Statistics 101L – Laboratory 13

Inference for the population mean, $\mu$.

Last week’s lab looked at the sample mean $\bar{y}$ by sampling from a population of 250 females who took an introductory statistics class. This week the data collected in last week’s lab will be used to make inferences about the population mean, $\mu$, the average height of all females in the population.

1. Each member of the group should take one of the random samples from last week’s lab and

   a) Construct a 95% confidence interval for the population mean height of female students.
   b) How many of the confidence intervals contain the population mean $\mu = 166.6$ cm?
   c) Put this on the white board. Once all the groups in lab have put their numbers of intervals that contain the population mean on the board, compute a relative frequency of capturing the population mean for your lab section. You can continue to work on other parts of this lab while waiting for all the groups to put their numbers on the board.
   d) What should be the long run relative frequency of capturing the population mean?
   e) Suppose you were to combine the four random samples of size $n = 10$ to create a random sample of size $n = 40$, would the confidence interval for the population mean height based on the sample of size $n = 40$ be wider, about the same width of narrower than a confidence interval for the population mean height based on the sample of size $n = 10$? Explain your answer briefly. Note: You do not, and should not, compute the confidence interval for the sample of size $n = 40$.

2. Four random samples of size $n = 10$ were combined to create a random sample of size $n = 40$. For this larger random sample, the sample mean is $\bar{y} = 164.45$ cms and the sample standard deviation is $s = 10.213$ cms. A normal quantile plot, outlier box plot and histogram for the sample data appear on the back of this sheet.

   a) Comment on each of the plots and indicate how each supports or fails to support the condition that the population distribution of female heights is nearly normal.
   b) Using this random sample, construct a 95% confidence interval for the population mean height of female students.
   c) Based on this interval could the population mean height of female students be 166.6 cms? Explain briefly.
   d) Using this random sample, test the hypothesis that the population mean height of female students is 166.6 cms against the alternative that the population mean height is something different from 166.6. Go through the steps of a hypothesis test.
Distribution of a random sample of heights of 40 female students.
Stat 101L – Laboratory 13
Group Answer Sheet

Names of Group Members: ____________________, ____________________
____________________, ____________________

1) Each member of the group should take one of the random samples and construct a 95% confidence interval for the population mean height, μ.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample Mean, ( \bar{y} )</th>
<th>Sample Std. Dev., ( s )</th>
<th>95% Confidence Interval for ( \mu )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>( \bar{y} )</td>
<td>( s )</td>
<td>( \bar{y} - t^* \left( \frac{s}{\sqrt{n}} \right) )</td>
</tr>
<tr>
<td>Sample 2</td>
<td>( \bar{y} )</td>
<td>( s )</td>
<td></td>
</tr>
<tr>
<td>Sample 3</td>
<td>( \bar{y} )</td>
<td>( s )</td>
<td></td>
</tr>
<tr>
<td>Sample 4</td>
<td>( \bar{y} )</td>
<td>( s )</td>
<td></td>
</tr>
</tbody>
</table>

c) How many of the intervals contain \( \mu = 166.6 \text{ cm} \) ?

d) The relative frequency of capturing the population mean for your lab section.

e) What should be the long run relative frequency of capturing the population mean?

f) Suppose you were to combine the four random samples of size \( n = 10 \) to create a random sample of size \( n = 40 \), would the confidence interval for the population mean height based on the sample of size \( n = 40 \) be wider, about the same width of narrower than a confidence interval for the population mean height based on the sample of size \( n = 10 \)? Explain your answer briefly.
2) Four random samples of size \( n = 10 \) were combined to create a random sample of size \( n = 40 \). For this larger random sample, the sample mean is \( \bar{y} = 164.45 \) cms and the sample standard deviation is \( s = 10.213 \) cms.

a) Comment on each of the plots and indicate how each supports or fails to support the condition that the population distribution of female heights is nearly normal.

- Normal quantile plot
- Outlier box plot
- Histogram

b) Construct a 95% confidence interval for the population mean height of female students.

c) Based on this interval could the population mean height of female students be 166.6 cms? Explain briefly.
d) Test the hypothesis that the population mean height of female students is 166.6 cms against the alternative that the population mean height is something different from 166.6. Go through the steps of a hypothesis test.

Step 1: Set up hypotheses.

Step 2: Check conditions.

Step 3: Calculate test statistic and P-value.

Step 4: Use the P-value to reach a decision.

Step 5: State a conclusion within the context of the problem.