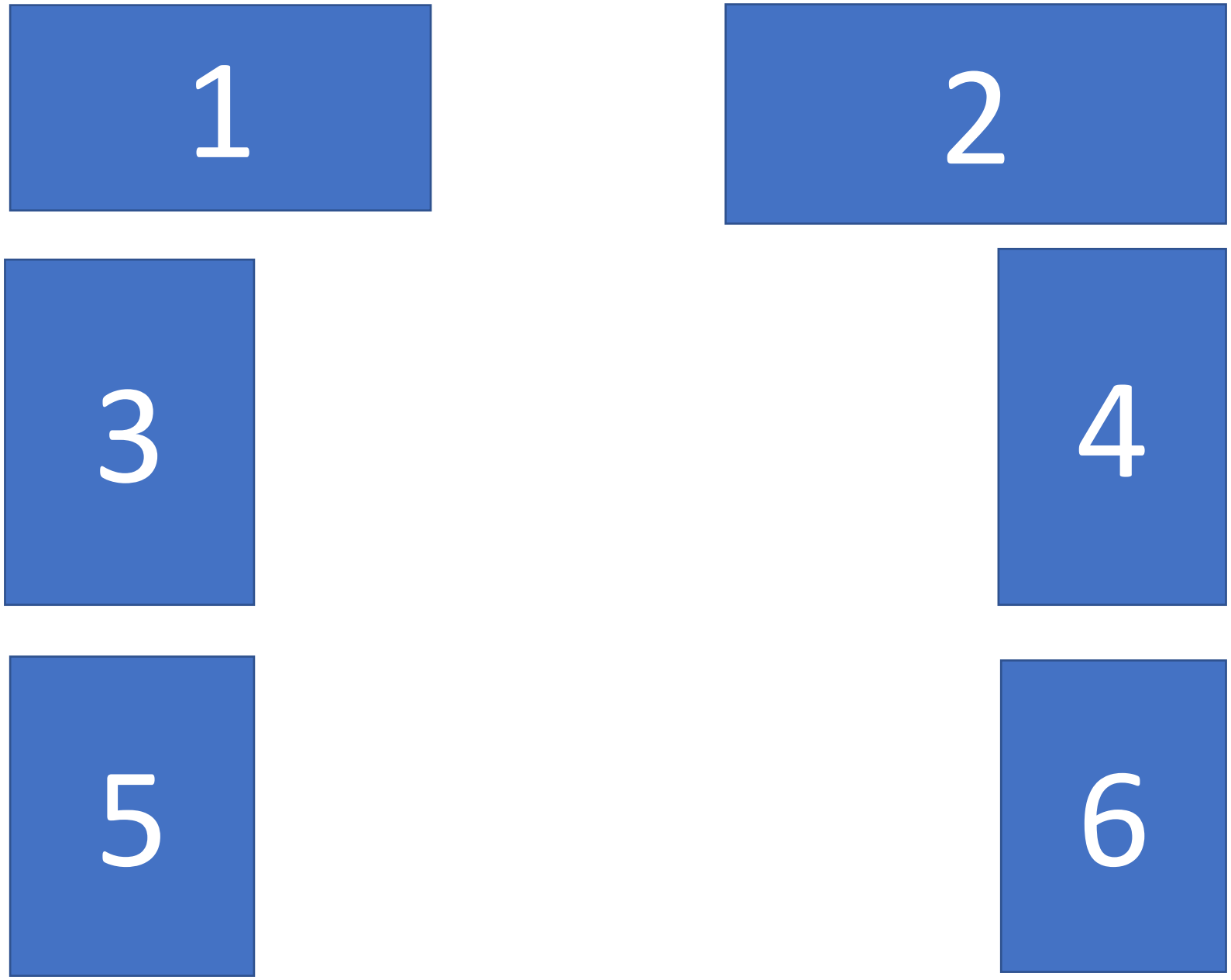
STA130 T0209

Week 4 - 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

- Course feedback
- Writing Tips and Examples
- Vocabulary
- Group discussion
- Writing activity

Course feedback

- Thank you for your feedback!
- Lectures ~ Homework ~ Tutorial
- R Code
- Writing activity
  - Why?
  - Not enough time?
  - No examples?

Writing – Critical components

- When communicating about your work, it's important to include 4 critical items:
  - **Purpose:** What is it that you're studying? Why should we care about the analytical work you've done?
  - **Summary of the methods you used:** What did you do? Why did you do it this way?
  - **Summary of the results:** We don't need to know everything you found – only the most critical things relating to your purpose! Remember, sometimes less is more!
  - **Conclusion:** What is your take away message? Remember, a conclusion is not the place to present new findings.

Writing - Style

- **Complete** — cover the important parts of the project, study, or analysis
- **Concise** — contain no excess wordiness or unnecessary information
- **Clear** — readable, well organized, and not too jargon-laden
- **Cohesive** — flows smoothly between the parts

Writing Example 1

An Assessment of Oral Health on the Pine Ridge Indian Reservation. (Gallegos, JR et al.)

We assessed the oral health of a group of local Indigenous people living in the Pine Ridge Indian Reservation. Based on a sample of 292 adults and children, screening personnel counted the number of decayed teeth, total teeth, and dental cavities (both filled and unfilled). On average, each individual had 4 decayed teeth. Half of adults had 27 or fewer teeth and 26% had an unfilled cavity. Participants had higher numbers of decayed teeth ($p<0.0001$) and lower numbers of filled teeth ($p<0.0001$) than expected. Amongst the people of Pine Ridge, our study documented a high prevalence of cavities, numerous people with missing teeth, and many unmet dental needs. Future studies of oral health related behaviors, and access to oral health care are needed to explain the dental, periodontal, and soft tissue problems that adversely affect the people of the Pine Ridge Indian Reservation.

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Purpose

Methods. Very simple because not statistics-based. You should include more detail here.

Results. Notice how only things critical to their purpose and methods are included. Very concise!

Conclusion (and recommendation)

Writing Example 2

Study skills and students' satisfaction with their performance positively affect their academic achievement. The current research was carried out to investigate the correlation of study skills with academic achievement among the medical and pharmacy students in 2013. This descriptive-analytical study was conducted on 148 students of basic medical sciences and pharmacy through convenience sampling. Data were collected by a valid and reliable questionnaire, consisting of two sections: Demographic information and questions about daily study hours, study skills in six domains, and students' satisfaction with study skills. Collected data sets were analyzed by SPSS-16 software. In total, 10.9% of students were reported to have favorable study skills. The minimum score was found for preparation for examination domain. Also, a significantly positive correlation was observed between students' study skills and their Grade Point Average (GPA) of previous term (P=0.001, r=0.269) and satisfaction with study skills (P=0.001, r=0.493). The findings indicated that students' study skills need to be improved. Given the significant relationship between study skills and GPA, as an index of academic achievement, and satisfaction, it is necessary to promote the students' study skills. These skills are suggested to be reinforced, with more emphasis on weaker domains.

Writing Example 3

This study explored the pattern of video game usage and video game addiction among male college students and examined how video game addiction was related to expectations of college engagement, college grade point average (GPA), and on-campus drug and alcohol violations. Participants were 477 male, first year students at a liberal arts college. In the week before the start of classes, participants were given two surveys: one of expected college engagement, and the second of video game usage, including a measure of video game addiction. Results suggested that video game addiction is (a) negatively correlated with expected college engagement, (b) negatively correlated with college GPA, even when controlling for high school GPA, and (c) negatively correlated with drug and alcohol violations that occurred during the first year in college. Results are discussed in terms of implications for male students' engagement and success in college, and in terms of the construct validity of video game addiction.

Writing examples

- How to write good abstracts: https://www.kibin.com/essay-writing-blog/10-good-abstract-examples/

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.

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- sampling distribution
- “due to chance”
- “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

Question 1

(Adapted from ISRS 3.17) Some people claim that they can tell the difference between Coke and a Pepsi in the first sip. In fact, soda drinkers often have strong preferences for one over the other. A researcher wanting to test the claim that people can tell the difference randomly sampled 50 people. He then filled 50 plain white cups with soda (25 with Coke and 25 with Pepsi) through random assignment, and asked each person to take one sip from their cup and identify the soda as Coke or Pepsi. 32 participants correctly identified the soda brand.

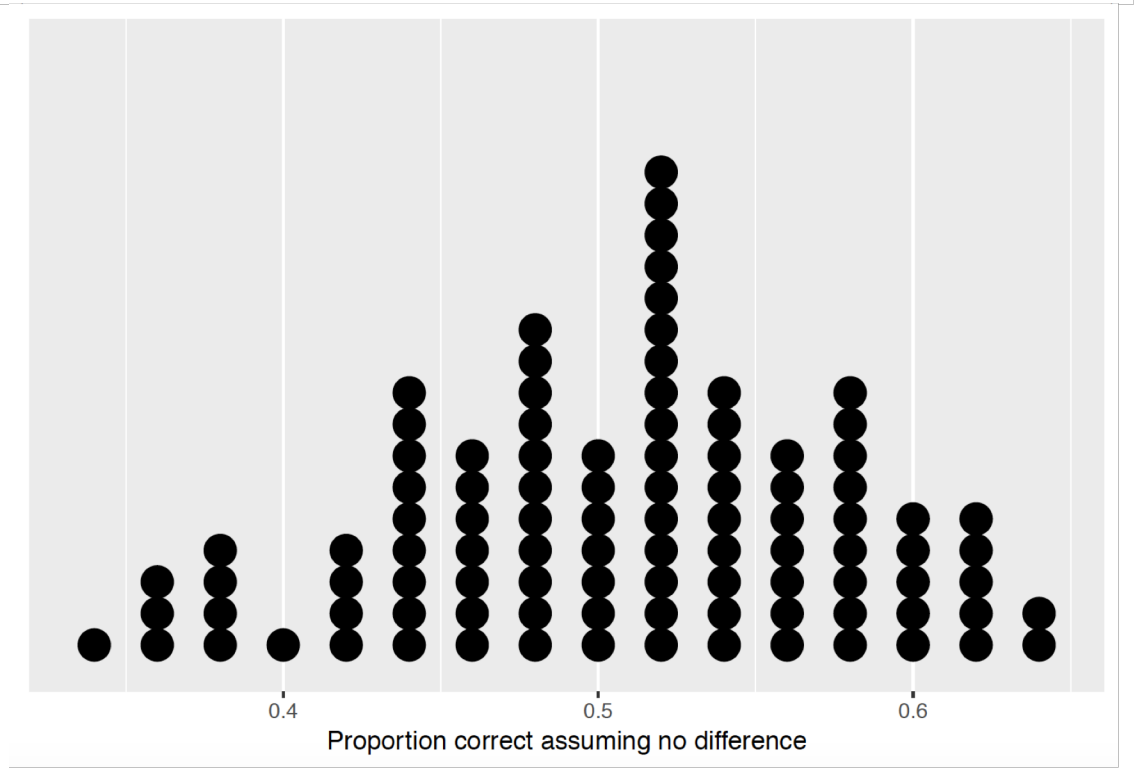
(a) What are appropriate null and alternative hypothesis to test the claim?

Question 1

(b) Assume you conduct a test of significance using simulation and get the following estimated sampling distribution of the test statistic assuming the null hypothesis is true. For simplicity, this distribution shows the results of only **100** simulations. There are 100 dots on the plot, one for each simulation.

i. What does each single dot in the plot represent?

ii. Based on this plot, what is your estimate of the P-value?



(c) Suppose the analysis described in (b) is repeated but this time 1000 simulations are used to get a better estimate of the P-value, and the resulting P-value was 0.01. What is an appropriate conclusion?

Group discussion

- *For Question 1, what would you expect to happen your p-value if you used 10 simulations versus 10,000 simulations? Explain.*
- *For Question 1d, which one(s) are valid? Explain.*

Question 1

(d) Which of the following statements is/are valid interpretations of the P-value:

i. The probability that participants can correctly identify the type of soda.

ii. The probability that participants cannot correctly identify the type of soda.

iii. The probability of getting results at least as extreme as the result in this study.

iv. The probability of getting results at least as extreme as the result in this study if participants really cannot correctly identify the type of soda.

Writing Activity

Imagine you work as a business analyst for Coca Cola. Your CEO has asked you to deliver a summary of these new research findings (for question 1) by the end of the day. It's already 3:30 pm and it's a Friday!

Remember, your CEO is a busy person. They only want the most important information and they don't want to read more than half a page of text. Use visuals to help get key points across, if you can. The CEO has only limited statistical background, so make sure everything is clear and makes sense! Remember to start with the purpose - your CEO is busy, they probably forgot what this was about! Also make sure to include a complete, but concise, summary of the methods, key results, and conclusion. You should also state how confident you in these research findings – remember, you're the statistics expert and the CEO is counting on *you* to summary this research!

Question 2

A Scottish woman noticed that her husband's smell changed. Six years later he was diagnosed with Parkinson's disease. His wife joined a Parkinson's charity and noticed that odour from other people. She mentioned this to researchers who decided to test her abilities. They recruited 6 people with Parkinson's disease and 6 people without the disease. Each of the recruits wore a t-shirt for a day, and the woman was asked to smell the t-shirts (in random order) and determine which shirts were worn by someone with Parkinson's disease. She was correct for 11 of the 12 t-shirts! You can read about this here.

a. Without conducting a simulation, describe what you would expect the sampling distribution of the proportion of correct guesses about the 12 shirts to look like if someone was really guessing.

b. Carry out a test using simulation to determine if there is evidence that this woman has some ability to identify Parkinson's disease by smell, or if she was a lucky guesser.

Set the random number seed to the last two digits of your student number before carrying out your simulation. Use 10,000 repetitions. We set the seed so that the results won't change each time this code is run or knitted. If we didn't do this, your written interpretations and conclusions may not be relavant to the new run of the code. (This simulation is similar to the code in Question 1 (b) with many more simulated values of the test statistic under the null hypothesis. 10,000 is a lot of repetitions - more that is likely needed, but we'll do this many repetitions this time anyway.)

c. The woman correctly identified all 6 people who had been diagnosed with Parkinson's but incorrectly identified one of the others as having Parkinson's. Eight months later he was was diagnosed with the disease. So the woman was actually correct 12 out of 12 times. Are you able to get the p-value for the test using this new data, without running a new simulation? What would you change from your answer to (b)? What wouldn't you change?

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