**Problems Section 2G**

1.  What assumptions should we check if we want to use sample data to create a confidence interval to estimate a population standard deviation or variance?

2.  A random sample of 45 high school students ACT exams has a skewed left distribution with a sample standard deviation ($s$) of 9.868.  What is the sample variance ($s^2$)?  What is the degrees of freedom?  Open StatKey at www.lock5stat.com, go to "Theoretical Distributions" and then click on "$\chi^2$".  Look up the Chi-squared critical values.  Use the critical values, degrees of freedom (n−1) and sample variance to construct a 90% confidence interval estimate of the population variance for all ACT exams.  Take the square root of your variance confidence interval to calculate a 90% confidence interval estimate for the population standard deviation.

Variance Confidence Interval Formula:

$$\frac{s^2(n-1)}{\chi^2_{upper}} < \text{Population Variance } (\sigma^2) < \frac{s^2(n-1)}{\chi^2_{lower}}$$

a)  Sample Variance = $(Sample\ Standard\ Deviation)^2$ =

b)  Degrees of Freedom = $n - 1$ =

c)  Chi-squared upper critical value =

d)  Chi-squared lower critical value =

e)  Variance Confidence Interval =

f)  Standard Deviation Confidence Interval =


3.  Use the following Statcato printout to check your variance confidence interval answer and your standard deviation confidence interval answer from the random sample ACT data in number 2.  Check the assumptions for a variance confidence interval.  Remember the data was skewed left.  Write down a sentence to explain the population variance confidence interval.  Write down a sentence to explain the population standard deviation confidence intervals.

## Confidence Interval - One population variance: confidence level = 0.9
Input: Summary data

| N | Variance | Stdev | 90.0%CI Variance | 90.0%CI Stdev |
|---|---|---|---|---|
| 45 | 97.377 | 9.868 | (70.8423, 143.8391) | (8.4168, 11.9933) |

a)  Check each of the assumptions for this problem.  Explain your answers.

b)  Write down a sentence to explain the population variance confidence interval.

c)  Write down a sentence to explain the population standard deviation confidence interval.

4.  A random sample of body temperatures in degrees Fahrenheit was taken from 50 randomly selected adults. Assume the sample data was normally distributed.  The sample standard deviation of 0.765 °F.  What is the sample variance ($s^2$)?  What is the degrees of freedom?  Open StatKey at www.lock5stat.com, go to "Theoretical Distributions" and then click on "$\chi^2$".  Look up the Chi-squared critical values.  Use the critical values, degrees of freedom (n−1) and sample variance to construct a 99% confidence interval estimate of the population variance for all body temperatures.  Take the square root of your variance confidence interval to calculate a 99% confidence interval estimate for the population standard deviation.

Variance Confidence Interval Formula:

$$\frac{s^2(n-1)}{\chi^2_{upper}} < \text{Population Variance } (\sigma^2) < \frac{s^2(n-1)}{\chi^2_{lower}}$$

a)  Sample Variance = $(Sample\ Standard\ Deviation)^2$ =

b)  Degrees of Freedom = $n - 1$ =

c)  Chi-squared upper critical value =

d)  Chi-squared lower critical value =

e)  Variance Confidence Interval =

f)  Standard Deviation Confidence Interval =

5.  Use the following Statcato printout to check your variance confidence interval answer and your standard deviation confidence interval answer from the random sample body temperature data in number 4.  Check the assumptions for a variance confidence interval.  Remember the data is normally distributed.  Write down a sentence to explain the population variance confidence interval.  Write down a sentence to explain the population standard deviation confidence intervals.

**Confidence Interval - One population variance: confidence level = 0.99**
Input: Summary data

| N | Variance | Stdev | 99.0%CI Variance | 99.0%CI Stdev |
|---|---|---|---|---|
| 50 | 0.585 | 0.765 | (0.3666, 1.0524) | (0.6054, 1.0258) |

a)  Check each of the assumptions for this problem.  Explain your answers.

b)  Write down a sentence to explain the population variance confidence interval.

c)  Write down a sentence to explain the population standard deviation confidence interval.

6. Go to www.matt-teachout.org, click on "Statistics" and then "Data Sets".  Open the "cereal data" in excel.  Copy the column of data labeled "sugar (grams per serving)".  Go to www.lock5stat.com and click on the "StatKey" tab.  Under the "Bootstrap Confidence Intervals" menu, click on "CI for Single Mean, Median, St.Dev."  Click on "Bootstrap Dot plot of Stdev".  Now click on "Edit Data" and paste the sugar data into StatKey.  Click on "Generate 1000 Samples" a few times to create the bootstrap sampling distribution for the standard deviation.  Use the bootstrap distribution to find a 99% confidence interval for the population standard deviation.

a)  Does this data meet the assumptions for a bootstrap confidence interval? Assume the data was collected randomly.  Explain your answer.

b)  How many bootstrap samples did you take?

c)  What is the shape of the bootstrap distribution for the standard deviation?

d)  Write the upper and lower limits of the bootstrap confidence interval for the population standard deviation.

e)  Write a sentence to explain the bootstrap confidence interval estimate of the population standard deviation.

7.  Go to www.matt-teachout.org, click on "Statistics" and then "Data Sets".  Open the "cereal data" in excel.  Copy the column of data labeled "carbs (grams per serving)".  Go to www.lock5stat.com and click on the "StatKey" tab.  Under the "Bootstrap Confidence Intervals" menu, click on "CI for Single Mean, Median, St.Dev."  Click on "Bootstrap Dot plot of Stdev".  Now click on "Edit Data" and paste the carb data into StatKey.  Click on "Generate 1000 Samples" a few times to create the bootstrap sampling distribution for the standard deviation.  Use the bootstrap distribution to find a 95% confidence interval for the population standard deviation.

a)  Does this data meet the assumptions for a bootstrap confidence interval? Assume the data was collected randomly.  Explain your answer.

b)  How many bootstrap samples did you take?

c)  What is the shape of the bootstrap distribution for the standard deviation?

d)  Write the upper and lower limits of the bootstrap confidence interval for the population standard deviation.

e)  Write a sentence to explain the bootstrap confidence interval estimate of the population standard deviation.

8. Go to www.matt-teachout.org, click on "Statistics" and then "Data Sets".  Open the "bear data" in excel.  Copy the column of data labeled "weight in pounds".  Go to www.lock5stat.com and click on the "StatKey" tab.  Under the "Bootstrap Confidence Intervals" menu, click on "CI for Single Mean, Median, St.Dev."  Click on "Bootstrap Dot plot of Stdev".  Now click on "Edit Data" and paste the bear weight data into StatKey.  Click on "Generate 1000 Samples" a few times to create the bootstrap sampling distribution for the standard deviation.  Use the bootstrap distribution to find a 90% confidence interval for the population standard deviation for the weight of bears.

a)  Does this data meet the assumptions for a bootstrap confidence interval? Assume the data was collected randomly.  Explain your answer.

b)  How many bootstrap samples did you take?

c)  What is the shape of the bootstrap distribution for the standard deviation?

d)  Write the upper and lower limits of the bootstrap confidence interval for the population standard deviation.

e)  Write a sentence to explain the bootstrap confidence interval estimate of the population standard deviation.

9.  Go to www.matt-teachout.org, click on "Statistics" and then "Data Sets".  Open the "bear data" in excel.  Copy the column of data labeled "length in inches".  Do not click on "head length" by mistake.  We want the overall length of the bears.  Go to www.lock5stat.com and click on the "StatKey" tab.  Under the "Bootstrap Confidence Intervals" menu, click on "CI for Single Mean, Median, St.Dev."  Click on "Bootstrap Dot plot of Stdev".  Now click on "Edit Data" and paste the bear length data into StatKey.  Click on "Generate 1000 Samples" a few times to create the bootstrap sampling distribution for the standard deviation.  Use the bootstrap distribution to find a 99% confidence interval for the population standard deviation for the length of bears.

a)  Does this data meet the assumptions for a bootstrap confidence interval? Assume the data was collected randomly.  Explain your answer.

b)  How many bootstrap samples did you take?

c)  What is the shape of the bootstrap distribution for the standard deviation?

d)  Write the upper and lower limits of the bootstrap confidence interval for the population standard deviation.

e)  Write a sentence to explain the bootstrap confidence interval estimate of the population standard deviation.

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