7.E: Introduction to Hypothesis Testing (Exercises)

1. In your own words, explain what the null hypothesis is.

Answer:

Your answer should include mention of the baseline assumption of no difference between the sample and the population.

2. What are Type I and Type II Errors?
3. What is α?

Answer:

Alpha is the significance level. It is the criteria we use when decided to reject or fail to reject the null hypothesis, corresponding to a given proportion of the area under the normal distribution and a probability of finding extreme scores assuming the null hypothesis is true.

4. Why do we phrase null and alternative hypotheses with population parameters and not sample means?
5. If our null hypothesis is "$H_0 : \mu = 40$", what are the three possible alternative hypotheses?

Answer:

$H_A : \mu \neq 40$, $H_A : \mu > 40$, $H_A : \mu < 40$

6. Why do we state our hypotheses and decision criteria before we collect our data?
7. When and why do you calculate an effect size?

Answer:

We calculate an effect size when we find a statistically significant result to see if our result is practically meaningful or important

8. Determine whether you would reject or fail to reject the null hypothesis in the following situations:
   a. z= 1.99, two-tailed test at α = 0.05
   b. z = 0.34, $z*$ = 1.645
   c. p = 0.03, α = 0.05
   d. p = 0.015, α = 0.01
9. You are part of a trivia team and have tracked your team's performance since you started playing, so you know that your scores are normally distributed with μ = 78 and σ = 12. Recently, a new person joined the team, and you think the scores have gotten better. Use hypothesis testing to see if the average score has improved based on the following 8 weeks' worth of score data: 82, 74, 62, 68, 79, 94, 90, 81, 80.

Answer:

Step 1: $H_0 : \mu = 78$ "The average score is not different after the new person joined", $H_A : \mu > 78$ "The average score has gone up since the new person joined."

Step 2: One-tailed test to the right, assuming α = 0.05, $z*$ = 1.645.

Step 3: $\overline{X}$= 88.75, $\sigma_{\overline{X}}$ = 4.24, z = 2.54.

Step 4: $z > z*$, Reject H_0. Based on 8 weeks of games, we can conclude that our average score ($\overline{X}$ = 88.75) is higher now that the new person is on the team, z = 2.54, p < .05. Since the result is significant, we need an effect size: Cohen's d = 0.90, which is a large effect.

10. You get hired as a server at a local restaurant, and the manager tells you that servers' tips are $42 on average but vary about $12 ($\mu$ = 42, σ = 12). You decide to track your tips to see if you make a different amount, but because this is your first job as a server, you don't know if you will make more or less in tips. After working 16 shifts, you find that your average nightly amount is $44.50 from tips. Test for a difference between this value and the population mean at the α = 0.05 level of significance.