

1. Vineesh is performing a hypothesis test and considering two significance levels: $\alpha = 0.01$ and $\alpha = 0.05$.
 - a. Which α would give a lower probability of making a Type I error? Explain.
 - b. Which α would give a test with higher power? Explain.
 - c. Which α would give a lower probability of making a Type II error? Explain.

2. A pharmaceutical company is testing a new vaccine for preventing a common cold virus. Historical data suggests that the existing vaccine has an efficacy rate of 50%. The pharmaceutical company hopes to find convincing statistical evidence that the new vaccine's efficacy rate is greater than 50%. If the actual efficacy rate for the new vaccine is 60%, the power of the hypothesis test is 0.88.
 - a. Interpret the power of the test in context.
 - b. Calculate the probability of making a Type II error.

3. A high school is testing the effectiveness of a new teaching method intended to improve the pass rate in a freshman-level math class, which is currently 60%. Suppose the Experience First, Formalize Later (EFFL) method was taught to a random sample of 100 freshmen-level math students and a hypothesis test is performed at the $\alpha = 0.05$ level to determine if EFFL has a higher pass rate than the current pass rate. Suppose the actual pass rate using EFFL is 72%.
- State the null and alternative hypotheses using symbols and words.
 - The probability of making a Type I error is $\alpha = 0.05$. Interpret this probability.
 - The probability of making a Type II error is 0.19. Interpret this probability.
 - Calculate and interpret the power of the test.
4. A city's transportation department is evaluating new traffic management measures. They want to determine if these measures reduce the proportion of travelers who wait more than 5 minutes for the bus during peak hours. Before the measures, the proportion was 0.25. Suppose they select a random sample of 150 travelers and perform a one-proportion z -test with $\alpha = 0.10$ to test $H_0 : p = 0.25$ versus $H_a : p < 0.25$, where p is the true proportion of travelers who wait more than 5 minutes for the bus during peak hours. If the actual proportion is 0.20, the power of the test is 0.56.
- How can the transportation department decrease the probability of making a Type I error? Explain.
 - Give two ways to increase the power of the test.

5. A student at a large high school will run for class president if she believes that the majority of the students will vote for her. She plans to ask a random sample of students if they would vote for her and then perform a one-proportion z -test of $H_0 : p = 0.5$ versus $H_a : p > 0.5$, where p is the true proportion of students who would vote for her in the class president election. Suppose the actual proportion who would vote for her is 0.60. Which of the following scenarios would produce the highest power for this test?

- A) A significance level of 0.05 and a sample size of 50 students
- B) A significance level of 0.10 and a sample size of 100 students
- C) A significance level of 0.05 and a sample size of 100 students
- D) A significance level of 0.10 and a sample size of 50 students

6. A hypothesis test for a population proportion has the following hypotheses:

$$H_0 : p = 0.7$$

$$H_a : p < 0.7$$

Assuming the α and sample size stay the same, in which of the following scenarios would the power of the test be greatest?

- A) The actual population proportion is 0.5.
- B) The actual population proportion is 0.7.
- C) The actual population proportion is 0.9.
- D) None of the above.