

## 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.**

