Friday Quiz 2 Solutions - STAT 252

Context: A pharmaceutical company has developed a new pain relief medication and wants to assess its effectiveness compared to the current leading pain reliever in the market. They conducted a randomized controlled trial involving individuals suffering from chronic back pain. The company recruited 400 participants and randomly assigned them into two groups: Group A received the new medication, while Group B received the leading pain reliever. After six weeks of treatment, participants were asked to rate their pain levels on a scale of 0 to 100, with 0 indicating no pain and 100 indicating severe pain. The results indicated that the average pain score for Group A was 68.2, with a standard deviation of 15, while for Group B, it was 65.8, with a standard deviation of 17.

Question 9

Question 9: State the null and the alternative hypotheses in the context of the problem using only words.

1) Solution (Full-credit response)

Null Hypothesis (H):
There is **no difference in the population mean pain scores** between those who take the new medication (Group A) and those who take the current leading pain reliever (Group B). Mathematically, this could be written as: but symbols are not required.:

$$H_0 : \mu_A = \mu_B$$

Alternative Hypothesis (H):
There **is a difference in the population mean pain scores** between the new medication and the current leading pain reliever.

Mathematically:

$$H_1 : \mu_A \neq \mu_B$$

This expresses the company's goal to determine whether the new medication differs in effectiveness from the current one **based on population averages**.

2) Rubric (Total: 3 points)

Component	Criteria	Points
Null Hypothesis (H)	States that the **population mean pain scores** are equal for both medications; symbols optional, but wording must refer to **population mean**	1.0
Alternative Hypothesis (H)	States that the **population mean pain scores** differ between the two medications; again, symbols optional but concept must be clear	1.0
Contextual Framing and Clarity	Clear phrasing in context (mentions **pain scores**, **new medication vs. current medication**, and compares **population means**)	1.0

Note:
- Full credit is awarded if hypotheses are correct **in words**, even if symbols are not provided.
- Deduct if student refers only to sample means or omits reference to **population-level inference**.

Question 10

Question 10: If the p-value is 0.2543, write a conclusion regarding this analysis in the context of the above scenario. Include the type of error that would be committed.

PTS: 3

1) Solution (Full-credit response)

Since the p-value is **0.2543**, which is much greater than 0.10, we **fail to reject the null hypothesis**. This means we do **not have any statistical evidence** to conclude that the **population mean pain scores** differ between the new pain relief medication and the current leading pain reliever.

In context, this suggests that the data do not provide convincing evidence that the new medication is more or less effective in reducing pain compared to the standard medication.

By failing to reject the null hypothesis when there **actually is a difference**, we risk making a **Type II error** - concluding there is no difference in pain relief when, in reality, the new medication may actually be more or less effective.

2) Rubric (Total: 3 points)

Total: 3 points

Component	Criteria	Points
Decision about the null	Clearly states **fail to reject the null hypothesis** based on the p-value being greater than the significance level (e.g., 0.10 or 0.05)	1.0
Contextual conclusion	States conclusion **in context**, referring to **population mean pain scores** and indicating **no statistically significant difference**	1.0
Type of error identified	Correctly identifies that if we **fail to reject a false null hypothesis**, we risk making a **Type II error**	1.0

Helpful Notes for Grading:

- The **p-value = 0.2543** is too large to reject at conventional levels (e.g., 0.10), so the correct conclusion is to **fail to reject the null**.
- Students must include context: pain scores, population means, and mention of the medications.
- For full credit on error type, they must identify **Type II error** — the risk of concluding no difference when there actually is one.