Stat 101L: Lecture 30

More on Testing

- 500 randomly selected U.S. adults were asked the question: "Would you be willing to pay much higher taxes in order to protect the environment?"
- 216 answered yes

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More on Testing

- Is this convincing evidence that the proportion of all U.S. adults who are willing to pay higher taxes is different from 50%?

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Test of Hypothesis

- Step 1: State your null and alternative hypotheses.
  - H_0: $p = 0.50$
  - H_A: $p \neq 0.50$

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Test of Hypothesis

- Step 2: Check conditions
  - Independence
  - Random sampling condition
  - 10% condition
  - Success/Failure condition

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Test of Hypothesis

- Step 3: Calculate the test statistic value and convert it into a P-value.

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.432 - 0.5}{\sqrt{\frac{0.5(0.5)}{500}}}$$

$$z = \frac{-0.068}{0.0224} = -3.04$$

$$\text{P - value} = 2(0.0012) = 0.0024$$

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Test of Hypothesis

- Step 4: Use the P-value to reach a decision.
  - The P-value is small therefore we should reject H_o

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Test of Hypothesis

- Step 5: State your conclusion in the context of the problem.
  - There is convincing evidence that the proportion of the population willing to pay more taxes is different from 50%.

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Thinking about the P-value

- The P-value is the probability of getting a value of the sample proportion as extreme as the one we actually observed, *given* that the null hypothesis is true.

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Thinking about the P-value

- The P-value is *NOT* the probability that the null hypothesis is true.
- The smaller the P-value the more comfortable we feel about rejecting the null hypothesis.

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What is a small P-value?

- A small P-value is one that corresponds to a rare occurrence.
- What is a "rare occurrence"?
- We can define what is a "rare occurrence" by setting a level of significance or "alpha level".

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"Rare Occurrence"

- Many use the rule of thumb that a "rare occurrence" is anything with a probability less than 0.05.
- A small P-value would then be any P-value less than 0.05.

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"Rare Occurrence"

- We can define a "rare occurrence" as anything with a probability less than, say, 0.01.
- If the P-value is less than 0.01, then the result is statistically significant at the 0.01 level.

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Significance

- Statistical significance indicates a result that cannot be explained by the variation due to random sampling.
- Statistical significance is not necessarily practical significance.

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CIs and Tests

- A 95% confidence interval for the proportion of the U.S. population willing to pay more taxes to protect the environment is

  38.8% to 47.6%.

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CIs and Tests

- 50% is not in the confidence interval, therefore, 50% is not a plausible value for the population proportion.
- This agrees with the decision to reject the null hypothesis that p=0.50.

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