QUIZ 14

In one month, the national mean price per gallon (in dollars) of gasoline was 3.108. The data table here represents a random sample of 20 gas stations in city A. Is gas in city A more expensive than the nation? Assume the data come from a normal population with no outliers. Complete parts (a) through (d) below.

3.01	3.08	3.09	3.08
3.15	3.13	3.13	3.14
3.14	3.15	3.17	3.16
3.23	3.23	3.22	3.22
3.23	3.21	3.21	3.24

(a) What type of test should be used?

- A hypothesis test regarding two population standard deviations
- A hypothesis test regarding the difference between two population proportions from independent samples using the standard normal test statistic
- ★ A hypothesis test regarding a single population mean using Student's approximate t
- A hypothesis test regarding the difference of two means using a matched-pairs design

(b) Determine the null and alternative hypotheses.

H_0: $\mu = 3.108$

H_1: $\mu > 3.108$

(Type integers or decimals.)

(c) Use technology to calculate the P-value.

0.001 (Round to three decimal places as needed.)

(d) Draw a conclusion based on the hypothesis test. Choose the correct answer below.

A. No meaningful conclusion can be drawn because no level of significance was stated.

B. Although no level of significance is stated, the P-value is so small that the null hypothesis can be rejected. There is sufficient evidence to conclude that the gas prices in city A are lower than the national average.

C. Although no level of significance is stated, the P-value is large enough that the null hypothesis cannot be rejected. There is insufficient evidence to conclude that the gas prices in city A are higher than the national average.

★ D. Although no level of significance is stated, the P-value is so small that the null hypothesis can be rejected. There is sufficient evidence to conclude that the gas prices in city A are higher than the national average.

A sampling method is dependent when the individuals selected for one sample are used to determine the individuals in the second sample.

A survey asked, "How many tattoos do you currently have on your body?" Of the 1211 males surveyed, 193 responded that they had at least one tattoo. Of the 1093 females surveyed, 142 responded that they had at least one tattoo. Construct a 90% confidence interval to judge whether the proportion of males that have at least one tattoo differs significantly from the proportion of females that have at least one tattoo. Interpret the interval.

Let p_1 represent the proportion of males with tattoos and p_2 represent the proportion of females with tattoos. Find the 90% confidence interval for $p_1 - p_2$.

The lower bound is 0.005.

The upper bound is 0.053.

(Round to three decimal places as needed.)

Interpret the interval.

★ A. There is 90% confidence that the difference of the proportions is in the interval. Conclude that there is a significant difference in the proportion of males and females that have at least one tattoo.

A random sample of size $n = 12$ obtained from a population that is normally distributed results in a sample mean of 45.4 and sample standard deviation 11.8. An independent sample of size $n = 18$ obtained from a population that is normally distributed results in a sample mean of 51.5 sample standard deviation 15.4. Does this constitute sufficient evidence to conclude that the population means differ at the $\alpha = 0.01$ level of significance?

Click here to view the standard normal distribution table (page 1). Click here to view the standard normal distribution table (page 2).
Click here to view the table of critical t-values.
Click here to view the table of critical F-values (page 1). Click here to view the table of critical F-values (page 2).
Click here to view the table of critical F-values (page 3). Click here to view the table of critical F-values (page 4).

Write the hypotheses for the test.

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

Calculate the test statistic.

$t_0 = -1.23$ (Round to two decimal places as needed.)

Identify the critical value(s). Select the correct choice below and fill in the answer box(es) within your choice.
(Round to two decimal places as needed.)

- A. $z_\alpha =$
- B. $t_\alpha =$
- C. $-t_{\alpha/2} = -2.77$ and $t_{\alpha/2} = 2.77$

Use the given statistics to complete parts (a) and (b). Assume that the populations are normally distributed.
(a) Test whether $\mu_1 > \mu_2$ at the $\alpha = 0.01$ level of significance for the given sample data.
(b) Construct a 95% confidence interval about $\mu_1 - \mu_2$.

	Population 1	Population 2
n	26	25
$\bar{x}$	50.1	44.5
s	5.2	11.7

(a) Identify the null and alternative hypotheses for this test.

- A. $H_0: \mu_1 = \mu_2$, $H_1: \mu_1 \neq \mu_2$
- B. $H_0: \mu_1 = \mu_2$, $H_1: \mu_1 > \mu_2$
- C. $H_0: \mu_1 < \mu_2$, $H_1: \mu_1 = \mu_2$
- D. $H_0: \mu_1 = \mu_2$, $H_1: \mu_1 < \mu_2$
- E. $H_0: \mu_1 > \mu_2$, $H_1: \mu_1 = \mu_2$
- F. $H_0: \mu_1 \neq \mu_2$, $H_1: \mu_1 = \mu_2$

Find the test statistic for this hypothesis test.

2.19 (Round to two decimal places as needed.)

Determine the P-value for this hypothesis test.

0.018 (Round to three decimal places as needed.)

State the conclusion for this hypothesis test.

- A. Reject H_0. There is not sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that $\mu_1 > \mu_2$.
- B. Do not reject H_0. There is not sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that $\mu_1 > \mu_2$.
- C. Reject H_0. There is sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that $\mu_1 > \mu_2$.
- D. Do not reject H_0. There is sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that $\mu_1 > \mu_2$.

(b) The 95% confidence interval about $\mu_1 - \mu_2$ is the range from a lower bound of 0.406 to an upper bound of 10.794.
(Round to three decimal places as needed.)

A researcher wanted to determine if carpeted rooms contain more bacteria than uncarpeted rooms. The table shows the results for the number of bacteria per cubic foot for both types of rooms.

Full data set

Carpeted			Uncarpeted		
11.2	11.1	13.3	10.1	8.3	13
10.8	10.4	13	4.2	10.8	5.6
15.5	10		12	10.8	

Determine whether carpeted rooms have more bacteria than uncarpeted rooms at the $\alpha = 0.05$ level of significance. Normal probability plots indicate that the data are approximately normal and boxplots indicate that there are no outliers.

State the null and alternative hypotheses. Let population 1 be carpeted rooms and population 2 be uncarpeted rooms.

A. $H_0: \mu_1 < \mu_2$
$H_1: \mu_1 > \mu_2$

B. $H_0: \mu_1 = \mu_2$
$H_1: \mu_1 < \mu_2$

C. $H_0: \mu_1 = \mu_2$
$H_1: \mu_1 \neq \mu_2$

D. $H_0: \mu_1 = \mu_2$
$H_1: \mu_1 > \mu_2$

Determine the P-value for this hypothesis test.

P-value = 0.034 (Round to three decimal places as needed.)

State the appropriate conclusion. Choose the correct answer below.

A. Reject H_0. There is significant evidence at the $\alpha = 0.05$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.

Assume that the differences are normally distributed. Complete parts **(a)** through **(d)** below.

Observation	1	2	3	4	5	6	7	8
X_i	44.5	53.2	46.1	46.8	50.6	51.0	49.2	47.7
Y_i	46.7	53.3	49.2	50.7	52.7	53.8	49.8	46.8

(a) Determine $d_i = X_i - Y_i$ for each pair of data.

Observation	1	2	3	4	5	6	7	8
d_i	−2.2	−0.1	−3.1	−3.9	−2.1	−2.8	−0.6	0.9

(Type integers or decimals.)

(b) Compute $\bar{d}$ and s_d.

$\bar{d} = -1.738$ (Round to three decimal places as needed.)

$s_d = 1.645$ (Round to three decimal places as needed.)

(c) Test if $\mu_d < 0$ at the $\alpha = 0.05$ level of significance.

What are the correct null and alternative hypotheses?

A. $H_0: \mu_d > 0$
$H_1: \mu_d < 0$

B. $H_0: \mu_d < 0$
$H_1: \mu_d = 0$

C. $H_0: \mu_d = 0$
$H_1: \mu_d < 0$

D. $H_0: \mu_d < 0$
$H_1: \mu_d > 0$

P-value = 0.010 (Round to three decimal places as needed.)

D. Reject the null hypothesis. There is sufficient evidence that $\mu_d < 0$ at the $\alpha = 0.05$ level of significance.

To test the belief that sons are taller than their fathers, a student randomly selects 13 fathers who have adult male children. She records the height of both the father and son in inches and obtains the following data. Are sons taller than their fathers? Use the $\alpha = 0.01$ level of significance. Note: A normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Click the icon to view the table of data.

Which conditions must be met by the sample for this test? Select all that apply.

- ★ A. The differences are normally distributed or the sample size is large.
- B. The sample size must be large.
- ★ C. The sample size is no more than 5% of the population size.
- ★ D. The sampling method results in a dependent sample.
- E. The sampling method results in an independent sample.

Let $d_i = X_i - Y_i$. Write the hypotheses for the test.

H_0: $\mu_d = 0$

H_1: $\mu_d < 0$

Calculate the test statistic.

t_0 = −0.01 (Round to two decimal places as needed.)

Calculate the P-value.

P-value = 0.496 (Round to three decimal places as needed.)

Should the null hypothesis be rejected?

Do not reject H_0 because the P-value is greater than the level of significance. There is not sufficient evidence to conclude that sons are taller than their fathers at the 0.01 level of significance.

In randomized, double-blind clinical trials of a new vaccine, monkeys were randomly divided into two groups. Subjects in group 1 received the new vaccine while subjects in group 2 received a control vaccine. After the second dose, 108 of 730 subjects in the experimental group (group 1) experienced drowsiness as a side effect. After the second dose, 65 of 611 of the subjects in the control group (group 2) experienced drowsiness as a side effect. Does the evidence suggest that a higher proportion of subjects in group 1 experienced drowsiness as a side effect than subjects in group 2 at the $\alpha = 0.10$ level of significance?

Verify the model requirements. Select all that apply.

- A. The data come from a population that is normally distributed.
- ★ B. The sample size is less than 5% of the population size for each sample.
- ★ C. The samples are independent.
- ★ D. $n_1\hat{p}_1(1-\hat{p}_1) \geq 10$ and $n_2\hat{p}_2(1-\hat{p}_2) \geq 10$
- E. The samples are dependent.
- F. The sample size is more than 5% of the population size for each sample.

Determine the null and alternative hypotheses.

H_0: $p_1 = p_2$

H_1: $p_1 > p_2$

Find the test statistic for this hypothesis test.

2.26 (Round to two decimal places as needed.)

Determine the P-value for this hypothesis test.

0.012 (Round to three decimal places as needed.)

Interpret the P-value.

If the population proportions are equal, one would expect a sample difference proportion greater than the one observed in about 12 out of 1000 repetitions of this experiment.

(Round to the nearest integer as needed.)

★ C. Reject H_0. There is sufficient evidence to conclude that a higher proportion of subjects in group 1 experienced drowsiness as a side effect than subjects in group 2 at the $\alpha = 0.10$ level of significance.