Gov 50: 1. Introduction

Matthew Blackwell
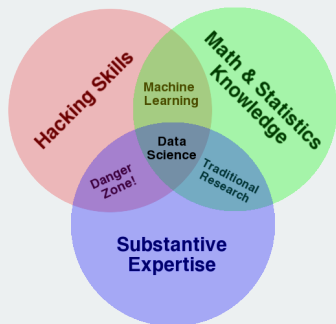
Harvard University

Roadmap

1. Welcome and Motivation

2. Course Details
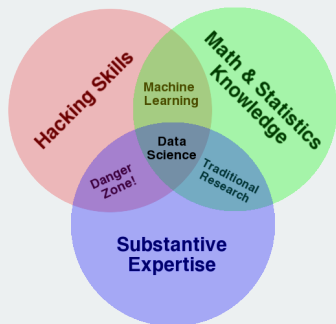
1/ Welcome and Motivation

What is data science?

- **Data science**: wrangling, visualizing, and analyzing data to understand the world

- **Data science**: wrangling, visualizing, and analyzing data to understand the world

- Who does data science? Tech companies, non-tech companies, nonprofits, governments.

Credit: Drew Conway

Glassdoor's No. 3 best job in the U.S. has seen job growth surge 480%

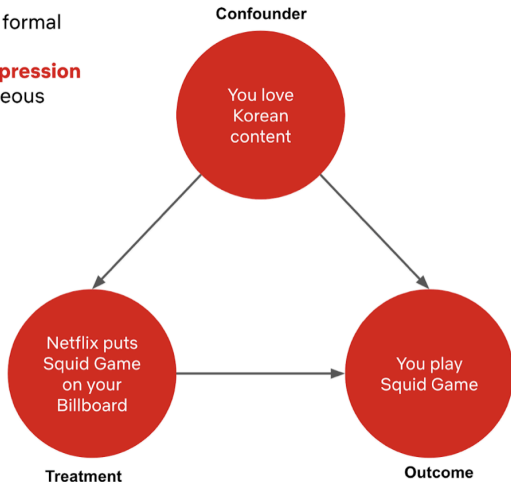BY **MEGHAN MALAS**

March 08, 2022, 1:12 PM

A COMMUTER BOARDS A BAY AREA RAPID TRANSIT (BART) TRAIN IN THE NEW MONTGOMERY STATION IN SAN FRANCISCO, CALIFORNIA, AS SEEN IN MARCH 2022. (PHOTOGRAPHER: DAVID PAUL MORRIS—BLOOMBERG/GETTY IMAGES)

What problems are data scientists working on?

Causality

Causal Inference provides formal tools to tease out the true **incremental** value of an **impression** for each profile: Heterogeneous Treatment Effect (**HTE**)

Confounder

You love Korean content

Treatment

Netflix puts Squid Game on your Billboard

Outcome

You play Squid Game

Compared to machine learning, causal inference allows us to build a robust framework that controls for confounders in order to estimate the true incremental impact to members
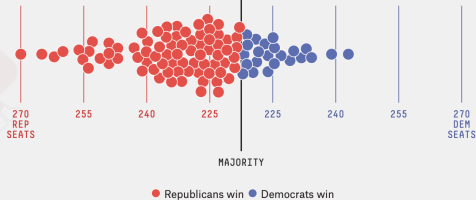
Measurement

How Kavanaugh's Ideology Compares With Other Federal Judges

Brett M. Kavanaugh

Neil M. Gorsuch, the president's first Supreme Court appointee

80 judges

60

40

20

0

−2.0 −1.5 −1.0 −0.5 0 0.5 1.0 1.5 2.0

← More liberal   More conservative →
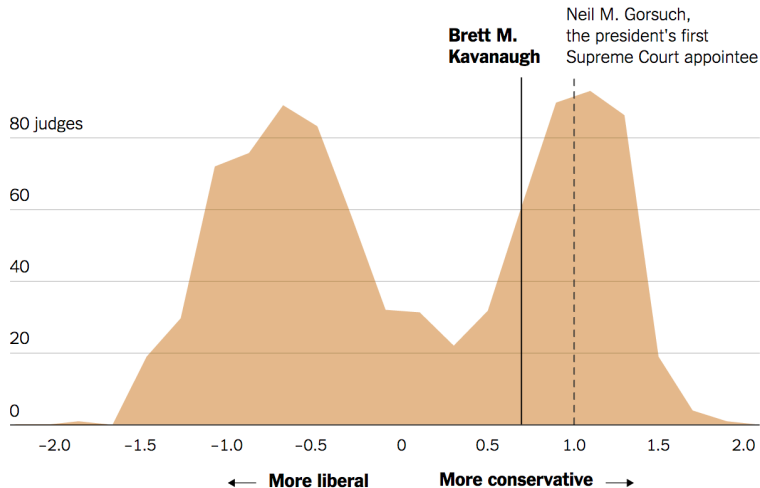
Based on the campaign finance scores of all current and former federal district and court of appeals judges nominated since 1980. | Source: Database on Ideology, Money in Politics, and Elections; Adam Bonica, Stanford University

Topic	Day	Week	Month	QTR
311 CALL CENTER PERFORMANCE			0.94	0.93
CODE ENFORCEMENT ON-TIME %	1.23	1.24	1.24	1.24
CODE ENFORCEMENT TRASH COLLECTION	1.25	1.18	1.15	1.10
GRAFFITI ON-TIME %	0.33	0.13	0.20	0.27
MISSED TRASH ON-TIME %	1.21	1.20	1.20	1.20
PARKS MAINTENANCE ON-TIME %	0.82	0.83	0.90	0.88
POTHOLE ON-TIME %	1.25	0.88	0.69	0.67
SIGN INSTALLATION ON-TIME %	1.00	0.23	0.24	0.49
SIGNAL REPAIR ON-TIME %	1.25	1.25	1.10	1.09
STREETLIGHT ON-TIME %	0.55	0.60	0.56	0.54
TREE MAINTENANCE ON-TIME %	1.19	1.18	1.17	1.13
ON-TIME PERMIT REVIEWS	0.88	0.88	0.85	0.81
LIBRARY USERS	1.51	1.42	1.43	1.42
BPS ATTENDANCE				0.90
BFD RESPONSE TIME	0.91	0.94	0.94	0.94
BFD INCIDENTS	1.03	0.92	0.93	0.94
EMS RESPONSE TIME	0.90	0.84	0.84	0.84
PART 1 CRIMES	2.26	1.48	1.41	1.40

Who Gets Miscounted In The Census ?
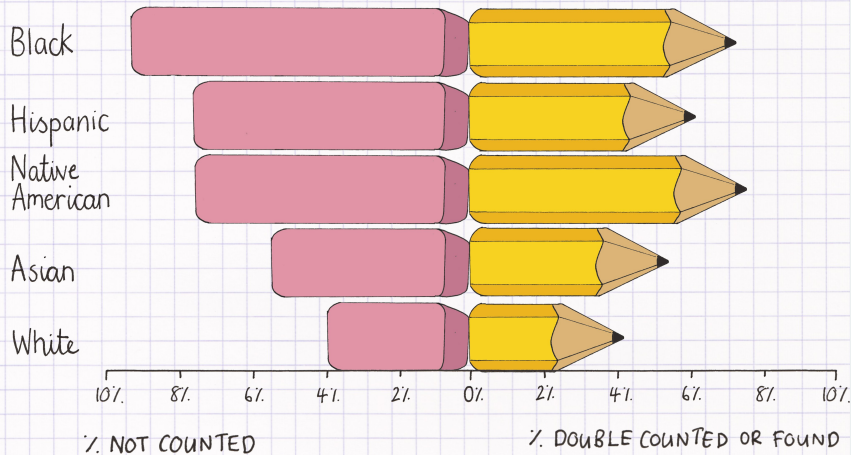
Understanding how the past matters

States / Counties scatterplots: Obama Share, 2008 versus Proportion Slave, 1860
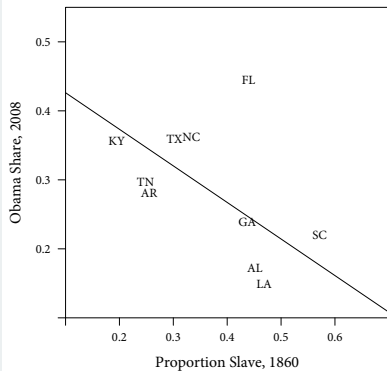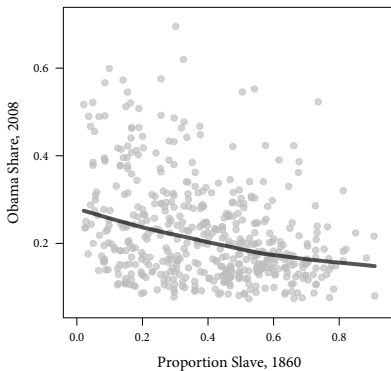
2/ Course Details

FIGURE 3.   Directed Acyclic Graph Showing the Causal Relationships Present in Analyzing Causal Mechanisms
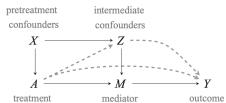
Notes: Dashed red lines represent the controlled direct effect of the treatment not through the mediator. Unobserved errors are omitted.
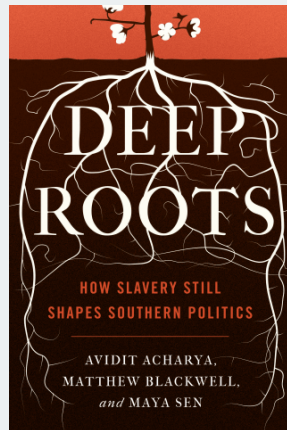
What will you learn in this class?

- Summarize and visualize data

What will you learn in this class?

- Summarize and visualize data

- Wrangle messy data into tidy forms

What will you learn in this class?

- Summarize and visualize data

- Wrangle messy data into tidy forms

- Evaluate claims about causality

What will you learn in this class?

- Summarize and visualize data

- Wrangle messy data into tidy forms

- Evaluate claims about causality

- Be able to use linear regression to analyze data

What will you learn in this class?

- Summarize and visualize data

- Wrangle messy data into tidy forms

- Evaluate claims about causality

- Be able to use linear regression to analyze data

- Understand uncertainty in data analysis and how to quantify it

What will you learn in this class?

- Summarize and visualize data

- Wrangle messy data into tidy forms

- Evaluate claims about causality

- Be able to use linear regression to analyze data

- Understand uncertainty in data analysis and how to quantify it

- Use professional tools like R, RStudio, git, and GitHub

Teaching philosophy

- Deliberate pacing and tons of support.

Teaching philosophy

- Deliberate pacing and tons of support.

- Emphasize intuition and computational approaches over mathematical equations.

Teaching philosophy

- Deliberate pacing and tons of support.

- Emphasize intuition and computational approaches over mathematical equations.

- Practice, practice, practice.

Pep talk, part I
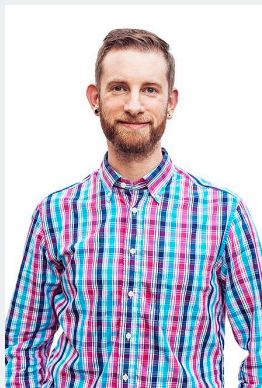
Hadley Wickham (chief data scientist at RStudio)

It's easy when you start out programming to get really frustrated and think, "Oh it's me, I'm really stupid," or, "I'm not made out to program." But, that is absolutely not the case. Everyone gets frustrated. I still get frustrated occasionally when writing R code. It's just a natural part of programming. So, it happens to everyone and gets less and less over time. Don't blame yourself. Just take a break, do something fun, and then come back and try again later.

Hadley Wickham ✓
@hadleywickham

The only way to write good code is to write tons of shitty code first. Feeling shame about bad code stops you from getting to good code

10:11 AM · Apr 17, 2015 · Echofon

892 Retweets   **55** Quote Tweets   **1,144** Likes

Should I take this course?

- Prerequisites: **NONE** (no prior coding, statistics, data science)

Should I take this course?

- Prerequisites: **NONE** (no prior coding, statistics, data science)
- Gov 50 fulfills Gov methods requirement, data science track, and QRD

Should I take this course?

- Prerequisites: **NONE** (no prior coding, statistics, data science)
- Gov 50 fulfills Gov methods requirement, data science track, and QRD
- Material useful to students interested in political science, sociology, economics, public policy, health policy, and many other fields in the social sciences.

Class meetings

- Lectures:

Class meetings

- Lectures:
    - Broad coverage of the course material.

Class meetings

- Lectures:
    - Broad coverage of the course material.
    - Coding demonstrations (follow along with your laptop!)

Class meetings

- Lectures:
    - Broad coverage of the course material.
    - Coding demonstrations (follow along with your laptop!)
    - Slides/videos will be posted to Canvas shortly before lecture.

Class meetings

- Lectures:
  - Broad coverage of the course material.
  - Coding demonstrations (follow along with your laptop!)
  - Slides/videos will be posted to Canvas shortly before lecture.

- Section:

Class meetings

- Lectures:

  - Broad coverage of the course material.
  - Coding demonstrations (follow along with your laptop!)
  - Slides/videos will be posted to Canvas shortly before lecture.

- Section:

  - Guided practice through problems and concepts led by our amazing TFs.

Class meetings

- Lectures:
  - Broad coverage of the course material.
  - Coding demonstrations (follow along with your laptop!)
  - Slides/videos will be posted to Canvas shortly before lecture.

- Section:
  - Guided practice through problems and concepts led by our amazing TFs.
  - Material in section will closely mirror assignments.

Class meetings

- Lectures:
    - Broad coverage of the course material.
    - Coding demonstrations (follow along with your laptop!)
    - Slides/videos will be posted to Canvas shortly before lecture.

- Section:
    - Guided practice through problems and concepts led by our amazing TFs.
    - Material in section will closely mirror assignments.
    - Open sectioning: go to what is convenient for you.

Class meetings

- Lectures:
    - Broad coverage of the course material.
    - Coding demonstrations (follow along with your laptop!)
    - Slides/videos will be posted to Canvas shortly before lecture.

- Section:
    - Guided practice through problems and concepts led by our amazing TFs.
    - Material in section will closely mirror assignments.
    - Open sectioning: go to what is convenient for you.
    - We will have certain sections for students who are more/less comfortable with the material

Computing

- We'll use the R statistical environment to analyze data

Computing

- We'll use the R statistical environment to analyze data
  - It's free

Computing

- We'll use the R statistical environment to analyze data
    - It's free
    - Extremely popular for data analysis

Computing

- We'll use the R statistical environment to analyze data
  - It's free
  - Extremely popular for data analysis
  - Academics, 538, NYT, Facebook, Google, Twitter, nonprofits, governments all use R.

Computing

- We'll use the R statistical environment to analyze data
    - It's free
    - Extremely popular for data analysis
    - Academics, 538, NYT, Facebook, Google, Twitter, nonprofits, governments all use R.
    - Huge benefit to your resume to have R skills.

Computing

- We'll use the R statistical environment to analyze data

  - It's free
  - Extremely popular for data analysis
  - Academics, 538, NYT, Facebook, Google, Twitter, nonprofits, governments all use R.
  - Huge benefit to your resume to have R skills.

- Interface with R via a program called RStudio

Computing

- We'll use the R statistical environment to analyze data

    - It's free
    - Extremely popular for data analysis
    - Academics, 538, NYT, Facebook, Google, Twitter, nonprofits, governments all use R.
    - Huge benefit to your resume to have R skills.

- Interface with R via a program called RStudio

- Problem Set 0 on the website helps get everything installed.

Computing

- We'll use the R statistical environment to analyze data
    - It's free
    - Extremely popular for data analysis
    - Academics, 538, NYT, Facebook, Google, Twitter, nonprofits, governments all use R.
    - Huge benefit to your resume to have R skills.

- Interface with R via a program called RStudio

- Problem Set 0 on the website helps get everything installed.

- Lots of help in section, study halls, office hours.

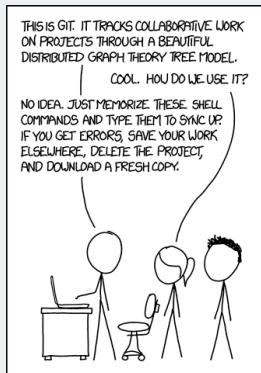- Other core tools: git and GitHub
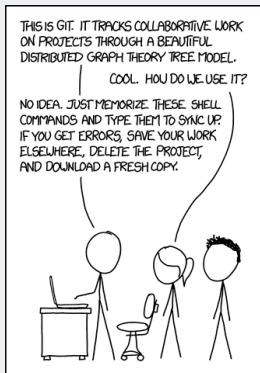
- Other core tools: git and GitHub
  - **Version control system**: an archive of project versions.

- Other core tools: git and GitHub
  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily

git and GitHub

- Other core tools: git and GitHub
  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily
  - Makes collaboration much more mangeable.

- Other core tools: git and GitHub

  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily
  - Makes collaboration much more mangeable.

- Will feel very odd at first, but you git used to it
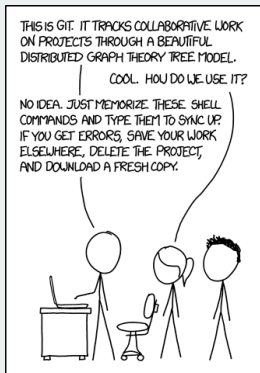
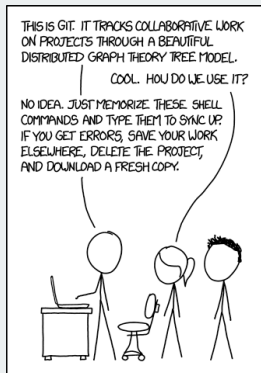# git and GitHub

- Other core tools: git and GitHub

  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily
  - Makes collaboration much more mangeable.

- Will feel very odd at first, but you git used to it

- Why learn this now?

git and GitHub

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.

COOL. HOW DO WE USE IT?

NO IDEA. JUST MEMORIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.
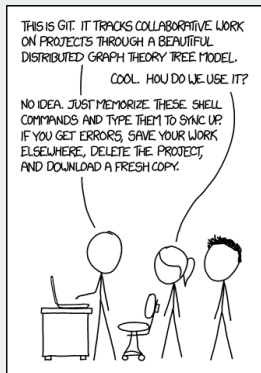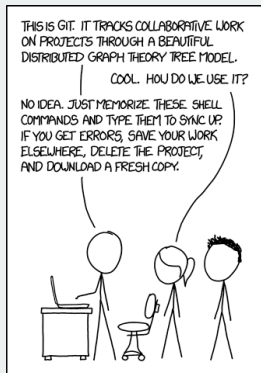
- Other core tools: git and GitHub

  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily
  - Makes collaboration much more mangeable.

- Will feel very odd at first, but you git used to it

- Why learn this now?

  - Knowing git/GitHub is a huge plus for data jobs.

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.

COOL. HOW DO WE USE IT?

NO IDEA. JUST MEMORIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.
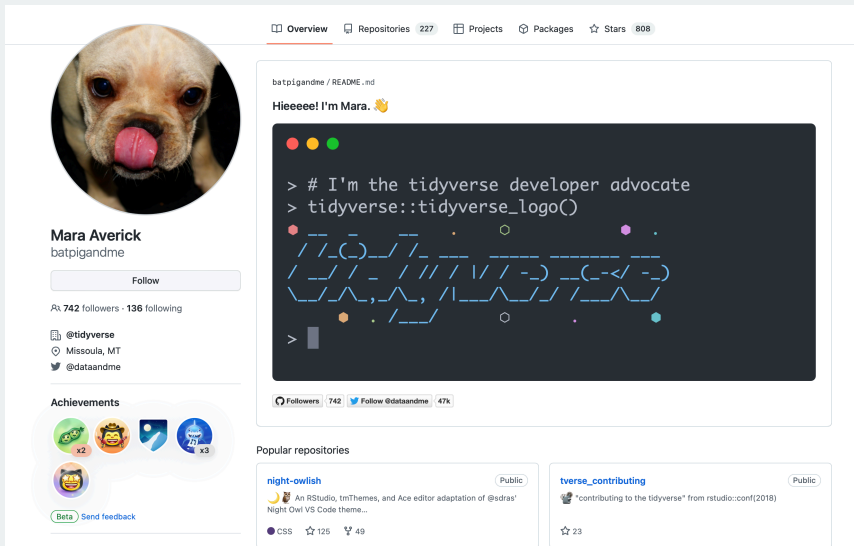
- Other core tools: git and GitHub
  - **Version control system**: an archive of project versions.
  - Allows you to revert back to old versions easily
  - Makes collaboration much more mangeable.
- Will feel very odd at first, but you git used to it
- Why learn this now?
  - Knowing git/GitHub is a huge plus for data jobs.
  - Your GitHub profile can showcase your amazing new skills with data!

Sample GitHub profile

Textbook

- 3 primary textbooks (links on syllabus):

Textbook

- 3 primary textbooks (links on syllabus):
    - Modern Dive (free online)

Textbook

- 3 primary textbooks (links on syllabus):
  - Modern Dive (free online)
  - "Quantitative Social Science: An Introduction in tidyverse" by Kosuke Imai (not free)

Textbook

- 3 primary textbooks (links on syllabus):
  - Modern Dive (free online)
  - "Quantitative Social Science: An Introduction in tidyverse" by Kosuke Imai (not free)
  - Introduction to Modern Statistics (free online)

Textbook

- 3 primary textbooks (links on syllabus):

    - Modern Dive (free online)
    - "Quantitative Social Science: An Introduction in tidyverse" by Kosuke Imai (not free)
    - Introduction to Modern Statistics (free online)

- We'll move back and forth.

Textbook

- 3 primary textbooks (links on syllabus):

    - Modern Dive (free online)
    - "Quantitative Social Science: An Introduction in tidyverse" by Kosuke Imai (not free)
    - Introduction to Modern Statistics (free online)

- We'll move back and forth.

- Sometimes same material in two/three different books. Choose which helps most!

Assignments

- Roughly weekly homeworks throughout semester

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus
  - Lowest score dropped.

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus
  - Lowest score dropped.

- Two take-home "exams" which are just HWs done by yourself.

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus
  - Lowest score dropped.

- Two take-home "exams" which are just HWs done by yourself.

- Final project: a data essay

Assignments

- Roughly weekly homeworks throughout semester

  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus
  - Lowest score dropped.

- Two take-home "exams" which are just HWs done by yourself.

- Final project: a data essay

  - Find data, pose a research question, answer it using data.

Assignments

- Roughly weekly homeworks throughout semester
  - Posted on Thursday morning, due following Wednesday.
  - Dates on syllabus
  - Lowest score dropped.

- Two take-home "exams" which are just HWs done by yourself.

- Final project: a data essay
  - Find data, pose a research question, answer it using data.
  - Submitted as a public GitHub repository and website

Assignments

- Roughly weekly homeworks throughout semester

    - Posted on Thursday morning, due following Wednesday.
    - Dates on syllabus
    - Lowest score dropped.

- Two take-home "exams" which are just HWs done by yourself.

- Final project: a data essay

    - Find data, pose a research question, answer it using data.
    - Submitted as a public GitHub repository and website
    - First item in your public data portfolio

Tutorials

- Getting practice with R can be overwhelming, so we'll introduce new skills through online tutorials.

Tutorials

- Getting practice with R can be overwhelming, so we'll introduce new skills through online tutorials.

- Guided practice on R, helping to introduce new concepts.

Tutorials

- Getting practice with R can be overwhelming, so we'll introduce new skills through online tutorials.

- Guided practice on R, helping to introduce new concepts.

  - Low stakes/stress: graded simply on completion.

Tutorials

- Getting practice with R can be overwhelming, so we'll introduce new skills through online tutorials.

- Guided practice on R, helping to introduce new concepts.

  - Low stakes/stress: graded simply on completion.
  - Generally, due on Monday nights, but see schedule

Tutorials

- Getting practice with R can be overwhelming, so we'll introduce new skills through online tutorials.

- Guided practice on R, helping to introduce new concepts.
    - Low stakes/stress: graded simply on completion.
    - Generally, due on Monday nights, but see schedule

- Lecture/HW won't be the first time you're trying some code!

Ed discussion board

Grades

- Grade breakdown as follows:

Grades

- Grade breakdown as follows:
    - R tutorials (10% of final grade)

Grades

- Grade breakdown as follows:
  - R tutorials (10% of final grade)
  - Homeworks (40% of final grade)

Grades

- Grade breakdown as follows:
    - R tutorials (10% of final grade)
    - Homeworks (40% of final grade)
    - Exams (30% of final grade)

Grades

- Grade breakdown as follows:
    - R tutorials (10% of final grade)
    - Homeworks (40% of final grade)
    - Exams (30% of final grade)
    - Final project (20% of final grade)

Grades

- Grade breakdown as follows:

    - R tutorials (10% of final grade)
    - Homeworks (40% of final grade)
    - Exams (30% of final grade)
    - Final project (20% of final grade)

- Final grade is curved

Grades

- Grade breakdown as follows:

    - R tutorials (10% of final grade)
    - Homeworks (40% of final grade)
    - Exams (30% of final grade)
    - Final project (20% of final grade)

- Final grade is curved

- **Bump-up**: we bump up grades of students close to the cutoff who make valuable contributions to the course.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.
  - Will happen weekly, exact number of hours will depend on enrollment.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.

  - Will happen weekly, exact number of hours will depend on enrollment.
  - Peer tutors with experience in statistics and R will be on hand to help you if you get stuck or have question.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.

  - Will happen weekly, exact number of hours will depend on enrollment.
  - Peer tutors with experience in statistics and R will be on hand to help you if you get stuck or have question.
  - Best to come in groups and work together, grab a tutor when stuck.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.

  - Will happen weekly, exact number of hours will depend on enrollment.
  - Peer tutors with experience in statistics and R will be on hand to help you if you get stuck or have question.
  - Best to come in groups and work together, grab a tutor when stuck.

- Group Study Hall on Tue/Wed evenings before problem set is due.

Study Halls

- Study Halls: a place to work on Gov 50 and get help.

  - Will happen weekly, exact number of hours will depend on enrollment.
  - Peer tutors with experience in statistics and R will be on hand to help you if you get stuck or have question.
  - Best to come in groups and work together, grab a tutor when stuck.

- Group Study Hall on Tue/Wed evenings before problem set is due.

- Bottom line: **we want you to succeed in this class!**

What should you do today?

- Try to get everything set up on your computer (Problem Set 0)

What should you do today?

- Try to get everything set up on your computer (Problem Set 0)
  - Problem Set 0 drop-in help sessions this week!

What should you do today?

- Try to get everything set up on your computer (Problem Set 0)
  - Problem Set 0 drop-in help sessions this week!
- Start Tutorial 1 on basics of R and data visualization

What should you do today?

- Try to get everything set up on your computer (Problem Set 0)
  - Problem Set 0 drop-in help sessions this week!
- Start Tutorial 1 on basics of R and data visualization
  - Can be done on the web before installing R on your computer.

What should you do today?

- Try to get everything set up on your computer (Problem Set 0)
  - Problem Set 0 drop-in help sessions this week!

- Start Tutorial 1 on basics of R and data visualization
  - Can be done on the web before installing R on your computer.

- **Tell your friends**: data science is more fun with friends along for the journey.