Applied Statistical Analysis

EDUC 6050

Week 3

Finding clarity using data

Today

1. More Statistical Terminology
2. Central Tendency
3. Variability

Reading

Questions from Chapter 1

Reading

Quick, Quiet, Qualifying Quiz

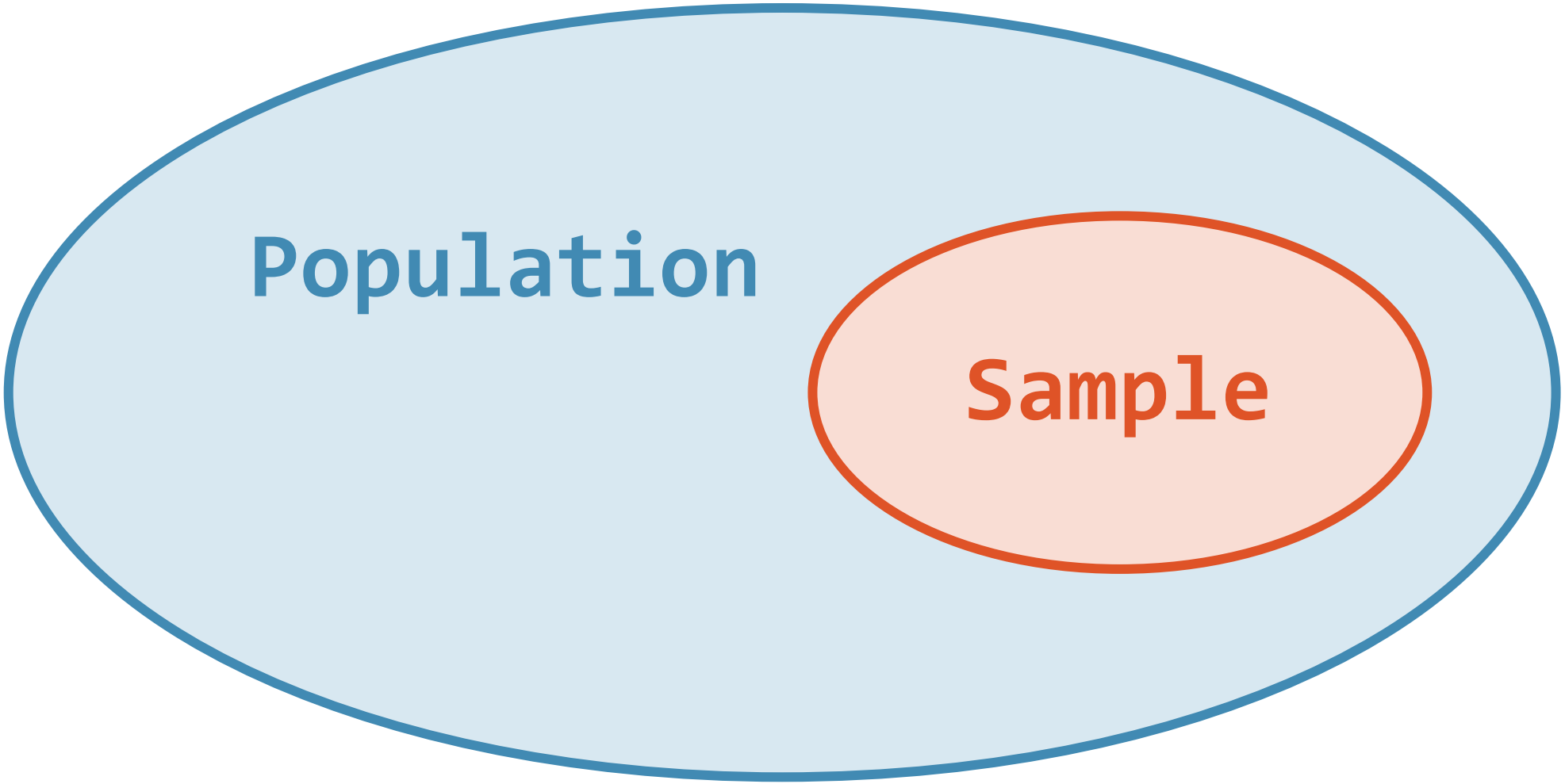
Reading

1. What is the difference between a sample and a population?
2. What are descriptive statistics?
3. True or False. Inferential statistics help us use our sample to understand the population.
4. True or False. Independent Variables are also known as outcomes.
5. Hypothesis tests inform us about the _____ of our findings.

Reading

6. True or False. Hypothesis testing informs us about the population.
7. What is the difference between qualitative and quantitative?
8. Is a nominal variable more qualitative or quantitative?
9. What is the difference between ratio and interval levels of measurement?
10. How satisfied are you with your answers?

Review: Vocabulary of Statistics



Review: Vocabulary of Statistics

Descriptive Statistics

Describing the data that you have (your sample)

Inferential Statistics

Understanding what your data say about the population

Review: Vocabulary of Statistics

Independent Variables

"predictors" or "IV"

These are the variables that we think are causing or influencing the outcome

Dependent Variables

"outcomes" or "DV"

These are the variables that we think are caused by an independent variable

Review: Vocabulary of Statistics

Hypothesis Testing (Inferential Statistics)

“Null Hypothesis Significance Testing”

Gives us an idea about what the population may look like based on our sample (accounts for **sampling error**) = “significance”

Review: Vocabulary of Statistics

Hypothesis Testing (Inferential Statistics)

"Null Hypothesis Significance Testing"

Effect Sizes

"Magnitude of the effect"

Tells us how big the effect is = "meaningfulness"

Review: Scales of Measurement

4 General Types (see pg. 11)

Scale	*Definition*	*What the scale allows you to do*
Nominal	Categories based on qualitative similarity (no order to the categories)	Count the number of things in the categories
Ordinal	Like nominal, but the categories can be ranked	Count and rank the number of things in each category
Interval	Quantify how much of something	Count, rank, and quantify how much of something there is (zero does not mean there's nothing)
Ratio	Quantify how much of something (zero means there is none of that thing)	Count, rank, and quantify how much of something there is with a meaningful zero

Review: Scales of Measurement

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Increasing degree of information

Review: Scales of Measurement

These lie on a spectrum from qualitative to quantitative

Review: Scales of Measurement

Discrete

Cannot be broken down into smaller units

Number of siblings, racial groups, have the disease or not

Continuous

Can be broken into smaller units

Time to finish an exam, height of a person

Break Time

Reliability and Validity

Reliability: the consistency of the measure

Validity: does it measure what we think it measures?

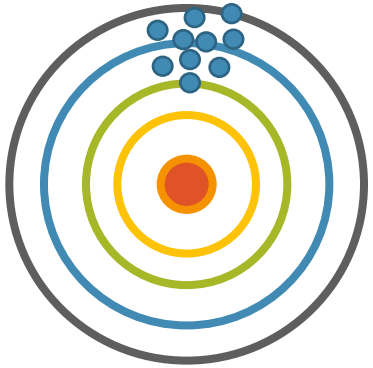
Reliability and Validity

Reliability: the consistency of the measure

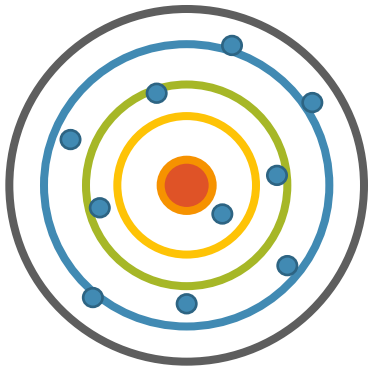
Validity: does it measure what we think it measures?

Reliable
Valid

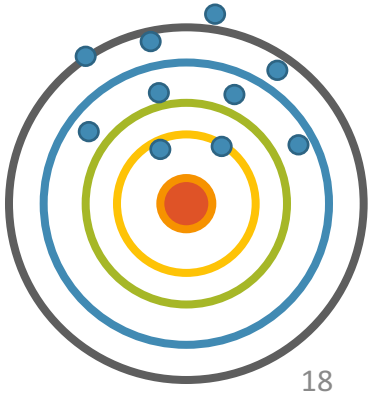
Reliable
Not Valid



Not Reliable
Valid



Not Reliable
Not Valid



Reliability and Validity

Reliability

Compare with factor analyses (not covered in the class)

Validity

Compare with correlations with things that should correlate or shouldn’t

Often based on theory

Correlation and Experimentation

Correlation

observational, no treatment/intervention

Experimentation

treatment/intervention (best if groups are randomized)

What are the pro's and con's of each?

Correlation and Experimentation

Depends on the field how often each are used

Possible, but difficult, to convince of causation with correlational (observational) data

Correlation does not imply causation

AND

Correlation does not imply it isn’t causal

Central Tendency

What does this mean?

Mean

"arithmetic average"

Sum of scores divided by number of scores

Median

"the middle score"

The number where half of the scores are above and half are below

Mode

"most common score"

The most common score

Central Tendency

Measure	When to use it
Mean	With interval/ratio data that are ~normally distributed
Median	With ordinal data With interval/ratio data that are skewed or have outliers
Mode	With nominal data

Outliers = points far from the other points

Central Tendency

See Figure 2.2 (page 42)

Computing the Mean

$$\frac{\text{Sum of scores}}{\text{Number of scores}}$$

$$M = \frac{\sum X}{N}$$

Computing the Median

1. Order the values from lowest to highest
2. Find the middle value
3. If two are in the middle, take the average of those two

Computing the Mode

Find the value that is the most common

Mean, Median, and Mode for Age?

Mean, Median, and Mode for Degree?

Age	Degree
21	MS
25	MEd
34	PhD
21	PhD
22	MEd
28	MS
33	MS
29	MS

Mean, Median, and Mode for Age?

Mean = 213/8 = 26.6

Median = 21 21 22 25 28 29 33 34 = 26.5

Mode = 21

Mean, Median, and Mode for Degree?

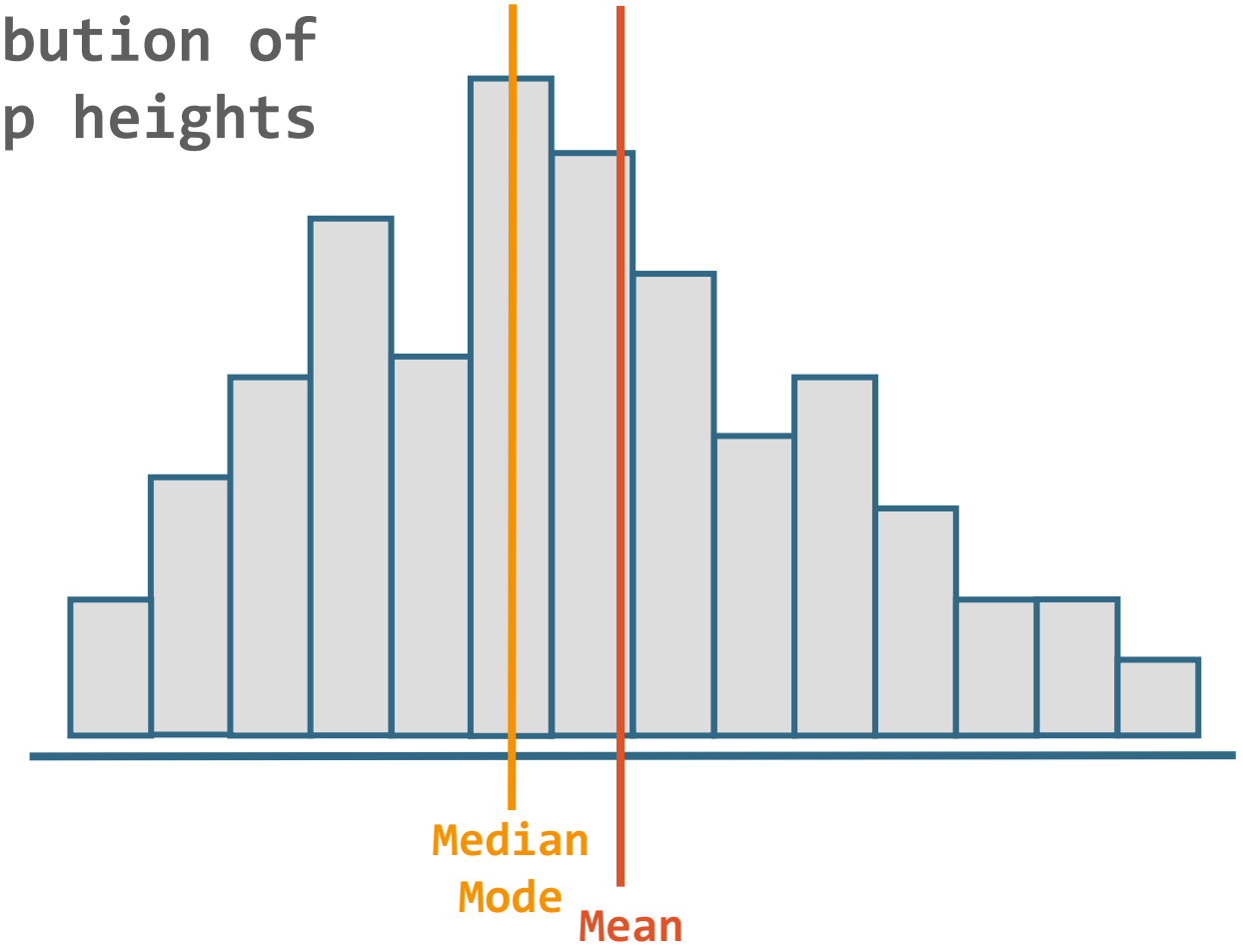
Mean = ...

Median = ...

Mode = 21

Age	Degree
21	MS
25	MEd
34	PhD
21	PhD
22	MEd
28	MS
33	MS
29	MS

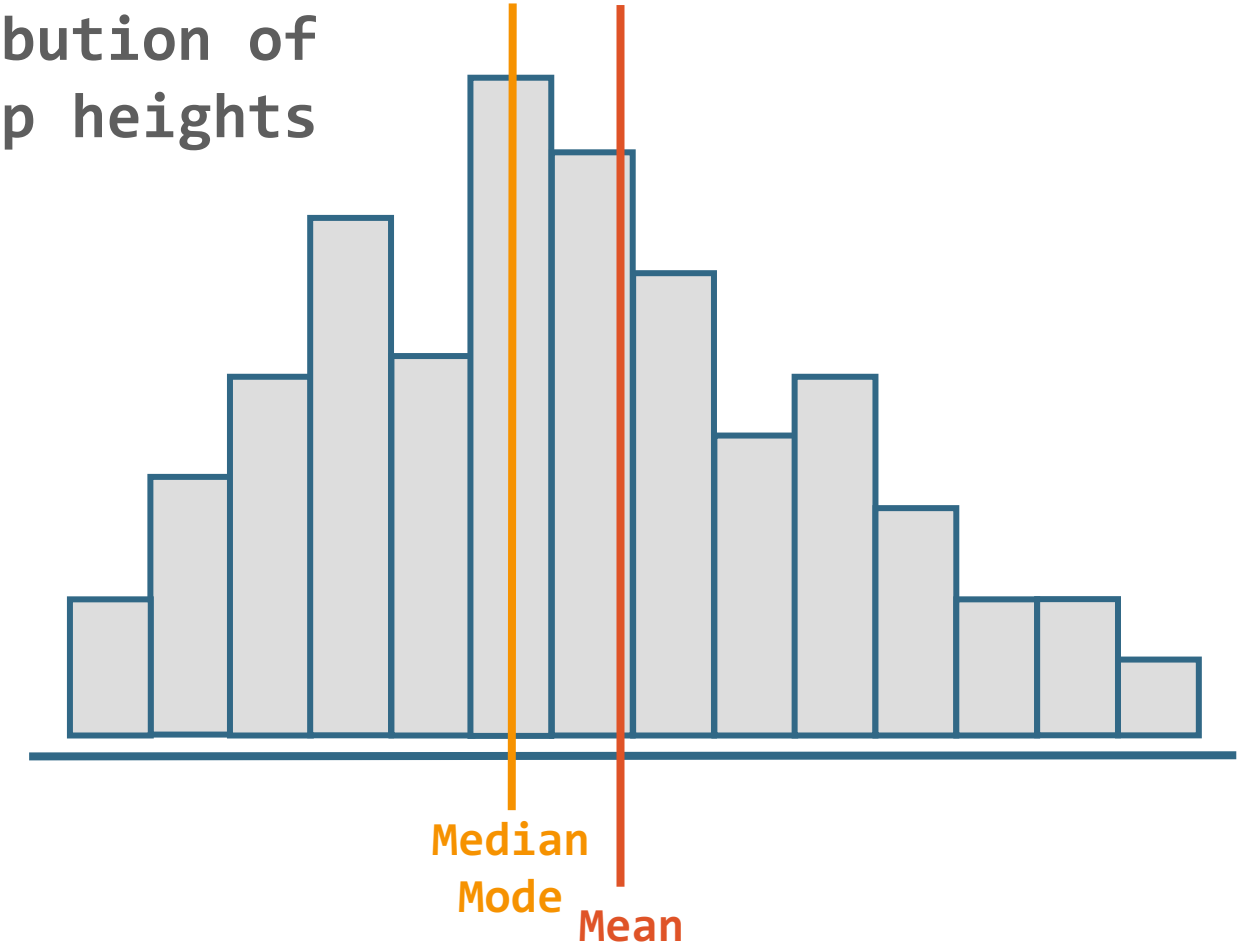
The distribution of jump heights



What about the spread of the data?

This is what variability is all about

The distribution of jump heights



What about the spread of the data?

Variability

“spread”

Measure	What is It
Range	Max - Min
Standard Deviation	The typical (or standard) distance each score is from the mean

Variability

Measure	When to Use	Possible Values
Range	Ordinal, Interval, Ratio	0+
Standard Deviation	Interval, Ratio	0+

Computing Range

Two approaches:

1. Max – Min
2. “[Min] to [Max]”

Computing Standard Deviation

Essentially it is the deviation from the mean (X – M)

$$SD = \sqrt{\frac{\sum (X - M)^2}{N - 1}}$$

Other Stuff about Standard Deviation

There is a population standard deviation denoted σ but is usually unknown

Our SD is an estimate of the population standard deviation

Variability

What is the range of Age?

What is the range of Grade?

Age	Grade
21	A
25	B
34	A
21	B
22	C
28	B
33	B
29	A

Variability

What is the range of Age?

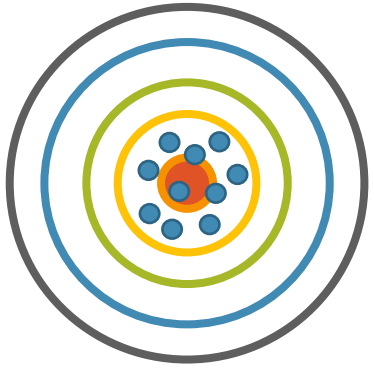
Range = 34 – 21 = 13
= 21 to 34

What is the range of Grade?

Range = A to C

Age	Grade
21	A
25	B
34	A
21	B
22	C
28	B
33	B
29	A

Review



1. The figure to the right is reliable/unreliable and valid/invalid.
2. When should you use the mean? What about the median?
3. What does the standard deviation tell us?
4. Can we obtain a standard deviation with nominal data?

Another look at Jamovi

Questions?

Next week:

1. Statistics terminology continued (hypothesis testing, populations and samples, descriptive and inferential statistics, effect sizes, confidence intervals, Type I and II errors)
2. Chapters 4, 5, and 6 in Book
3. Statistical Organizer due