AP Statistics Unit 6 – Quick Notes

1. Overview

Goal: Estimate or test a population proportion (p) or a difference in proportions ($p_1 - p_2$) using sample data.

Types:

- One-sample z-interval or z-test for p
- Two-sample z-interval or z-test for $p_1 - p_2$

2. Conditions

One-sample:

- Random sample / random assignment
- Independence: $n \leq 0.1N$
- Normality: Success–Failure ($np \geq 10$, $n(1-p) \geq 10$ for tests; use $\hat{p}$ in intervals)

Two-sample:

- Random samples or random assignment for each group
- Independence: within and between groups ($n_1 \leq 0.1N_1$, $n_2 \leq 0.1N_2$)
- Normality: $n_1p_1 \geq 10$, $n_1(1-p_1) \geq 10$ $n_2p_2 \geq 10$, $n_2(1-p_2) \geq 10$

3. One-Sample z-Interval

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

Interpret: "We are C% confident that the interval from [ ] to [ ] captures the true proportion of [context]."

4. One-Sample z-Test

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

p-value = probability (from normal curve) of observing a result as extreme or more extreme in the direction of H_a.

5. Two-Sample z-Interval

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

Interpret: "We are C% confident that the interval from [ ] to [ ] captures the true difference in proportions of [context]."

6. Two-Sample Z-Test

Pooled proportion:

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

Test statistic:

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\hat{p}_c(1-\hat{p}_c)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

7. Steps for Inference

State: Define parameter, state H_0 and H_a (test) or confidence level (interval).
Plan: Choose procedure, check conditions.
Do: Calculate statistic, df, and CI or p-value.
Conclude: Interpret in context.

8. Errors and Power

- Type I error: reject H_0 when H_0 is true (α)
- Type II error: fail to reject H_0 when H_a is true (β)
- Power: $1 - \beta$, probability of correctly rejecting H_0

9. Common Pitfalls

- Using $\hat{p}$ instead of p_0 in test standard error
- Forgetting to pool in two-sample tests
- Not stating conclusions in context
- Forgetting to check conditions