College Prep Stats

9.2 ~ 9.3 Extra Practice

1. A study in the July 7, 2009, issue of USA TODAY stated that the 401(k) participation rate among U.S. employees of Asian heritage is 76%, whereas the participation rate among U.S. employees of Hispanic heritage is 66%. Suppose that these results were based on random samples of 100 U.S. employees from each group.

$100 \cdot 0.76 = 76$, $100 \cdot 0.66 = 66$, $x_1 = 76$, $x_2 = 66$, $n_1 = 100$, $n_2 = 100$

a. Using the 0.05 significance level, can you conclude that the 401(k) participation rates are different for all U.S. employees of Asian heritage and all U.S. employees of Hispanic heritage?

$H_0: p_1 = p_2$ $H_1: p_1 \neq p_2$

$z = 1.5583$

P-Value $= 0.1192 > 0.05$,

Fail to reject H_0

There is not sufficient evidence to support the claim ...

b. Construct a 95% confidence interval for the difference between the two population proportions.

95% CI: $(-0.025, 0.22501)$

2. A July 2009 Pew Research Center survey asked a variety of science questions of independent random samples of scientists and the public at-large (http://people-press.org/report/528/). One of the questions asked was whether all parents should be required to vaccinate their children. The percentage of people answering "yes" to this question was 69% of the general public and 82% of scientists. Suppose that the survey included 110 members of the general public and 105 scientists.

$110 \cdot 0.69 = 75.9$ $105 \cdot 0.82 = 86.1$ $x_1 = 76$, $x_2 = 86$, $n_1 = 110$, $n_2 = 105$

a. Using the 1% significance level, can you conclude that the percentage of the general public who feels that all parents should be required to vaccinate their children is less than the percentage of all scientists who feels that all parents should be required to vaccinate their children?

$H_0: p_1 = p_2$, $H_1: p_1 < p_2$

$z = -2.1792$

P-Value $= 0.0147 > 0.01$

Fail to reject H_0

There is not sufficient evidence to support the claim ...

b. Construct a 98% confidence interval for the difference between the two population proportions. Use the critical-value and p-value approaches. c. The actual sample sizes used in the survey were 2001 members of the general public and 1005 scientists. Repeat parts a and b using the actual sample sizes. Does your conclusion change in part b?

98% CI: $(-0.2628, 0.00657)$

3. A state that requires periodic emission tests of cars operates two emissions test stations, A and B, in one of its towns. Car owners have complained of lack of uniformity of procedures at the two stations, resulting in different failure rates. A simple random sample of 400 cars at Station A showed that 53 of those failed the test; another simple random sample of 470 cars at Station B found that 51 of those failed the test.

$x_1 = 53$, $x_2 = 51$, $n_1 = 400$, $n_2 = 470$

a. Testing at the 5% significance level, can you conclude that the two population proportions are different?

$H_0: p_1 = p_2$, $H_1: p_1 \neq p_2$

$z = 1.0870$

P-Value $= 0.2770 > 0.05$

Fail to reject H_0

There is not sufficient evidence to support the claim ...

b. Construct a 95% confidence interval for the difference between the two population proportions.

95% CI: $(-0.0195, 0.06752)$

4. The management of a supermarket chain wanted to investigate if the percentages of men and women who prefer to buy national brand products over the store brand products are different. A study of a sample of 600 men shoppers at the company's supermarkets showed that 246 of them prefer to buy national brand products over the store brand products. Another sample of 700 women shoppers at the company's supermarkets showed that 266 of them prefer to buy national brand products over the store brand products.

$x_1 = 246, \quad x_2 = 266, \quad n_1 = 600, \quad n_2 = 700$

a. Testing at the 0.05 significance level, can you conclude that the proportions of all men and all women shoppers at these supermarkets who prefer to buy national brand products over the store brand products are different?

$H_0: p_1 = p_2, \quad H_1: p_1 \neq p_2$

$z = 1.1036$

$P\text{-Value} = 0.2698 > 0.05$

Fail to reject H_0

There is not sufficient evidence to support the claim that ...

b. Construct a 95% confidence interval for the difference between the proportions of all men and all women shoppers at these supermarkets who prefer to buy national brand products over the store brand products.

95% CI: $(-0.0233, 0.08331)$

5. The lottery commissioner's office in a state conducted a study and wanted to find if the percentages of men and women who play the lottery often are different. A sample of 500 men taken by the commissioner's office showed that 160 of them play the lottery often. Another sample of 300 women showed that 66 of them play the lottery often.

$x_1 = 160, \quad x_2 = 66, \quad n_1 = 500, \quad n_2 = 300$

a. Testing at the 0.01 significance level, can you conclude that the proportions of all men and all women who play the lottery often are different?

$H_0: p_1 = p_2, \quad H_1: p_1 \neq p_2$

$z = 3.0414$

$P\text{-Value} = 0.0024 < 0.01$

Reject H_0

There is sufficient evidence to support the claim ...

b. Construct a 99% confidence interval for the difference between the proportions of all men and all women who play the lottery often.

99% CI: $(0.01825, 0.18175)$

6. A company claims that its medicine, Brand A, provides faster relief from pain than another company's medicine, Brand B. A researcher tested both brands of medicine on two groups of randomly selected patients. The results of the test are given in the following table. The mean and standard deviation of relief times are in minutes. Assume that the two populations are normally distributed.

Brand	Sample Size	Mean of Relief Times	Standard Deviation of Relief Times
A	25	44	11
B	22	49	9

a. Test at the 0.01 significance level whether the mean relief time for Brand A is less than that for Brand B.

$H_0: \mu_1 = \mu_2 \quad H_1: \mu_1 < \mu_2$

$t = -1.7128$

$P\text{-value} = 0.0468 > 0.01$

Fail to reject H_0

There is not sufficient evidence to support the claim that ...

b. Construct a 99% confidence interval for the difference between the mean relief times for the two brands of medicine.

99% CI: $(-12.85, 2.8531)$

7. A consumer organization tested two paper shredders, the Piranha and the Crocodile, designed for home use. Each of 10 randomly selected volunteers shredded 100 sheets of paper with the Piranha, and then another sample of 10 randomly selected volunteers each shredded 100 sheets with the Crocodile. The Piranha took an average of 203 seconds to shred 100 sheets with a standard deviation of 6 seconds. The Crocodile took an average of 187 seconds to shred 100 sheets with a standard deviation of 5 seconds. Assume that the shredding times for both machines are normally distributed.

$n_1 = 10,\quad n_2 = 10,\quad \bar{x}_1 = 203,\quad \bar{x}_2 = 187\quad s_1 = 6,\quad s_2 = 5$

a. Using the 0.01 significance level, can you conclude that the mean time taken by the Piranha to shred 100 sheets is greater than that for the Crocodile?

$H_0: \mu_1 = \mu_2,\quad H_1: \mu_1 > \mu_2$

$t = 6.4782$

$P\text{-Value} = 0.0000025 < 0.01$

Reject H_0

There is sufficient evidence to support the claim that ---

b. Construct a 99% confidence interval for the difference between the two population means.

99% CI: $(8.8638,\ 23.136)$

8. A simple random sample of 45 customers who drive luxury cars showed that their average distance driven between oil changes was 3187 miles with a sample standard deviation of 42.40 miles. Another simple random sample of 40 customers who drive compact lower-price cars resulted in an average distance of 3214 miles with a standard deviation of 50.70 miles.

$n_1 = 45,\quad \bar{x}_1 = 3187,\quad s_1 = 42.40,\quad n_2 = 40,\quad \bar{x}_2 = 3214,\quad s_2 = 50.70$

a. Using the 0.05 significance level, can you conclude that the mean distance between oil changes is lower for all luxury cars than for all compact lower-price cars?

$H_0: \mu_1 = \mu_2,\quad H_1: \mu_1 < \mu_2$

$t = -2.6449$

$P\text{-Value} = 0.00496 < 0.05$

Reject H_0

There is sufficient evidence to support the claim that ...

b. Construct a 95% confidence interval for the difference in the mean distance between oil changes for all luxury cars and all compact lower-price cars.

95% CI: $(-47.33,\ -6.67)$

9. Quadro Corporation has two supermarket stores in a city. The company's quality control department wanted to check if the customers are equally satisfied with the service provided at these two stores. A sample of 380 customers selected from Supermarket I produced a mean satisfaction index of 7.6 (on a scale of 1 to 10, 1 being the lowest and 10 being the highest) with a standard deviation of .75. Another sample of 370 customers selected from Supermarket II produced a mean satisfaction index of 8.1 with a standard deviation of .59.

$n_1 = 380,\quad \bar{x}_1 = 7.6,\quad s_1 = 0.75,\quad n_2 = 370,\quad \bar{x}_2 = 8.1,\quad s_2 = 0.59$

a. Test at the 0.01 significance level whether the mean satisfaction indexes for all customers for the two supermarkets are different.

$H_0: \mu_1 = \mu_2,\quad H_1: \mu_1 \neq \mu_2$

$t = -10.1617$

$P\text{-Value} \approx 0 < 0.01$

Reject H_0

There is sufficient evidance to support the claim ....

b. Construct a 98% confidence interval for the difference between the mean satisfaction indexes for all customers for the two supermarkets.

98% CI: $(-0.6147,\ -0.3853)$