Quiz Questions - Section 1

Question 1 — 2 / 2 points

Which expression gives the 95% confidence interval for the difference of two population proportions ($p_1 - p_2$)?

- ○ $(\hat{p}_1 - \hat{p}_2) \pm 1.64 \times SE$
- ✓◉ $(\hat{p}_1 - \hat{p}_2) \pm 1.96 \times SE$
- ○ $(\hat{p}_1 - \hat{p}_2) \pm 2.58 \times SE$
- ○ $(\hat{p}_1 - \hat{p}_2) \pm t^* \times SE$

Question 2 — 1 / 1 point

Statement: "A confidence interval for a difference ($p_1 - p_2$) that **includes zero** indicates that zero is a plausible value for the true difference at the given confidence level."

Is this statement true or false?

- ○ False
- ✓◉ True

Question 3 — 2 / 2 points

When performing a z-test comparing two population proportions, which formula correctly represents the standard error of the difference $(\hat{p}_1 - \hat{p}_2)$ calculated under the assumption that the null hypothesis $H_0 : p_1 = p_2$ is true?

- ○ $SE_0 = \sqrt{\frac{\hat{p}_1 - \hat{p}_2}{n_1 + n_2}}$
- ✓◉ $SE_0 = \sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}$
- ○ $SE_0 = \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$
- ○ $SE_0 = \sqrt{\frac{(\hat{p}_1 - \hat{p}_2)^2}{n_1 n_2}}$

Question 4 — 3 / 3 points

What does the p-value represent in a hypothesis test?

- ○ The probability that the alternative hypothesis (H_a) is true.
- ○ The probability that the null hypothesis (H_0) is true.
- ✓◉ The probability of observing the collected data (or data more extreme) if the null hypothesis (H_0) were actually true.
- ○ The chosen significance level (α) for the test.

Question 5 — 4 / 4 points

Match the core concepts of hypothesis testing to their descriptions.

✓ __2__	The research hypothesis; what we suspect might be true if the default assumption is rejected.	1. Null Hypothesis (H_0)
✓ __1__	The default assumption or claim being tested, often representing the status quo or 'no change'.	2. Alternative Hypothesis (H_a)
✓ __4__	A value calculated from sample data used to decide between the null and alternative hypotheses.	3. Critical Value
✓ __3__	The cut-off point on the test statistic's distribution that defines the rejection region for the null hypothesis.	4. Test Statistic

Section 2

Question 6 — 2 / 2 points

A public health survey investigated vaccination coverage differences between populations. In the urban sample, 120 out of 400 respondents reported being vaccinated (yielding a sample proportion $\hat{p}_1 = 0.30$). In the rural sample, 125 out of 500 respondents were vaccinated ($\hat{p}_2 = 0.25$).

The observed difference in these sample proportions is $\Delta = \hat{p}_1 - \hat{p}_2 = +0.05$.

Based on this data, what is the plausible range for the true difference in vaccination proportions ($p_1 - p_2$) between the underlying urban and rural populations? Select the correct 95% confidence interval below, rounded to three decimal places.

- ○ [−0.109, +0.009]
- ✓◉ [-0.009, +0.109]
- ○ [+0.009, +0.109]
- ○ [−0.050, +0.150]

Question 7 — 2 / 2 points

Field experiments test interventions in real-world settings to understand their causal effects. In this study, researchers wanted to see if the way information was framed could influence voter support for environmental policy.

To estimate the effect of messaging on voter opinion, a randomized experiment was conducted. Group 1 received an SMS message using a specific policy framing (e.g., highlighting potential job creation from the bill); out of 800 voters in this group, 200 subsequently expressed support for a climate bill (sample proportion $\hat{p}_1 = 0.25$). Group 2 (the control group) received a neutral reminder message (e.g., simply stating 'Vote on the climate bill next Tuesday'); out of 600 voters, 180 supported the bill (sample proportion $\hat{p}_2 = 0.30$).

The observed difference in support rates (treatment - control) is $\Delta = \hat{p}_1 - \hat{p}_2 = -0.05$.

A 95% confidence interval for the true difference in population proportions $p_1 - p_2$ was calculated as [-0.097, -0.003].

Based **only** on this confidence interval and using a 5% significance level ($\alpha = 0.05$), what conclusion can be drawn about the effectiveness of the policy-framing message compared to the neutral reminder?

- ○ The policy framing (Group 1) generated significantly higher support than the neutral reminder (Group 2).
- ○ There is no statistically significant difference in support between the two message types.
- ✓◉ The policy framing (Group 1) generated significantly lower support than the neutral reminder (Group 2).
- ○ The result is inconclusive because the confidence interval includes zero.

Question 8 — 2 / 2 points

A public health department is investigating whether there is a statistically significant difference in COVID-19 vaccination rates between urban and rural populations in their jurisdiction. They collected the following sample data:

* Urban Sample: 120 out of 400 residents were vaccinated ($\hat{p}_1 = 0.30$)

* Rural Sample: 125 out of 500 residents were vaccinated ($\hat{p}_2 = 0.25$)

To formally test the null hypothesis that the true population proportions are equal ($H_0 : p_1 = p_2$, meaning $p_1 - p_2 = 0$), calculate the appropriate pooled two-proportion z-test statistic. Assume the samples are independent.

Select the value below that best matches your calculation, rounded to two decimal places.

- ✓◉ +1.67
- ○ +1.28
- ○ +2.33
- ○ −1.67

Question 9 — 2 / 2 points

Recall the randomized field experiment investigating voter support for a climate bill, comparing a policy-framing SMS message (Group 1) against a neutral reminder (Group 2). The sample data was:

* Group 1 (Policy Framing): 200/800 supported ($\hat{p}_1 = 0.25$)

* Group 2 (Neutral Reminder): 180/600 supported ($\hat{p}_2 = 0.30$)

We previously constructed a confidence interval to estimate the difference between these groups ($p_1 - p_2$). Now, let's calculate the test statistic needed to formally test the null hypothesis that there is no difference in the true population proportions ($H_0 : p_1 = p_2$) against the two-sided alternative ($H_a : p_1 \neq p_2$).

Compute the pooled two-proportion z-test statistic. Select the value below that best matches your result, rounded to two decimal places.

- ✓◉ -2.08
- ○ −1.64
- ○ +2.08
- ○ −2.58