

Math 10 MPS - Homework 6 ANSWERS

1. What are the two types of hypotheses used in a hypothesis test? How are they related?

Ho: Null Hypotheses – A statement about a population parameter that is assumed to be true for the purposes of testing

Ha: Alternative Hypothesis - A statement about a population parameter that is assumed to be true is the Null Hypothesis is rejected during testing.

These two Hypotheses are complements of each other.

2. Describe the two types of error possible in a hypothesis test decision.

Type I error: Rejecting a true Ho

Type II error: Failing to reject a false Ho

True or False?

In Exercises 3-8, determine whether the statement is true or false. If it is false, rewrite it as a true statement.

3. In a hypothesis test, you assume the alternative hypothesis is true. **False, you assume the Null Hypothesis is true.**

4. A statistical hypothesis is a statement about a sample. **False, it is a statement about a population parameter.**

5. If you decide to reject the null hypothesis, you can support the alternative hypothesis. **True**

6. The level of significance is the maximum probability you allow for rejecting a null hypothesis when it is actually true. **True**

7. A large P-value in a test will favor a rejection of the null hypothesis. **False, a small p-value supports rejecting the null hypothesis.**

8. If you want to support a claim, write it as your null hypothesis. **False, to support a claim write it as the alternative hypothesis.**

Stating Hypotheses

In Exercises 9-14, use the given statement to represent a claim. Write its complement and state which is Ho and which is Ha.

9. Ha: $p > .65$ **Ho: $p \leq .65$**

10. Ho: $\mu \leq 128$ **Ha: $\mu > 128$**

11. Ha: $\sigma^2 \neq 5$ **Ho: $\sigma^2 = 5$**

12. Ho: $\mu = 1.2$ **Ha: $\mu \neq 1.2$**

13. Ho: $p \geq 0.45$ **Ha: $p < 0.45$**

14. Ha: $\sigma < 0.21$ **Ho: $\sigma \geq 0.21$**

15. A study claims more than 60% of students text-message frequently. In a poll of 1000 students, 660 students said they text message frequently. Can you support the study's claim? Conduct the test with $\alpha = 1\%$

$$\mathbf{H_0: p \leq 0.60} \quad \mathbf{H_a: p > 0.60}$$

$$\alpha = 1\% \quad \mathbf{Model: } Z = \frac{\hat{p} - p_0}{\sqrt{\frac{(p_0)(1 - p_0)}{n}}}$$

Reject H_0 if p-value $< .01$

$$\hat{p} = \frac{660}{1000} = 0.66$$

$$Z = \frac{0.66 - 0.60}{\sqrt{\frac{(0.60)(1 - 0.60)}{100}}} = 3.87$$

$$P(Z > 3.87) \approx .0000$$

Reject H_0

The study is correct. More than 60% of students text-message frequently.

16. 15 I-pod users were asked how many songs were on their I-pod. Here are the summary statistics of that study:

$$\bar{X} = 650 \quad s = 200$$

- a. Can you support the claim that the number of songs on a user's I-pod is different from 500? Conduct the test with $\alpha = 5\%$.

Ho: $\mu = 500$ Ha: $\mu \neq 500$

Test of mean vs. Hypothesized Value, population standard deviation unknown.

$$t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}} \quad df = 14$$

Due to the small sample size, we must assume the data is approximately normal (or at least not heavily skewed) for the central limit theorem to apply.

Reject Ho if $t > 2.145$ or $t < -2.145$ (Two tailed test)

$$t = (650 - 500) / (200 / \sqrt{15}) = 2.90 \rightarrow \text{Reject Ho}$$

The mean number of songs on a user's I-pod is not 500. It is more.

- b. Can you support the claim that the population standard deviation is under 300? Conduct the test with $\alpha = 5\%$.

Ho: $\sigma \geq 300$ Ha: $\sigma < 300$

Chi square test of standard deviation vs. Hypothesized Value

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} \quad df = 14 \quad \alpha = .05$$

Reject Ho if $\chi^2 < 6.571$ (lower tailed test)

1. $\chi^2 = \frac{(14)200^2}{300^2} = 6.22 \rightarrow \text{Reject Ho}$

The standard deviation is under 300.

