



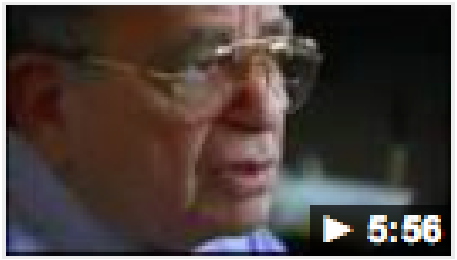
Money Ball

What is Mathematical Modeling?

NOVA Online | Trillion Dollar Bet
www.pbs.org/wgbh/nova/stockmarket/
Welcome to the companion Web site to "**Trillion Dollar Bet**," originally broadcast on February 8, 2000. The film tells the fascinating story of the invention of the ...
The Formula that Shook The ... - Transcripts - A Trader's Lexicon - Resources

Videos for trillion dollar bet - Report videos

Trillion Dollar Bet 1 - YouTube
youtube.com
Jan 8, 2009

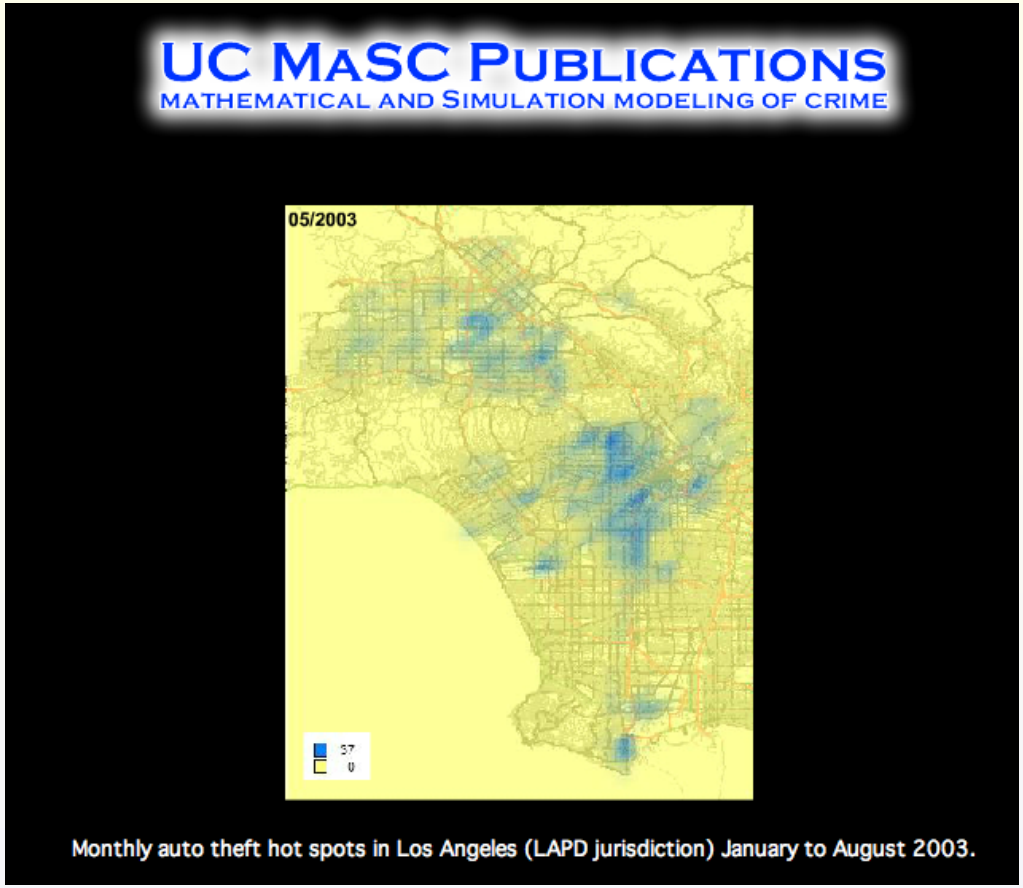


The **Trillion Dollar Bet** - YouTube
youtube.com
Sep 15, 2007

The Midas Formula Stockmarket ...
youtube.com
Aug 23, 2011

Trillion Dollar Bet

What is Mathematical Modeling?



LAPD Fighting Crime with Math

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?

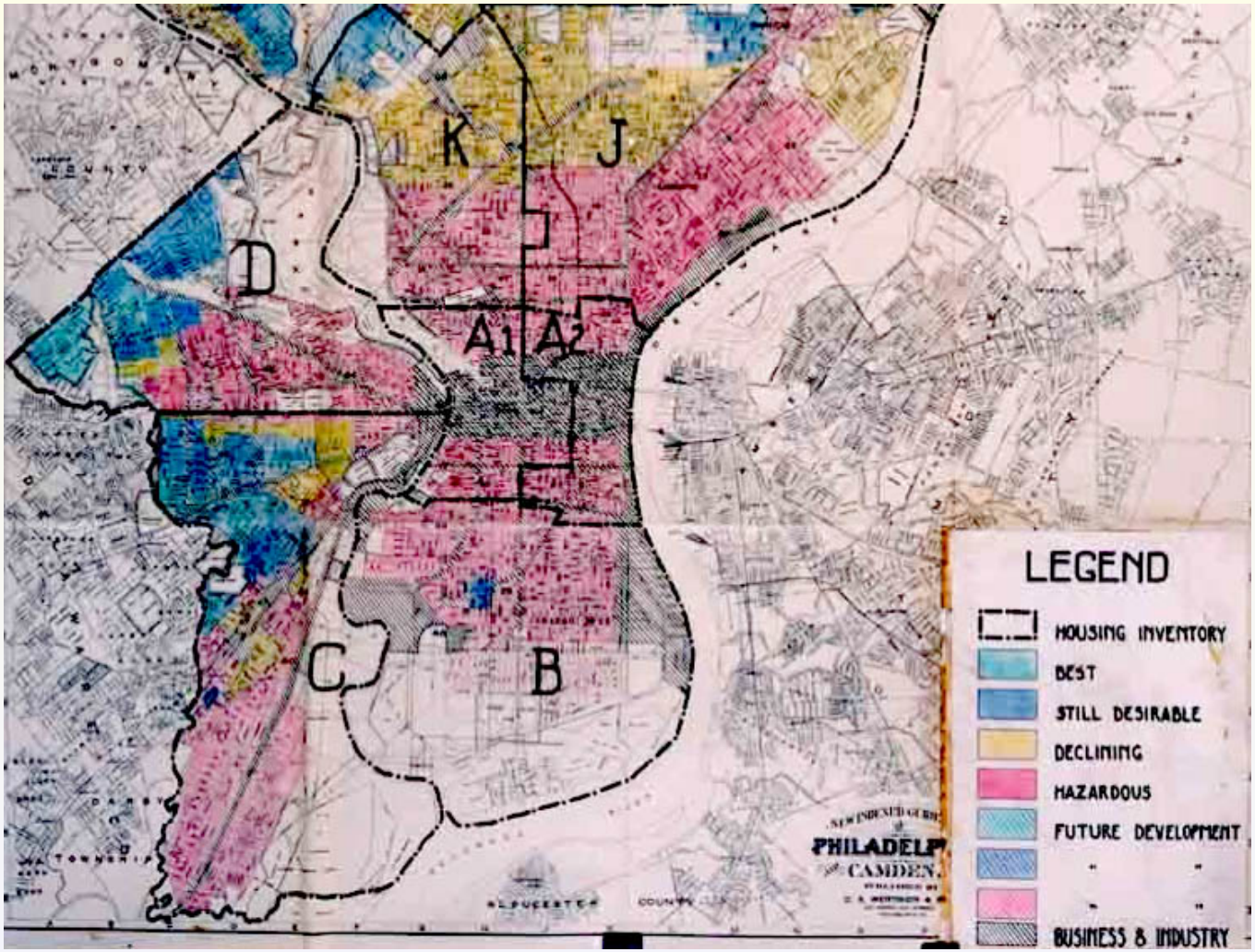
- The scope of the project must be within the time table for the course
- The deliverables are reasonable and appropriate

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

Example: Insurance Redlining



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.

Acknowledgement

Programmings in this class

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

Tutorial: LaTeX

LaTeX is a computer language for writing a scholarly paper:

	HTML	LaTeX

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

Compiler	Firefox and etc.	pdflatex and etc.
Output	Web-page	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.

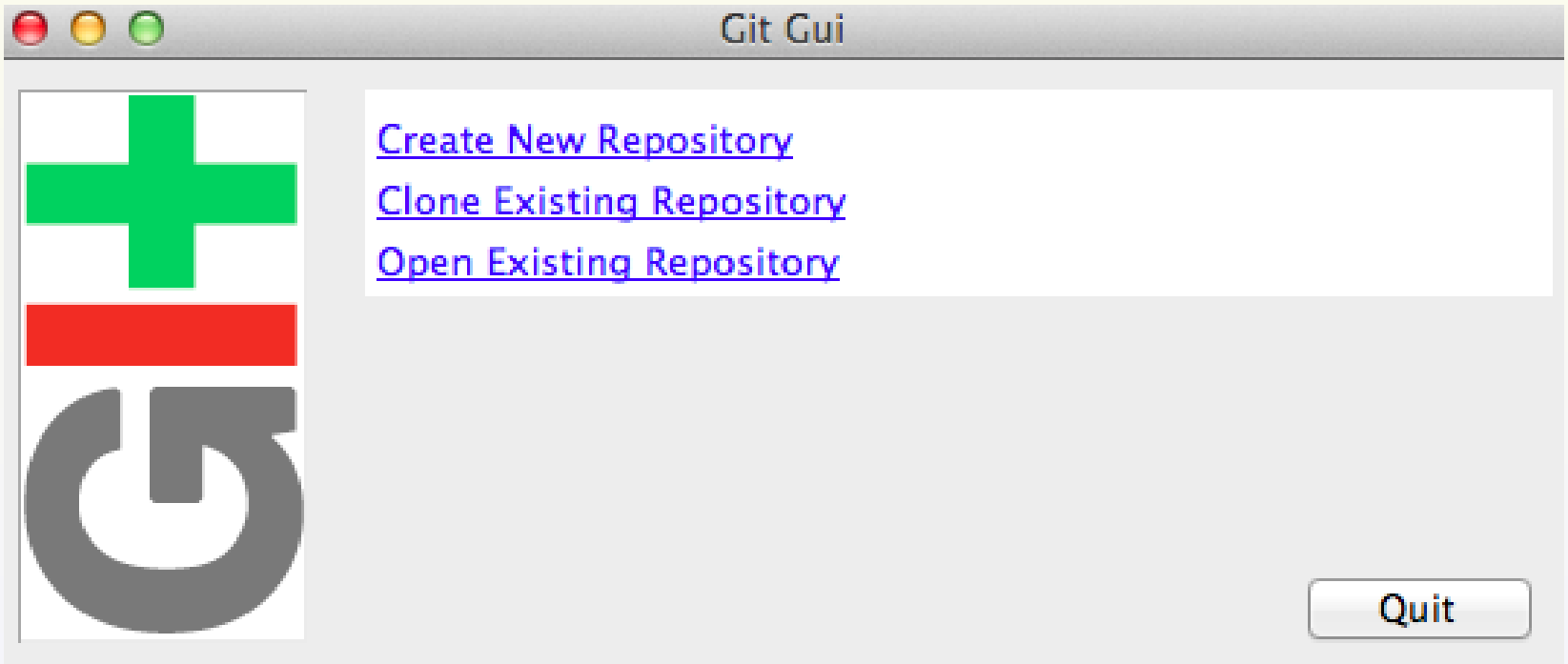
Tutorial: Git

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

An alternative: `git gui`

Tutorial: Git

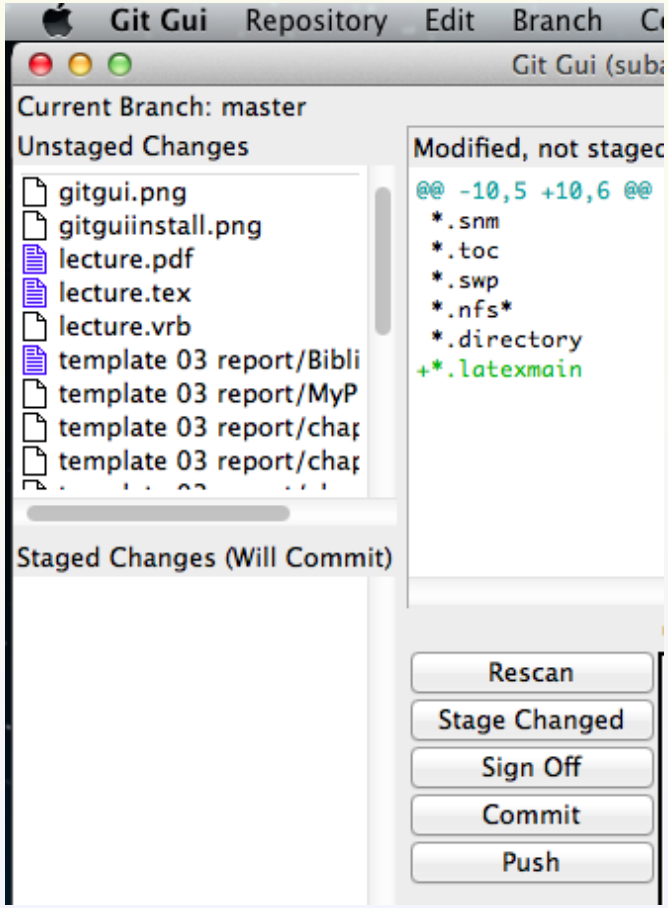
```
cd ~/
git clone http://cis.jhu.edu/~nhlee/550400.git
```



An alternative: `git gui`

Tutorial: Git

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



An alternative: `git gui`

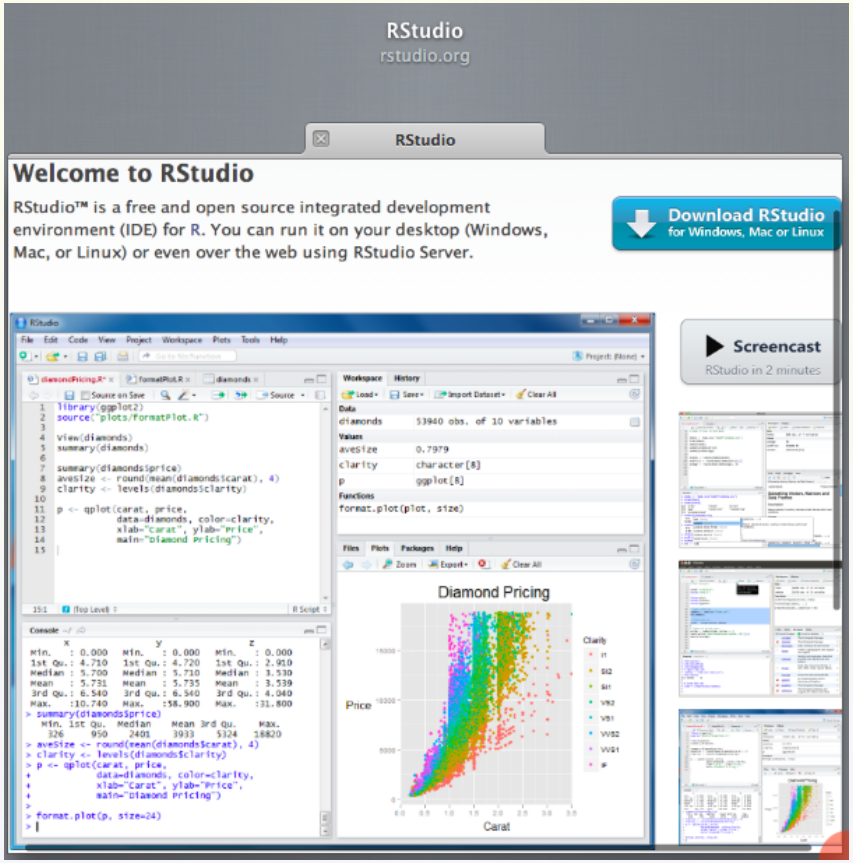
Tutorial: Git

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

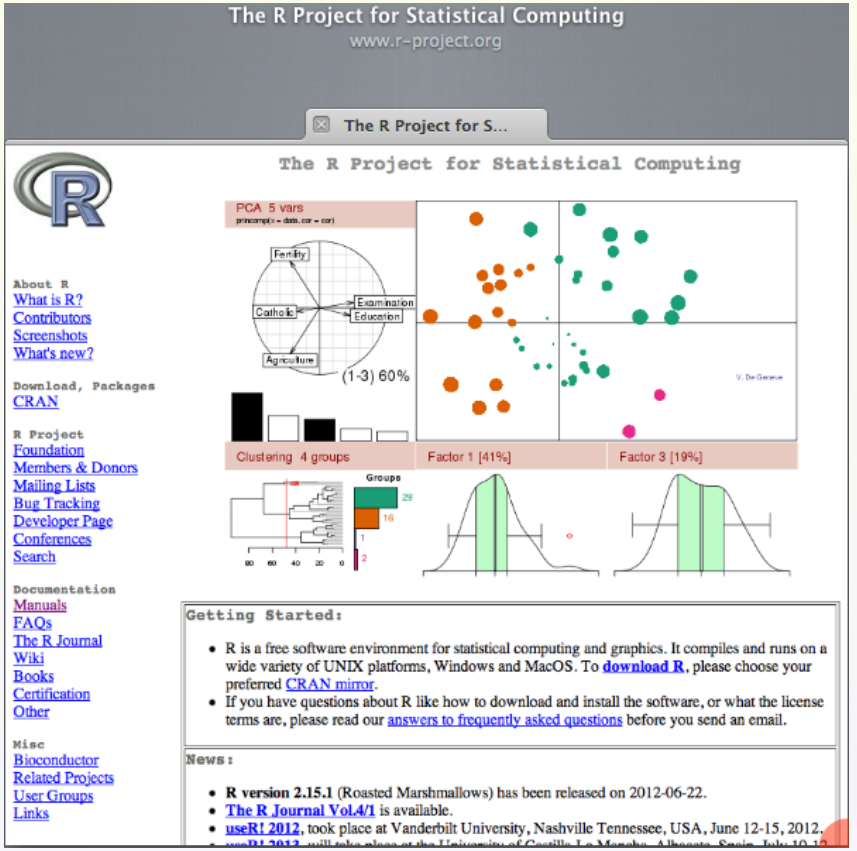
Unofficial Way to Access the Course Folder

`http://cis.jhu.edu/~nhlee/550400.html/`

Demo: R



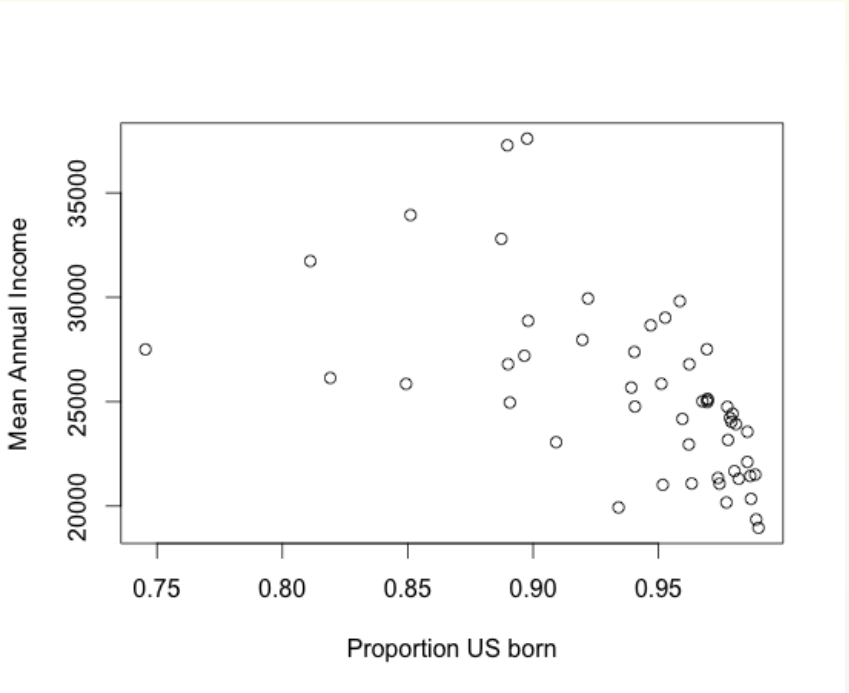
R Studio



R

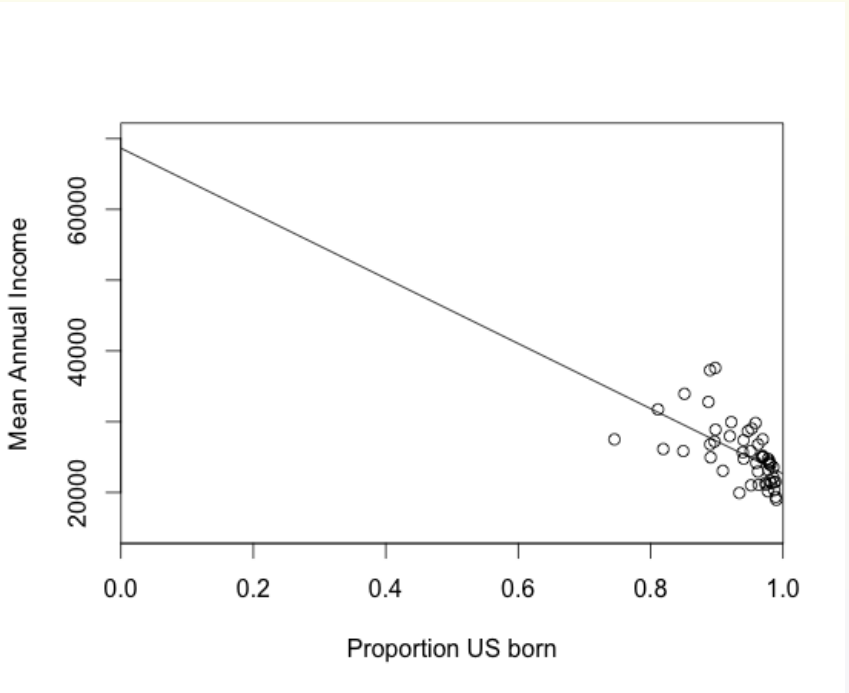
Demo: R

```
install.packages(faraway)
require(faraway)
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))
```



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