Introduction to Statistics for the Social Sciences
Spring 2015, Dr. Suzanne Delaney
Homework #13

This homework will provide practice in calculating confidence intervals using the normal curve. We will assume a normal curve for these problems. In all of these problems, we will be finding the raw scores that border the middle 95% (or 99%) of the curve.

Note: These problems are based on problems 1, 3, & 7 from chapter 9 (Lind text). Please refer to chapter 9 for additional assistance if needed.

There are two types of problems in this homework assignment:
Type 1: These are just like problems on previous homework assignments that ask you to “find the raw scores that border the middle 95% of the curve”. Just as in the past, you will use this formula: \( x = \bar{x} + z\sigma \)

Remember, raw score = mean + (z score)(standard deviation)

Type 2: These problems will ask you to “find confidence intervals” using either a 95% or 99% level of confidence. You’ll see that these problem are very similar to problems on previous homework assignments in that they ask you to “find the raw scores that border the middle 95% of the curve” but these problems will ask you to use the SEM (standard error of the mean) rather than just the standard deviation. You will use this formula: \( x = \bar{x} + z\sigma_x \)

Raw score = mean + (z score)(standard error of the mean)

Example solution: Please assume a distribution with a mean of 30 and a standard deviation of 2.

- Find the 2 raw scores that border the middle 95% of this distribution
  Remember, raw score = mean + (z score)(standard deviation)
  Lower boundary raw score = mean + (-z score)(standard deviation) = 30 + (-1.96)(2) = 26.08
  Upper boundary raw score = mean + (z score)(standard deviation) = 30 + (1.96)(2) = 33.92
  26.08 and 33.92 are the two raw scores that border the middle 95% of the curve

- Find the 95% confidence interval based on a sample size of 16, the mean is still 30 and the standard deviation is still 2.
  First you have to calculate the SEM (standard error of the mean)
  \( SEM = \sigma / \sqrt{n} = SEM = 2/\sqrt{16} = 2/4 = .5 \)
  Remember, raw score = mean + (z score)(standard error of the mean)
  Confidence Interval lower boundary raw score = mean + (-z score)(standard error of the mean) 30 + (-1.96)(.5) = 29.02
  Confidence Interval upper boundary raw score = mean + (z score)(standard error of the mean) 30 + (1.96)(.5) = 30.98
  29.02 and 30.98 are the two raw scores that border 95% confidence interval
Please show your work (write small and neat).

1. Please assume a distribution with a mean of 55 and a standard deviation of 10. (Based on problem 1 in the Lind text)
   - Find the 2 raw scores that border the middle 99% of this distribution
     \[ \text{Remember, raw score} = \text{mean} + (z \text{ score}) \times \text{standard deviation} \]
     
     Lower boundary raw score is _________
     Upper boundary raw score is _________

   - Mean is still 55 and standard deviation is still 10.
   Find the 99% confidence interval based on a sample size of 49
     \[ \sigma_x = \frac{\sigma}{\sqrt{n}} \]
     
     Confidence Interval lower boundary raw score is _________
     Confidence Interval upper boundary raw score is _________

2. Please assume a distribution with a mean of 20 and a standard deviation of 5. (Based on problem 3 in the Lind text)
   - Find the 2 raw scores that border the middle 95% of this distribution

     Lower boundary raw score is _________
     Upper boundary raw score is _________

   - Mean is still 20 and standard deviation is still 5.
   Find the 95% confidence interval based on a sample size of 10
     \[ \sigma_x = \frac{\sigma}{\sqrt{n}} \]
     
     Confidence Interval lower boundary raw score is _________
     Confidence Interval upper boundary raw score is _________

3. Bob owns a gas station. He would like to report the average number of gallons of gas he sold to the middle 95% of his customers last year. Please assume a distribution with a mean of 8.6 and a standard deviation of 2.3.
   - Find the 2 raw scores that border the middle 95% of this distribution
     \[ \text{Remember, raw score} = \text{mean} + (z \text{ score}) \times \text{standard deviation} \]
     
     Lower boundary raw score is _________
     Upper boundary raw score is _________

   - Bob then took a sample of 60 sales made this month and wants to use that sample to predict how much gas he will sell in the future. The mean is still 8.6 and standard deviation is still 2.3.
   Find the 95% confidence interval based on his sample of 60 sales.
     \[ \sigma_x = \frac{\sigma}{\sqrt{n}} \]
     
     Confidence Interval lower boundary raw score is _________
     Confidence Interval upper boundary raw score is _________

4. Bob changed his mind and wants to measure the middle 99% rather than the middle 95%.
   Please rework this problem using values for 99% rather than 95% intervals. (Based on problem 7 in the Lind text)

     Lower boundary raw score is _________
     Upper boundary raw score is _________

     Confidence Interval lower boundary raw score is _________
     Confidence Interval upper boundary raw score is _________

5. When Bob changed from a 95% interval to a 99% interval what happened to the size of the interval. Did it get wider or narrower or did it not change at all?

     The interval got ____________________________.