Test 2 Review
Chaptes 16, 17, 18, 20, 21, 22, 23

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Outline

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1. Two Types of Parameters
2. Means
   - One Sample
   - Two Samples
3. Porportions
   - One Sample
   - Two Samples

Two Types of Parameters

- We had two types of parameter: means and proportions.
- Means are averages, derived from numerical data.
- Proportions are ratios, derived from categorical data.
- The population mean is μ and the sample mean is $\overline{x}$.
- The population proportion is p and the sample proportion is $\hat{p}$.

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Means – One Sample, σ Known

- The sampling distribution of $\overline{x}$ is normal, with mean μ and standard deviation $\sigma/\sqrt{n}$.
- Thus, a confidence interval for μ is

$$\overline{x} \pm z^* \left(\frac{\sigma}{\sqrt{n}}\right).$$

- For hypothesis testing, the test statistic is

$$z = \frac{\overline{x} - \mu}{\sigma/\sqrt{n}}.$$

Means – One Sample, σ Unknown

- If σ is unknown, then we use s as an estimator of σ and use t instead of z.
- Thus, a confidence interval for μ is

$$\overline{x} \pm t^* \left(\frac{s}{\sqrt{n}}\right).$$

- For hypothesis testing, the test statistic is

$$t = \frac{\overline{x} - \mu_0}{s/\sqrt{n}}.$$

- Degrees of freedom = $n - 1$.

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Means – Two Samples, σ_1, σ_2 Known

- The sampling distribution of $\overline{x}_1 - \overline{x}_2$ is normal, with mean $\mu_1 - \mu_2$ and standard deviation
$$\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}.$$
- Thus, a confidence interval for $\mu_1 - \mu_2$ is
$$(\overline{x}_1 - \overline{x}_2) \pm z^* \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}.$$
- For hypothesis testing, the test statistic is
$$z = \frac{\overline{x}_1 - \overline{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}.$$

Means – Two Samples, σ_1, σ_2 Unknown

- If σ_1 and σ_2 are unknown, which is usually the case, then we use s_1 and s_2 as estimators of σ_1 and σ_2 and use t instead of z.
- Thus, a confidence interval for μ is

$$(\overline{x}_1 - \overline{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}.$$

- For hypothesis testing, the test statistic is

$$t = \frac{\overline{x}_1 - \overline{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}.$$

- Degrees of freedom = $(n_1 - 1) + (n_2 - 1)$.

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Porportions – One Sample

- The sampling distribution of $\hat{p}$ is normal, with mean p and standard deviation $\sqrt{\frac{p(1-p)}{n}}$.
- Thus, a confidence interval for p is

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}.$$

- For hypothesis testing, the test statistic is

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

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Porportions – Two Samples

- The sampling distribution of $\hat{p}_1 - \hat{p}_2$ is normal, with mean $p_1 - p_2$ and standard deviation

$$\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}.$$

- Thus, a confidence interval for $p_1 - p_2$ is

$$(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}.$$

- For hypothesis testing, the test statistic is

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}},$$

where $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$.