

10.1 The Null Hypothesis

Answers

1. Mp3 player sales would go down if the price were increased by \$10.
2. The average dog owner owns less than 2 cats.
3. The average cat owner also owns at least 1 dog.
4. The average subcompact gets 30mpg or less
5. The average computer gamer owns less than 4 games.
6. The average temperature in Northern CO during the month of March is 70 degrees or greater.
7. Fewer than 28% of astronomers can name more than 50 stars.
8. 35% or more astronomers can name 75 or more stars.
9. $H_0: X \geq 1\%$ and $H_1: X < 1\%$
10. $H_0: 20\% \geq X \geq 35\%$ and $H_1: 20\% < X \cup X < 35\%$
11. $H_0: X \leq 71\%$ and $H_1: X > 71\%$
12. $H_0: X \geq 20\%$ and $H_1: X < 20\%$
13. $H_0: X \geq 2\%$ and $H_1: X < 2\%$
14. $H_0: 2\% \geq X \geq 10\%$ and $H_1: 2\% < X \cup X < 10\%$
15. $H_0: X \geq 4\%$ and $H_1: X < 4\%$
16. $H_0: X \leq 80\%$ and $H_1: X > 80\%$

10.2 Critical Values

Answers

1. $Z = -1.65$
2. $Z = 2.05$
3. $Z = -1.96, 1.96$
4. $Z = -2.05$
5. $Z = -2.33$
6. $Z = -2.58, 2.58$
7. $Z = -1.28$
8. $Z = 1.28$
9. $Z = -1.65, 1.65$
10. $\alpha = .1003$
11. $\alpha = .099$
12. $\alpha = .001$
13. $\alpha = .0098$
14. $\alpha = .0495$
15. $\alpha = .0099$

10.3 Tails

Answers

- a) $H_1: \mu < 31$ and $H_0: \mu \geq 31$
b) This is a right-tailed test, since the null hypothesis values are located on the right.
- a) $H_1: \mu < 72hrs$ and $H_0: \mu \geq 72hrs$
b) This is a right-tailed test, since the null hypothesis values are located on the right.
- a) $H_1: 45\% < X < 55\%$ and $H_0: 45\% > X \cup X > 55\%$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: X \geq 70\%$ and $H_0: X < 70\%$
b) This is a left-tailed test, since the null hypothesis values are located on the left.
- a) $H_1: \mu < 51secs$ and $H_0: \mu \geq 52secs$
b) This is a right-tailed test, since the null hypothesis values are located on the right.
- a) $H_1: 5.5oz < \mu < 6.5oz$ and $H_0: 5.5oz > \mu \cup \mu > 6.5oz$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: \mu \geq 5hrs$ and $H_0: \mu < 5hrs$
b) This is a left-tailed test, since the null hypothesis values are located on the left.
- a) $H_1: \mu = 13$ and $H_0: 13 > \mu \cup \mu > 13$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: 72 < \mu < 83$ and $H_0: 72 > \mu \cup \mu > 83$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: \mu = 72\%$ and $H_0: 72\% > \mu \cup \mu > 72\%$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: -1.5 \leq Z \leq 1.5$ and $H_0: -1.5 > Z \cup Z > 1.5$
b) This is a two-tailed test, since the null hypothesis values are located at the ends of the graph.
- a) $H_1: Z \leq 1.5$ and $H_0: Z > 1.5$
b) This is a right-tailed test, since the null hypothesis values are located on the right.
- a) $H_1: -1 \leq Z$ and $H_0: -1 > Z$
b) This is a left-tailed test, since the null hypothesis values are located on the left.

10.4 Confidence Intervals

Answers

1. A confidence interval is the interval within which you expect to capture a specific value. The confidence interval width is dependent on the confidence level.
2. confidence interval = $\bar{x} \pm Z_{\alpha/2} * \bar{\sigma}$
3. The interval is the range of values expected to capture the population mean, the level is the number of times out of 100 that the repeated experiment would be expected to capture the population mean within the given interval.
4. The margin of error describes the probability that the null hypothesis will be incorrectly rejected.
5. $Z_{\alpha/2} * \bar{\sigma}$
6. The misconception is that a 99% confidence level means that there is a 99% probability that the mean of the population is within the given range.
7. Assuming a large sample ($n \geq 30$), the sample standard deviation may be used to calculate the estimated population standard deviation.
8. Yes, by the Central Limit Theorem
9. 2.326
10. 99%
11. 85%, greater confidence comes from a wider interval.
12. 39.607 to 40.393
13. You are confident that the true average number of marbles per bag is between 39.607 and 40.393. Repeated testing should bear out that claim 99 times out of 100.
14. 196.4 to 228.1
15. The manager can be should be only moderately confident that the true average number of customers is between 196.4 to 228.1, as repeated testing is expected to reinforce the given results only 50 times out of 100.

10.5 The T-Test

Answers

1. A t -test is a hypothesis test with critical values determined using a student's t -distribution.
2. $n < 30, \sigma$ is unknown
3. The t -distribution is broader and has thicker tails.
4. 2.583
5. 3.250
6. 1.721
7. 2.120
8. 1.356
9. T -test
10. Null: $GPA \leq 3.0$, Alternative: $GPA > 3.0$
11. 0.468 (students who get 0.452 forgot to divide by $n-1$ for sample SD)
12. 3.162
13. $df=14$
14. Using: $\bar{x} \pm t_{\alpha/2} \left(\frac{\bar{\sigma}}{\sqrt{n}} \right) \rightarrow 3.162 \pm 1.761 \left(\frac{0.468}{3.873} \right) \rightarrow 3.162 \pm 1.761 * .121 \rightarrow 3.162 \pm .213$
15. He should fail to reject, since $2.949 < 3.0 < 3.375$.

10.6 Putting it Together

Answers

1. Yes, $n \geq 30$
2. $H_0: \mu = \$50, H_1: \mu \neq \50
3. -0.285
4. No, $Z = -0.285 > -2.97$
5. Yes, $n \geq 30, \sigma$ is known
6. $H_0: \mu \geq \$45, H_1: \mu < \45
7. $Z = -0.27833$
8. No, $Z > -1.96$
9. No
10. 95 out of 100 samples should be +/- \$12 of \$45
11. No, $n < 30$
12. $H_0: \mu = \$45, H_1: \mu \neq \45
13. 1.569
14. 25
15. 2.056
16. $\bar{x} \pm 3.226 = 39.26$ to 45.72
17. No, $39.26 < \mu < 45.72$