Lecture 5: Visualizing Numerical Data

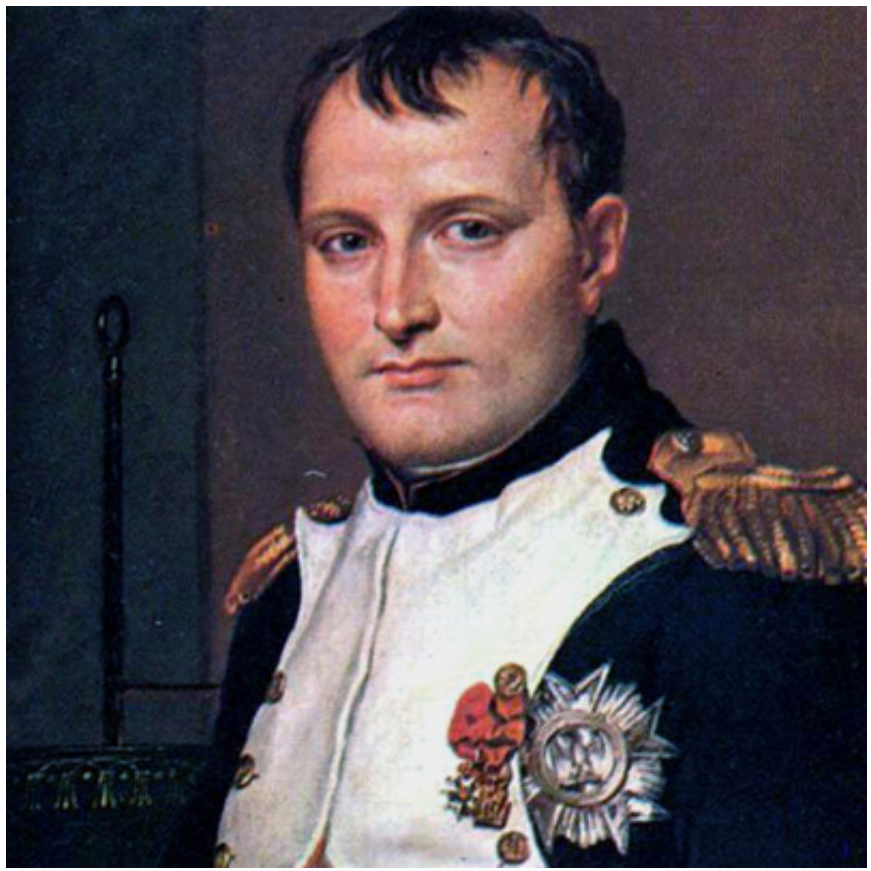
Chapter 1.6 + 1.7

Goals for Today

- Visualizing numerical data
- Histograms
- Measures of Central Tendency: Mean, Median, and Mode
- Measure of Spread: Sample variance and sample standard deviation

Famous Example 1: Napoleon's March on Russia in 1812

In 1812, Napoleon led a French invasion of Russia, at one point marching on Moscow.



Famous Example 1: Napoleon's March on Russia in 1812

The advance and retreat on Moscow was an unmitigated disaster:

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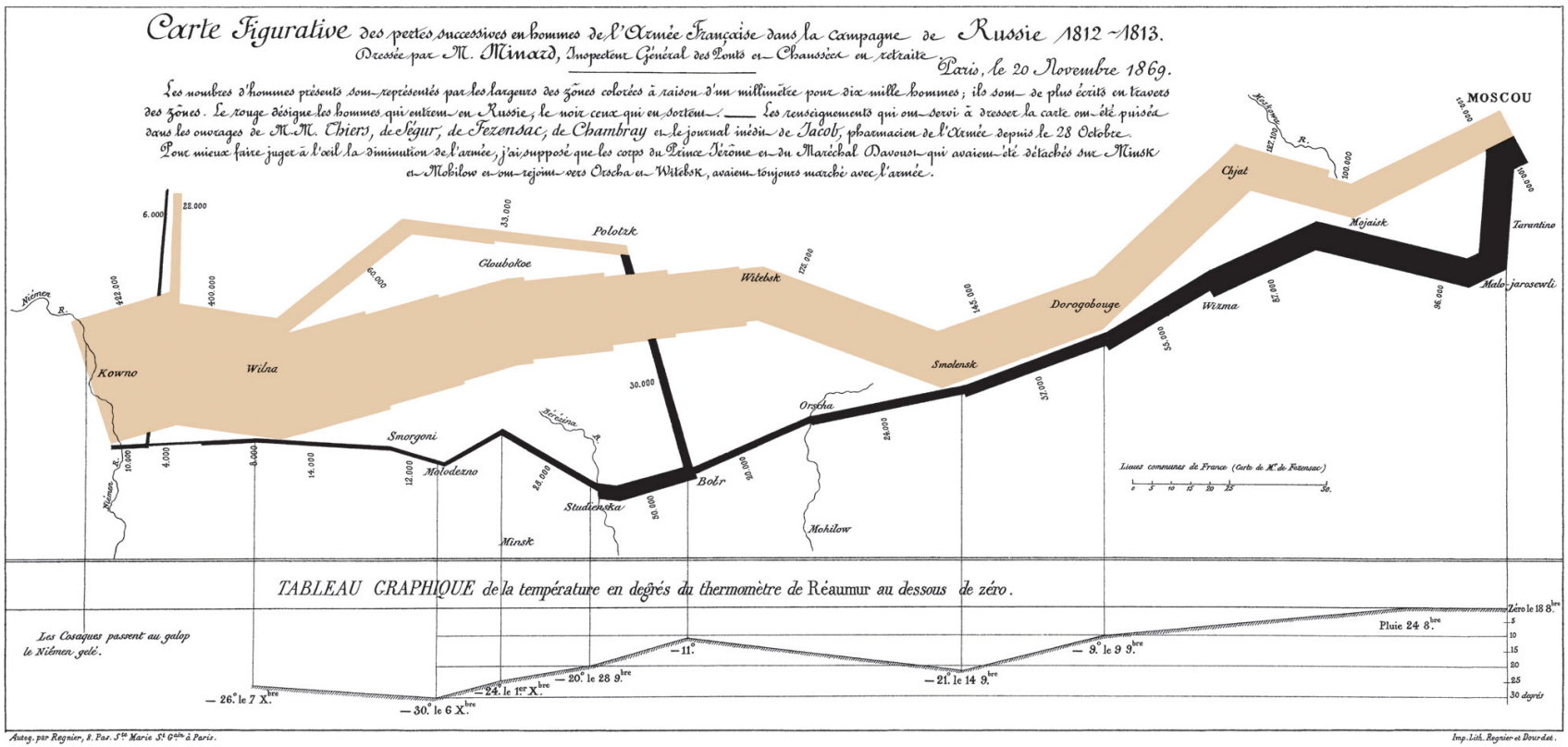

Famous Example 2: 1854 Broad Street Cholera Outbreak

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Snow created the following map to investigate:

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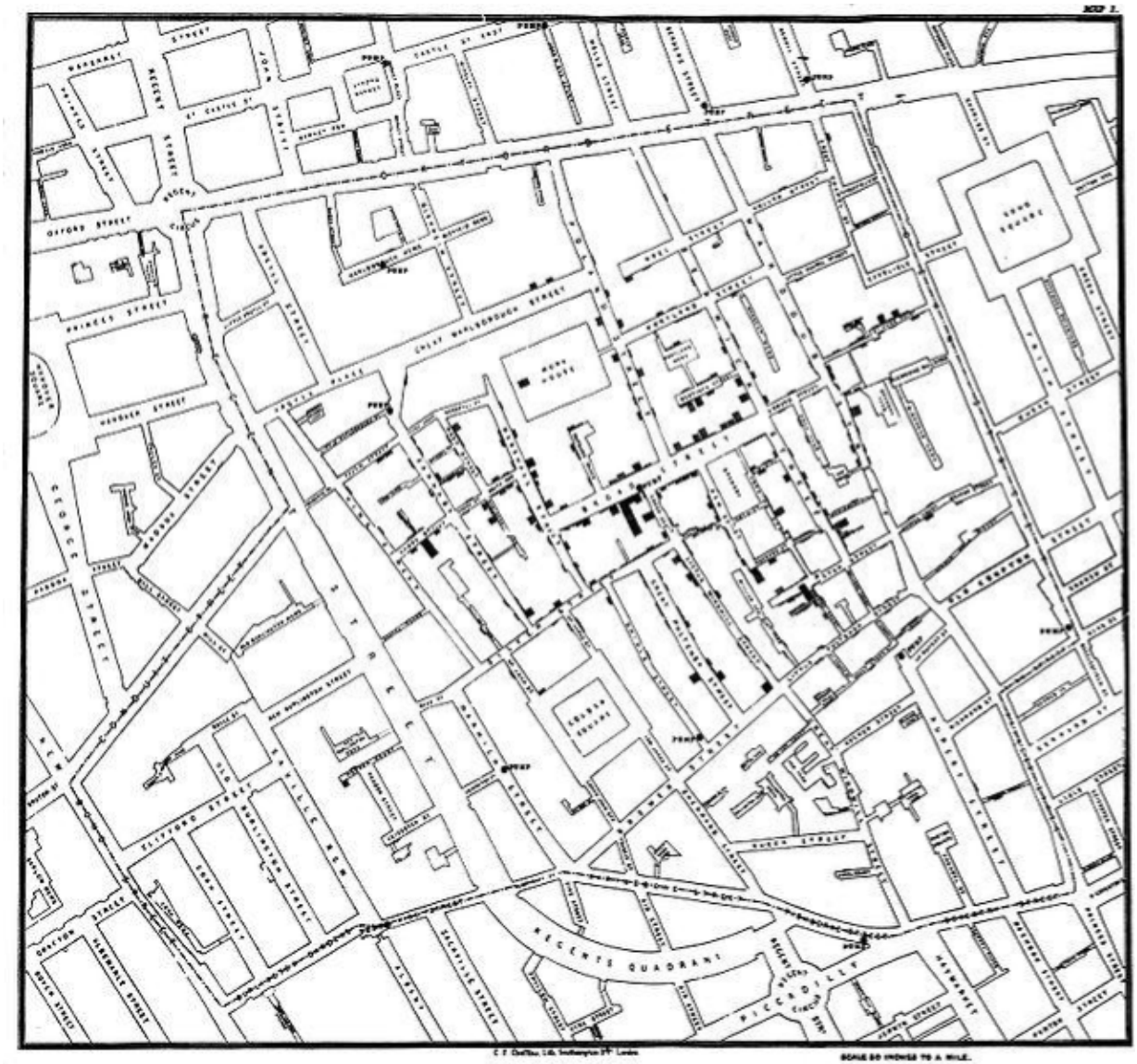

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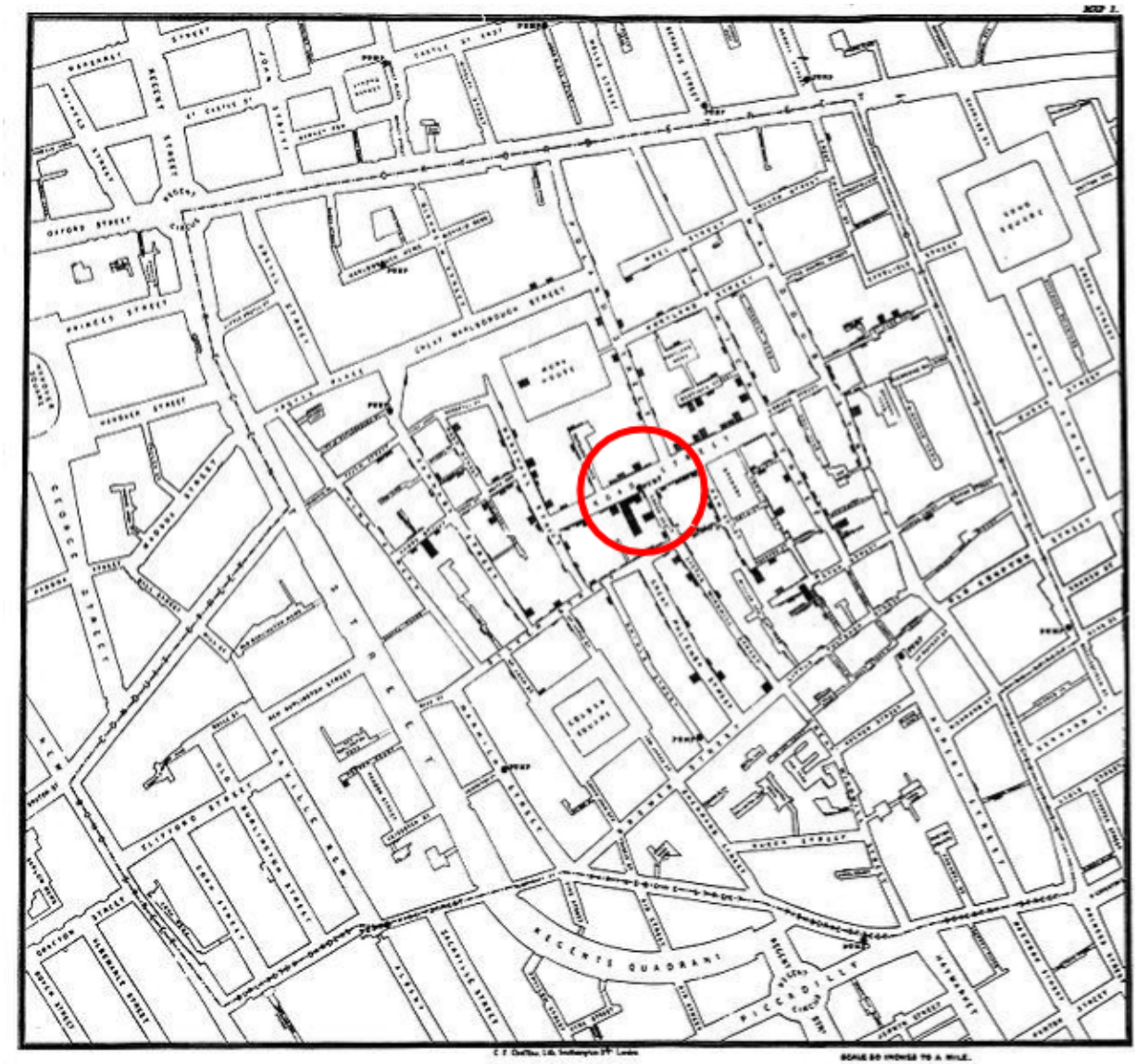

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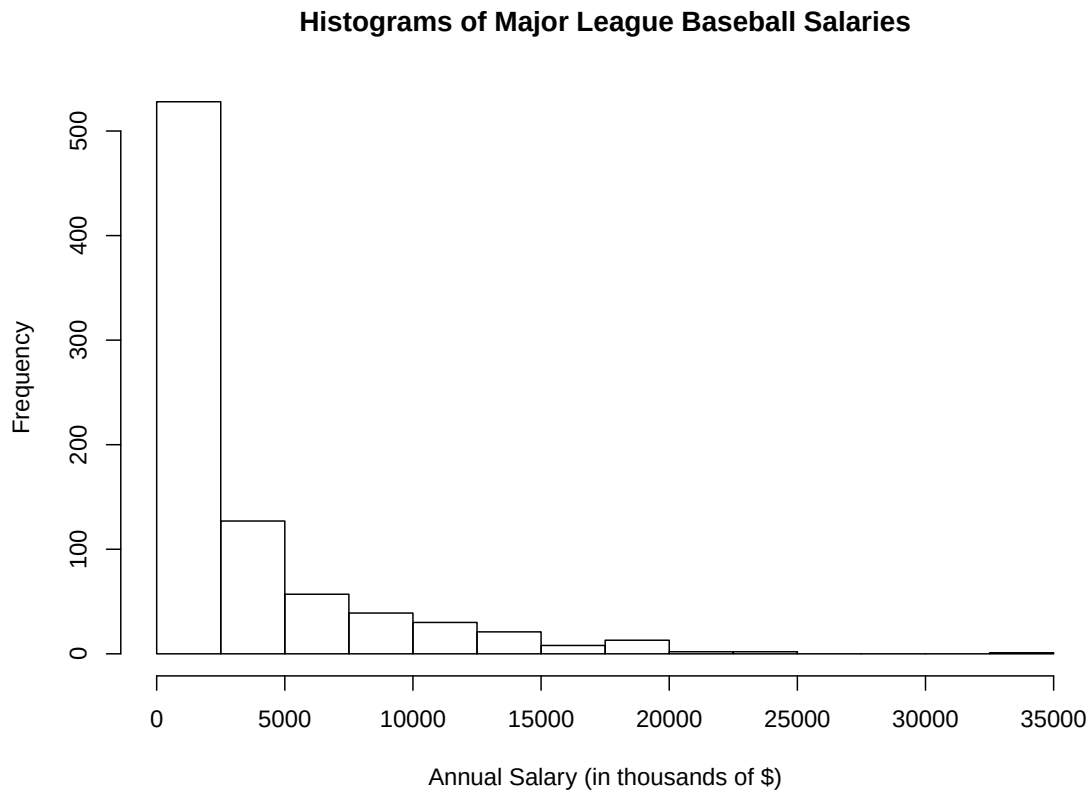
This led to the discovery that cholera was transmitted by food and water being contaminated by fecal matter and not via the air. This was a watershed moment in the emerging field of epidemiology.

Histograms

http://rpubs.com/moonstomper/histograms

Skew and Long Tail

In the `openintro` package is MLB salary data in 2010. The histogram:



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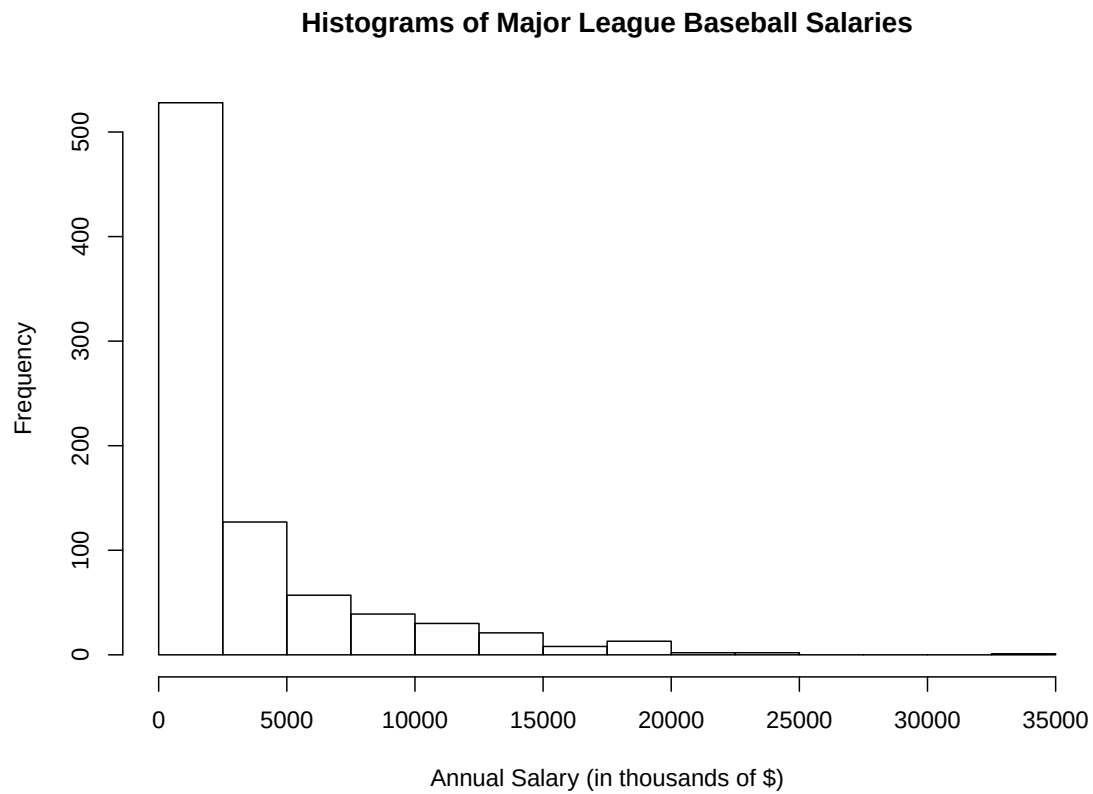

The data has a long tail to the right: data is right-skewed. i.e. a small number of players who make a VERY large amount of money.

Trick to Remembering Which Skew is Which

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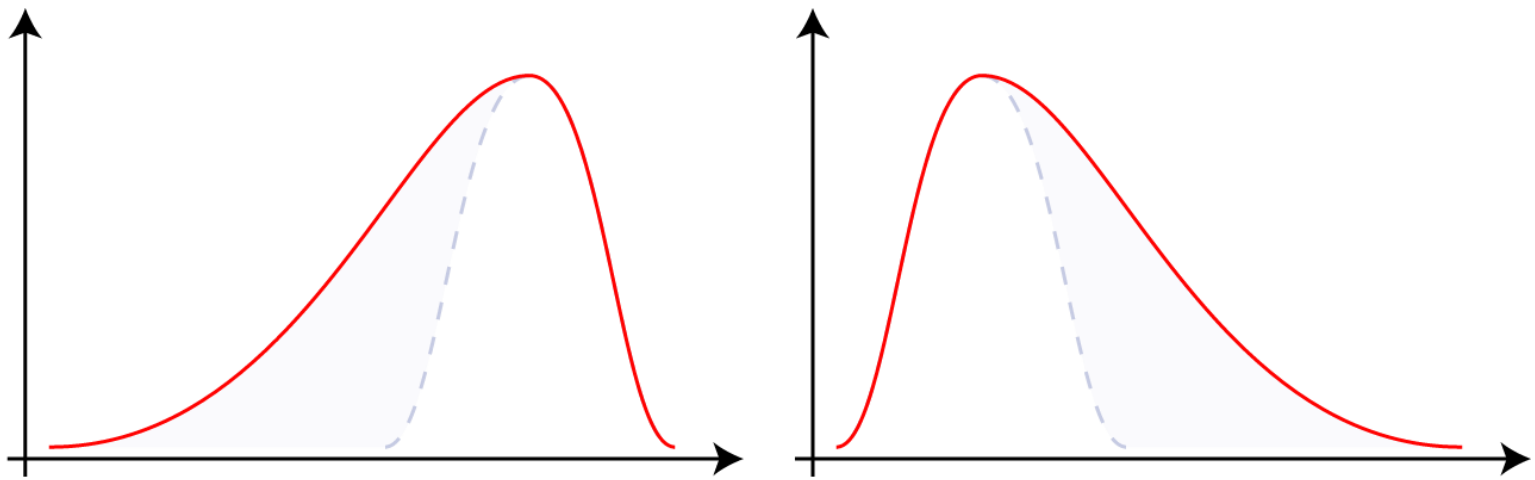

Mean

Median

Mean vs Median: Imaginary Scenario

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- The CEO earns \$1000 an hour, while the others earn \$20, \$21, \$30, and \$40 an hour.
- The employees complain that they are paid too little.
- The CEO counters that the mean hourly salary is $\overline{x} = \frac{20+21+30+40+1000}{5} = 222.20$ an hour, which is really high.

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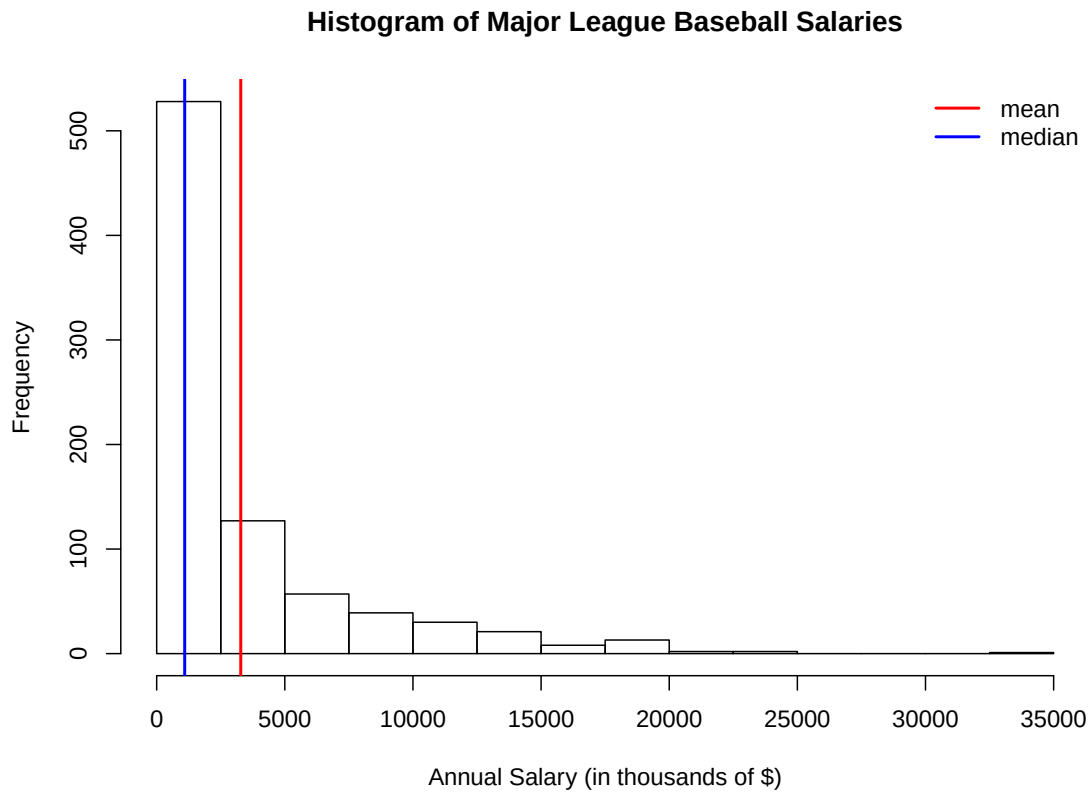
Ex: http://www.zillow.com/home-values/

Mean vs Median: Back to MLB Salary Data



Mode

A mode is the value that appears the most often in a data set. So out of (1, 3, 3, 5, 6), the modal value is 3.

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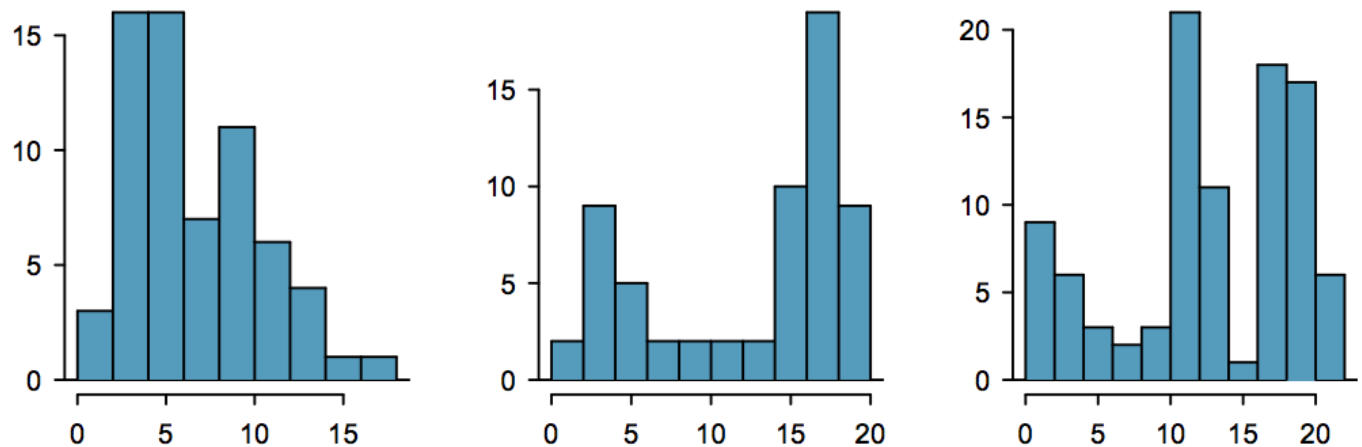
Modes also describe peaks, but this can get subjective. A distribution can be unimodal, bimodal, or multimodal:



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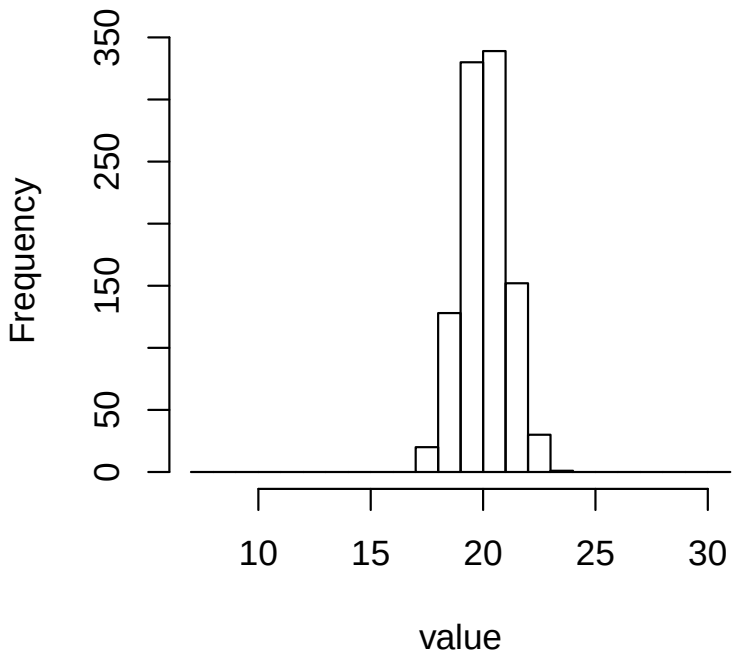

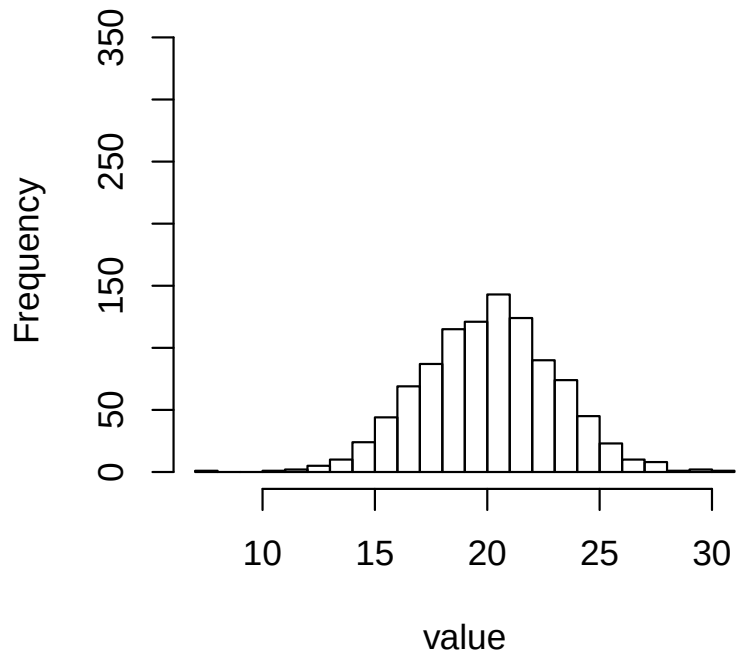

Measure of Spread

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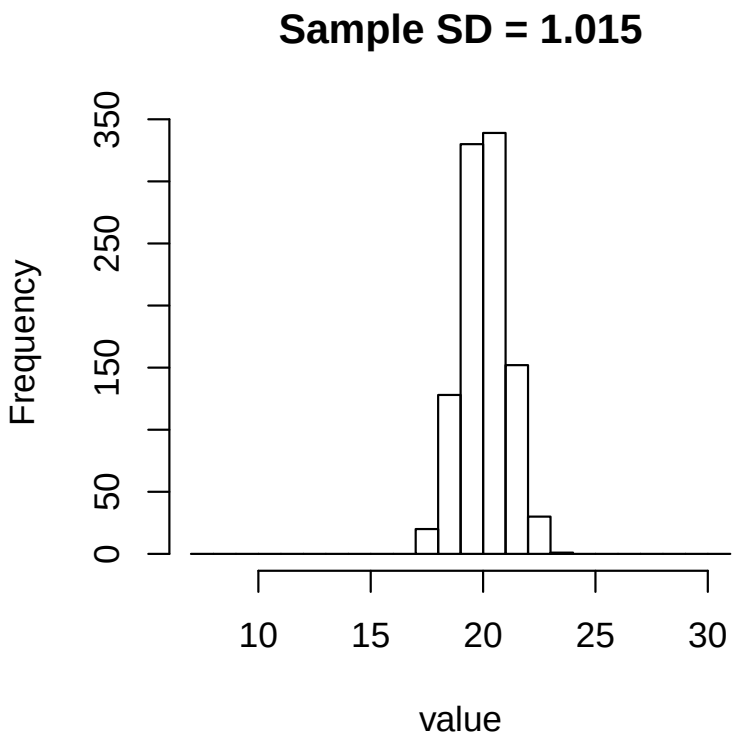
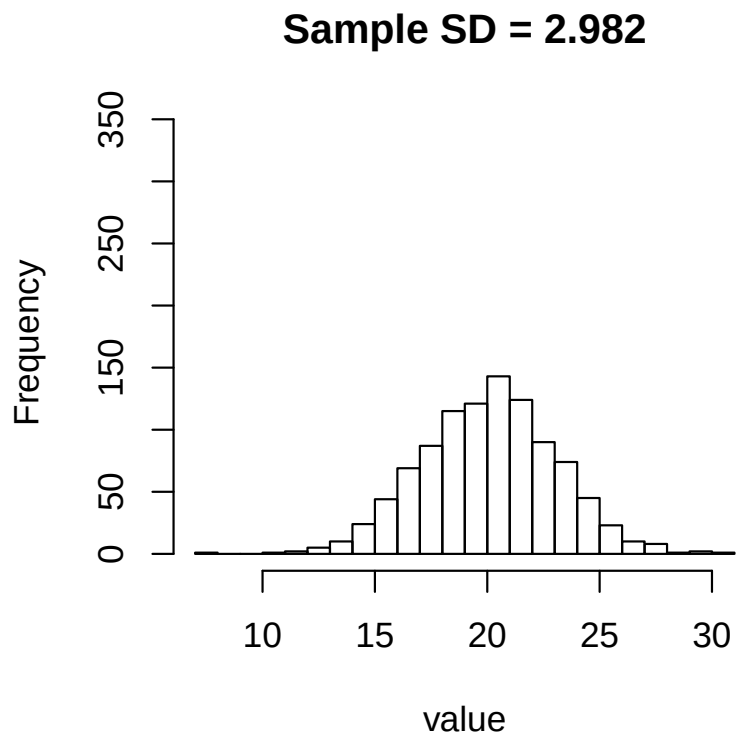
Back to example:





How to Compute the Sample Standard Deviation

Read section 1.6.4. The formula really doesn't make much intuitive sense, but is the way it is due to mathematical convenience. Fortunately there is an `R` command: `sd()`

Next Time

- Another simple data visualization tool: boxplots
- Examining/Visualizing Categorical Data