

Name _____

Solve the problem.

- 1) Use the appropriate table to find the following
- F
- value: 1) _____

$F_{0.025, v_1 = 4, v_2 = 14}$

- A) 4.15 B) 8.66 C) 3.80 D) 3.89

- 2) One indication of how strong the real estate market is performing is the proportion of properties that sell in less than 30 days after being listed. Of the condominiums in a Florida beach community that sold in the first six months of 2006, 75 of the 115 sampled had been on the market less than 30 days. For the first six months of 2007, 25 of the 85 sampled had been on the market less than 30 days. Test the hypothesis that the proportion of condominiums that sold within 30 days decreased from 2006 to 2007. Use
- $\alpha = .01$
- . 2) _____

- 3) We are interested in comparing the average supermarket prices of two leading colas. Our sample was taken by randomly selecting eight supermarkets and recording the price of a six-pack of each brand of cola at each supermarket. The data are shown in the following table: 3) _____

Supermarket	Price		Difference
	Brand 1	Brand 2	
1	\$2.25	\$2.30	\$-0.05
2	2.47	2.45	0.02
3	2.38	2.44	-0.06
4	2.27	2.29	-0.02
5	2.15	2.25	-0.10
6	2.25	2.25	0.00
7	2.36	2.42	-0.06
8	2.37	2.40	-0.03
	$x_1 = 2.3125$	$x_2 = 2.3500$	$x_d = -0.0375$
	$s_1 = 0.1007$	$s_2 = 0.0859$	$s_d = 0.0381$

Find a 98% confidence interval for the difference in mean price of brand 1 and brand 2.

- A)
- 0.0375 ± 0.0347
- B)
- 0.0375 ± 0.0404
- C)
- 0.0375 ± 0.0471
- D)
- 0.0375 ± 0.1393

- 4) In order to compare the means of two populations, independent random samples of 144 observations are selected from each population with the following results. 4) _____

Sample 1	Sample 2
$\bar{x}_1 = 7,123$	$\bar{x}_2 = 6,957$
$s_1 = 175$	$s_2 = 225$

Use a 95% confidence interval to estimate the difference between the population means ($\mu_1 - \mu_2$). Interpret the confidence interval.

5) Four different leadership styles used by Big-Six accountants were investigated. As part of a designed study, 15 accountants were randomly selected from each of the four leadership style groups (a total of 60 accountants). Each accountant was asked to rate the degree to which their subordinates performed substandard field work on a 10-point scale—called the "substandard work scale". The objective is to compare the mean substandard work scales of the four leadership styles. The data on substandard work scales for all 60 observations were subjected to an analysis of variance.

5) _____

ONE-WAY ANOVA FOR SUBSTAND BY STYLE

SOURCE	DF	SS	MS	F	P
BETWEEN	3	2862.49	954.164	6.050	0.0012
WITHIN	56	8831.93	157.713		
TOTAL	59	11,694.42			

Interpret the results of the ANOVA *F*-test shown on the printout for $\alpha = 0.05$.

- A) At $\alpha = .05$, nothing can be said.
- B) At $\alpha = .05$, there is no evidence of interaction.
- C) At $\alpha = .05$, there is insufficient evidence of differences among the substandard work scale means for the four leadership styles.
- D) At $\alpha = .05$, there is sufficient evidence of differences among the substandard work scale means for the four leadership styles.

6) A partially completed ANOVA table for a completely randomized design is shown here.

6) _____

Source	df	SS	MS	F
Time		25.2		
Error	11			
Total	13	86.4		

- a. Complete the ANOVA table.
- b. How many treatments are involved in the experiment?
- c. Do the data provide sufficient evidence to indicate a difference among the population means? Test using $\alpha = .05$.

7) A local consumer reporter wants to compare the average costs of grocery items purchased at three different supermarkets, A, B, and C. Prices (in dollars) were recorded for a sample of 60 randomly selected grocery items at each of the three supermarkets. In order to reduce item-to-item variation, the prices were recorded for each item on the same day at each supermarket.

7) _____

The results of a Bonferroni analysis are summarized below.

Supermarket	A	B	C
Mean Price	1.665	1.919	1.925

Interpret the Bonferroni analysis results.

- A) A has a significantly larger mean price than either of the other two supermarkets.
- B) B and C have significantly different mean prices.
- C) C has a significantly larger mean price than either of the other two supermarkets.
- D) A has a significantly smaller mean price than either of the other two supermarkets.

8) A new weight-reducing technique, consisting of a liquid protein diet, is currently undergoing tests by the Food and Drug Administration (FDA) before its introduction into the market. The weights of a random sample of five people are recorded before they are introduced to the liquid protein diet. The five individuals are then instructed to follow the liquid protein diet for 3 weeks. At the end of this period, their weights (in pounds) are again recorded. The results are listed in the table. Let μ_1 be the true mean weight of individuals before starting the diet and let μ_2 be the true mean weight of individuals after 3 weeks on the diet.

8) _____

Person	Weight Before Diet	Weight After Diet
1	167	160
2	212	207
3	205	202
4	214	208
5	221	217

Summary information is as follows: $\bar{d} = 5$, $s_d = 1.58$.

Test to determine if the diet is effective at reducing weight. Use $\alpha = .10$.

9) A local consumer reporter wants to compare the average costs of grocery items purchased at three different supermarkets, A, B, and C. Prices (in dollars) were recorded for a sample of 60 randomly selected grocery items at each of the three supermarkets. In order to reduce item-to-item variation, the prices were recorded for each item on the same day at each supermarket.

9) _____

The results of the ANOVA test are summarized in the following table.

Source	df	Anova SS	Mean Square	F Value	Pr > F
Supermkt	2	2.6412678	1.3206399	39.23	0.0001
Item	59	215.5949311	3.6541514	108.54	0.0001
Error	118	3.9725322	0.0336655		
Corrected Total	179	222.2087311			

What is the value of the test statistic for determining whether the three supermarkets have the same average prices?

- A) 0.0001 B) 1.3206 C) 108.54 D) 39.23

10) An experiment was conducted using a randomized block design. The data from the experiment are displayed in the following table.

10) _____

BLOCK	TREATMENT		
	1	2	3
1	4	9	2
2	3	12	2
3	6	8	3

Fill in the missing entries for an ANOVA table.

SOURCE	df	SS	MS	F
Treatments		86.22		
Blocks				
Error				
Total		100.22		

11) Suppose it desired to compare two physical education training programs for preadolescent girls. A total of 62 girls are randomly selected, with 31 assigned to each program. After three 6-week periods on the program, each girl is given a fitness test that yields a score between 0 and 100. The means and variances of the scores for the two groups are shown in the table. (Notice that here we are given the sample variance—most times we have the sample standard deviation.)

11) _____

	n	\bar{x}	s^2
Program 1	31	78.7	201.3
Program 2	31	75.1	259.2

Test to determine if the variances of the two programs differ. Use $\alpha = .05$.

Preliminary data analyses indicates that you can reasonably use nonpooled t-procedures on the given data. Apply a nonpooled t-test to perform the required hypothesis test, using either the critical-value approach or the P-value approach.

- 12) A researcher was interested in comparing the GPAs of students at two different colleges. Independent simple random samples of 8 students from college A and 13 students from college B yielded the following GPAs. 12) _____

College A	College B
3.7	3.8 2.8
3.2	3.2 4.0
3.0	3.0 3.6
2.5	3.9 2.6
2.7	3.8 4.0
3.6	2.5 3.6
2.8	3.9
3.4	

At the 10% significance level, do the data provide sufficient evidence to conclude that the mean GPA of students at college A differs from the mean GPA of students at college B?

(Note: $\bar{x}_1 = 3.1125$, $\bar{x}_2 = 3.4385$, $s_1 = 0.4357$, $s_2 = 0.5485$.)

Test the claim that the samples come from populations with the same mean. Assume that the populations are normally distributed with the same variance.

- 13) A consumer magazine wants to compare the lifetimes of ballpoint pens of three different types. The magazine takes a random sample of pens of each type in the following table. 13) _____

Brand 1	Brand 2	Brand 3
260	181	238
218	240	257
184	162	241
219	218	213

Do the data indicate that there is a difference in mean lifetime for the three brands of ballpoint pens? Use $\alpha = 0.01$.

Preliminary data analyses indicate that you can reasonably consider the assumptions for using pooled t-procedures satisfied. Perform the required hypothesis test by using either the critical-value approach or the P-value approach.

- 14) A researcher was interested in comparing the amount of time spent watching television by women and by men. Independent simple random samples of 14 women and 17 men were selected, and each person was asked how many hours he or she had watched television during the previous week. The summary statistics are as follows. 14) _____

Women	Men
$\bar{x}_1 = 12.9$	$\bar{x}_2 = 16.4$
$s_1 = 4.0$	$s_2 = 4.2$
$n_1 = 14$	$n_2 = 17$

At the 5% significance level, do the data provide sufficient evidence to conclude that the mean time spent watching television by women is less than the mean time spent watching television by men?

Answer Key

Testname: STA3123_E2_SAMPLEEXAM

1) D

2) $\hat{p}_1 \approx .65$ and $\hat{p}_2 = .29$; The test statistic is $z = \frac{(.65 - .29) - 0}{\sqrt{\frac{.65(.35)}{115} + \frac{.29(.71)}{85}}} \approx 5.43$.

The rejection region is $z > 2.33$. Since the test statistic falls in the rejection region, we reject the null hypothesis in favor of the alternative hypothesis that $(p_1 - p_2) > 0$. We conclude that the proportion of condominiums that sold within 30 days was greater in the first half of 2006 than in the first half of 2007.

3) B

4) $(7,123 - 6,957) \pm 1.96\sqrt{\frac{175^2}{144} + \frac{225^2}{144}} \approx 166 \pm 46.56$

5) D

6) a.

S	df	SS	MS	F
T	2	25.2	12.6	2.26
E	11	61.2	5.56	
T	13	86.4		

b. 3

c. No; $F = 2.26$ is less than $F_{.05} = 3.98$ with $df = 2$ and 11 .

7) D

8) To determine if the diet is effective at reducing weight, we test:

$$H_0: \mu_D = 0$$

$$H_a: \mu_D > 0$$

The test statistic is $t = \frac{\bar{x}_d - 0}{s_d/\sqrt{n}} = \frac{5 - 0}{\frac{1.58}{\sqrt{5}}} = 7.07$.

The rejection region requires $\alpha = .10$ in the upper tail of the t distribution with $df = n - 1 = 5 - 1 = 4$. $t_{.10} = 1.533$. The rejection region is $t > 1.533$.

Since the observed value of the test statistic falls in the rejection region ($t = 7.07 > 1.533$), H_0 is rejected. There is sufficient evidence to indicate that the diet is effective at reducing weight when testing at $\alpha = .10$.

9) D

10) SOURCE

SOURCE	df	SS	MS	F
Treatments	2	86.22	43.11	13.15
Blocks	2	0.889	0.444	0.136
Error	4	13.11	3.28	
Total	8	100.22		

Answer Key

Testname: STA3123_E2_SAMPLEEXAM

11) To determine if the variances of the two programs differ, we test:

$$H_0: \sigma_1^2 = \sigma_2^2$$

$$H_a: \sigma_1^2 \neq \sigma_2^2$$

$$\text{The test statistic is } F = \frac{s_2^2}{s_1^2} = \frac{259.2}{201.3} = 1.288.$$

This test requires $\alpha/2 = .05/2 = .025$ in the upper tail of the F distribution with $v_1 = n_2 - 1 = 30$ and $v_2 = n_1 - 1 = 30$ df. From Table X, Appendix A, $F_{.025} = 2.07$. The rejection region is $F > 2.07$.

Since the observed value of the test statistic does not fall in the rejection region ($F = 1.288 \not> 2.07$), H_0 cannot be rejected.

There is insufficient evidence to indicate the variances of the two programs differ when testing at $\alpha = .05$.

12) $H_0: \mu_1 = \mu_2$

$$H_a: \mu_1 \neq \mu_2$$

$$\alpha = 0.10$$

$$t = -1.506$$

$$\text{Critical values} = \pm 1.740$$

Do not reject H_0 . At the 10% significance level, the data do not provide sufficient evidence to conclude that the mean GPA of students at college A differs from the mean GPA of students at college B.

13) Test statistic: $F = 1.620$. Critical value: $F = 8.02$.

Fail to reject the claim of equal means. The data do not provide sufficient evidence to conclude that there is a difference in the mean lifetimes of the three brands of ballpoint pen.

14) $H_0: \mu_1 = \mu_2$

$$H_a: \mu_1 < \mu_2$$

$$\alpha = 0.05$$

$$t = -2.359$$

$$\text{Critical value} = -1.699$$

Reject H_0 . At the 5% significance level, the data provide sufficient evidence to conclude that the mean time spent watching television by women is less than the mean time spent watching television by men.