

Math 10 - Homework Chapter 9

1. What are the two types of hypotheses used in a hypothesis test? How are they related?
2. Describe the two types of error possible in a hypothesis test decision.

True or False? In Exercises 3-8, determine whether each 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.
4. A statistical hypothesis is a statement about a sample.
5. If you decide to reject the null hypothesis, you can support the alternative hypothesis.
6. The level of significance is the maximum probability you allow for rejecting a null hypothesis when it is actually true.
7. A large P-value in a test will favor a rejection of the null hypothesis.
8. If you want to support a claim, write it as your null hypothesis.

Stating Hypotheses In Exercises 9-14, use the given statement to represent a claim. Write its complement and state which is H_0 and which is H_a .

9. 23. $p > .65$
10. 24. $\mu \leq 128$
11. 25. $\sigma^2 \neq 5$
12. 26. $\mu = 1.2$
13. 27. $p \geq 0.45$
14. 28. $\sigma < 0.21$

Think about the context of the claim. *Determine* whether you want to support or reject the claim.

- a. State the null and alternative hypotheses in words.
 - b. Write the null and alternative hypotheses in appropriate symbols
 - c. Describe in words Type I error (the consequence of rejecting a true null hypothesis.)
 - d. Describe in words Type II error (the consequence of failing to reject a false null hypothesis.)
15. You represent a chemical company that is being sued for paint damage to automobiles. You want to support the claim that the mean repair cost per automobile is not \$650. How would you write the null and alternative hypotheses?
16. You are on a research team that is investigating the mean temperature of adult humans. The commonly accepted claim is that the mean temperature is about 98.6°F. You want to show that this claim is false. How would you write the null and alternative hypotheses?
17. A light bulb manufacturer claims that the mean life of a certain type of light bulb is at least 750 hours. You are skeptical of this claim and want to refute it.
18. As stated by a company's shipping department, the number of shipping errors per million shipments has a standard deviation that is less than 3. Can you support this claim?
19. A research organization reports that 33% of the residents in Ann Arbor, Michigan are college students. You want to reject this claim.
20. The results of a recent study show that the proportion of people in the western United States who use seat belts when riding in a car or truck is under 84%. You want to support this claim.

21. In your work for a national health organization, you are asked to monitor the amount of sodium in a certain brand of cereal. You find that a random sample of 82 cereal servings has a mean sodium content of 232 milligrams with a standard deviation of 10 milligrams. At $\alpha = 0.01$, can you conclude that the mean sodium content per serving of cereal is over 230 milligrams?

<p>(a) (DESIGN) State your Hypothesis</p>	<p>(d) (DESIGN) Determine decision rule (pvalue method)</p> <p>(e) (DATA) Conduct the test and circle your decision</p>
<p>(b) (DESIGN) State Significance Level of the test and explain what it means,</p>	<p style="text-align: center;">Reject Ho Fail to Reject Ho</p> <p>(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.</p>
<p>(c) (DESIGN) Determine the statistical model (test statistic)</p>	

22. A tourist agency in Florida claims the mean daily cost of meals and lodging for a family of four traveling in Florida is \$284. You work for a consumer protection advocate and want to test this claim. In a random sample of 50 families of four traveling in Florida, the mean daily cost of meals and lodging is \$292 and the standard deviation is \$25. At $\alpha = 0.05$, do you have enough evidence to reject the agency's claim?

<p>(a) (DESIGN) State your Hypothesis</p>	<p>(d) (DESIGN) Determine decision rule (critical value method)</p>
<p>(b) (DESIGN) State Significance Level of the test and explain what it means.</p>	<p>(e) (DATA) Conduct the test and circle your decision</p> <p style="text-align: center;">Reject H_0 Fail to Reject H_0</p> <p>(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.</p>
<p>(c) (DESIGN) Determine the statistical model (test statistic)</p>	

23. An environmentalist estimates that the mean waste recycled by adults in the United States is more than 1 pound per person per day. You want to test this claim. You find that the mean waste recycled per person per day for a random sample of 12 adults in the United States is 1.2 pounds and the standard deviation is 0.3 pound. At $\alpha = 0.05$, can you support the claim?

<p>(d) (DESIGN) State your Hypothesis</p>	<p>(d) (DESIGN) Determine decision rule (critical value method)</p>
<p>(e) (DESIGN) State Significance Level of the test and explain what it means.</p>	<p>(e) (DATA) Conduct the test and circle your decision</p> <p style="text-align: center;">Reject H_0 Fail to Reject H_0</p>
<p>(f) (DESIGN) Determine the statistical model (test statistic)</p>	<p>(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.</p>

24. A government association claims that 44% of adults in the United States do volunteer work. You work for a volunteer organization and are asked to test this claim. You find that in a random sample of 1165 adults, 556 do volunteer work. At $\alpha = 0.05$, do you have enough evidence to reject the association's claim?

<p>(a) (DESIGN) State your Hypothesis</p>	<p>(d) (DESIGN) Determine decision rule (pvalue method)</p>
<p>(b) (DESIGN) State Significance Level of the test and explain what it means,</p>	<p>(e) (DATA) Conduct the test and circle your decision</p> <p style="text-align: center;">Reject H_0 Fail to Reject H_0</p> <p>(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.</p>
<p>(c) (DESIGN) Determine the statistical model (test statistic)</p>	

25. The geyser Old Faithful in Yellowstone National Park is claimed to erupt for on average for about three minutes. Thirty-six observations of eruptions of the Old Faithful were recorded (time in minutes)

1.8	1.98	2.37	3.78	4.3	4.53
1.82	2.03	2.82	3.83	4.3	4.55
1.88	2.05	3.13	3.87	4.43	4.6
1.9	2.13	3.27	3.88	4.43	4.6
1.92	2.3	3.65	4.1	4.47	4.63
1.93	2.35	3.7	4.27	4.47	6.13

Sample mean = 3.394 minutes. Sample standard deviation = 1.168 minutes

Test the hypothesis that the mean length of time for an eruption is 3 minutes answering ALL the following questions:

- A. General Question
 - a. Why do you think this test is being conducted?

- B. Design
 - a. State the null and alternative hypotheses
 - b. What is the appropriate test statistic/model?
 - c. What is significance level of the test?
 - d. What is the decision rule?

- C. Conduct the test
 - a. Are there any unusual observations that question the integrity of the data or the assumptions of the model? (additional problem only)
 - b. Is the decision to reject or fail to reject H_0 ?

- D. Conclusions - State a one paragraph conclusion that is consistent with the decision using language that is clearly understood in the context of the problem. Address any potential problems with the sampling methods and address any further research you would conduct.

26. Define the following terms:

- a. Parameter
- b. Statistic
- c. Statistical Inference
- d. Hypothesis
- e. Hypothesis Testing
- f. Null Hypothesis (H_0)
- g. Alternative Hypothesis (H_a)
- h. Type I Error
- i. Type II Error
- j. Level of Significance (α)
- k. Beta (β)
- l. Statistical Model
- m. Test Statistic
- n. Model Assumptions
- o. Critical value(s)
- p. Rejection Region
- q. p-value
- r. Decision Rule
- s. Power
- t. Effect Size

27. 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 $\alpha = 1\%$

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

29. Consider the design procedure in the test you conducted in Question 28a. Suppose you wanted to conduct a Power analysis if the population mean under H_a was actually 550. **Use the online Power calculator** (link on website) to answer the following questions.

- a. Determine the Power of the test.
- b. Determine Beta.
- c. Determine the sample size needed if you wanted to conduct the test in Question 8a with 95% power.

30. The drawing shown diagrams a hypothesis test for population mean design under the Null Hypothesis (top drawing) and a specific Alternative Hypothesis (bottom drawing). The sample size for the test is 200.

a. State the Null and Alternative Hypotheses

b. What are the values of μ_0 and μ_a in this problem?

c. What is the significance level of the test?

d. What is the Power of the test when the population mean = 4?

e. Determine the probability associated with Type I error.

f. Determine the probability associated with Type II error.

g. Under the Null Hypothesis, what is the probability the sample mean will be over 6?

h. If the significance level was set at 5%, would the power increase, decrease or stay the same?

i. If the test was conducted, and the p-value was .085, would the decision be Reject or Fail to Reject the Null Hypothesis?

j. If the sample size was changed to 100, would the shaded on area on the bottom (H_a) graph increase, decrease or stay the same?

