10.2 Section Exercises

Rejection Regions for Hypothesis Tests for Population Means (σ Known)

Draw the rejection region for the hypothesis test for the population mean with the given hypotheses. Assume that the population standard deviation is known and the sample size is at least 30.

1. H_0: $\mu = 65$ and H_a: $\mu > 65$, $\alpha = 0.05$
2. H_0: $\mu = 5$ and H_a: $\mu \neq 5$, $c = 0.90$
3. H_0: $\mu = 3.2$ and H_a: $\mu < 3.2$, $\alpha = 0.01$
4. H_0: $\mu = 700$ and H_a: $\mu > 700$, $c = 0.98$
5. H_0: $\mu = 0.19$ and H_a: $\mu \neq 0.19$, $c = 0.95$
6. H_0: $\mu = 0.166$ and H_a: $\mu < 0.166$, $\alpha = 0.10$

p-Values for Hypothesis Tests for Population Means (σ Known)

Calculate the p-value for the hypothesis test for the population mean with the given hypotheses and test statistic.

7. H_0: $\mu = 60$ and H_a: $\mu < 60$, $z = -1.48$
8. H_0: $\mu = 1.07$ and H_a: $\mu > 1.07$, $z = 2.27$
9. H_0: $\mu = 2.89$ and H_a: $\mu \neq 2.89$, $z = -2.21$
10. H_0: $\mu = 144$ and H_a: $\mu \neq 144$, $z = 1.65$
11. H_0: $\mu = 0.56$ and H_a: $\mu > 0.56$, $z = 1.61$
12. H_0: $\mu = 760$ and H_a: $\mu < 760$, $z = -2$

Conclusions of Hypothesis Tests for Population Means (σ Known)

Determine the appropriate conclusion for a hypothesis test with the given level of significance.

13. p-value $= 0.0166$, $\alpha = 0.01$
14. p-value $= 0.0197$, $\alpha = 0.02$
15. p-value $= 0.0465$, $\alpha = 0.05$
16. p-value $= 0.0485$, $\alpha = 0.02$
17. p-value $= 0.1190$, $\alpha = 0.10$
18. p-value $= 0.0094$, $\alpha = 0.01$
19. H_0: $\mu = 409$ and H_a: $\mu < 409$, $\alpha = 0.05$, $z = -1.87$
20. H_0: $\mu = 0.65$ and H_a: $\mu > 0.65$, $\alpha = 0.10$, $z = 1.22$
21. H_0: $\mu = 2$ and H_a: $\mu \neq 2$, $\alpha = 0.02$, $z = -2.28$
22. H_0: $\mu = 3010$ and H_a: $\mu \neq 3010$, $\alpha = 0.01$, $z = 2.69$
23. H_0: $\mu = 10.3$ and H_0: $\mu > 10.3$; $\alpha = 0.10$; $z = 1.97$
24. H_0: $\mu = 408$ and H_a: $\mu < 408$; $\alpha = 0.05$; $z = -1.76$

Hypothesis Tests for Population Means (σ Known)

Perform each hypothesis test. For each exercise, complete the following steps.

a. State the null and alternative hypotheses.
b. Determine which distribution to use for the test statistic, and state the level of significance.
c. Calculate the test statistic.
d. Draw a conclusion using the given level of significance and interpret the decision.

25. A manufacturer must test that his bolts are 2.00 cm long when they come off the assembly line. He must recalibrate his machines if the bolts are too long or too short. After sampling 100 randomly selected bolts off the assembly line, he calculates the sample mean to be 1.90 cm. He knows that the population standard deviation is 0.50 cm. Assuming a level of significance of 0.05, is there sufficient evidence to show that the manufacturer needs to recalibrate the machines?

26. The U.S. Energy Information Administration claimed that in 2017, U.S. residential customers used an average of 10,399 kilowatt hours (kWh) of electricity. A local power company believes that residents in their area use more electricity on average than EIA's reported average. To test their claim, the company chooses a random sample of 125 of their customers and calculates that these customers used an average of 10,678 kWh of electricity in the prior year. Assuming that the population standard deviation is 1361 kWh, is there sufficient evidence to support the power company's claim at the 0.05 level of significance?

Source: U.S. Energy Information Administration. "How much electricity does an American home use?" 26 Oct. 2018. https://www.eia.gov/tools/faqs/faq.php?id=97&t=3 (20 Mar. 2019).

27. A wedding website states that the average cost of a wedding in 2017 was $25,764. One concerned bride hopes that the average is less than reported. To see if her hope is correct, she surveys 55 recently married couples and finds that the average cost of weddings in the sample was $23,015. Assuming that the population standard deviation is $7235, is there sufficient evidence to support the bride's hope at the 0.10 level of significance?

Source: The Wedding Report, Inc. "Cost of Wedding." 2019. https://www.costofwedding.com (20 Mar. 2019).

28. A national business magazine reports that the mean age of retirement for women executives is 61.0. A women's rights organization believes that this value does not accurately depict the current trend in retirement. To test this, the group polled a simple random sample of 95 recently retired women executives and found that they had a mean age of retirement of 61.5. Assuming the population standard deviation is 2.5 years, is there sufficient evidence to support the organization's belief at the 0.05 level of significance?

29. The board of a major credit card company requires that the mean wait time for customers when they call customer service is 3.00 minutes. To make sure that the mean wait time is not exceeding the requirement, an assistant manager tracks the wait times of 45 randomly selected calls. The mean wait time was calculated to be 3.40 minutes. Assuming the population standard deviation is 1.45 minutes, is there sufficient evidence to say that the mean wait time for customers is longer than 3.00 minutes with a 98% level of confidence?

30. A survey by Constant Contact reported that small businesses spend 20 hours a week marketing their business. A local chamber of commerce claims that small businesses in their area are not growing because these businesses are spending less than 20 hours a week on marketing. The chamber conducts a survey of 80 small businesses within their state and finds that the average amount of time spent on marketing is 19.3 hours a week. Assuming that the population standard deviation is 4.3 hours, is there sufficient evidence to support the chamber of commerce's claim at the 0.01 level of significance?

Source: Small Business Trends. "Small Businesses Spend 20 Hours Per Week on Marketing." 1 Nov. 2017. https://smallbiztrends.com/2016/09/how-much-time-do-you-spend-marketing-your-business.html (20 Sept. 2019).