STA130 Fall 2019 - T0107

Week 4 – Statistical Inference

(Materials used in this presentation are provided by the U of T Statistical Sciences Department.

This presentation was prepared by Vivian Ngo.)

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Agenda

- Vocabulary
- R Live Coding & HW Q1
- Group discussion 1
- Group discussion 2
- Group discussion 3
- Writing activity

Vocabulary

- hypothesis testing
- null hypothesis
- alternative hypothesis
- **P-value**
- statistically significant
- significance level
- parameter
- statistic
- test statistic
- observed value
- sample
- population
- inference
- strength of evidence: e.g. strong, moderate, or weak, or no evidence
- sampling distribution
- “at least as extreme”/ “as extreme or more extreme”
- generalize
- assumption
- statistical model
- meaningful difference
- random
- probability
- loop
- simulation
- two-sided test
- one-sided test

Hypotheses

- Null Hypothesis
- Alternative Hypotheses
- Examples?

P-value

- A p-value is the probability of obtaining an effect at least as extreme as the one in your sample data, assuming the truth of the **null hypothesis.**
- **Examples?**
- Critically, p-values address only one question: how likely are your data, assuming a true null hypothesis?
- It does **NOT** measure support for the alternative hypothesis
- Statistical significance does not mean practical significance

P-value (cont'd)

- *Other important notes to make:*
- A p-value can (almost) never be zero. If R gives you a p-value of zero, this means you're not looking at enough digits. In this case, we say $p<0.0001$. Never say $p=0$!
- You can never accept your hypotheses! You can only reject or fail to reject.
- Often, we assess statistical significance based on a threshold of $p=0.05$. If $p>0.05$, then the chance of observing your outcome due to chance alone was greater than 5% (5 times in 100 or more). In this case, you would fail to reject the null hypothesis and would not accept the alternative hypothesis.
- Evidence of statistically significance is either present or it's not. Never say that something is "almost" statistically significant.

R Live Coding – HW Q1

Group discussion 1

- *For Question 1, what would you expect to happen your p-value if you used 10 simulations versus 10,000 simulations? Explain.*

Group discussion 2

- *For Question 1e, which statement is/are valid? Explain.*

Group discussion 3

- *From Question 3d: Some people claim that they can tell the difference between Coke or Pepsi in the first sip. A researcher wanting to test the claim that people can distinguish (correctly or incorrectly) between them randomly selected 30 people. He then filled 30 plain white cups with Pepsi and asked each person to take one sip from their cup and identify the drink as Coke or Pepsi. 13 participants correctly identified the drink as Pepsi and the other 17 participants said the drink was Coke. Does this suggest that people can correctly (or incorrectly) tell a difference between the two drinks? Suppose you did a simulation analysis with 1000 simulations and the resulting P-value was 0.04.*
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- *For Question 3d, what is an appropriate conclusion? Are there any limitations to this analysis?*

Writing Activity

- To be announced