Mathematics 231

Lecture 25

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Announcements

- Reading
  - Today   M&M 8.1   493-501
  - Next class   M&M 7.2   447-467

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Topics

- Hypothesis testing for a single population proportion
- Calculating power using Stata
- Calculating power by hand

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Test for a Population Proportion

Given an SRS of size, n, we want to test $H_0 : p = p_0$ against $H_A : p \neq p_0$ (two-sided)

Use test statistic: $z = \dfrac{\hat{p} - p_0}{\sqrt{\dfrac{p_0(1 - p_0)}{n}}}$

When $H_0 : p = p_0$ is true, this statistic has a standard normal distribution if $np_0 \geq 10$ and $n(1 - p_0) \geq 10$.

Calculate p-value: $2P(Z > |z|)$ when H_A is two-sided.

Note: $np_0 \geq 10$ and $n(1 - p_0) \geq 10$ must be satisfied

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Coin Tossing Experiment

- English mathematician John Kerrich flipped a coin 10,000 times and obtained 5067 heads.
- Test whether the proportion of heads differs from 0.50.
- The sample proportion is 0.5067.
- Large sample properties hold.

Coin Tossing Experiment

Given n = 10,000 we want to test $H_0 : p = 0.5$ against $H_A : p \neq 0.5$ (two-sided).

Use test statistic:

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.5067 - 0.5}{\sqrt{\frac{0.5(1-0.5)}{10000}}} = 1.34$$

When H_0 is true, this statistic has a standard normal distribution.

p-value = 0.09; fail to reject H_0 and conclude that the population proportion not significantly different from 0.5.

Power Calculations in Stata

- If you know the sample size (n), the level of the test (α), the population SD (σ), and the null (μ_0) and alternative (μ_A) means, then the power of a test for a population mean can be done in Stata.
- In the command window you can type:
  sampsi μ_0 μ_A, alpha(α) n(n) sd(σ) onesample

Power Calculations in Stata

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. sampsi 0 8.1, sd(26.4) n(110) onesample
Estimated power for one-sample comparison of mean to
  hypothesized value

Test Ho: m =      0, where m is the mean in the population

Assumptions:

        alpha =   0.0500  (two-sided)
  alternative m =     8.1
           sd =    26.4
  sample size n =     110

Estimated power:

        power =   0.8958
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