

Stat 104 – Lecture 23

Interpretation

- Getting a value of the sample proportion of 0.904 is very unusual if one were random sampling from a population with population proportion $p = 0.94$.
- The P-value is small, therefore reject H_0 .

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Conclusion

- Based on this sample, the company's claim appears to be false. The true proportion of the new corn hybrid seeds that germinate is less than 94%.

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Test of Hypothesis

- Step 1: Check conditions
 - Random sampling condition
 - Success/Failure condition
 - np and $n(1 - p)$ are at least 15

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Test of Hypothesis

- Step 2: State your null and alternative hypotheses.

$$-H_0: p = p_0$$

$$-H_A: p < p_0$$

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Test of Hypothesis

- Step 3: Calculate the value of the test statistic.

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

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Test of Hypothesis

- Step 4: Calculate P-value.
 - Use Table Z
- Step 5: Reach a decision and state your conclusion in the context of the problem.

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Test of Hypothesis

- Decision
 - If the P-value is small, reject H_0
 - If the P-value is not small, fail to reject H_0
- Conclusion
 - What does rejecting, or failing to reject, H_0 mean in the context of the problem.

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Alternatives

- $H_0: p = p_0$
 - $H_A: p < p_0$, P-value = $\Pr < z$
 - $H_A: p > p_0$, P-value = $\Pr > z$
 - $H_A: p \neq p_0$, P-value = $\Pr > |z|$

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Alternatives

- $H_0: p = p_0$
- $H_A: p \neq p_0$
 - If z is a negative value, P-value = $2(\text{Probability less than } z)$
 - If z is a positive value, P-value = $2(\text{Probability greater than } z)$

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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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Step 1

- Check conditions
 - Random sampling condition
 - Success/Failure condition
 - np and $n(1 - p)$ are each 250 which is at least 15

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Step 2 – Hypotheses

- p is the proportion of all U.S. adults who are willing to pay higher taxes in order to protect the environment

$$-H_0: p = 0.50$$

$$-H_A: p \neq 0.50$$

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Step 3 – Test Statistic

- Calculate the test statistic.

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

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

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Step 4 – Probability value

- Calculate the P-value.
- The probability of z being less than -3.04 is 0.0012.
- The P-value is $2(0.0012) = 0.0024$

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Step 5 – Results

- Reject the null hypothesis because the P-value is small (< 0.05).
- There is convincing evidence that the proportion of the U.S. adult population willing to pay more taxes to protect the environment is different from 50%.

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Confidence Interval for p

- We are 95% confident that p will fall between

$$\hat{p} - 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \text{ and } \hat{p} + 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

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Example

$$\hat{p} = 0.432$$

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{0.432(0.568)}{500}} = 0.022$$

$$0.432 - 1.96(0.022) \text{ to } 0.432 + 1.96(0.022)$$

$$0.432 - 0.043 \text{ to } 0.432 + 0.043$$

$$0.389 \text{ to } 0.475$$

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