

Name Coj

Date: _____

AP Statistics - Mr. Bannon

Period _____

Unit 11 - Review

Part I - Multiple choice

1) Which of the following best describes what we mean when say that t -procedures are robust?

- a. The t -procedures work well with almost any distribution.
- b. The numerical value of t is not affected by outliers.
- ☒ c. The t -procedures will still work reasonably well even if the assumption of normality is violated.
- d. t -procedures can be used as long as the sample size is at least 40.
- e. t -procedures are as accurate as z -procedures.

2) Using a sample size of 25, what is the critical t -value for a 95% confidence interval?

- A. 1.708
- B. 1.711
- C. 2.060
- ☒ D. 2.064
- E. 2.172

$df = 24$

use t -table

3) When a sample size of 12 is used to perform a two-sided test for the mean, a t -value of 2.1 is significant to what level?

- A. Between 0.5% and 1%
- B. Between 1% and 2.5%
- ☒ C. Between 2.5% and 5%
- ☒ D. Between 5% and 10%
- E. Between 10% and 15%

1 sided

2 sided

4) It has been calculated that a 99% confidence interval for the difference between two population means is (12.4, 19.3). Which of the following are true?

- ☒ I. The probability that the real difference is between 12.4 and 19.3 is 0.99.
- ☒ II. There is a 1% chance that the real difference is less than 12.4 and a 1% chance that the real difference is greater than 19.3.
- ☒ III. We are 99% confident that the real difference in population means is between 12.4 and 19.3.

- A. I only
- ☒ B. III only
- C. I and II
- D. I and III

5) Which of the following are true statements?

- I. The shape of the t -distributions changes as the sample size decreases.
- II. The t -distributions are mound-shaped and symmetric.
- III. The t -distributions may be used wherever the z -distribution is appropriate.

- A. I only
- B. I and II
- C. I and III
- D. II and III
- E. I, II, and III



6) A gasoline additive is being tested to determine the amount of improvement that can be expected in gas mileage. Twelve cars are randomly selected to be included in the study. The results are given below. Construct a 95% confidence interval for the improvement in gas mileage.

Before Additive	17	22	23	19	18	19	24	23	19	22	21	20
After Additive	19	22	25	21	24	21	24	25	21	25	22	21

- A. 1.92 ± 0.80
- B. 1.92 ± 0.81
- C. 1.92 ± 0.88
- D. 1.92 ± 0.98
- E. 1.92 ± 0.99

Calc.

For problems 7- The following data was collected from 30 college students as to the number of miles they drive, one way, to college.

7	9	6	18	24	9	17	16	32	24
17	34	18	18	45	24	29	30	16	19
6	26	9	17	30	17	2	19	24	4

7) What would be the margin of error for a 95% confidence interval?

- A. 3.00
- B. 3.44
- C. 3.57
- D. 3.72
- E. 4.70

$$ME = t^* \frac{s}{\sqrt{n}} = 2.045 \frac{9.9887}{\sqrt{30}}$$

Which of the following are true statements?

- ~~I.~~ The area under the curve of the t -distribution between ± 1 standard deviation is greater when $d.f. = 5$ than when $d.f. = 10$.
- ~~II.~~ There is less area in the tails, beyond ± 3 standard deviations, of the t -distribution when $d.f. = 5$ than when $d.f. = 10$.
- III. For a given α , the critical t -value increases as $d.f.$ decreases.

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I, II, and III



- 9) Two manufacturers sell boxes of cereal with a net weight listed as 28 ounces. A testing company wants to determine the difference in average weight in the two brands of cereal. The same number of boxes of each brand of cereal will be tested. A preliminary study has shown that the standard deviation in weight for each brand is 0.28 ounces. How many boxes of each cereal must be included in the study to be 95% sure of being within 0.1 ounces of the actual difference in average weight?

A. 43
 B. 61
 C. 64
 D. 74
 E. 105

$$ME = Z^* \sqrt{\frac{\sigma_1^2}{n} + \frac{\sigma_2^2}{n}}$$

$$n = 61$$

Part II - Free Response

- 1) A professor at a large state college has been teaching statistics for many years. She tells her classes that she thinks females generally score higher on statistics tests than do males. This caused such a debate among the faculty that they decided to conduct a study. Thirty-five female and 32 male students are randomly selected from the several hundred students who take statistics classes each year. A common test is administered to these students. The following chart summarizes the results of the study.

	\bar{x}	s	n
Females	71.2	3.9	35
Males	68.9	3.5	32

~~Construct a 95% confidence interval for the difference in the averages between the females and the males.~~ Construct a 95% confidence interval for the difference in the averages between the females and the males.

$$3) CI = (\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$= (71.2 - 68.9) \pm t^* \sqrt{\frac{3.9^2}{35} + \frac{3.5^2}{32}}$$

$$df = 64.98$$

$$4) CI = (.49439, 4.1056)$$

- 4) We are 95% Conf. that the true diff. between male and female Average stats test scores is between (.49439, 4.1056)

- 2) A group of 175 married couples are enrolled in a study to see if women have a stronger reaction than men to videos that contain violent material. At the conclusion of the study, each couple is given a questionnaire designed to measure the intensity of their reaction. Higher values indicate a stronger reaction. The means and standard deviations for all men, all women, and the differences between husbands and wives are as follows:

	\bar{x}	s
Men	8.56	1.42
Women	8.97	1.84
Difference (Husband-Wife)	-0.38	1.77

Do the data give strong statistical evidence that wives have a stronger reaction to violence in videos than do their husbands?

Since each couple is getting both treatments this is a one sample t matched pairs test. So we only care about difference.

Step 3 $H_0: \mu_{\text{diff}} = 0$ $t = -2.84$

$H_a: \mu_{\text{diff}} < 0$ $p = .0025240878$

Step 4 Since the p-value of .0025240878 is very small we can reject H_0 , meaning that we have strong evidence that women do have a stronger reaction to violent material than their male spouse.

- 3) An avid reader, Booker Worm, claims that he reads books that average more than 375 pages in length. A random sample of 13 books on his shelf had the following number of pages: 595, 353, 434, 382, 420, 225, 408, 422, 315, 502, 503, 384, 420. Do the data support Booker's claim? Test at the 0.05 level of significance.

Step 1 The population of interest is all of Booker Worm's books that he read. The parameter of interest is the average number of pages he reads per book.

H_0 : The Average number of pages per book that Booker reads is less than or $= 375$

H_a : The Average number of pages per book that Booker reads is greater than 375

Step 2 I am going to produce a t-test to test Booker's claim.

Assuming the random sample of 13 books was taken as an SRS we can continue.

Assuming that Booker read more than 130 books we can use μ_y and σ_y .

The boxplot of the sample shows no major skew or outliers so we can use a t distribution.



Step 3 $t = 1.48$

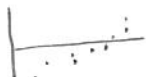
$P = .0821067883$

Step 4 Since the p-value is not less than .05, we can't reject the H_0 . We can't say he reads more than 375.

- 4) The local farmers association in Cass County wants to estimate the mean number of bushels of corn produced per acre in the county. A random sample of 13 1-acre plots produced the following results (in number of bushels per acre): 98, 103, 95, 99, 92, 106, 101, 91, 99, 101, 97, 95, 98. Construct a 95% confidence interval for the mean number of bushels per acre in the entire county. The local association has been advertising that the mean yield per acre is 100 bushels. Do you think it is justified in this claim?

Step 1 The population of interest is all 1-acre plots of corn. The parameter is the average bushels of corn per acre in Cass County.

Step 2 I am going to produce a 95% Confidence Interval to determine where the true Average bushels of corn per acre is between. Assuming that the random sample of 13 plots were taken as an SRS, we can continue. Assuming there are more than 130 total plots, we can use σ_x & μ_x . The Normal probability plot shows a linear trend, so we can safely use a t-distribution.



Step 3 $CI = \bar{x} \pm t^* \frac{s}{\sqrt{n}} = 98.0769 \pm 2.179 \frac{4.2113}{\sqrt{13}} = (95.531, 100.62)$

Step 4 I am 95% Confident that the true Average of bushels per acre of corn in Cass County is between (95.531, 100.62).

Since the claim of $\mu = 100$ is in my interval I can not reject that claim.

- 5) The statistics teacher, Dr. Tukey, gave a 50-point quiz to his class of 10 students and they didn't do very well, at least by Dr. Tukey's standards (which are quite high). Rather than continuing to the next chapter, he spent some time reviewing the material and then gave another quiz. The quizzes were comparable in length and difficulty. The results of the two quizzes were as follows.

Student	1	2	3	4	5	6	7	8	9	10
Quiz 1	42	38	34	37	36	26	44	32	38	31
Quiz 2	45	40	36	38	34	28	44	35	42	30

Do the data indicate that the review was successful, at the .05 level, at improving the performance of the students on this material? Give good statistical evidence for your conclusion.

1-sample matched pairs t-test

Difference	1	2	3	4	5	6	7	8	9	10
between	3	2	2	1	-2	2	0	3	4	-1
Q1 + Q2										

Step 3 $H_0: \mu_{diff} = 0$

$H_a: \mu_{diff} > 0$

$t = 2.3$

$p = .0222517686$

Step 4 Since the p-value is less than .05 we can reject H_0 . Dr. Tukey's review did improve the students' scores.