Base R Graphics

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February 27, 2018

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COMPASS Workshops

Computing for Data Analysis in the Social Sciences

- Free, open-source statistical programming and data analysis workshops using R and RStudio
- Open to everyone with a Princeton ID
- No programming experience is necessary or expected
- Attendees should bring a laptop computer to fully participate in the workshops

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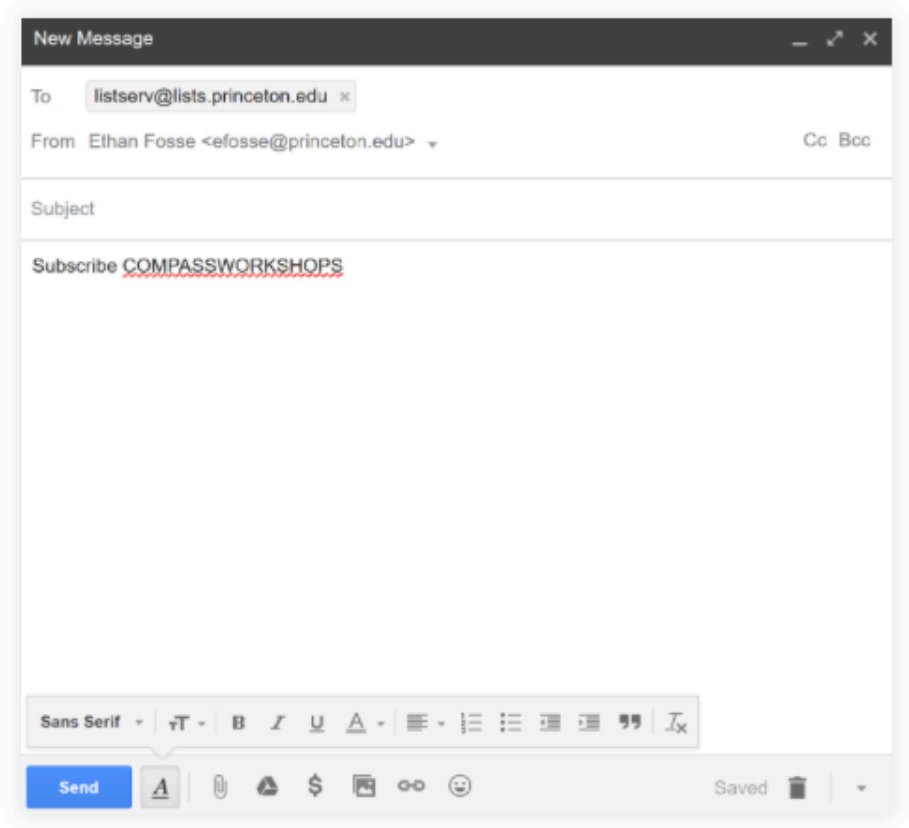

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  - Marc Ratkovic (Assistant Professor, Department of Politics)
  - Matthew Salganik (Professor, Department of Sociology)

Todays' Contents

1. Before You Begin
2. Today's Project
3. Things to Cover
4. Learning by Doing
5. Research Questions

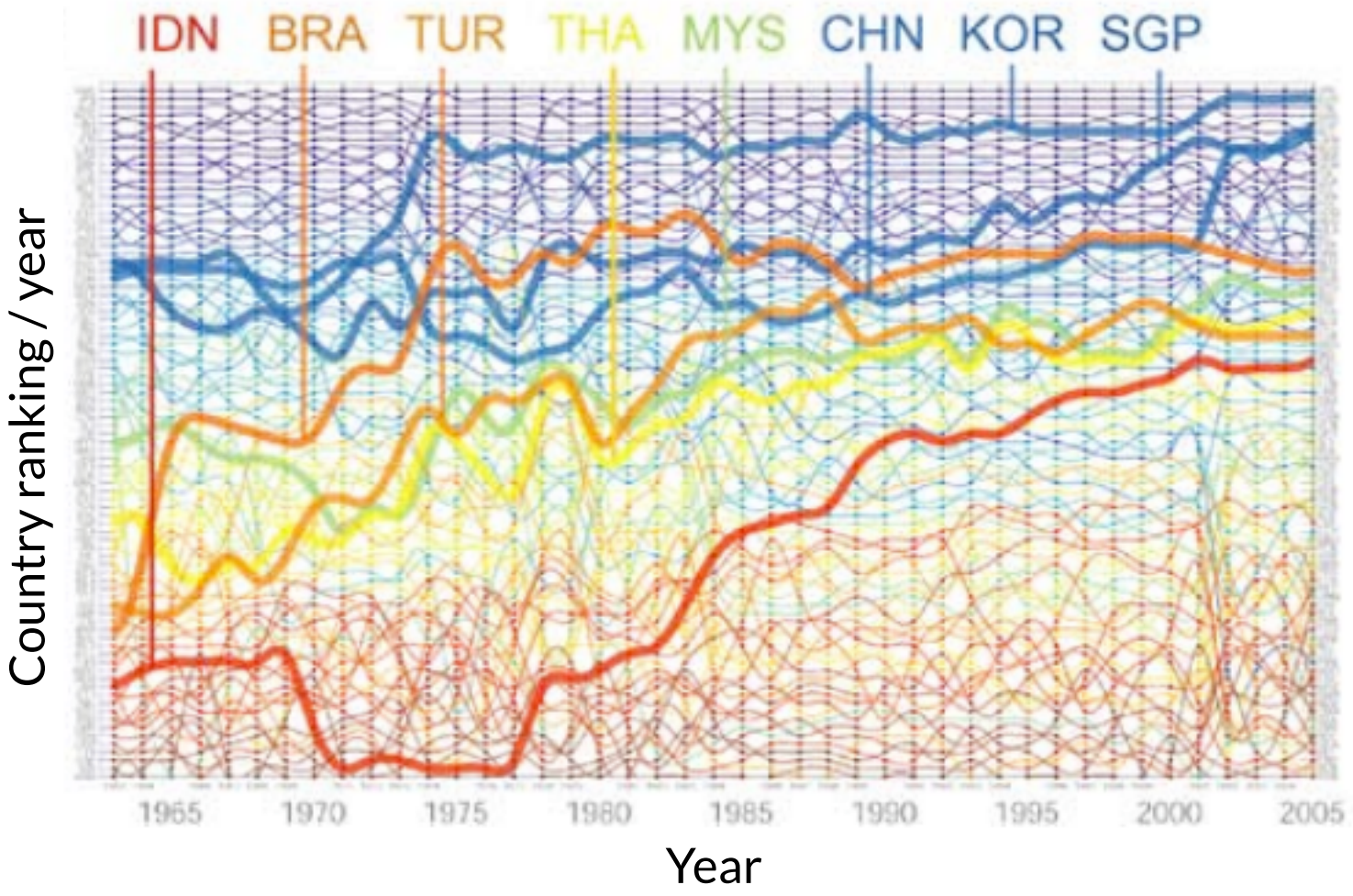
Motivation

A dataset is just a collection of numbers and strings (very complex not understandable in its naïve format). In order to understand the systemic patterns behind a dataset, we use statistics and graphs (simpler understandable).

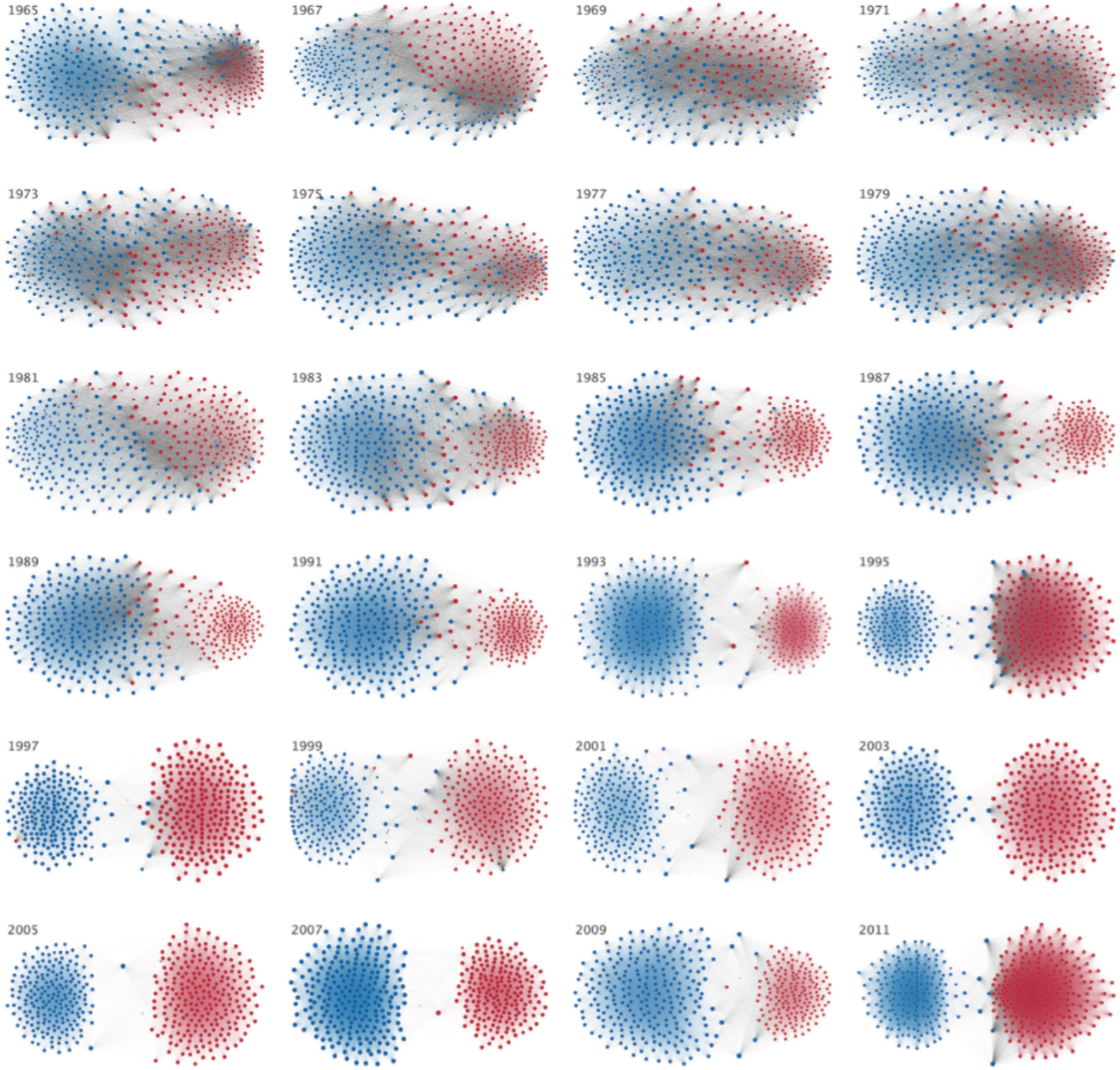
Power of Graphs

Often, graphs convey more information with less complexity in a very effective way.

Evolution (Ranking) of Industrial Complexity



Hidalgo and Hausmann (2009)



Rise of Polarization in US House

Blue: Democrat

Red: Republican

Tie weight: roll call vote similarity

Layout: High weight pairs more likely to be located closely.

Andris et al (2015)

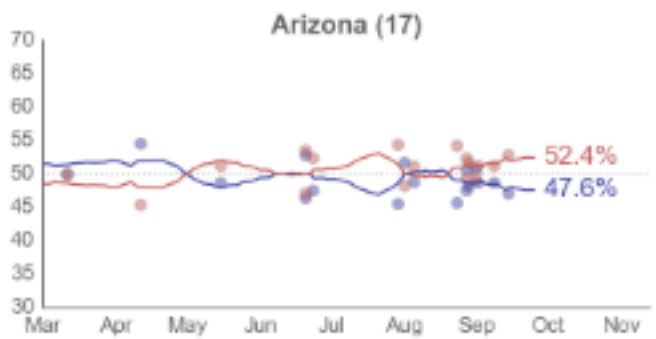
Things to Cover :: Base R Graphics

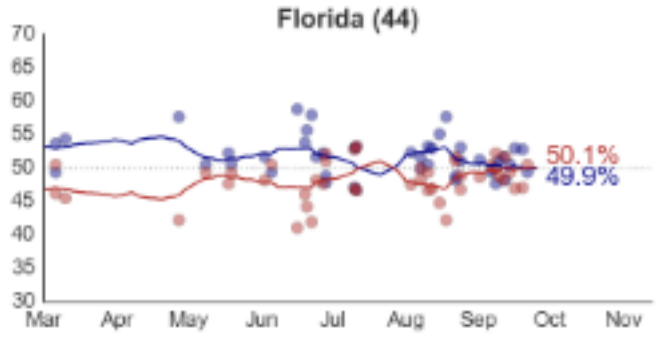
- Bar plot
- Box plot
- Scatter plot
- Histogram

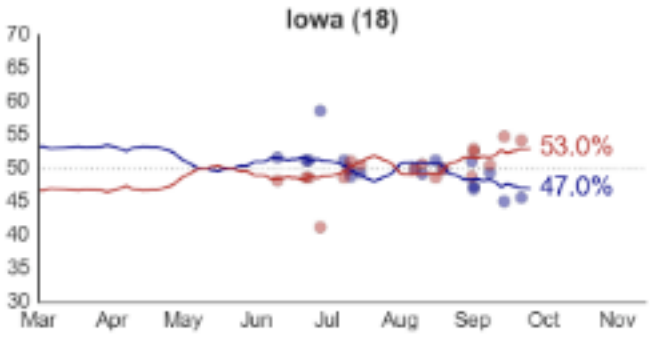
Project 1

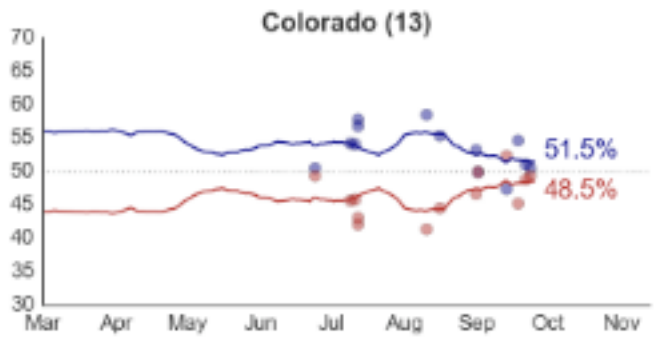
State-level Polls

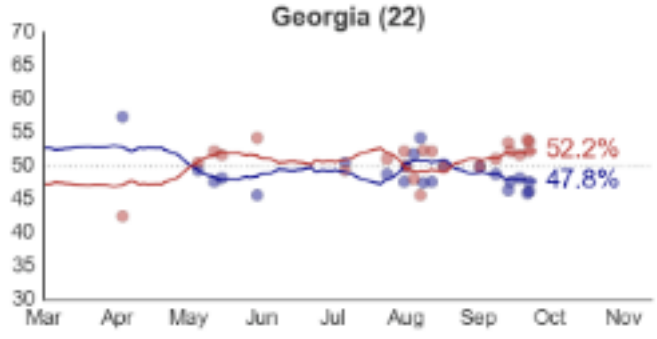
Generic Approach to Election Prediction

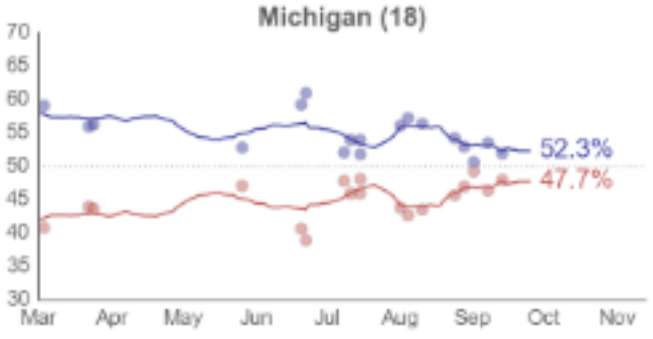








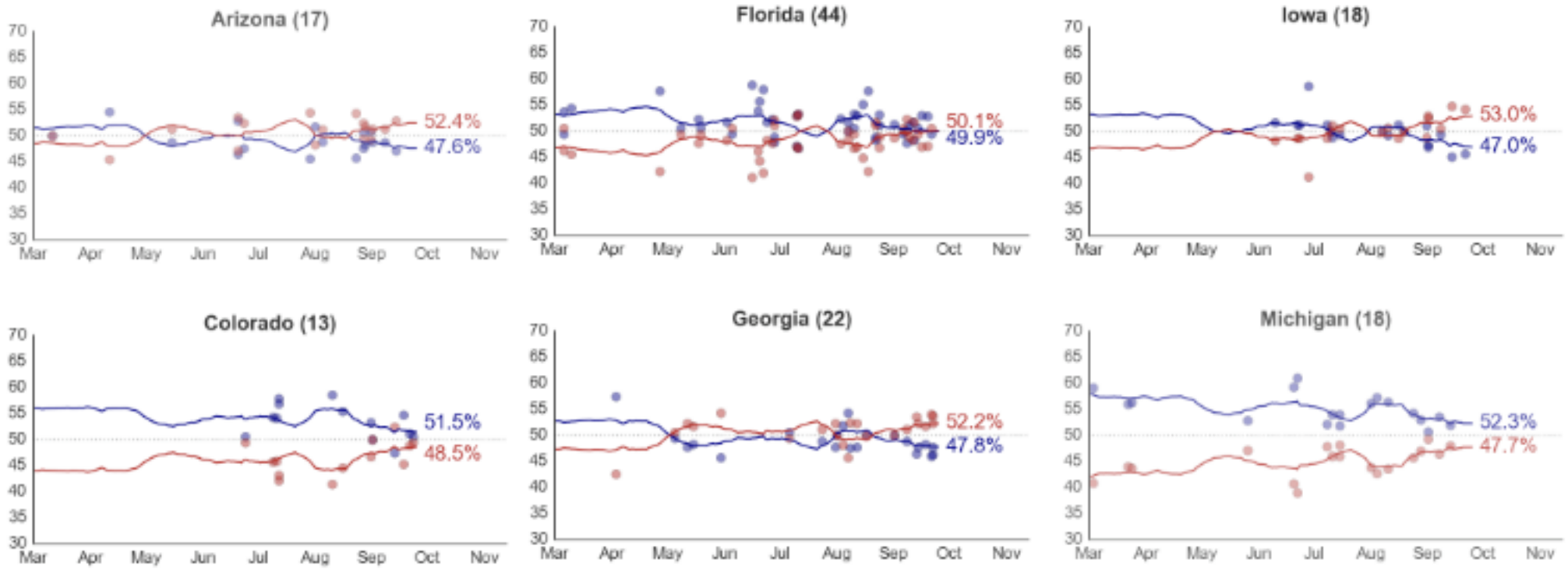




VOTAMATIC

Polling Analysis and Election Forecasting

Generic Approach to Election Prediction



Statistical **aggregation** of state **poll** results over time

Download the Dataset and Slides

https://compass-workshops.github.io/info/

1. Right click on Week 3 Data
2. Save as to a preferred location

Make sure you know the location!

Downloaded from http://election.princeton.edu/

Attendance Survey

Get back to Rstudio: Loading your Dataset

Task 1: Convert the downloaded CSV (Comma Separated Values) File into an R object.

```
rm(list=ls())
## Delete your workspace
getwd()
## Check your current working directory
setwd("<location of your dataset>")
## Set your working directory
polls = read.csv("2016_StatePolls_final.csv")
## Load data
```

Quick Inspection of Poll Data Frame

```
polls         1345 obs. of 19 variables
 State : Factor w/ 34 levels "AK","AZ","CA",.…
 pollster : Factor w/ 208 levels "Abt SRBI Inc…
 pop : int 409 2609 2712 2777 4092 2419 1823 1…
 vtype : Factor w/ 3 levels "Adults","Likely V…
 method : Factor w/ 8 levels "Automated Phone"…
 begmm : int 11 11 11 11 11 11 11 11 11 11 ...
 begdd : int 1 1 1 1 1 1 1 1 1 1 ...
 begyy : int 2016 2016 2016 2016 2016 2016 201…
 endmm : int 11 11 11 11 11 11 11 11 11 11 ...
 enddd : int 7 7 7 7 7 7 7 7 7 7 ...
 endyy : int 2016 2016 2016 2016 2016 2016 201…
 trump : num 48 42 31 40 45 45 35 52 47 49 ...
 clinton : num 31 45 56 43 47 45 52 35 38 36 .…
 other : num NA NA NA NA NA NA NA NA NA NA ...
 undecided: num NA NA NA NA NA NA NA NA NA NA
 Begdate : Factor w/ 205 levels
 Enddate : Factor w/ 200 levels "1/18/2016","1…
 Middate : Factor w/ 196 levels "1/15/2016","1…
 etc : num 21 13 13 17 8 10 13 13 15 15 ...
```

pop : int 409 2609 2712 2777 4092 241
1823 1700 1781 1311 ...

```
View(polls)
## Spreadsheet-style data viewer
summary(polls)
## Summarize variables on your console
names(polls)
## Names of all variables
dim(polls)
nrow(polls)
ncol(polls)
## Dimensional information
head(polls)
tail(polls)
```

Generate etc for miscellaneous responses

```
summary(polls$other)
summary(polls$undecided)
polls$etc<-100-polls$trump-polls$clinton
```

- Now polls$etc contains rest of the responses other than Clinton and Trump

plot command structure

```
plot_command(command-specific,main="title",xlab="xlabel",ylab="ylabel")
```

e.g.
- plot
- barplot
- pie
- hist

e.g.
- single variable, x
- multiple variables: x,y
- variables, **parameters**

generic parameters
- symbol
- color
- line style
- line width
- ……

plot.new() :: starting a new plot

```
plot.new()
```

dev.off() :: reset/complete graphic device

```
dev.off()
```

barplot() :: values by factor

```
barplot(table,main="title",xlab="xlabel",ylab="ylabel")
```

N by 2 table:
[categorical, numeric]

e.g.

States	Frequency

factor

numeric value

Question 1

- Are contested states more likely to be polled?

  (with the assumption that our dataset contains almost all of the poll records w/o bias)

```
Goal: First compute the frequency table of polling by state
table(polls$State)
```

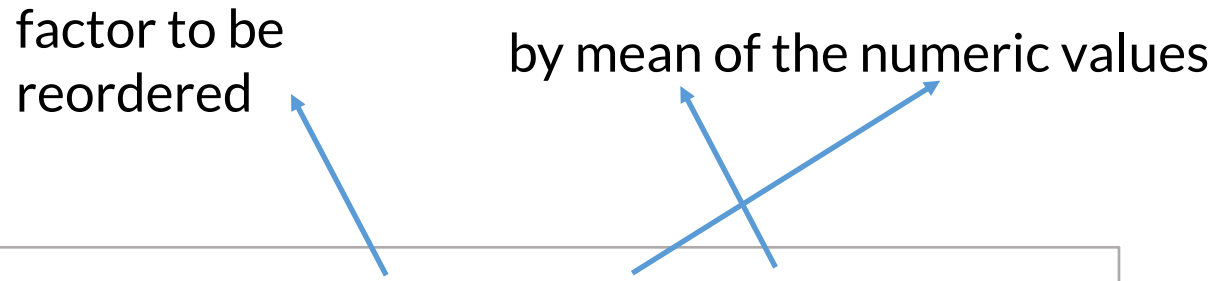
```
barplot(table(polls$State),main="Unordered")
## simple bar plot (Q: what is the order in the x values?)
```

- Goal: Reorder x values depending on support rate

Question 1

- Are contested states more likely to be polled?

(with the assumption that our dataset contains almost all of the poll records w/o bias)



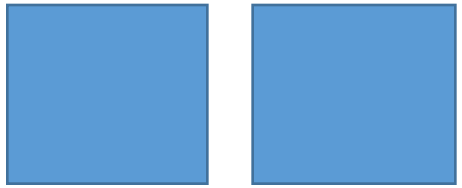

```
polls_r <- transform(polls,State = reorder(State, trump, mean))
levels(polls_r$State) ## compare with levels(polls$State)
## reorder states by Trump support rate
barplot(table(polls_r$State),main="Ordered by %Trump")
## ordered plot!
mean(polls_r$trump[polls_r$State=="MD"])
```

par() :: subplots

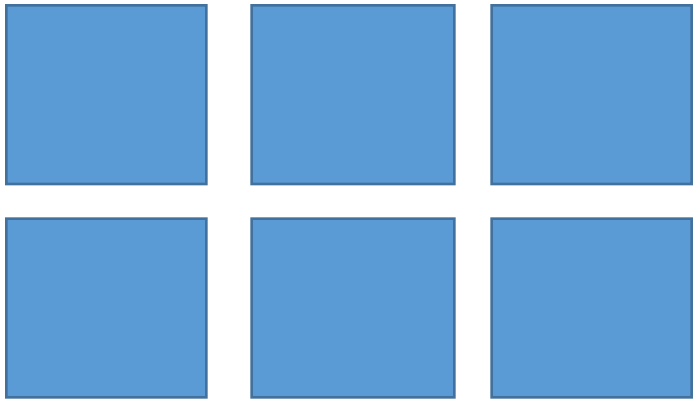
```
par(mfrow=c(#rows,#cols))
```

e.g.

```
par(mfrow=c(1,2))
```



```
par(mfrow=c(2,3))
```



Question 1

- Are contested states more likely to be polled?

  (with the assumption that our dataset contains almost all of the poll records w/o bias)

```
par(mfrow=c(2,1))
barplot(table(polls$State),main="Simple Bar Plot")
barplot(table(polls_r$State),main="Ordered by %Trump")
## with subplot function
```

Project 2

Information for 136 movies released from Hollywood in 2011

Loading your Dataset

Import Hollywood movie dataset using a package **Lock5Data**

```
install.packages("Lock5Data")
## Install package Lock5Data which contains the Hollywood dataset
data(HollywoodMovies2011)
## Load data
movies<- na.omit(HollywoodMovies2011)
## drop all observations with at least one NA
```

Information for 136 movies released from Hollywood in 2011

Quick Inspection of Poll Data Frame

```
movies                    111 obs. of 14 variables
  Movie : Factor w/ 136 levels "30 Minutes or Less",..: 50 73
  LeadStudio : Factor w/ 34 levels "20th Century Fox",..: 24 1
  RottenTomatoes : int 67 68 44 96 90 93 75 35 69 69 ...
  AudienceScore : int 65 58 38 92 77 84 91 58 73 72 ...
  Story : Factor w/ 22 levels "","Comedy","Discovery",..: 10 1
  Genre : Factor w/ 9 levels "Action","Adventure",..: 7 7 4 6
  TheatersOpenWeek : int 2408 3321 3049 4375 2918 944 2534 361
  BOAverageOpenWeek: int 5511 15829 10365 38672 8995 6177 1027
  DomesticGross : num 54 104 100 381 169 ...
  ForeignGross : num 43 98.2 115.9 947.1 119.3 ...
  WorldGross : num 97 202 216 1328 288 ...
  Budget : num 1.5 5 20 125 32.5 17 25 80 27 35 ...
  Profitability : num 64.67 40.38 10.81 10.62 8.87 ...
  OpeningWeekend : num 13.3 52.6 31.6 169.2 26.2 ...
  attr(*, "na.action")=Class 'omit' Named int [1:25] 9 21 22 2
  .. ..- attr(*, "names")= chr [1:25] "9" "21" "22" "25" ...
```

```
View(movies)
## Spreadsheet-style data viewer
summary(movies)
## Summarize variables on your console
names(movies)
## Names of all variables
dim(movies)
nrow(movies)
ncol(movies)
## Dimensional information
head(movies)
tail(movies)
```

hist () :: distribution of values

```
hist(x,breaks=bins,main="title",xlab="xlabel",ylab="ylabel")
```

breaks: number of bins

x,: numeric

```
hist(movies$RottenTomatoes, breaks=10, col="red", xlab="Rating",
main="Colored histogram with 10 bins")
```

TOP BOX OFFICE Get Tickets

65%	Miss Peregrine's Home for Peculi...	$28.9M
83%	Deepwater Horizon	$20.2M
63%	The Magnificent Seven	$15.6M
62%	Storks	$13.5M
82%	Sully	$8.3M
36%	Masterminds	$6.5M

Question 2

- What is more correlated with gross income, budget or critics rating?

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- Check bivariate correlations of each pair on different graphs

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- What is more correlated with gross income, budget or critics rating?
- Check bivariate correlations of each pair on different graphs

```
par(mfrow=c(1,2))
## 1 by 2 subplots
plot(movies$RottenTomatoes,log10(movies$WorldGross))
plot(log10(movies$Budget),log10(movies$WorldGross))
## log10: logarithm function with base 10
```

Question 2

- What is more correlated with gross income, budget or critics rating?
- Check bivariate correlations of each pair on different graphs

```
par(mfrow=c(1,2))
## 1 by 2 subplots
plot(movies$RottenTomatoes,log10(movies$WorldGross),col=movies$Genre)
plot(log10(movies$Budget),log10(movies$WorldGross),col=movies$Genre)
## log10: logarithm function with base 10
legend('topleft', legend=unique(movies$Genre), col=unique(movies$Genre),
pch=21)
par(mfg=c(1,1))
```

plot() :: add linear trend plot

```
lines(x,y_predicted,main="title",xlab="xlabel",ylab="ylabel")
```


x, y_predicted: numeric

plot() :: add linear trend plot

```
lines(x,y_predicted,main="title",xlab="xlabel",ylab="ylabel")
```

x, y_predicted: numeric

```
mod1 <- lm(log10(movies$WorldGross) ~ movies$RottenTomatoes)
## Linear regression
preds1 <- predict(mod1)
## predicted value obtained by linear regression
plot(movies$RottenTomatoes,log10(movies$WorldGross))
lines(movies$RottenTomatoes, preds1)
```

plot() :: add linear trend plot

```
lines(x,y_predicted,main="title",xlab="xlabel",ylab="ylabel")
```


x, y_predicted: numeric

```
mod2 <- lm(log10(movies$WorldGross) ~ log10(movies$Budget))
## Linear regression
preds2 <- predict(mod2)
## predicted value obtained by linear regression
plot(log10(movies$Budget),log10(movies$WorldGross))
lines(log10(movies$Budget), preds2)
```

Question 3

- Is there significant difference in rating/budget by genre?

Question 3

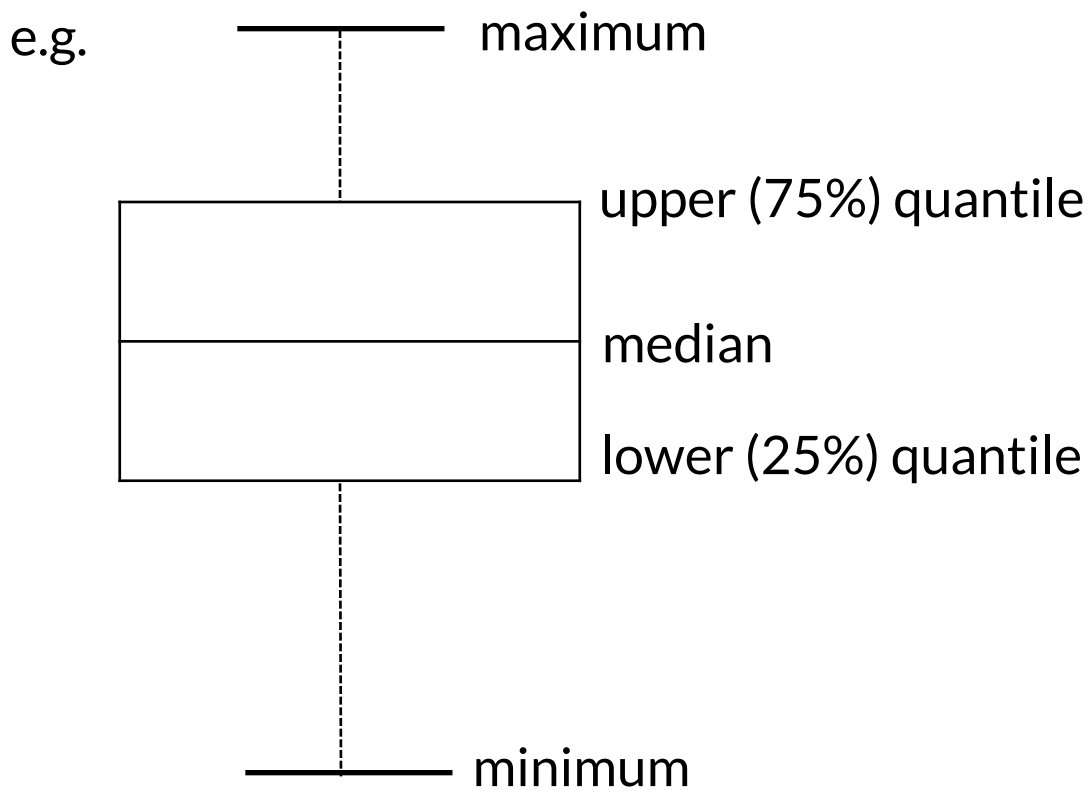
- Is there significant difference in rating/budget by genre?
- Check bivariate correlations of each pair on different graphs

boxplot() :: include distributional information

```
boxplot(y~x,main="title",xlab="xlabel",ylab="ylabel")
```

numeric

categorical(factor)



Question 3

- Is there significant difference in rating/budget by genre?
- Check bivariate correlations of each pair on different graphs.

```
par(las=2)
## horizontal text
par(mfrow=c(1,2))
boxplot(movies$RottenTomatoes~movies$Genre,xlab="Genre",ylab="Rating")
## Genre VS Rating
boxplot(movies$Budget~movies$Genre,xlab="Genre",ylab="Budget")
## Genre VS Budget
```

pdf() :: save graph as pdf

```
pdf("file_name.pdf",width=width_length,height=heigth_length)
```

```
dev.off() ## defaulting
pdf("boxplots.pdf")
par(las=2)
## horizontal text
par(mfrow=c(1,2))
boxplot(movies$RottenTomatoes~movies$Genre,xlab="Genre",ylab="Rating")
## Genre VS Rating
boxplot(movies$Budget~movies$Genre,xlab="Genre",ylab="Budget")
## Genre VS Budget
dev.off() ## This needs to be added let R know the drawing is complete!!
```

Thank you

SPRING 2018 SCHEDULE

February 13	**Introduction to R and RStudio [Friend 101]** (Ethan)	Slides Data Code
February 20	**Data Wrangling in R [Green Hall Room 1-C-4C]** (Yunkyu)	Slides Data Code
February 27	**Base R Graphics** (Yunkyu)	
March 6	**Hypothesis Testing** (Ethan)	