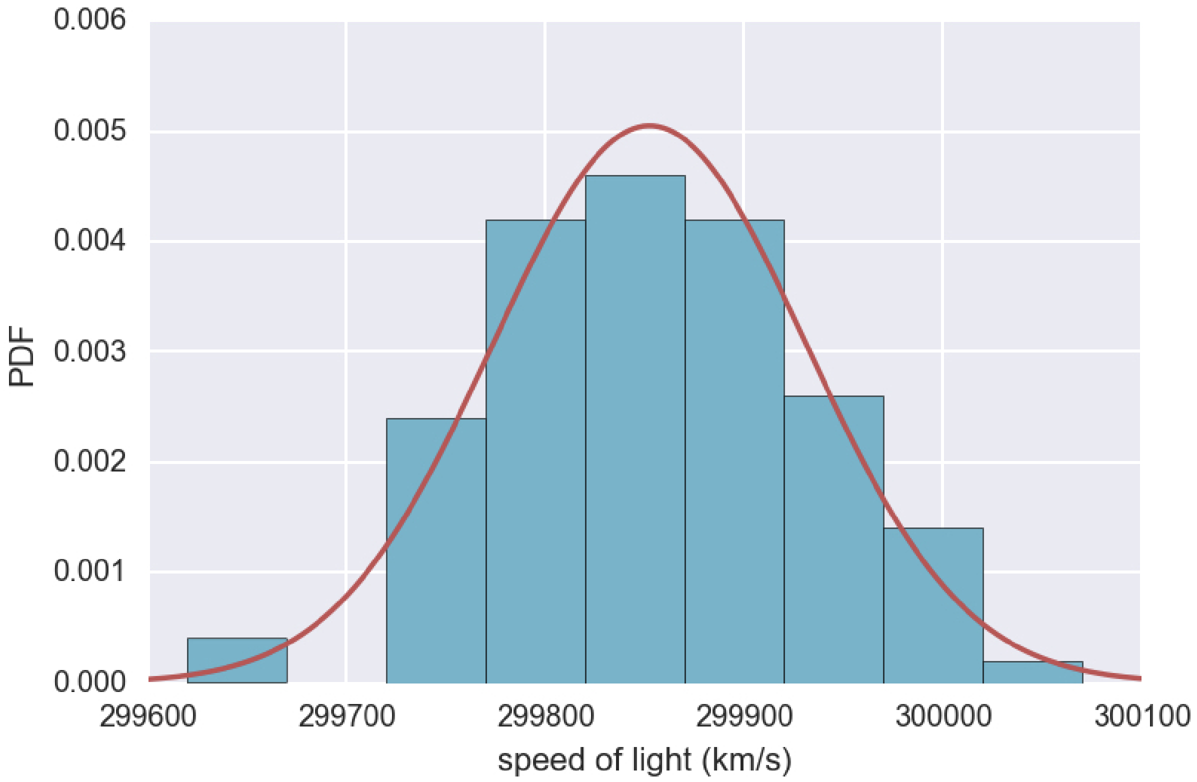
Optimal parameters

STATISTICAL THINKING IN PYTHON (PART 2)

Justin Bois

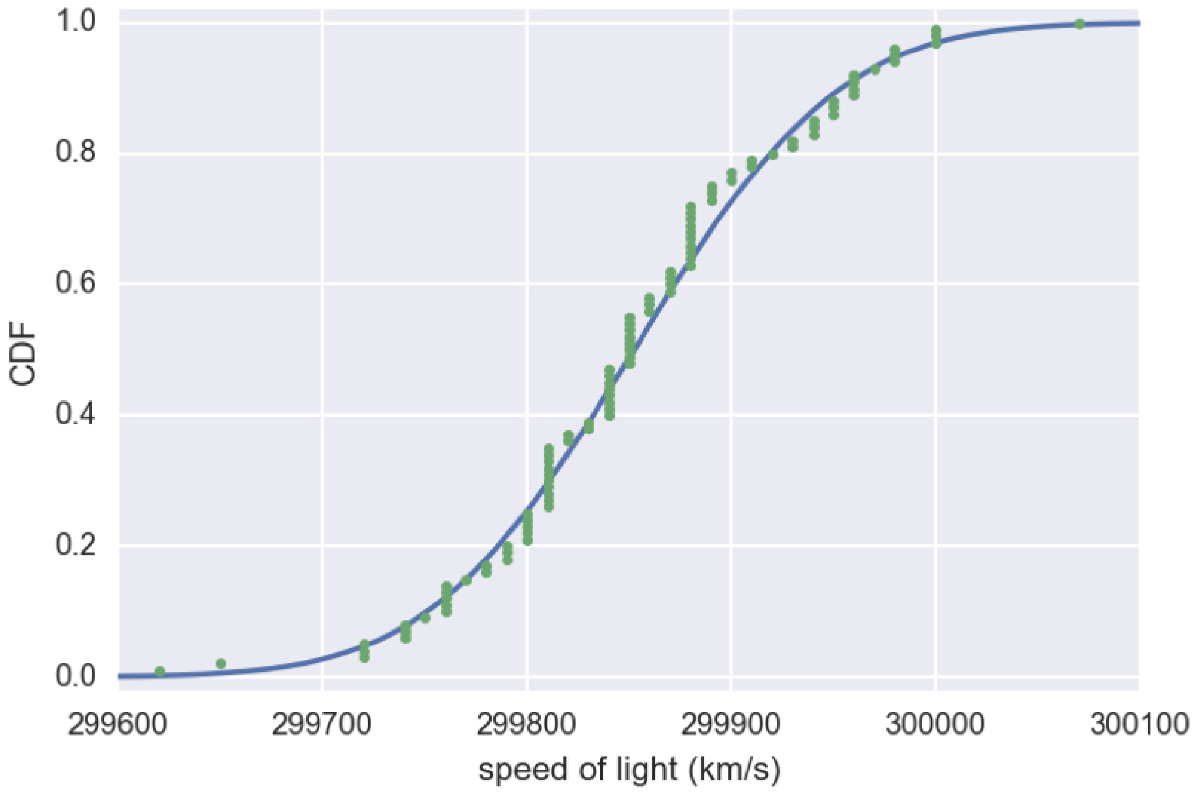
Lecturer at the California Institute of Technology

Histogram of Michelson's measurements



[1] Data: Michelson, 1880

CDF of Michelson's measurements

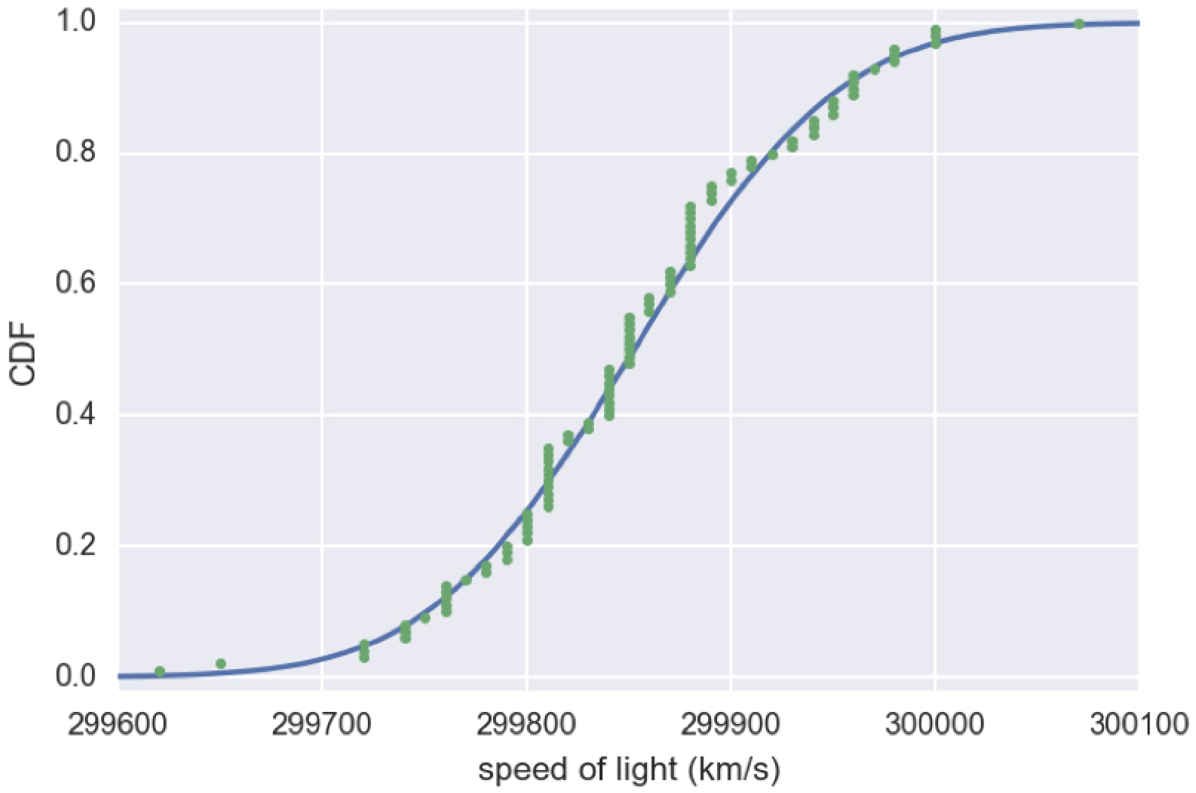


[1] Data: Michelson, 1880

Checking Normality of Michelson data

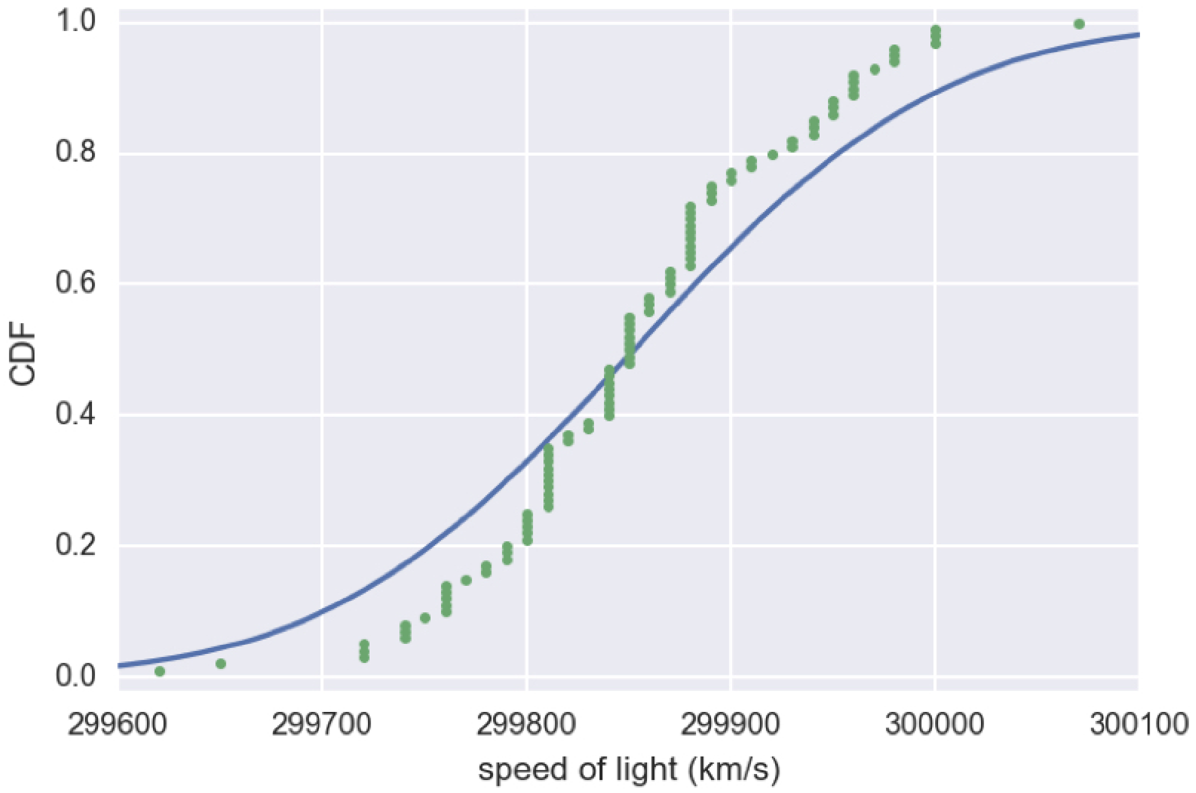
```
import numpy as np
import matplotlib.pyplot as plt

mean = np.mean(michelson_speed_of_light)
std = np.std(michelson_speed_of_light)
samples = np.random.normal(mean, std, size=10000)
```

CDF of Michelson's measurements



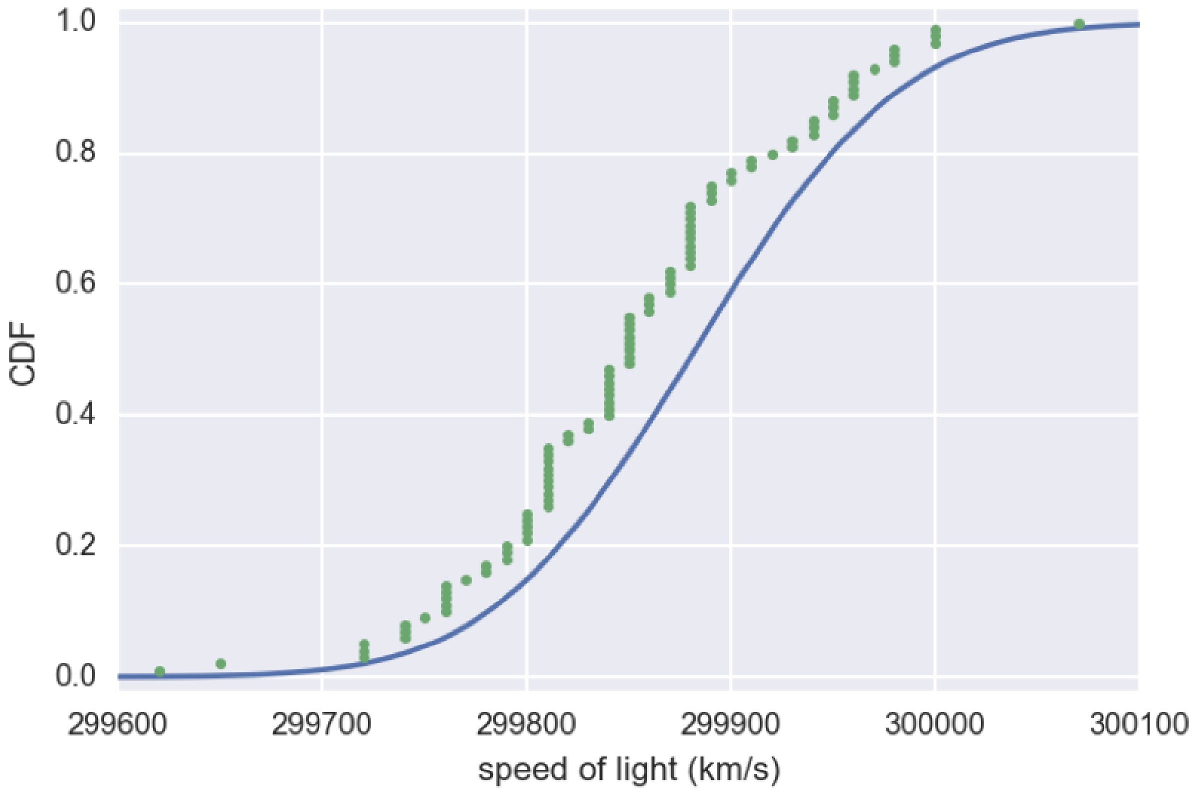
[1] Data: Michelson, 1880

CDF with bad estimate of st. dev.



[1] Data: Michelson, 1880

CDF with bad estimate of mean

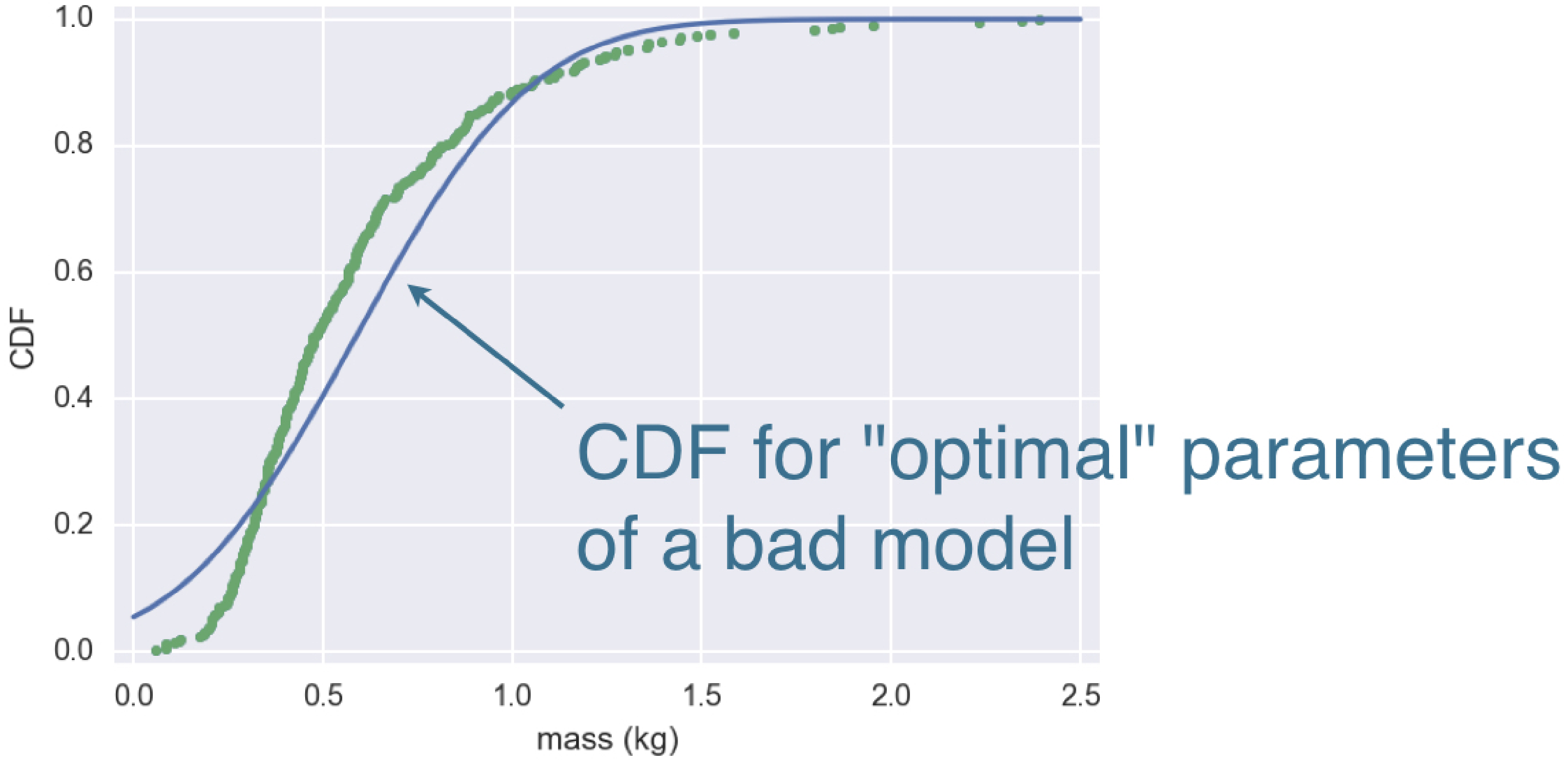


[1] Data: Michelson, 1880

Optimal parameters

- Parameter values that bring the model in closest agreement with the data

Mass of MA large mouth bass



[1] Source: Mass. Dept. of Environmental Protection

Packages to do statistical inference

scipy.stats

Packages to do statistical inference

scipy.stats

statsmodels

Packages to do statistical inference

scipy.stats

statsmodels

hacker stats
with numpy

[1] Knife image: D [2] M Commons, CC BY [3] SA 3.0

Let's practice!

STATISTICAL THINKING IN PYTHON (PART 2)

Linear regression by least squares

STATISTICAL THINKING IN PYTHON (PART 2)

Justin Bois

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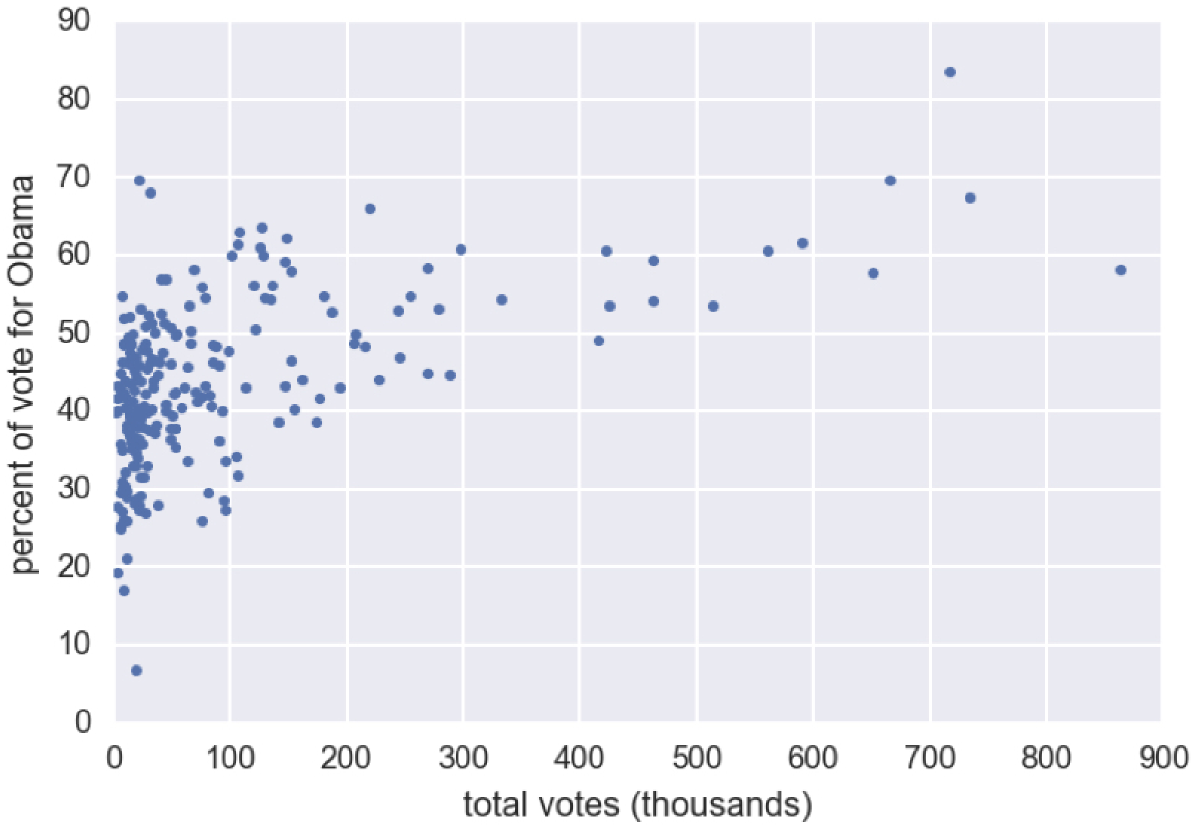
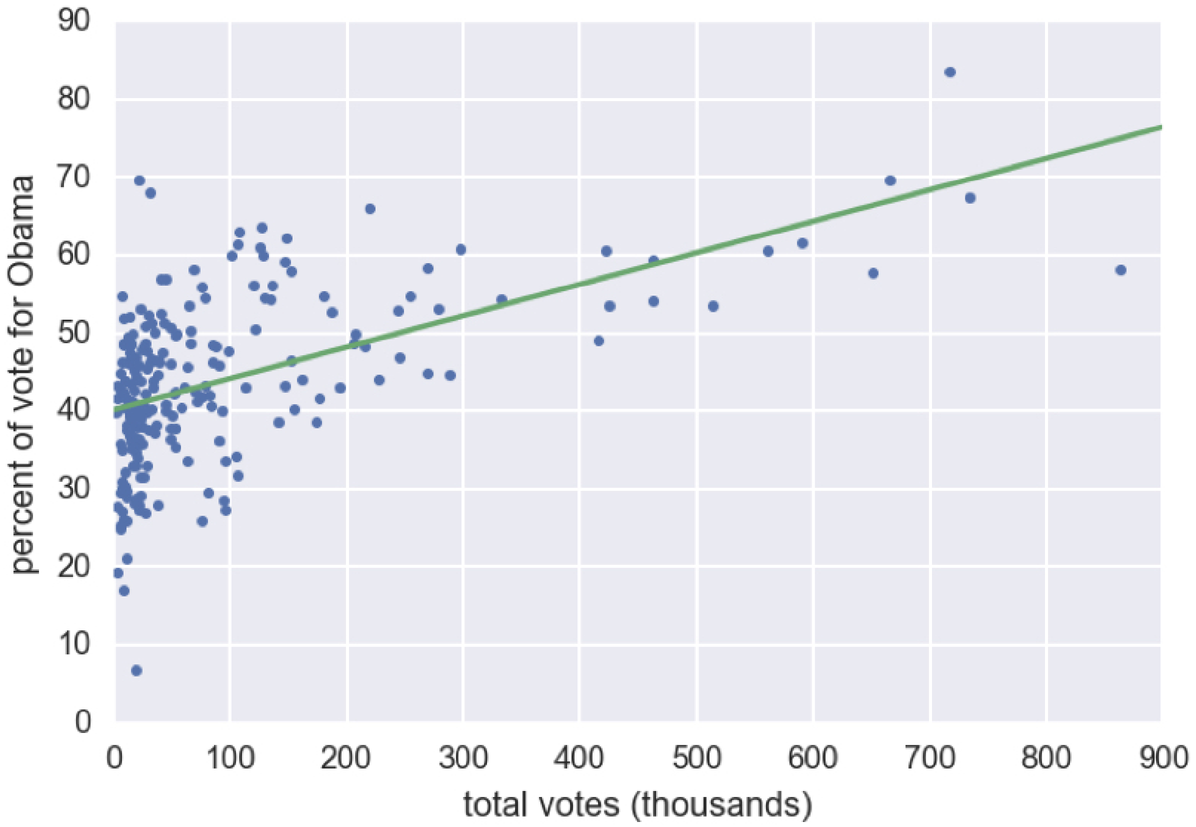
2008 US swing state election results



[1] Data retrieved from Data.gov (https://www.data.gov/)

2008 US swing state election results



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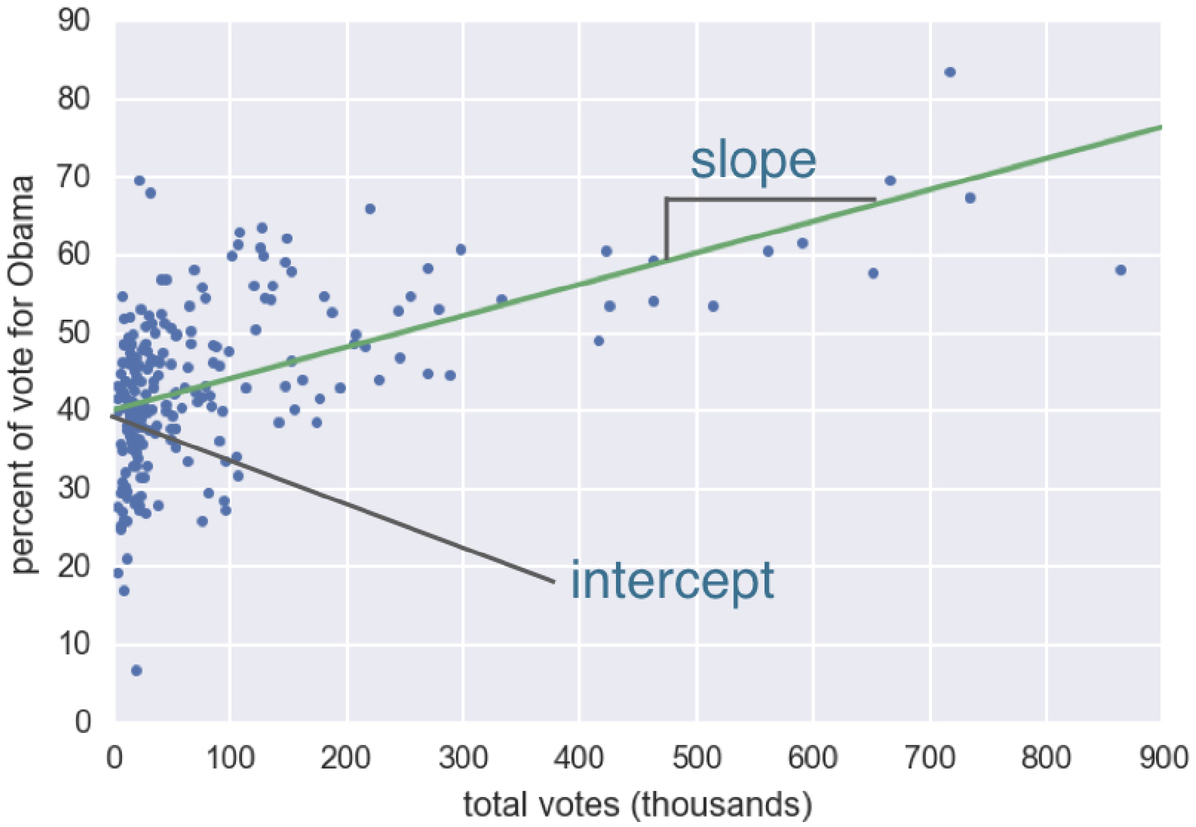
2008 US swing state election results



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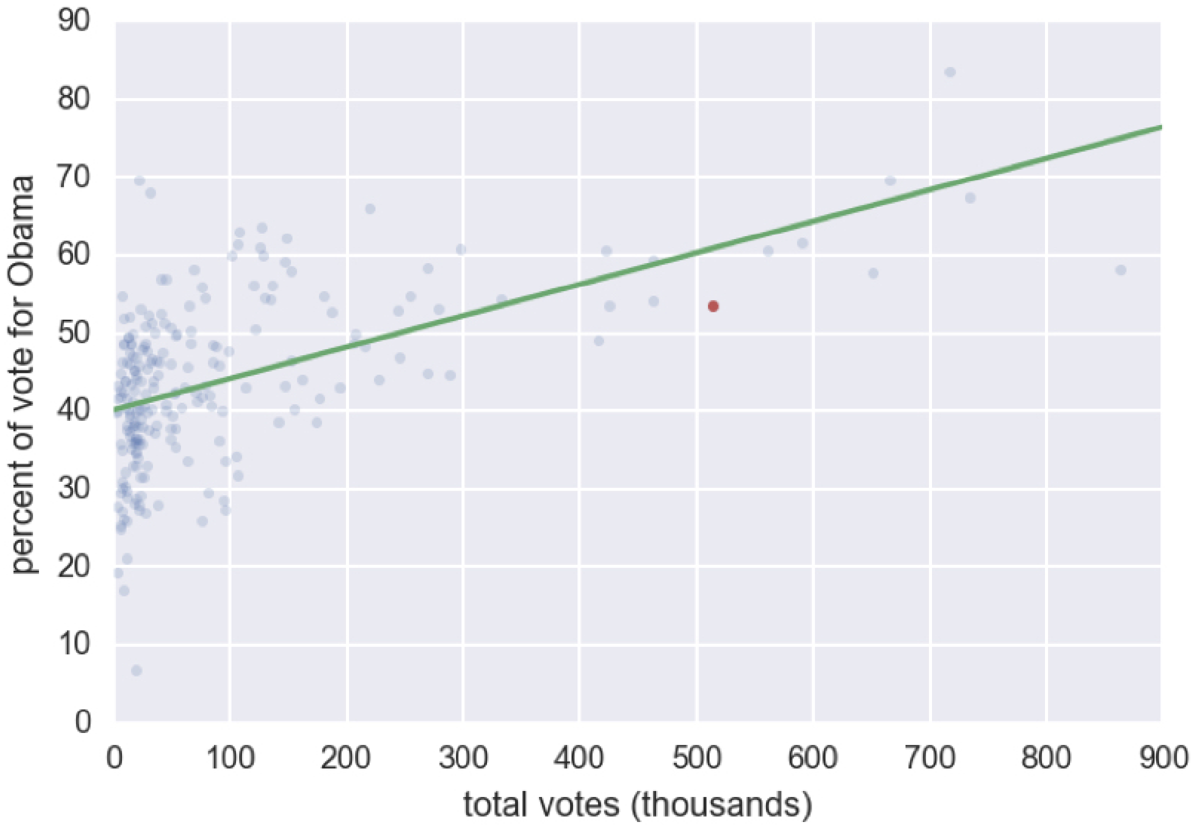
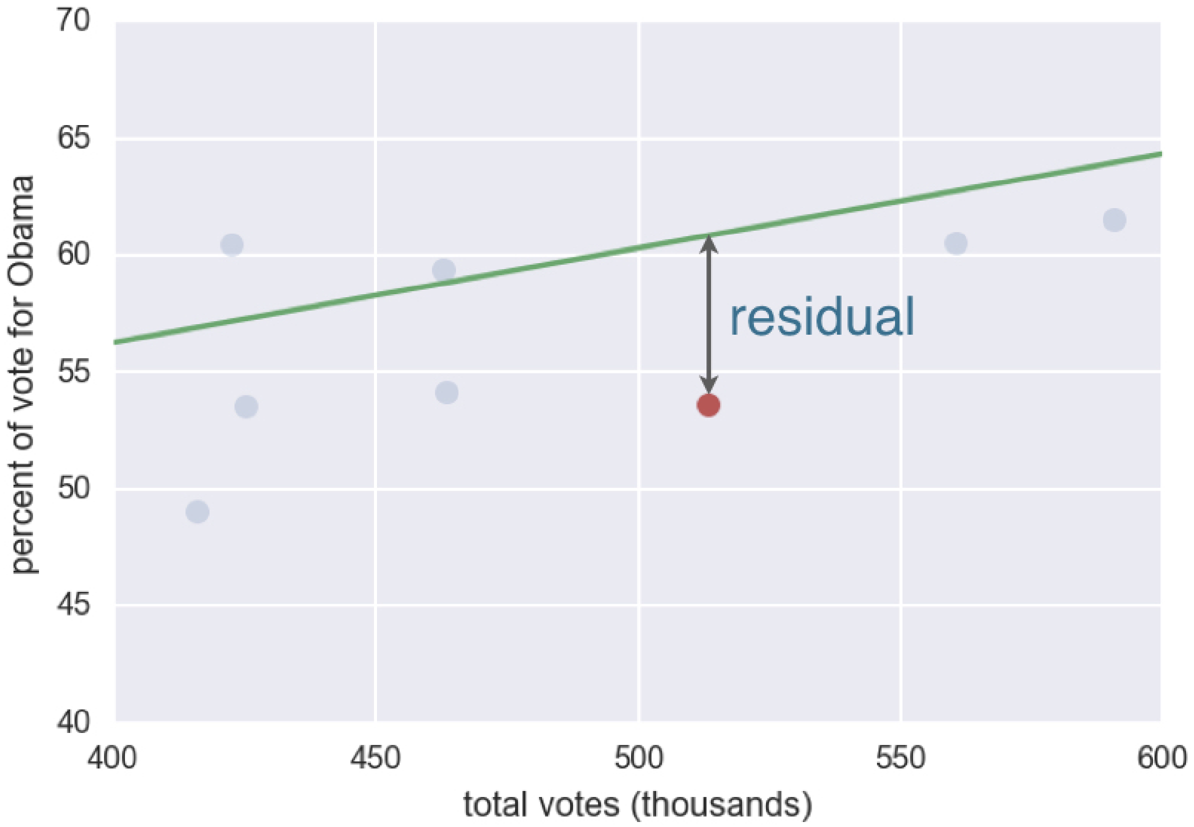
2008 US swing state election results



[1] Data retrieved from Data.gov (https://www.data.gov/)

Residuals



[1] Data retrieved from Data.gov (https://www.data.gov/)

Least squares

- The process of finding the parameters for which the sum of the squares of the residuals is minimal

Least squares with np.polyfit()

```
slope, intercept = np.polyfit(total_votes,
                              dem_share, 1)

slope
```

```
4.037071700946555e-05
```

```
intercept
```

```
40.113911968641744
```

Let's practice!

STATISTICAL THINKING IN PYTHON (PART 2)

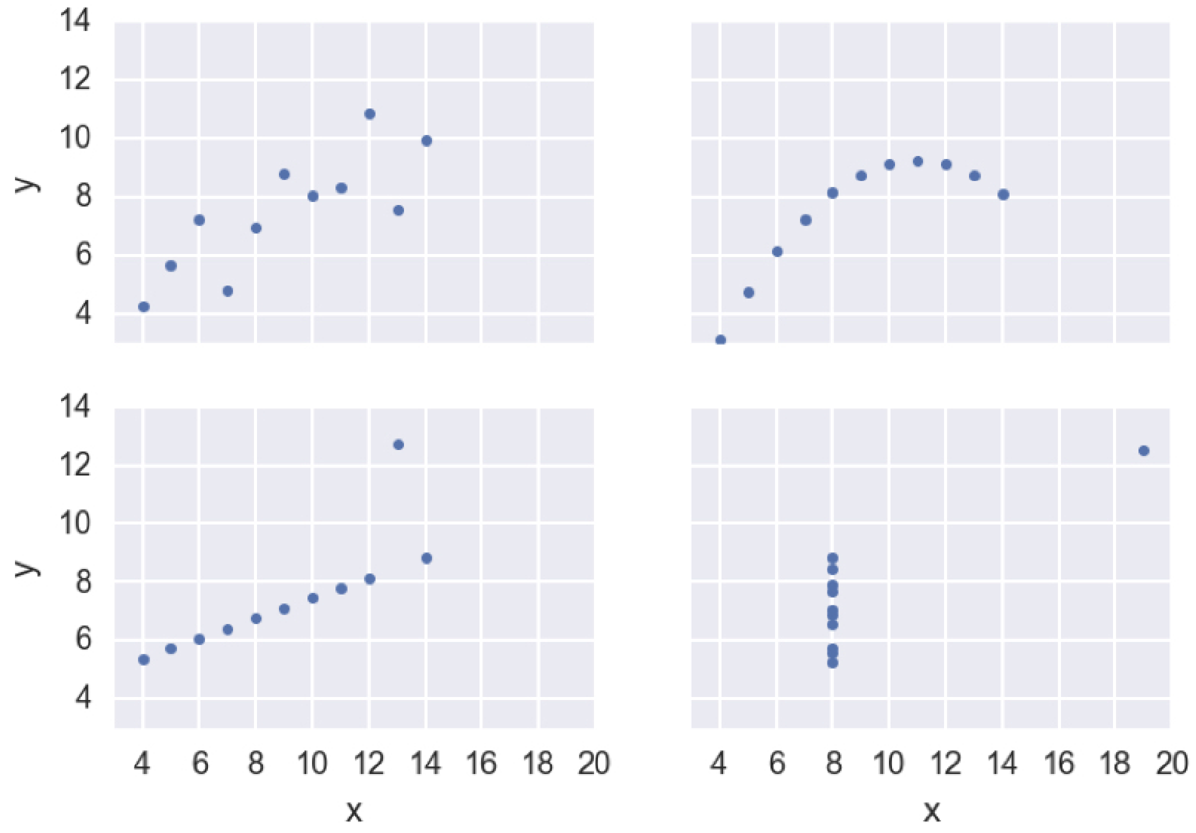
The importance of EDA: Anscombe's quartet

STATISTICAL THINKING IN PYTHON (PART 2)

Justin Bois

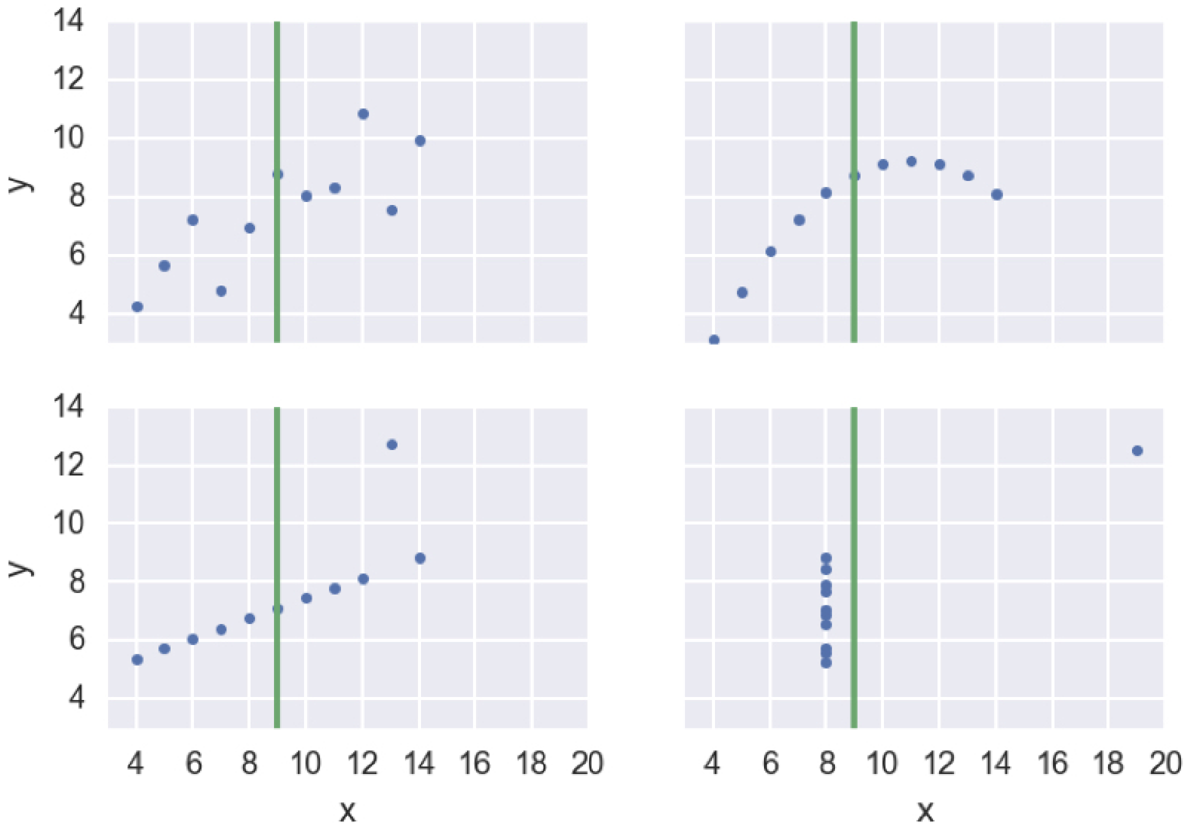
Lecturer at the California Institute of Technology

Anscombe's quartet



[1] Data: Anscombe, The American Statistician, 1973

Anscombe's quartet



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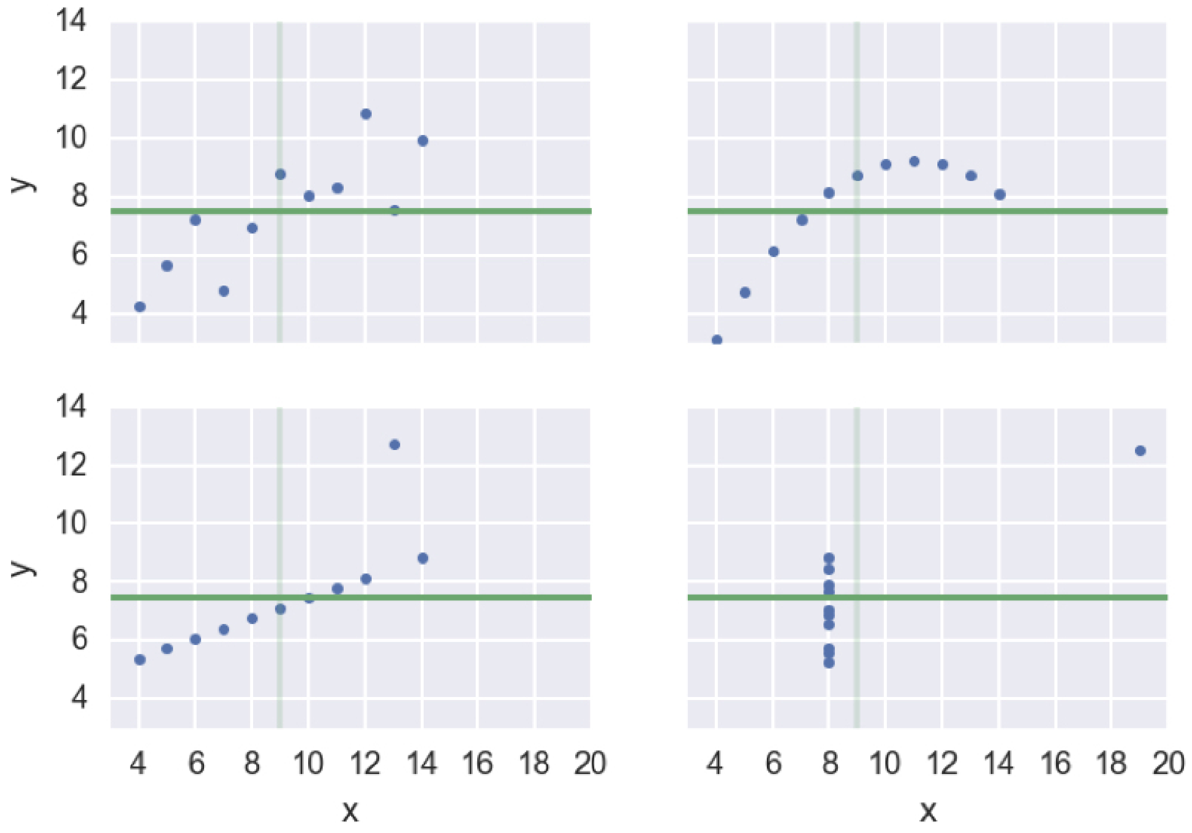
Anscombe's quartet



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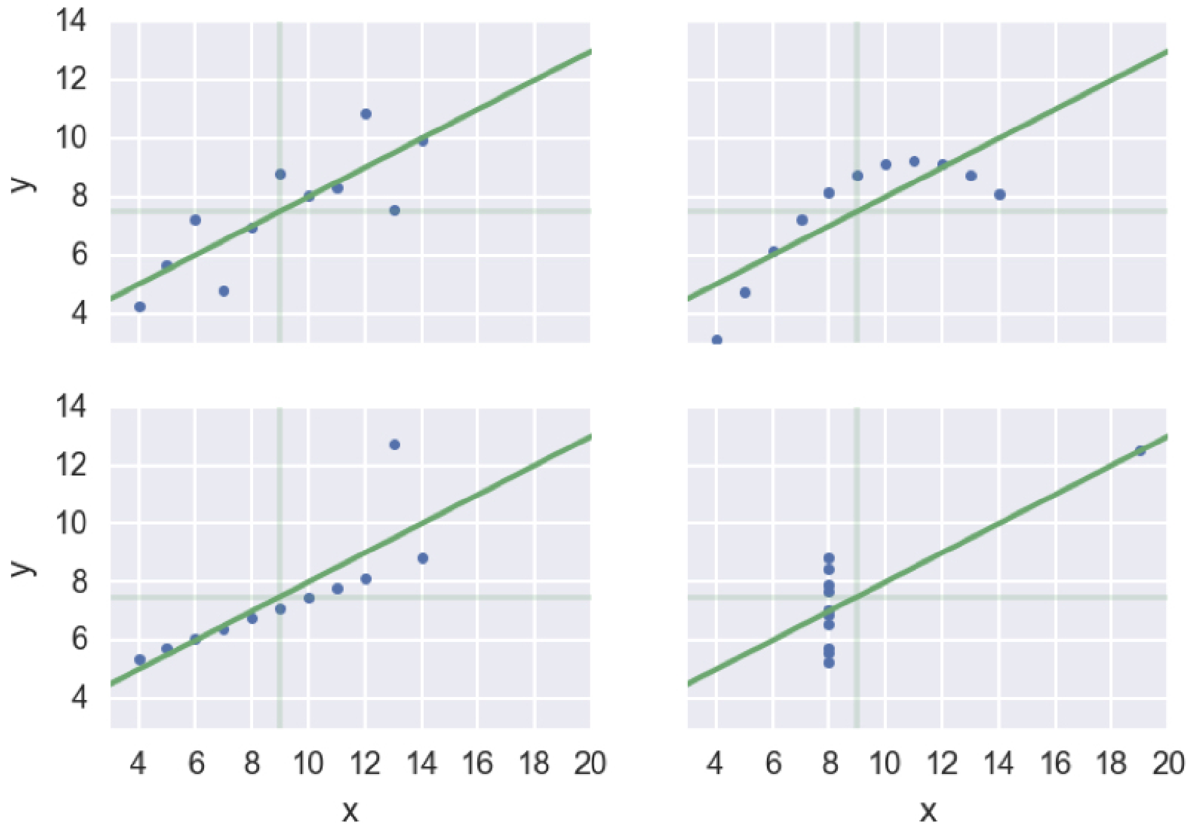
Anscombe's quartet



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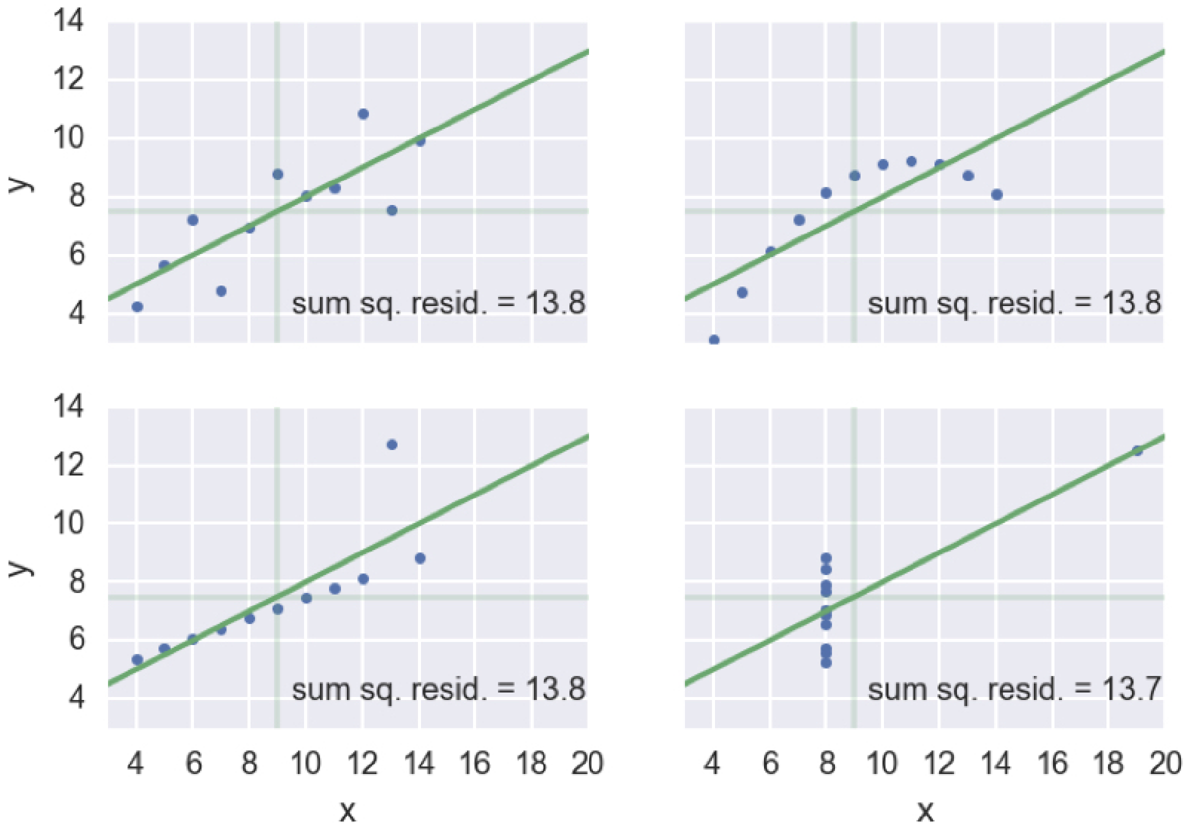
Anscombe's quartet

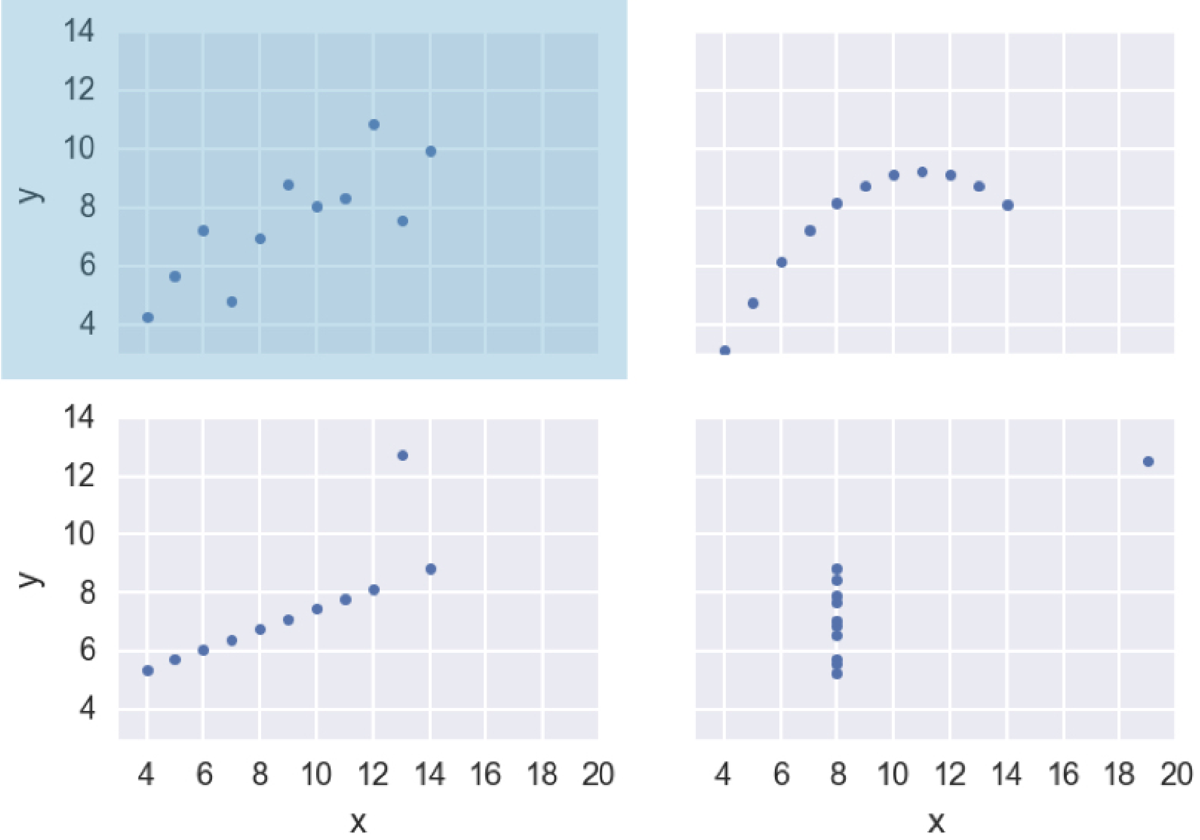


[1] Data: Anscombe, The American Statistician, 1973

Look before you leap!

- Do graphical EDA first

Anscombe's quartet



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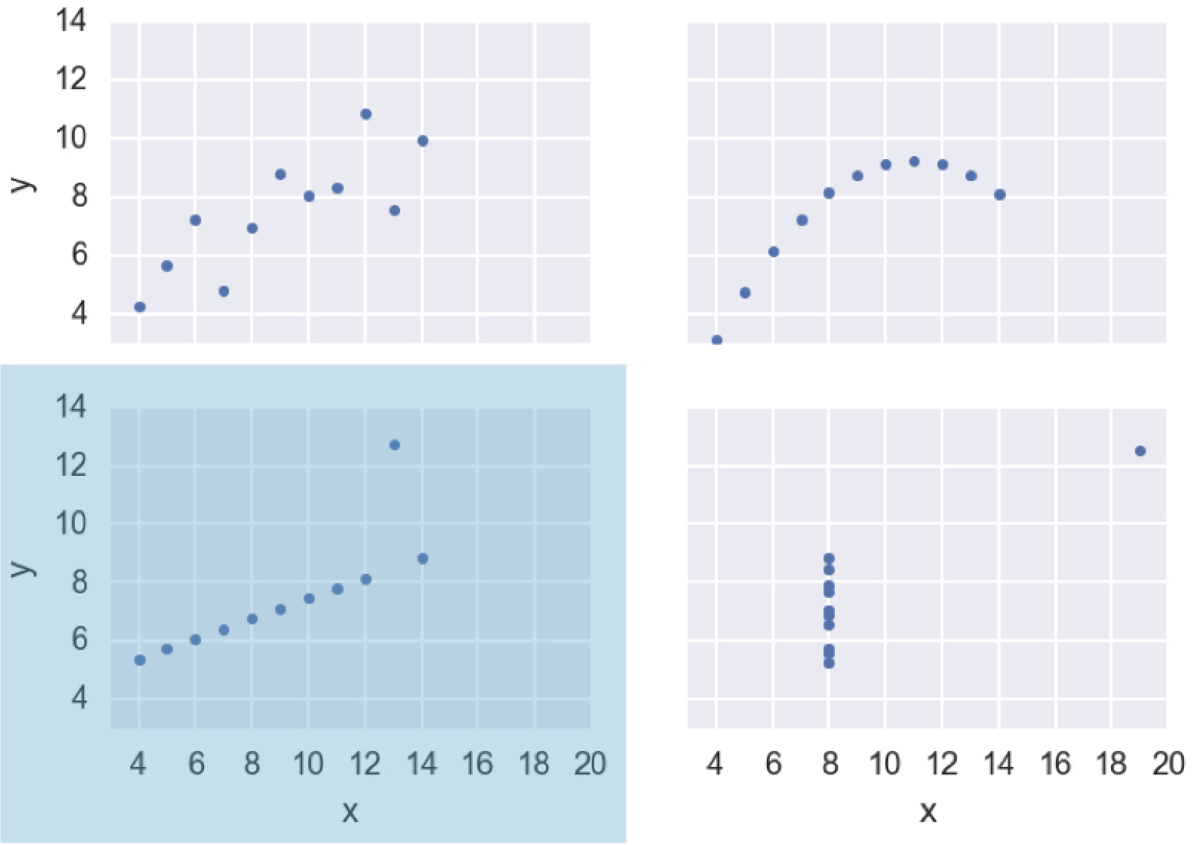
Anscombe's quartet



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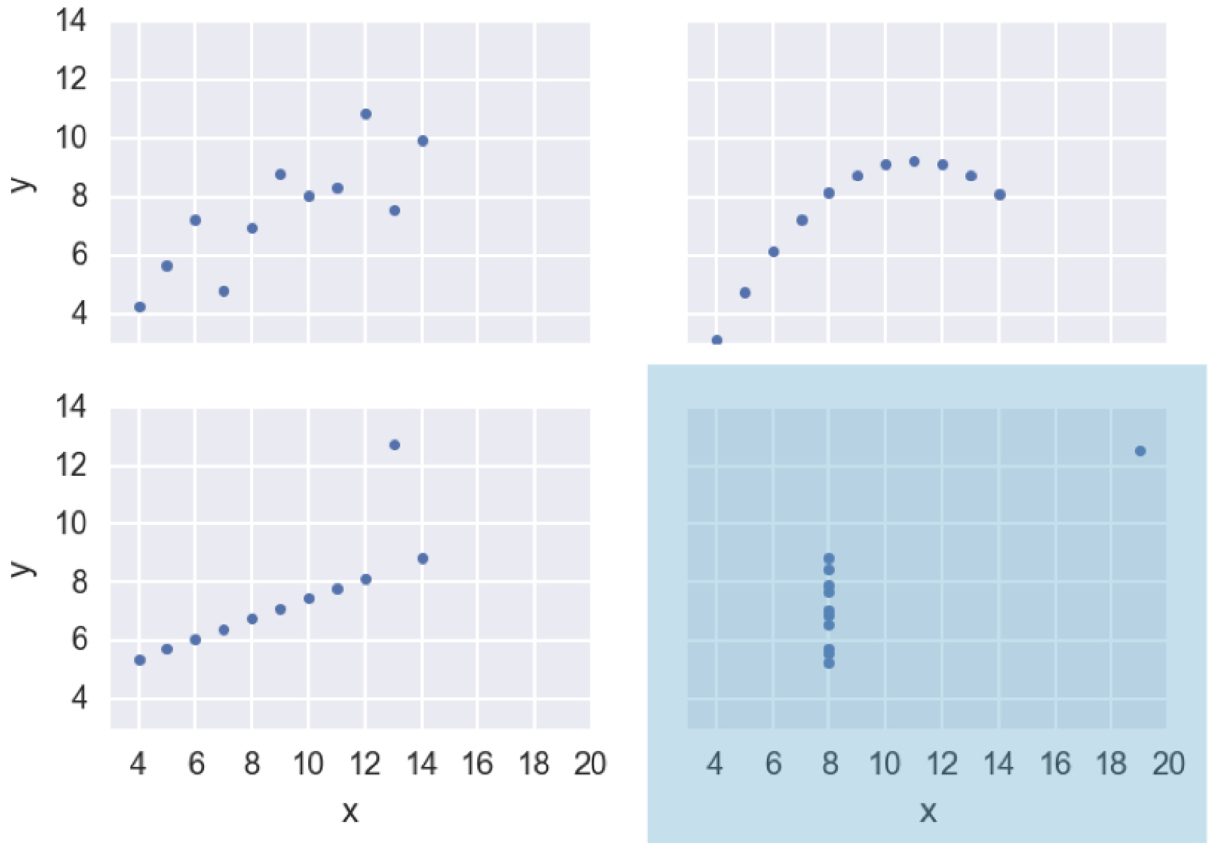
Anscombe's quartet



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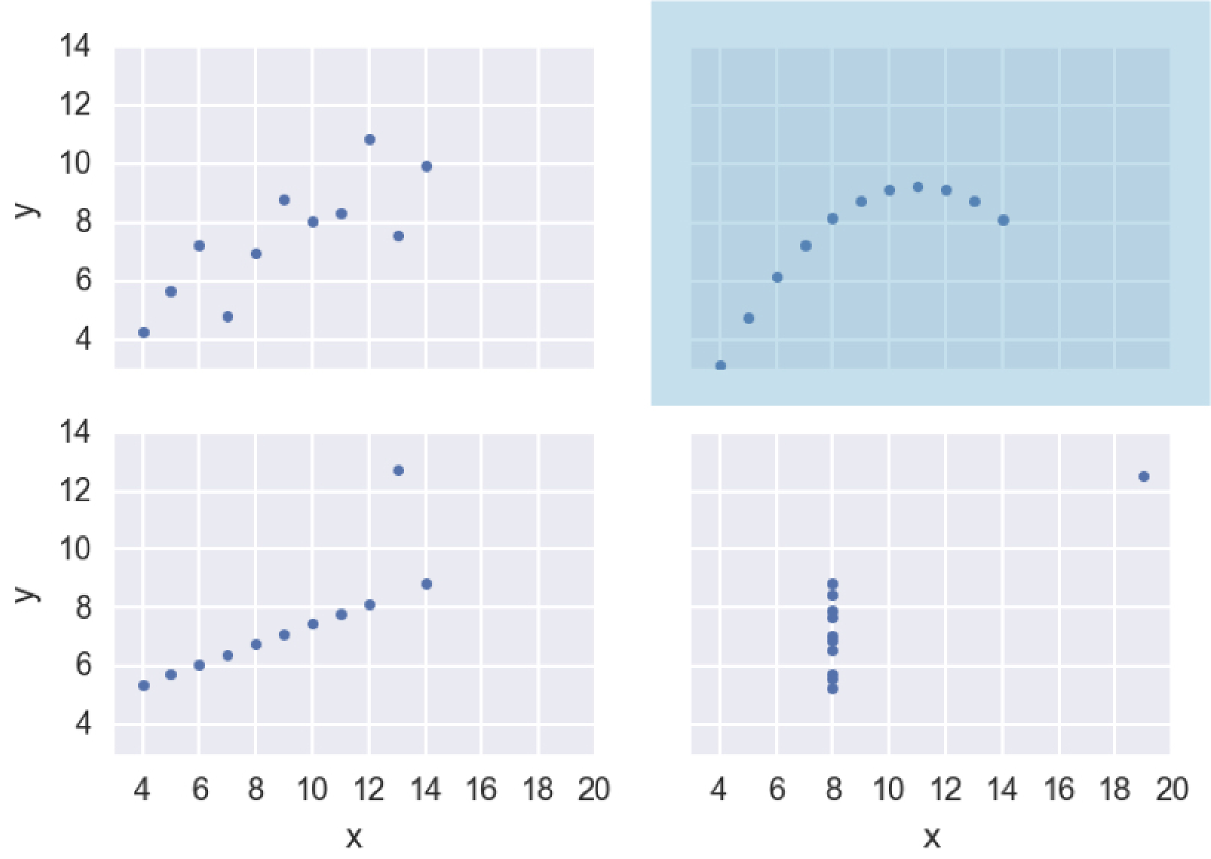
Anscombe's quartet



[1] Data: Anscombe, The American Statistician, 1973

Let's practice!

STATISTICAL THINKING IN PYTHON (PART 2)