AP STATISTICS • EXERCISE SHEET

6.11 Carrying Out a Test for the Difference of Two Population Proportions

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

Build the skills to answer exam questions on **carrying out a test for a difference of two proportions**.

You must be able to:

- compute the test statistic z using the pooled standard error
- find the **p-value** and compare it to α
- state a conclusion in context

1 Worked examples

Study these first. Each one shows the method for a question type used later.

The full procedure

1. State $H_0 : p_1 = p_2$ and H_a; check conditions.
2. Compute $z = \dfrac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}_c(1-\hat{p}_c)\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$.
3. Find the **p-value** from z.
4. Compare to α: reject H_0 if p-value $< \alpha$, else fail to reject.
5. State the conclusion **in context**.

A worked test

$\hat{p}_1 = 0.60$ ($n_1 = 50$), $\hat{p}_2 = 0.45$ ($n_2 = 60$). Pooled $\hat{p}_c = \frac{30+27}{110} = 0.518$. Then

$$z = \frac{0.60 - 0.45}{\sqrt{0.518(0.482)\left(\frac{1}{50}+\frac{1}{60}\right)}} \approx \frac{0.15}{0.096} \approx 1.57,$$

a two-sided p-value $\approx 0.12 > 0.05$ – fail to reject H_0.

2 Practice

2.1 State the steps to carry out a two-proportion test. [2]

2.2 A two-proportion test gives $z = 2.5$. State whether this is likely significant at $\alpha = 0.05$. [1]

2.3 State what to compare the p-value to. [1]

3 Exam-style questions

3.1 After computing z, you find the [1]

- **A** slope
- **B** p-value
- **C** mean
- **D** residual

3.2 A two-proportion test rejects H_0 when the p-value is [1]

- **A** above α
- **B** below α
- **C** exactly zero
- **D** exactly one

3.3 A two-proportion test gives a p-value of 0.03 at $\alpha = 0.05$.

(a) State the decision. [1]

(b) State whether the two proportions differ significantly. [1]

(c) State the conclusion in context. [1]

4 Go further

- work through the **6.11 Carrying Out a Test for the Difference of Two Population Proportions** lesson on the **Learn** page;
- read the **Inference for Categorical Data: Proportions** section of the AP Statistics handout on the **Know** page.

Solutions

2.1 state hypotheses and check conditions; compute z; find the p-value; compare to α and conclude in context.

2.2 yes —$z = 2.5$ gives a small p-value, likely below 0.05.

2.3 the significance level α.

3.1 B.

3.2 B.

3.3 (a) reject H_0. (b) yes. (c) there is convincing evidence that the two proportions differ.