1. **(1 point)** `carroll_problib/statistics/lane/Chapter09/problem01.pg`
A population has a mean of 78 and a standard deviation of 19.

(a) What are the mean ____ and standard deviation ____ of the sampling distribution of the mean for a sample of size $N = 11$?

(b) What are the mean ____ and standard deviation ____ of the sampling distribution of the mean for a sample of size $N = 39$?

(Relevant section: **Sampling Distribution of the Mean**)

Answer(s) submitted:

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(incorrect)

2. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/test.pg`
Scores on a national 8th grade reading test are normally distributed with a mean of 128 and a standard deviation of 14.

Find:
(a) the probability that a single test score selected at random will be greater than 138: ____

(b) the probability that a random sample of 23 scores will have a mean greater than 130: ____

(c) the probability that a random sample of 41 scores will have a mean greater than 130: ____

(d) the probability that the mean of a sample of 14 scores will be either less than 126 or greater than 130: ____

Hint: Recall that the standard error for the sampling distribution of a sample mean scales with the reciprocal of the square root of the sample size.

Answer(s) submitted:

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(incorrect)

3. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/SamplingDistribution1.pg`

(a) The mean time that it takes an Energizer AA battery to drain from 1.5volts to 1volt when used in a hand-held video game is advertised to be 7.5 hours. We take a sample of 14 Energizer batteries and find the average of our sample of 7.24 hours and a standard deviation of 0.61. For the hypothesis test

$$H_0 : \mu = 7.5 \quad \text{against} \quad H_A : \mu < 7.5,$$

where μ is the average time for the battery to drain from 1.5 volts to 1 volt, what are the center and the standard error of the underlying sampling distribution?
Center = ____
Standard Error = ____

(b) It is estimated that 80% of Carroll College nursing students pass their final competency exam on the first try. To test this claim, one of the nursing professors gathers a random sample of 49 nursing graduates and finds that 70% of them passed their exam on the first try. For the hypothesis test

$$H_0 : p = 0.8 \quad \text{against} \quad H_A : p < 0.8,$$

where p is the proportion of nursing students that pass on their first try, what are the center and the standard error of the underlying sampling distribution?
Center = ____
Standard Error = ____

(c) The mathematics major and the biology major at Carroll College both have "senior exit exams" that the majors must pass in order to graduate. To test the claim that the two majors have different passing rates on their exit exams we gather 44 biology graduates and 20 math graduates and find the 25 biology graduates passed on their first try and 11 math graduates passed on their first try. For the hypothesis test

$$H_0 : p_{math} - p_{bio} = 0 \quad \text{against} \quad H_A : p_{math} - p_{bio} \neq 0,$$

where p_{math} is the proportion of past math majors that pass on the first try and p_{bio} is the proportion of biology majors that pass on the first try, what are the center and the standard error of the underlying sampling distribution?
Center = ____
Standard Error = ____

Answer(s) submitted:

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(incorrect)

4. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/SamplingDistribution2.pg`

(a) The mean time that it takes an Energizer AA battery to drain from 1.5volts to 1volt when used in a hand-held video game is advertised to be 7.6 hours. We take a sample of 14 Energizer batteries and find the average of our sample of 7.23 hours and a standard deviation of 0.53. For the hypothesis test

$$H_0 : \mu = 7.6 \quad \text{against} \quad H_A : \mu < 7.5,$$

where μ is the average time for the battery to drain from 1.5 volts to 1 volt, what are the center and the standard error of the underlying sampling distribution?
Center = _____
Standard Error = _____

(b) It is estimated that 80% of Carroll College nursing students pass their final competency exam on the first try. To test this claim, one of the nursing professors gathers a random sample of 44 nursing graduates and finds that 70% of them passed their exam on the first try. For the hypothesis test

$$H_0 : p = 0.8 \quad \text{against} \quad H_A : p < 0.8,$$

where p is the proportion of nursing students that pass on their first try, what are the center and the standard error of the underlying sampling distribution?
Center = _____
Standard Error = _____

(c) The mathematics major and the biology major at Carroll College both have ”senior exit exams” that the majors must pass in order to graduate. To test the claim that the two majors have different passing rates on their exit exams we gather 46 biology graduates and 20 math graduates and find the 30 biology graduates passed on their first try and 11 math graduates passed on their first try. For the hypothesis test

$$H_0 : p_{math} - p_{bio} = 0 \quad \text{against} \quad H_A : p_{math} - p_{bio} \neq 0,$$

where p_{math} is the proportion of past math majors that pass on the first try and p_{bio} is the proportion of biology majors that pass on the first try, what are the center and the standard error of the underlying sampling distribution?
Center = _____
Standard Error = _____

(d) A high school senior is weighing all of the options before committing to a college. One factor is the price of books so she compares the prices of the books requires for 22 randomly selected courses that were offered at both schools and finds that the average difference is $\bar{x} = 3$ and the standard deviation is $s = 3.94$. She calculates the difference in price for each book. What are the center and standard error of the sampling distribution of the differences?
Center = _____
Standard Error = _____

(e) We would like to know if the 100m dash times at the 2016 Rio Olympics were statistically different than those in the 2012 London Olympics. The mean at the London Olympics was 9.81 seconds with a standard deviation of 0.046. The mean at the Rio Olympics was 9.80 seconds with a standard deviation of 0.035. In both cases this data was taken from the finals which contained 8 athletes. What are the center and standard error of the sampling distribution of the difference of means?
Center = _____
Standard Error = _____

Answer(s) submitted:

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(incorrect)

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5. (1 point) `carroll_problib/statistics/InterStats/One_Sample_Mean/physicstest.pg`

This year Carroll graduates 8 physics majors, and each of them takes a standardized national physics test. All students across the country who take this test have an average score of 62. The scores of these 8 students are as follows:

56 57 75 75 78 85 86 95

(a) Test to see if the sample mean is significantly different from 62 at the 0.02 level.

Report the test statistic _____ and p _____ value.
Are these scores significantly different from 62 at the 0.02 level?

- A. Yes
- B. No
- C. Maybe

This p value is the probability of what, exactly?

- A. This is the probability that this year’s graduating Carroll physics students have an average score this far or farther away from 62 by random chance.
- B. This is the probability that if we randomly selected 8 students from all the students who took the test nationally that we would just happen to have an average this far or farther away from 62 by random chance.
- C. This is the probability that this year’s graduating Carroll physics students have an average score of 62 by random chance.
- D. This is the probability that if we randomly selected 8 students from all the students who took the test nationally that we would just happen to have an average of 62 by random chance.

(b) We find that one of the scores above is in error and that instead of 57 it should have been 75.
Are these corrected scores significantly different from 62 at the 0.02 level?

- A. Yes

- B. No
- C. Maybe

Answer(s) submitted:

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(incorrect)

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6. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/watches.pg`

45 people are randomly selected and the accuracy of their wristwatches is checked, with positive errors representing watches that are ahead of the correct time and negative errors representing watches that are behind the correct time. The 45 watches have an average error of 116 sec and the standard standard deviation of the watch errors is 168 sec. Use a 0.02 significance level to test the claim that the average watch reads the correct time (use a two-sided alternative).

What is our null hypothesis?

- A. $H_0 \neq 116$
- B. $H_0 : \bar{x} \neq 116$
- C. $H_0 : \mu \neq 0$
- D. $H_0 : \mu = 116$
- E. $H_0 \neq 0$
- F. $H_0 = 0$
- G. $H_0 = 116$
- H. $H_0 : \bar{x} \neq 0$
- I. $H_0 : \mu \neq 116$
- J. $H_0 : \mu = 0$
- K. $H_0 : \bar{x} = 116$
- L. $H_0 : \bar{x} = 0$

What is our alternative hypothesis?

- A. $H_A = 0$
- B. $H_A : \bar{x} \neq 0$
- C. $H_A : \mu \neq 116$
- D. $H_A : \mu = 0$
- E. $H_A : \bar{x} = 116$
- F. $H_A = 116$
- G. $H_A : \mu \neq 0$
- H. $H_A : \bar{x} = 0$
- I. $H_A : \mu \neq 116$
- J. $H_A : \bar{x} \neq 116$

The test statistic is ________

The P-Value is ________

This p value is the probability of what, exactly?

- A. This is the probability that all people with watches have an average error of 116 and bigger, or -116 and smaller.
- B. This is the probability that, if the average watch reads the correct time, we would randomly select a group of 45 people with an average error of 116 and bigger.
- C. This is the probability that the average watch reads the correct time.
- D. This is the probability that, if the average watch doesn't read the correct time, we would randomly select a group of 45 people with an average error of 116 and bigger, or -116 and smaller.
- E. This is the probability that, if the average watch reads the correct time, we would randomly select a group of 45 people with an average error of 116 and bigger, or -116 and smaller.

The final conclusion is

- A. There is sufficient evidence to warrant rejection of the claim that the average watch reads the correct time.
- B. There is not sufficient evidence to warrant rejection of the claim that the average watch reads the correct time.

Answer(s) submitted:

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(incorrect)

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7. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/statstests.pg`

Scores on a large standardized test are normally distributed with a national average score of 72. Here are Carroll College we have 21 students who take this test and get an average score of 73 with a standard deviation of 16. Use a significance level of 0.01.

What is our null hypothesis?

- A. $H_0 : \mu = 73$
- B. $H_0 = 72$
- C. $H_0 : \bar{x} = 73$
- D. $H_0 : \bar{x} \neq 72$
- E. $H_0 : \bar{x} = 72$
- F. $H_0 : \mu = 72$
- G. $H_0 : \bar{x} \neq 73$
- H. $H_0 : \mu \neq 72$
- I. $H_0 \neq 72$
- J. $H_0 : \mu \neq 73$
- K. $H_0 \neq 73$
- L. $H_0 = 73$

What is our alternative hypothesis?

- A. $H_A : \bar{x} \neq 72$
- B. $H_A : \bar{x} = 73$
- C. $H_A : \mu \neq 72$
- D. $H_A = 73$
- E. $H_A : \mu = 72$
- F. $H_A : \bar{x} \neq 73$

- G. $H_A = 72$
- H. $H_A : \mu \neq 73$
- I. $H_A : \bar{x} = 72$
- J. $H_A : \mu \neq 73$

The test statistic is ________

The conclusion is

- A. There is not sufficient evidence to reject the claim that the mean score is equal to 72.
- B. There is sufficient evidence to reject the claim that the mean score is equal to 72.

What do we learn from this analysis?

- A. Carroll students did not score significantly higher than average on this test.
- B. Carroll students scored significantly higher than average on this test.

Answer(s) submitted:

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(incorrect)

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8. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/salaries.pg`

Starting salaries of 125 college graduates who have taken a statistics course have a mean of \$43,442. Suppose we know that the population standard deviation σ is \$9,290.
Using a 0.98 degree of confidence, find both of the following:

A. The margin of error E

____

B. The confidence interval for the mean μ:

_______ $< \mu <$ _______

C. Which is the best interpretation of this confidence interval?

- A. We are 98% confident that the average salary of all college graduates who have taken a statistics course is in this range.
- B. We are 98% confident that the salary of all college graduates who have taken a statistics course is in this range.
- C. We are 98% confident that the salary of these 125 college graduates who have taken a statistics course is in this range.
- D. We are 98% confident that the average salary of these 125 college graduates who have taken a statistics course is in this range.
- E. 98% of the salaries of all college graduates who have taken a statistics course are in this range.
- F. 98% of the salaries of these 125 college graduates who have taken a statistics course are in this range.

Answer(s) submitted:

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(incorrect)

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9. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/fish.pg`

We randomly select 120 fish from a reservoir and measure the length of them. The average length of the fish is 34.2 cm with a standard deviation of 2.54 cm.

(a) Find a 90% confidence interval for the average length of all fish in the reservoir μ .
_____ $\leq \mu \leq$ _____

(b) Find a 95% confidence interval for the average length of all fish in the reservoir μ .
_____ $\leq \mu \leq$ _____

(c) Find a 99% confidence interval for the average length of all fish in the reservoir μ .
_____ $\leq \mu \leq$ _____

(d) Which is the best interpretation of this 99

- A. If we did this study many times, each time gathering a new sample of fish and computing an interval, in the long run about 99
- B. This interval contains the lengths of 99
- C. This interval contains the lengths of 99
- D. We can say with 99
- E. We can say with 99
- F. We can say with 99
- G. If we did this study many times, each time gathering a new sample of fish and computing an interval, in the long run about 99

Answer(s) submitted:

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(incorrect)

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10. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/tomatoes.pg`

We are studying a new variety of cherry tomato plants. In each scenario below, our agricultural research station grows a different number of tomato plants, then counts the number of tomatoes produced by each plant. We then compute the average and standard deviation of the number of tomatoes produced by the sample.

Calculate a 95% confidence interval for the average number of tomatos produced in each of the following scenarios:

(a) $n = 90,\ \bar{x} = 99.4,\ s = 3.38$

_________ $\leq \mu \leq$ _________

(b) $n = 95,\ \bar{x} = 23.9,\ s = 2.97$

_________ $\leq \mu \leq$ _________

(c) $n = 95,\ \bar{x} = 44.1,\ s = 3.43$

_________ $\leq \mu \leq$ _________

(d) $n = 110,\ \bar{x} = 63.4,\ s = 2.43$

_________ $\leq \mu \leq$ _________

(e) Explain the meaning of these confidence intervals.

- A. If we did this study many times, each time growing a new sample of tomato plants and computing an interval, in the long run only about 5
- B. The number of tomatoes produced by 95
- C. If we did this study many times, each time growing a new sample of tomato plants and computing an interval, in the long run about 95
- D. We are 95
- E. The number of tomatoes produced by 95
- F. We are 95

Answer(s) submitted:

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(incorrect)

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11. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/athleteIQ.pg`

Use the given data to find the 95% confidence interval estimate of the population mean μ. Assume that the population has a normal distribution.

IQ scores of professional athletes:
Sample size $n = 20$
Mean $\bar{x} = 106$
Standard deviation $s = 14$

_________ $< \mu <$ _________

Which of the following is the best explanation of what this interval means?

- A. We are 95
- B. 95
- C. We are 95
- D. 95
- E. We are 95
- F. We are 95
- G. If we conducted this study many times, each time gathering a new sample and computing a new interval, then in the long run, 95

Answer(s) submitted:

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(incorrect)

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12. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/cds.pg`

Listed below are the lengths (in minutes) of randomly selected music CDs from record label ABC, published in the last 10 years.

¡table cellpadding=10px¿ ¡tr¿¡td¿72.1¡/td¿¡td¿43.6¡/td¿¡td¿45.7¡/td¿¡td¿37.
¡tr¿¡td¿55.9¡/td¿¡td¿46.9¡/td¿¡td¿47.5¡/td¿¡td¿27.9¡/td¿¡td¿54.3¡/td¿¡td¿61.
¡tr¿¡td¿45.7¡/td¿¡td¿66.8¡/td¿¡td¿53.8¡/td¿¡td¿55.5¡/td¿¡td¿49.2¡/td¿¡td¿51.
¡tr¿¡td¿61.1¡/td¿¡td¿64.3¡/td¿¡td¿29.8¡/td¿¡td¿64.9¡/td¿¡td¿50.3¡/td¿¡td¿64.
¡tr¿¡td¿49.4¡/td¿¡td¿50.1¡/td¿¡td¿42.2¡/td¿¡td¿38.3¡/td¿¡td¿46.1¡/td¿¡td¿62.
¡tr¿¡td¿56.8¡/td¿¡td¿45.1¡/td¿¡td¿62.8¡/td¿¡td¿45.1¡/td¿¡td¿53.8¡/td¿¡/tr¿
¡/table¿

Hint: Copy the data and paste it into Excel to do this problem.

Use this data to construct a 98% confidence interval.

_________ $< \mu <$ _________

Which is the best interpretation of this confidence interval?

- A. We are 98% confident that the length of the CDs in this sample is in this range.
- B. We are 98% confident that length of CDs produced by ABC in the last 10 years is in this range.
- C. We are 98% confident that the average length of CDs produced by ABC is in this range.
- D. We are 98% confident that the average length of the CDs in this sample is in this range.
- E. We are 98% confident that the average length of CDs produced by ABC in the last 10 years is in this range.
- F. 98% of the CDs in this sample have lengths in this range.
- G. 98% of the all CDs produced by ABC in the past 10 years have lengths in this range.

Record label XYZ says that all of their CDs published in the last 10 years have an average of 62 minutes of music. We want to know if this is significantly different than the average length of CDs from ABC.

What is our null hypothesis?

- A. $H_0 : \mu = 62$
- B. $H_0 = 62$
- C. $H_0 : \mu \neq 62$
- D. $H_0 : \bar{x} = 62$
- E. $H_0 : \bar{x} \neq 62$
- F. $H_0 \neq 62$

What is our alternative hypothesis?

- A. $H_A = 62$

- B. $H_A : \bar{x} = 62$
- C. $H_A : \bar{x} \neq 62$
- D. $H_A : \mu \neq 62$
- E. $H_A : \mu = 62$

What is our test statistic?

____

What is the two-tailed p-value of this result?

____

Do we have a significant difference at the 0.02 level?

- A. Yes
- B. No
- C. Maybe

What does this hypothesis test mean?

- A. In the last 10 years, the CDs produced by XYZ ware longer than the CDs produced by ABC.
- B. The CDs produced by XYZ were longer on average than the CDs produced by ABC.
- C. In the last 10 years, the CDs produced by XYZ were longer on average than the CDs produced by ABC.
- D. In the last 10 years, the CDs produced by ABC were longer on average than the CDs produced by XYZ.
- E. In the last 10 years, the CDs produced by XYZ were not longer on average than the CDs produced by ABC.

Answer(s) submitted:

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(incorrect)

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13. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/batteries.pg`

If we randomly select groups of 18 batteries, measure how many hours they last, and then take the average of the 18 lifetimes, we find that the average lifetimes are normally distributed.

(a) We get a group of 18 batteries and find that their average lifetime is 105 hours with a standard deviation of 9 hours. What is the probability that we would get a group of 18 batteries with an average lifetime of 105 hours or more if the average lifetime of all batteries is 101 hours? _____
Is this probability significant at the 0.1 level? (one tailed)

- A. Yes
- B. No
- C. Maybe

(b) We get a group of 18 batteries and find that their average lifetime is 94 hours with a standard deviation of 9 hours. What is the probability that we would get a group of 18 batteries with an average lifetime of 94 hours or less if the average lifetime of all batteries is 101 hours? _____
Is this probability significant at the 0.1 level? (one tailed)

- A. Yes
- B. No
- C. Maybe

(c) We get a group of 18 batteries and find that their average lifetime is 105 hours with a standard deviation of 9 hours. Based on this data, we can say with 95

Answer(s) submitted:

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(incorrect)

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14. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/cholesterol.pg`

We are testing whether a particular program of low impact exercise can improve the cholesterol level of stroke patients. We enroll a group of stroke patients in our study, and after six weeks we measure their serum cholesterol level in mmol/L, resulting in the following data:

¡table cellpadding=10px¿ ¡tr¿¡td¿7.8¡/td¿¡td¿4.6¡/td¿¡td¿6.9¡/td¿¡td¿6.4¡/td¿
¡tr¿¡td¿7.2¡/td¿¡td¿5.4¡/td¿¡td¿8.9¡/td¿¡td¿5.3¡/td¿¡td¿8.6¡/td¿¡td¿5.2¡/td¿¡tc
¡tr¿¡td¿9¡/td¿¡td¿5.1¡/td¿¡td¿6.5¡/td¿¡td¿4.1¡/td¿¡td¿5.1¡/td¿¡td¿5.3¡/td¿¡td¿
¡tr¿¡td¿7.6¡/td¿¡td¿7.9¡/td¿¡td¿7.2¡/td¿¡td¿4.8¡/td¿¡td¿5.2¡/td¿¡td¿9¡/td¿¡td¿
¡tr¿¡td¿8.8¡/td¿¡td¿4.5¡/td¿¡td¿4.2¡/td¿¡td¿7.1¡/td¿¡td¿5.3¡/td¿¡td¿4.5¡/td¿¡tc
¡tr¿¡td¿7¡/td¿¡td¿4.6¡/td¿¡td¿4.9¡/td¿¡/tr¿ ¡/table¿
Hint: Copy the data and paste it into Excel to do this problem.

Construct a 92% confidence interval.

__________ $< \mu <$ __________

Which is the best interpretation of this confidence interval?

- A. If all stroke patients did our program of low impact exercise for six weeks, 95
- B. We are 95
- C. We are 95
- D. We are 95
- E. We are 95

From an existing study we know that the average cholesterol level of all stroke patients is 7.8 mmol/L. We want to know if the level in our patients is significantly different from this.

What is our null hypothesis?

- A. $H_0 = 7.8$
- B. $H_0 : \bar{x} = 7.8$
- C. $H_0 \neq 7.8$
- D. $H_0 : \bar{x} \neq 7.8$
- E. $H_0 : \mu \neq 7.8$

- F. $H_0 : \mu = 7.8$

What is our alternative hypothesis?

- A. $H_A = 7.8$
- B. $H_A : \mu = 7.8$
- C. $H_A : \bar{x} = 7.8$
- D. $H_A : \bar{x} \neq 7.8$
- E. $H_A : \mu \neq 7.8$

What is our test statistic?

____

What is the two-tailed p-value of this result?

____

Do we have a significant difference at the 0.08 level?

- A. Yes
- B. No
- C. Maybe

What can we conclude from this hypothesis test?

- A. Our exercise program lowers the average cholesterol level of stroke patients.
- B. Our exercise program does not lower the average cholesterol level of stoke patients.
- C. We are 95
- D. Our exercise program lowers the cholesterol level of stroke patients.

Answer(s) submitted:

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(incorrect)

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15. **(1 point)** `carroll_problib/statistics/InterStats/One_Sample_Mean/coke.pg`

Cans of coke are supposed to contain an average of 12 ounces. A new manufacturing system is put in place that saves money, but as the factory manager you want to be sure that it still delivers the right amount of soda. You measure the contents of 37 cans from the new manufacturing system, finding that these cans contain an average of 12.19 ounces, with a standard deviation of 0.43 ounces. That seems a little high, but it's not too big of a difference. Could this just be due to random variation in selecting this particular 37 cans? Or is this new manufacturing process putting in the wrong amount of soda on average?

What is our null hypothesis?

- A. $H_0 : \mu = 12$
- B. $H_0 : \bar{x} = 12$
- C. $H_0 : \mu \neq 12$
- D. $H_0 : \mu \neq 12.19$
- E. $H_0 = 12$
- F. $H_0 \neq 12.19$
- G. $H_0 : \bar{x} \neq 12$
- H. $H_0 : \bar{x} \neq 12.19$
- I. $H_0 \neq 12$
- J. $H_0 : \bar{x} = 12.19$
- K. $H_0 : \mu = 12.19$
- L. $H_0 = 12.19$

What is our alternative hypothesis?

- A. $H_A : \mu \neq 12.19$
- B. $H_A = 12.19$
- C. $H_A : \mu \neq 12$
- D. $H_A : \bar{x} \neq 12.19$
- E. $H_A : \mu = 12$
- F. $H_A : \mu \neq 12.19$
- G. $H_A = 12$
- H. $H_A : \bar{x} = 12$
- I. $H_A : \bar{x} = 12.19$
- J. $H_A : \bar{x} \neq 12$

When we analyze these results, what test statistic do we get?

____

What is the two-tailed p value we get from this hypothesis test?

____

What is this p-value the probability of?

- A. This is the probability that we would get a sample of 37 cans that contain an average greater than 12.19 ounces, or less than 11.81 ounces.
- B. This is the probability that we would get a sample of 37 cans that contain an average greater than 12.19 ounces, if the new manufacturing system fills cans with an average of 12 ounces.
- C. This is the probability that we would get a sample of 37 cans that contain an average greater than 12.19 ounces, or less than 11.81 ounces, if the new manufacturing system does not fill cans with an average of 12 ounces.
- D. This is the probability that we would get a sample of 37 cans that contain an average greater than 12 ounces, if the new manufacturing system fills cans with an average of 12.19 ounces.
- E. This is the probability that we would get a sample of 37 cans that contain an average greater than 12.19 ounces, or less than 11.81 ounces, if the new manufacturing system fills cans with an average of 12 ounces.
- F. This is the probability that the new manufacturing system produces cans with an average of 12 ounces.

Based on this sample, create a 95

__________ $< \mu <$ __________

Using $\alpha = 0.05$, do we have evidence that the new system is out of adjustment?

- A. Yes
- B. No
- C. Maybe

Answer(s) submitted:

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(incorrect)

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16. **(1 point)** carroll_problib/statistics/InterStats/One_Sample_Mean/mileage.pg

We randomly select a group of cars owned by people in Helena, and measure the mileage on each car, getting the following data:

¡table cellpadding=10px¿ ¡tr¿¡td¿53009¡/td¿¡td¿55199¡/td¿¡td¿56432¡/td¿¡td¿64675¡/td¿¡td¿53335¡/td¿¡td¿56146¡/td¿¡td¿48129¡/td¿¡/tr¿
¡tr¿¡td¿56410¡/td¿¡td¿45897¡/td¿¡td¿49576¡/td¿¡td¿46711¡/td¿¡td¿62195¡/td¿¡td¿52204¡/td¿¡td¿50382¡/td¿¡/tr¿
¡tr¿¡td¿59662¡/td¿¡td¿57867¡/td¿¡td¿49777¡/td¿¡td¿47076¡/td¿¡td¿51872¡/td¿¡td¿55878¡/td¿¡td¿71979¡/td¿¡/tr¿
¡tr¿¡td¿53495¡/td¿¡td¿42142¡/td¿¡td¿48147¡/td¿¡td¿42516¡/td¿¡td¿45772¡/td¿¡td¿53651¡/td¿¡td¿64359¡/td¿¡/tr¿
¡tr¿¡td¿72555¡/td¿¡td¿74038¡/td¿¡td¿87439¡/td¿¡td¿160510¡/td¿¡td¿168890¡/td¿¡td¿65704¡/td¿¡td¿40976¡/td¿¡/tr¿
¡/table¿

Hint: Copy the data and paste it into Excel to do this problem.

Construct a 97% confidence interval.

__________ $< \mu <$ __________

Which is the best interpretation of this confidence interval?

- A. 95
- B. We are 95
- C. We are 95
- D. We are 95
- E. 95
- F. We are 95

Someone from Missoula says that cars over there have an average of only 57000 miles on them. We want to know if this is significantly different than the average mileage on cars in Helena.

What is our null hypothesis?

- A. $H_0 : \mu \neq 57000$
- B. $H_0 : \bar{x} \neq 57000$
- C. $H_0 \neq 57000$
- D. $H_0 = 57000$
- E. $H_0 : \mu = 57000$
- F. $H_0 : \bar{x} = 57000$

What is our alternative hypothesis?

- A. $H_A = 57000$
- B. $H_A : \mu = 57000$
- C. $H_A : \bar{x} = 57000$
- D. $H_A : \bar{x} \neq 57000$
- E. $H_A : \mu \neq 57000$

What is our test statistic?

____

What is the two-tailed p-value of this result?

____

Do we have a significant difference at the 0.03 level?

- A. Yes
- B. No
- C. Maybe

What can we conclude from this hypothesis test?

- A. Cars owned by people in Missoula do not have a lower average mileage than cars owned by people in Helena.
- B. There is a significant difference between the average mileage of cars owned by people in Helena and the average mileage of cars owned by people in Missoula, but we cannot draw any conclusions about which is lower.
- C. We cannot tell whether or not the average mileage on cars owned by people in Missoula is different than the average mileage on cars owed by people in Helena.
- D. Cars owned by people in Helena have a lower average mileage than cars owned by people in Missoula.
- E. Cars owned by people in Missoula have lower mileage than cars owned by people in Helena.

Answer(s) submitted:

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(incorrect)

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17. **(1 point)** carroll_problib/statistics/lane/Chapter12/problem02.pg

A (hypothetical) experiment is conducted on the effect of alcohol on perceptual motor ability. Ten subjects are each tested twice, once after having two drinks and once after having two glasses of water. The two tests were on two different days to give the alcohol a chance to wear off. Half of the subjects were given alcohol first and half were given water first. The scores of the 10 subjects are shown below. The top number for each subject is their performance in the "water" condition. Higher scores reflect better performance. Test to see if alcohol had a significant effect.

Subject	1	2	3	4	5	6	7	8	9	10
Water	16	15	11	20	19	14	13	15	14	16
Alcohol	13	13	10	18	17	11	10	15	11	16

t-value = ______

p-value = ______

Does alcohol had a significant effect using an 0.01 alpha level?

- A. Yes
- B. No
- C. Maybe

Answer(s) submitted:

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(incorrect)

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18. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleTTest1.pg`

Each year the US Environmental Protection Agency (EPA) releases fuel economy data on cars manufactured in that year. Below are summary statistics on fuel efficiency (in miles/gallon for city driving) from random samples of cars with manual and automatic transmissions manufactured in 2012. We want to know if there is a statistical difference between the average fuel efficiencies between the two different types of transmission.

	Automatic Transmission	Manual Transmission
Mean	$\bar{x}_1 = 15.2$	$\bar{x}_2 = 19.6$
SD	$s_1 = 3.3$	$s_2 = 4.9$
Sample Size	$N_1 = 24$	$N_2 = 30$

(a) Choose the appropriate type of statistical hypothesis test from the following list:

- A. A two sample z test
- B. A paired z test
- C. A one sample z test
- D. A paired t test
- E. A one sample t test
- F. A two sample t test

(b) Choose the appropriate null hypothesis:

- A. $H_0 : \mu_{Automatic} - \mu_{Manual} \neq 0$
- B. $H_0 : \mu_{Automatic} - \mu_{Manual} > 0$
- C. $H_0 : \mu_{Automatic} - \mu_{Manual} < 0$
- D. $H_0 : \mu_{Automatic} - \mu_{Manual} = 4.4$
- E. $H_0 : \mu_{Automatic} = 15.2$ and $\mu_{Manual} = 19.6$
- F. $H_0 : \mu_{Automatic} = 0$ and $\mu_{Manual} = 0$
- G. $H_0 : \mu_{Automatic} - \mu_{Manual} = 0$
- H. $H_0 : \mu_{Automatic} - \mu_{Manual} = -4.4$

(c) Choose the appropriate alternative hypothesis:

- A. $H_A : \mu_{Automatic} - \mu_{Manual} > 0$
- B. $H_A : \mu_{Automatic} - \mu_{Manual} = 0$
- C. $H_A : \mu_{Automatic} - \mu_{Manual} = 4.4$
- D. $H_A : \mu_{Automatic} - \mu_{Manual} \neq 0$
- E. $H_A : \mu_{Automatic} - \mu_{Manual} < 0$
- F. $H_A : \mu_{Automatic} = 0$ and $\mu_{Manual} = 0$
- G. $H_A : \mu_{Automatic} = 15.2$ and $\mu_{Manual} = 19.6$
- H. $H_A : \mu_{Automatic} - \mu_{Manual} = -4.4$

(d) Calculate the standard error for the appropriate sampling distribution: $SE =$ ______

(e) Calculate the t test statistic for the summary data given: $t =$ ______

(f) How many degrees of freedom should you be using for your t test? $df =$ ______

(g) Calculate the p-value for the appropriate t test: $p =$ ______

(h) What is your decision at the $\alpha = 0.01$ level?

- A. We should reject the null hypothesis. It is unlikely that we would find such a difference just by chance.
- B. We cannot reject the null hypothesis. It is not unlikely that that we could find such a difference just by chance.

(i) Assuming that the data collection was not flawed, which of the following statements is most appropriate regarding our conclusion?

- A. The cars definitely do not have different gas mileages.
- B. The cars definitely have different gas mileages.
- C. We have sufficient evidence to suggest that the cars have the same gas mileages.
- D. We have sufficient evidence to suggest that the cars have different gas mileages.
- E. We do not have sufficient evidence to suggest that the cars have different gas mileages.
- F. None of the statements is an appropriate conclusion.

Answer(s) submitted:

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(incorrect)

19. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleTTest2.pg`

In this problem we consider a small set of evidence for global warming by comparing how temperatures have changed in the US from 1968 to 2008. Suppose that the daily high temperature reading on January 1 was collected in 1968 and 2008 from 50 randomly selected locations in the continental US and the paired differences was calculated (2008 temperature minus 1968 temperature). The average paired difference was 0.85 degrees with a standard deviation of 5 degrees. We are interested in determining whether these data provide strong evidence of temperature warming in the continental US.

(a) Choose the appropriate type of statistical hypothesis test from the following list:

- A. A two sample z test
- B. A paired z test
- C. A two sample t test
- D. A paired t test
- E. A one sample t test
- F. A one sample z test

(b) Choose the appropriate null hypothesis:

- A. $H_0 : \mu_{difference} = 0.85$
- B. $H_0 : \mu_{difference} = 0$
- C. $H_0 : \mu_{difference} > 0$
- D. $H_0 : \mu_{difference} < 0$
- E. $H_0 : \mu_{difference} \neq 0$

(c) Choose the appropriate alternative hypothesis:

- A. $H_A : \mu_{difference} = 0.85$
- B. $H_A : \mu_{difference} \neq 0$
- C. $H_A : \mu_{difference} < 0$
- D. $H_A : \mu_{difference} > 0$
- E. $H_A : \mu_{difference} = 0$

(d) Calculate the standard error for the appropriate sampling distribution: $SE =$ ________

(e) Calculate the t test statistic for the summary data given: $t =$ ________

(f) How many degrees of freedom should you be using for your t test? $df =$ ________

(g) Calculate the p-value for the appropriate t test: $p =$ ________

(h) What is your decision at the $\alpha = 0.03$ level?

- A. We should reject the null hypothesis. It is unlikely that we would find these temperature differences just by chance.
- B. We cannot reject the null hypothesis. It is not unlikely that we would find these temperature differences just by chance.

(i) Assuming that the data collection was not flawed, which of the following statements is most appropriate regarding our conclusion?

- A. The paired temperatures are definitely different.
- B. We have sufficient evidence to suggest that the paired temperatures are the same.
- C. We have sufficient evidence to suggest that the paired temperatures are different.
- D. The paired temperatures are not different.
- E. We do not have sufficient evidence to suggest paired temperatures are different.
- F. None of the statements is an appropriate conclusion.

Answer(s) submitted:

(incorrect)

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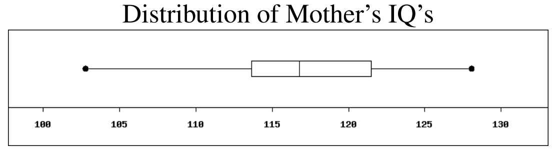
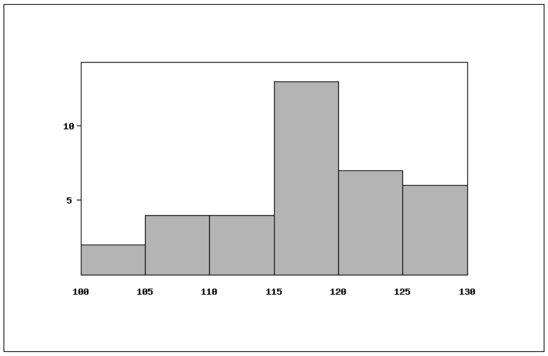
20. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleTTest3.pg`

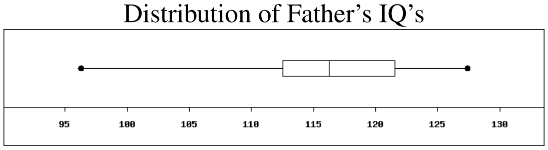
Suppose that researchers collected a simple random sample of 36 children who had been identified as gifted in a large city. The following histograms and boxplots show the distributions of the IQ scores of mothers and fathers of these children. Also provided are some sample statistics.

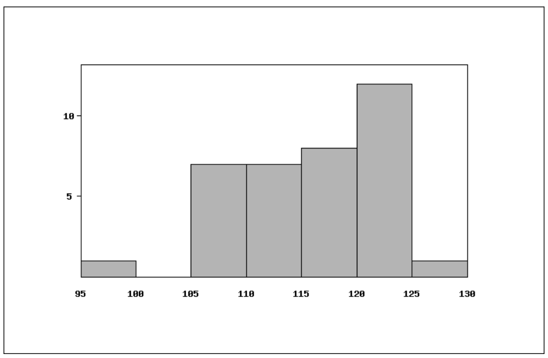
Distribution of Mother's IQ's



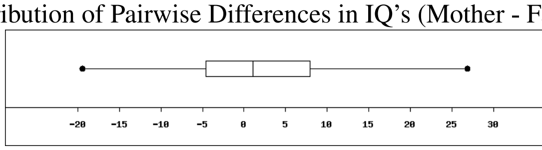


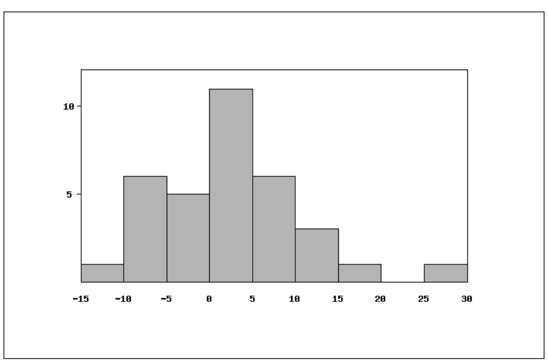
(Click on graph to enlarge)
Distribution of Father's IQ's





(Click on graph to enlarge)
Distribution of Pairwise Differences in IQ's (Mother - Father)





(Click on graph to enlarge)

	Mother	Father	Paired Diff. (Mother - Father)
Mean	116.5	112	1.18916666666667
SD	6.2	3.6	9.46412908226184
N	36	36	36

Now that you've seen all of the graphical and summary information let's answer some questions.
(a) We would like to know if the IQs of the mothers and fathers are related. Which type of test should we use?

- A. Two Sample t Test
- B. Matched Pairs z Test
- C. Matched Pairs t Test
- D. Two Sample z Test

(b) Now we will conduct a hypothesis test to evaluate if the collection of IQs of mothers and fathers is equal on average.
(i) Which of the following test styles should we be interested in running?

- A. A left-tailed test
- B. A right-tailed test
- C. A two-tailed test

(ii) Give the test statistic: ______
(iii) Give the p value for the hypothesis test. ______

(c) Does it appear that there is a statistical difference between the IQs of the collection of mothers and fathers at the $\alpha = 0.05$ level? (enter Y for yes or N for no). ______

Answer(s) submitted:

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(incorrect)

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21. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleTTest_TF.pg`
Consider each of the following True / False questions.

(a) When comparing means of two groups with equal sizes you should always use a paired t test.

- A. True
- B. False

(b) In a paired analysis we first take the difference of observations and then we do inference on these difference.

- A. False
- B. True

(c) In a paired analysis each observation in one data set is subtracted from the average of the other data set's observations.

- A. False
- B. True

(d) As the degrees of freedom increases the t distribution approaches normality.

- A. False
- B. True

Answer(s) submitted:

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(incorrect)

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22. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleTTest_WorkBackwards.pg`

A 96% confidence interval for a random sample of paired differences is (18.22 , 22.45). The confidence interval is based on a simple random sample of 20 paired differences. Calculate the margin of error, the mean paired difference, and the standard deviation of the 20 paired differences.

Margin of Error = ______

Mean Paired Difference = ______

Standard Deviation of the Paired Differences = ______

Answer(s) submitted:

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-

(incorrect)

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23. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleT_CI1.pg`

Each year the US Environmental Protection Agency (EPA) releases fuel economy data on cars manufactured in that year. Below are summary statistics on fuel efficiency (in miles/gallon for city driving) from random samples of cars with manual and automatic transmissions manufactured in 2012. We want to know if there is a statistical difference between the average fuel efficiencies between the two different types of transmission.

	Automatic Transmission	Manual Transmission
Mean	$\bar{x}_1 = 15.4$	$\bar{x}_2 = 20$
SD	$s_1 = 3.95$	$s_2 = 4.35$
Sample Size	$N_1 = 25$	$N_2 = 34$

(a) Calculate the standard error for the appropriate sampling distribution: $SE =$ ______

(b) We want to calculate a 95% confidence interval for the difference between the gas mileages for the automatic transmission and the manual transmission cars. What is the critical t-score that we should use to build our confidence interval? $t_{critical} =$ ______

(c) Calculate the margin of error, the lower bound, and the upper bound for the 95% confidence interval.

Margin of Error = ______

Lower Bound = ______

Upper Bound = ______

(d) Which of the following is the correct interpretation of the 95% confidence interval?

- A. We are 95% confident that the true difference in mean gas mileage between the automatic and manual transmission cars is between the lower and upper bound. This means that 95% of the paired differences in car gas mileages the difference was between the lower and upper bound.
- B. We are 95% confident that the true difference in mean gas mileage between the automatic and manual transmission cars is between the lower and upper bound. This means that in 95% of cars sampled we found a mean gas mileage between the lower and upper bound.
- C. We are 95% confident that the true difference in mean gas mileage between the automatic and manual transmission cars is between the lower and upper bound. This means that there is a probability of 0.95 that we will sample automatic and manual transmission cars and find the difference that we did.
- D. We are 95% confident that the true difference in mean gas mileage between the automatic and manual transmission cars is between the lower and upper bound. This means that in 95% of confidence intervals created in the same way we expect to capture the true difference in gas mileages.

Answer(s) submitted:

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(incorrect)

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24. **(1 point)** `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleT_CI2.pg`

Every year during home football games the Carroll College fans do push-up contests to see how many they can do. Suppose that a curious stats student in the stands kept track of the number of push-ups completed for several students of both genders.

Males	27	20	17	33	22	28	26	30	17	12
Females	8	31	24	11	12	24	16	12	3	7

1. Consider the hypothesis that males in this contest can do more pushups than females. Use an $\alpha = 0.01$ significance level to test the claim.

(a) What test method should be used?

- A. Two Sample z test
- B. Two Sample t test
- C. Matched Pairs t test

(b) The test statistic is ________

(c) Is there sufficient evidence to support the claim that males can do more pushups?

- A. Yes
- B. No

2. Construct a 99% confidence interval for the mean of the differences between males and females.

________ $< \mu <$ ________

Answer(s) submitted:

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(incorrect)

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25. (1 point) `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleT_CI3.pg`

The Paleo diet allows only for foods that humans typically consumed over the last 2.5 million years, excluding those agriculture-type foods that arose during the last 10,000 years or so. Researchers randomly divided 500 volunteers into two equal-sized groups. One group spent 6 months on the Paleo diet. The other group received a pamphlet about controlling portion sizes. Randomized treatment assignment was performed, and at the beginning of the study, the average difference in weights between the two groups was about 0 pounds. After the study, the Paleo group had lost 6.7 pounds with a standard deviation of 18.25 pounds while the control group had lost an average of 5.9 pounds with a standard deviation of 13.5 pounds.

(a) The 91% confidence interval for the difference between the two population paramters (Paleo - Control) is given as (-1.644 , 3.244). Interpret this interval in the context of the data.

- A. We are 91% confident that the true difference in weight loss is between -1.644 and 3.244. This means that there is a probability of 0.91 that we will sample people from the two groups and find the difference that we did.
- B. We are 91% confident that the true difference in weight loss is between -1.644 and 3.244. This means that in 91% of confidence intervals created in the same way we expect to capture the true difference in weight loss between the two groups.
- C. We are 91% confident that the true difference in weight loss is between -1.644 and 3.244. This means that in 91% of people sampled we found a mean weight loss between -1.644 and 3.244 bound.
- D. We are 91% confident that the true difference in weight loss is between -1.644 and 3.244.. This means that 91% of the paired differences in people the difference was between -1.644 and 3.244.

(b) Based on the 91% confidence interval, do the data provide convincing evidence that the Paleo diet is more effective for weight loss than the pamphlet (control)?

- A. No
- B. Yes

(c) Next we would like to support your answer to (b) with a statistical hypothesis test. Consider the two-sample t test for $H_0 : \mu_{Paleo} - \mu_{Pamphlet} = 0$ against $H_A : \mu_{Paleo} - \mu_{Pamphlet} > 0$. Fail to Reject Based on your answer to part (b) do you expect reject or fail to reject the null hypothesis?

- A. Fail to Reject
- B. Reject

(d) Finally, support your answer to part (c) with a p value. $p =$ ________

Answer(s) submitted:

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(incorrect)

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26. (1 point) `carroll_problib/statistics/InterStats/Two_Sample_Mean/TwoSampleT_Chicken1.pg`

Chicken farming is a multi-billion dollar industry, and any methods that increase the growth rate of young chicks can reduce consumer costs while increasing company profits, possibly by millions of dollars. An experiment was conducted to measure and compare the effectiveness of various feed supplements on the growth rate of chickens. Newly hatched chicks were randomly allocated into six groups, and each group was given a different feed supplement. Below are some summary statistics from this data set showing the distribution of weights by feed type.

	Mean	SD	Sample Size
casein	323.58	64.43	12
horsebean	160.20	38.63	10
linseed	218.75	52.24	12
meatmeal	276.91	64.90	11
soybean	246.43	54.13	14
sunflower	328.92	48.84	12

(a) Do these data provide strong evidence that the average weights of chickens that were fed lineseed and horsebean are different? Use a 5% significance level.
Hint: We are interested in the difference: $linseed - horsebean$
Test Statistic = ______
p-value = ______
Decision =

- ?
- We have evidence that the two groups are different
- We do not have evidence that the two groups are different
- We can make no conclusion

(b) Do these data provide strong evidence that the average weights of chickens that were fed lineseed and sunflower are different? Use a 5% significance level.
Hint: We are interested in the difference: $linseed - sunflower$
Test Statistic = ______
p-value = ______
Decision =

- ?
- We have evidence that the two groups are different
- We do not have evidence that the two groups are different
- We can make no conclusion

(c) Create a 99% confidence interval for the difference between the means of meatmeal and soybean.
Hint: We are interested in the difference: $meatmeal - soybean$
Lower Bound = ______
Upper Bound = ______

Answer(s) submitted:

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(incorrect)