E-411-PRMA

Lecture 2

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20 August 2015

SAT

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  - If Sigga got a 350 on the math section, how many people scored below her?
  - If Einar was in the 98% percentile in math, what was Einar's score?

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  - What percent of the people are between the 3rd and the 6th stanines?
- Various linear and non-linear transformations are done to create scores and scores may be normalized.

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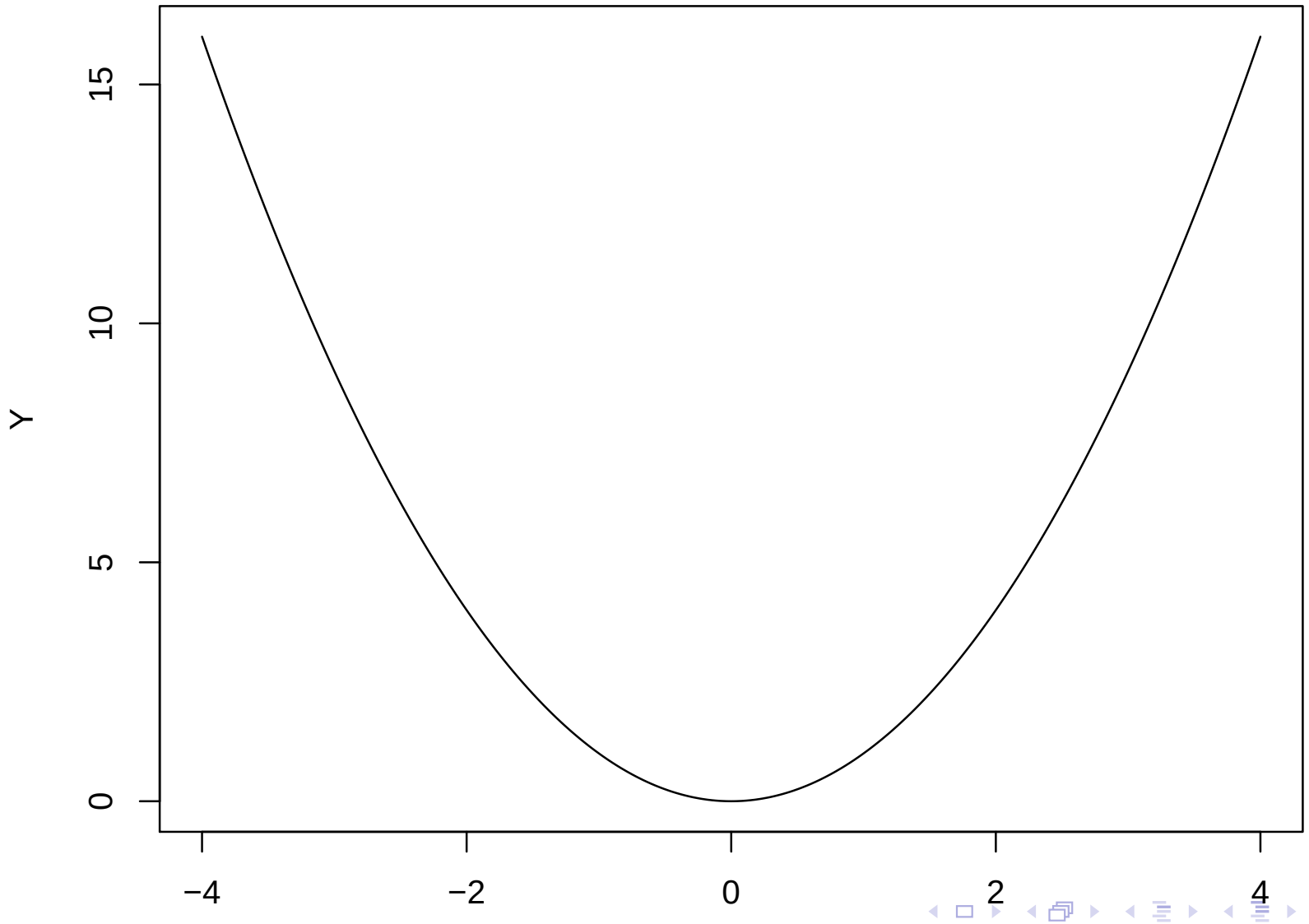
- Are we talking about the population or the sample?
- How does this relate to a hypothesis test?

What is a correlation?

- Is it an association?
- Does it imply causation?
- Is a correlation necessary for causation?
- Does it need linearity?
- Is it affected by variability?
- Is it affected by outliers?
- Is it related to the simple linear regression?

What is the Pearson correlation coefficient?



Pearson correlation coefficient

$$\frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2\sum((Y-\bar{Y})^2}}$$

Calculating Pearson correlation coefficient

	X	Y
	5	6
	3	0
	1	0
Mean	3	2

```
x <- c(5, 3, 1)
y <- c(6, 0, 0)
cor(x, y)
```

R correlation applet

1. Open RStudio
2. Open correlation_applet.R
3. Click the "Source" button

Spearman's rho

- Non-parametric measure of association
- Appropriate when at least one of your variables is ordinal variables
- Don't use Pearson's correlation with ordinal variables!

Simple Linear Regression

- If are you interested in predicting height given someone's weight, what would you do?

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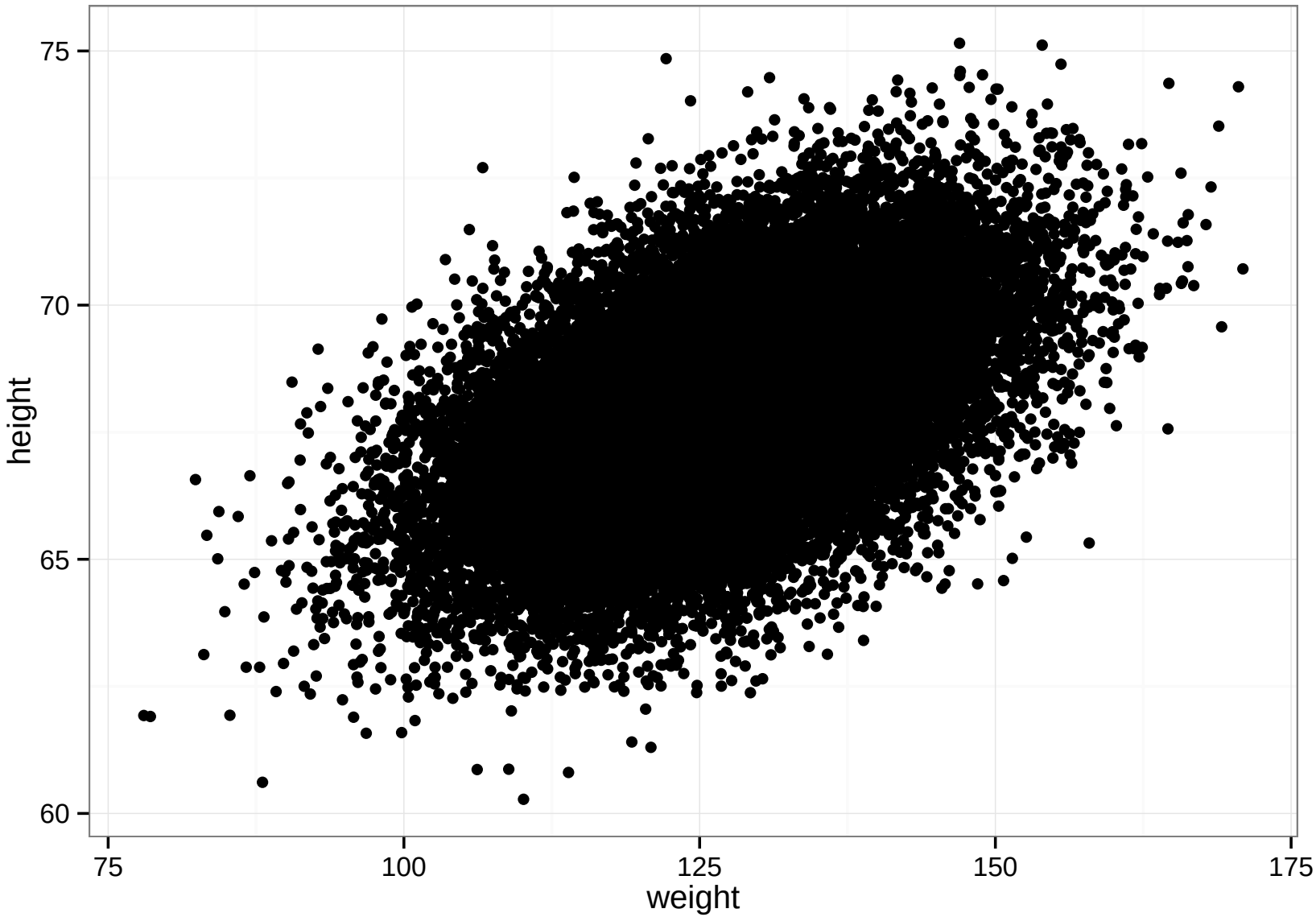
- We could consider a regression model.
- $Y_i = \beta_0 + \beta_1 * X_i$
- How could we assess if this is appropriate?

1993 Growth Survey of 25,000 Hong Kongese children

source: http://wiki.stat.ucla.edu/socr/index.php/SOCR_Data_Dinov_020108_HeightsWeights



Model Summary

Parameter	Estimate	SE	t-value	p-value
β_0	57.57	0.11	506.01	¡ .001
β_1	0.08	0.001	91.98	¡ .001

How does this relate to correlation?

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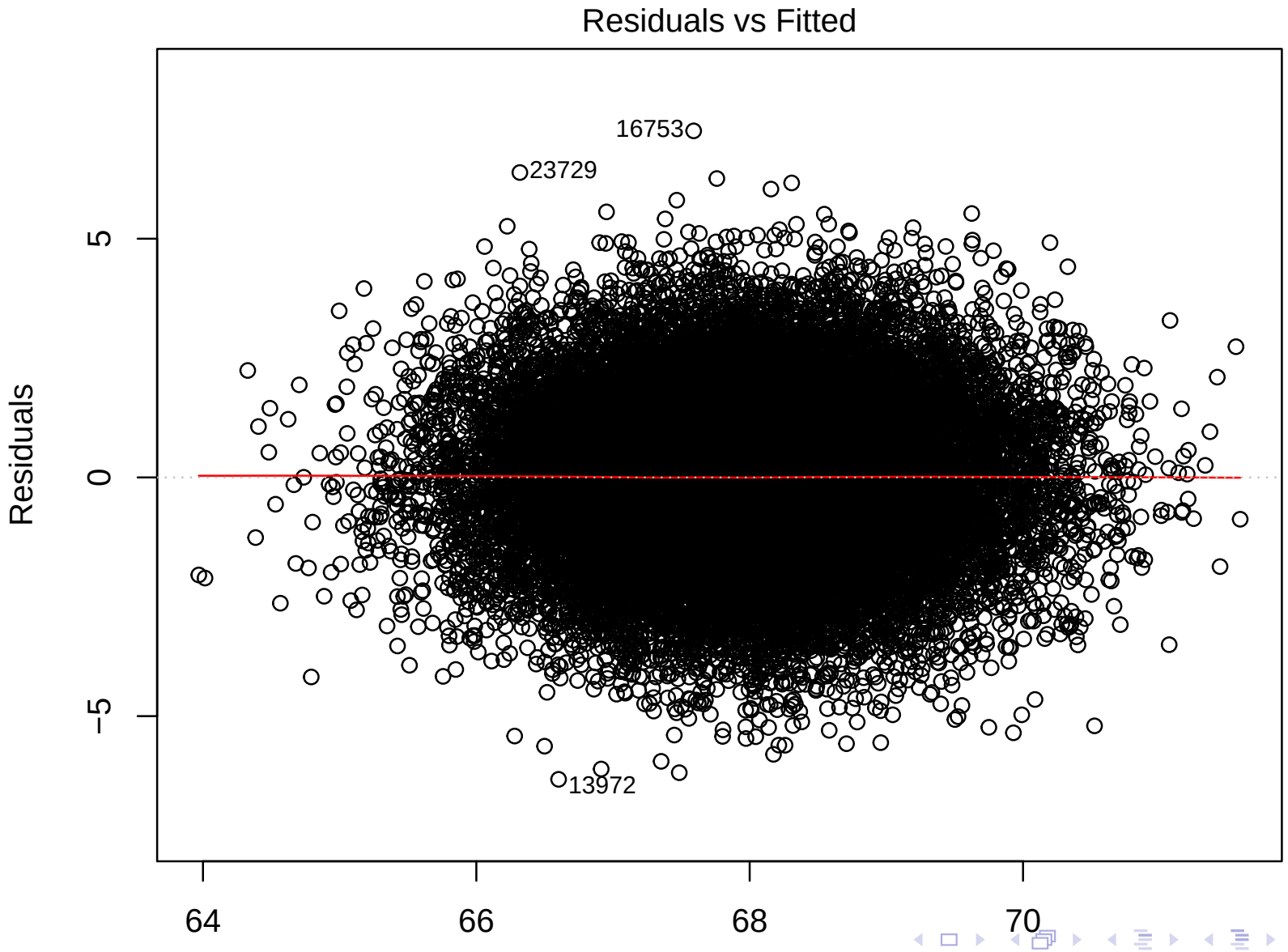
- $r = \beta_1 \frac{sd_x}{sd_y}$
- If $\beta_1 = 0.08$, the standard deviation of weight and height are 11.6608976 and 1.9016788, respectively, what is r?
- 0.5028585

Always look at the residuals



Brief history of testing

- 2200 BCE, Chinese believed to use testing for determining who would get governmental jobs
- Greek and Romans categorized individuals based on personality type ("blood" or "phlegm")
- Francis Galton's classification based on "natural gift" (i.e. eugenics)
  - Contributed to development of questionnaries, rating scales, and self-report inventories
- Wilhelm Wundt's laboratory and his focus on "standardization"
  - James Cattell's mental tests
  - Charles Spearman - reliability and factor analysis

Testing in the 20th century

- 1905, Binet and Simon publish a test measuring intelligence in mental retarded school children in Paris
- 1939, Wechsler publishes a test to measure intelligence in adults (would become WAIS)
- Group intelligence test administered by the US military during WWI and WWII
- WWI personality tests used to screen recruits

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- Test can be fair
- Test can benefit society

What makes a good test?

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- Understanding the normative sample is very important, why?

Sampling

- Simple random sample
- Stratified random sample
- Cluster random sample
- Purposive sample
- Convenience sample

Different Norms

- Percentiles
- Developmental Norms
  - Age Norms
    - A 6 year old performs at the level of a 10 year old
    - This is on this material only though!
  - Grade Norms
    - School year typically 10 months in the US
    - A 4th grader is performing at the level of a 5th grader in third month
    - This is on this material only though!
- National Norms, nationally representative
  - Anchor norms enable two tests to be compared
  - In USA, students could take SAT or ACT for admission to college

Fixed Reference and Criterion-Related

- Fixed reference group scores are used as the basis for calculation of future administrations of the test
- Raw scores are scaled relative to the performance of the fixed reference group
  - Answering 50 items correctly one year and 50 on the following year doesn't mean you'll have the same score
- SAT does this through using anchor items and equating
- Criterion-referenced, evaluate a score with reference to a set criteria or standard NOT other test takers
- What is the fairest way to score grades in a class room?