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Lecture 2: GGR376

Spatial Data Science II

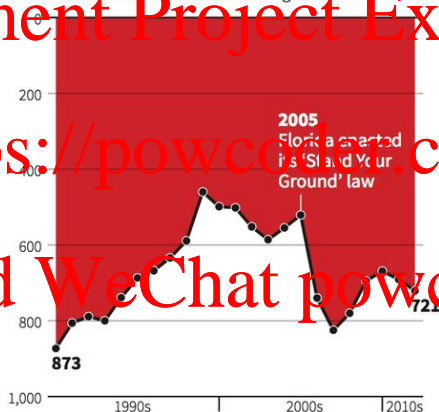
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Dr. Adams

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Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

REUTERS

Figure 1: REUTERS

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- ▶ Quantitative Revolution
- ▶ Central tendency
- ▶ RStudio Demo
- ▶ Distribution
- ▶ Cognitive Bias

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During the 1940s many geography departments were closing, including the geography program at Harvard University in 1948.

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"geography is not a university subject." - Harvard President James B. Conant (Harvard Magazine 2003)

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The discipline of geography went through a major transformation in the 1950s and 1960s, which is known as the quantitative revolution.

- ▶ Division was increasing between human and physical geography

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The critics of geography included:

- ▶ Only descriptive and unscientific, lacking the explanation of why?
- ▶ Few applications of geography at the time.
- ▶ Is geography a science or a social science?
- ▶ Following WWII the world was focused on technology

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Quantitative Revolution III

The quantitative revolution was in response to these critiques. It was primarily driven by geography departments in the USA.

The adoption and create of quantitative approaches in geography included:

- ▶ Descriptive Statistics
- ▶ Inferential Statistics
- ▶ Mathematical equations and models
 - ▶ Gravity model
- ▶ Stochastic models that incorporated probability
- ▶ Deterministic models
 - ▶ Location models

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Following the QR geographers begin to develop a number of technologies that are common place today.

- ▶ Geographic Information Systems/ Science
- ▶ Remote Sensing
- ▶ Statistical Modelling
- ▶ Spatial Analysis & Statistics

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In the 1970s the critiques of the QR included an inability to address issues of race, gender, class and war.

The fields of critical and feminist geography arose from these critics.

- ▶ Critical GIS/Cartography

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- ▶ Follow along on your laptop if you wish.

- ▶ RStudio Features / Windows

- ▶ Scripts

- ▶ Notebooks

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Classifying Data

The Steven's Classification

A widely adopted classification for levels of measurement

- ▶ Nominal
 - ▶ Categories are arbitrary
- ▶ Ordinal
 - ▶ A meaningful rank between the values
- ▶ Interval
 - ▶ The interval between values is meaningful (same distance)
- ▶ Ratio
 - ▶ Meaningful zero point
 - ▶ Allows multiplication and division to be sensible.

(Some) Measures of Central Tendency

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- ▶ **Arithmetic mean (mean)**

- ▶ Average or mean

- ▶ **Median**

- ▶ Middle Value in a set

- ▶ **Mode**

- ▶ Most frequent value

- ▶ **Geometric mean**

- ▶ n th root of the product of n numbers

- ▶ Often used for a set of numbers whose values are meant to be multiplied together or are exponential in nature

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Tiny changes big effects, and vice-versa (mean & median)

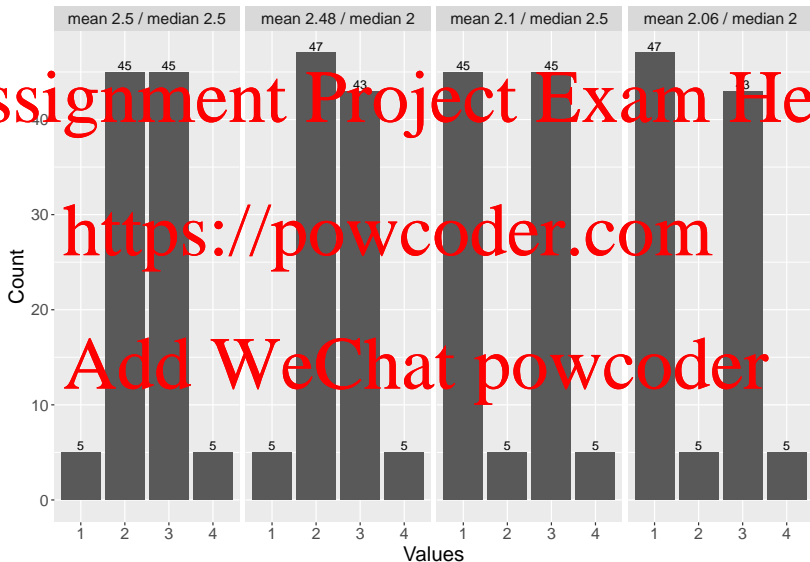


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How the mean and median are affected.



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Examining central tendencies on test data

file: school-grade-example-lecture-2

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- ▶ Modes

- ▶ unimodal,
 - ▶ bimodal, or
 - ▶ multimodal

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- ▶ Skewness

- ▶ Kurtosis

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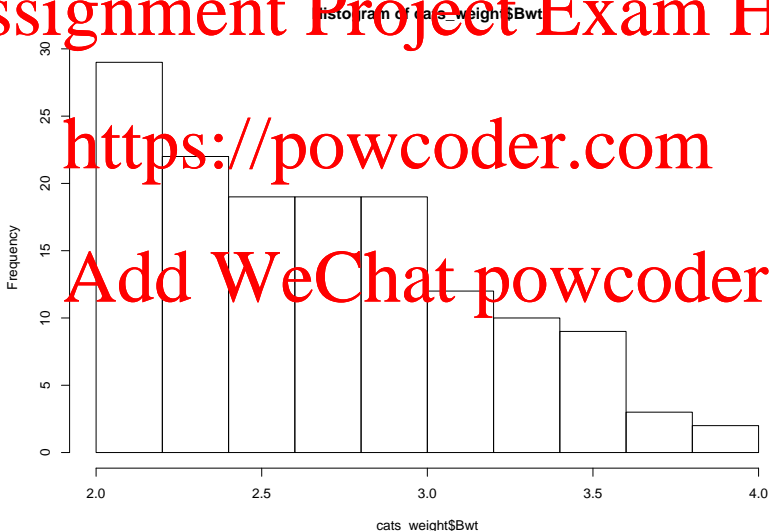
Unimodal example

Modes are peaks in a histogram. The heart and body weights of samples of male and female cats.

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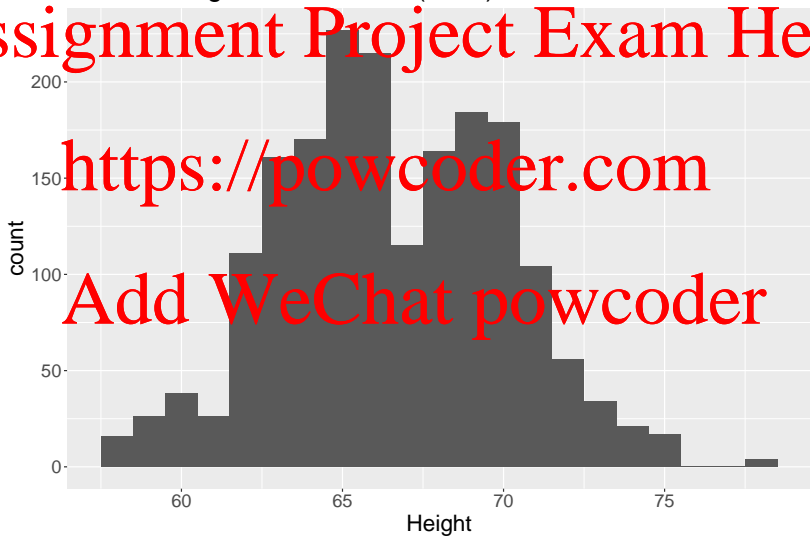
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Modes - Bimodal

Galton (1886) data on the heights of parents and their children.

Parent's heights from Galton (1886)



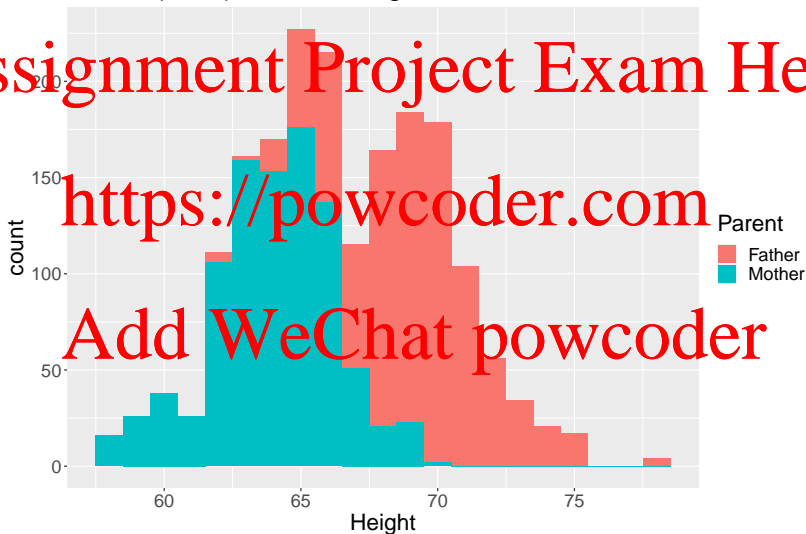
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Explore the data

Galton (1886) Parents' Heights



Law of small numbers

- ▶ Small samples may not abide by the same rules as the larger distribution.

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Fallacy of the maturity of chances (Gambler's Fallacy)

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The mistaken (and often unfortunate) belief that if something happens more frequently than normal during a period, that it will happen less often in the future.

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A Philosophical Essay on Probabilities (1796) - Pierre-Simon Laplace

- Identified that men who wanted a son would get anxious when lots of boys had been born recently, prior to their child's birth.

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Hot Hand

The belief of someone who achieves success on a random event, that they will have better luck at the event in the future.

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As the number of trials or observations increases, the actual or observed probability approaches the theoretical or expected probability

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<https://www.youtube.com/watch?v=MntX3zWNWec>

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Sequence of coin flips

1 1 1 1 0 1 1 1 1 0 0 1 1 0 0 1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 1 1 0 0 1
1 1 1 0 1 1 0 1 0 1 0 0 0 1 1 0 1 1 1 1 0 1 1 0 0 1 1 0 0 0 1 1 1 1 1
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Class example

- ▶ Dice / <https://www.random.org/dice/>
- ▶ Graph Paper / Paper

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Reading 2: Wickham, H. (2010). A layered grammar of graphics.
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Journal of Computational and Graphical Statistics, 19(1), 3-28

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Harvard Magazine. 2003. "Geographers' Birth and Job Prospects," 47.

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