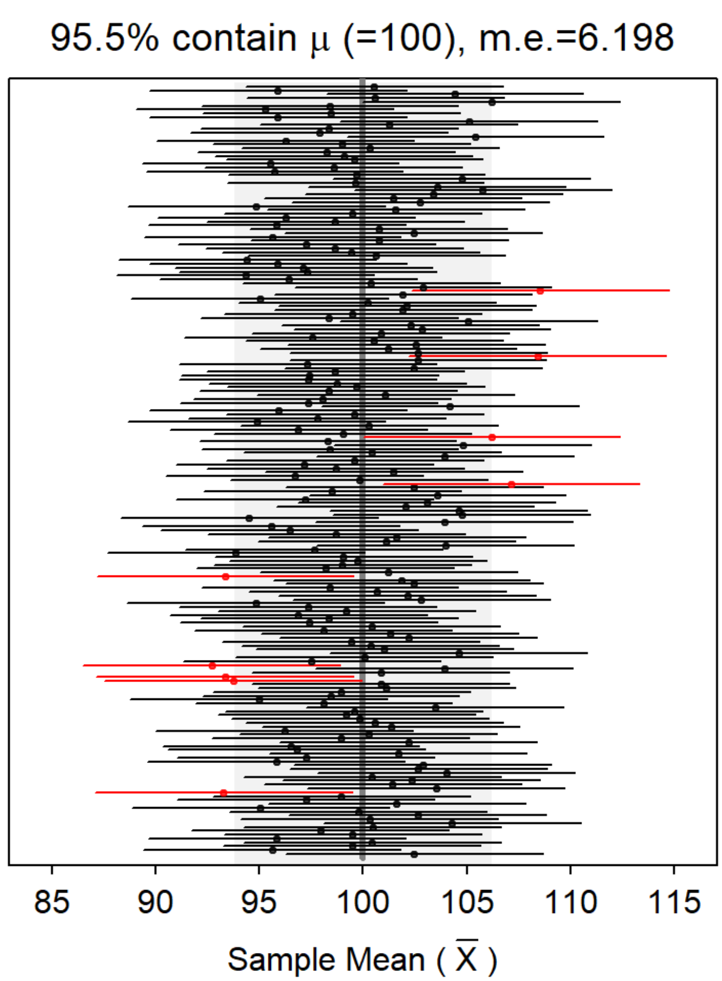
Assignment I

derekogle.com/NCMTH107/modules/CE/ConfRegions_CE1

The Concept of Confidence Intervals

The concept of confidence in a confidence interval (CI) is subtle because it depends on thinking about taking all possible samples from a known population distribution, computing the CI for each sample, and then determining if the CI captures the parameter or not. This thought process is complicated by the fact that the parameter is unknown, and taking all possible samples is impossible. The `ciSim()` function (with no arguments) can simulate this process and provide a graphical result of the CIs relative to the parameter from many (but not all possible) samples.

The plot below is an example from `ciSim()`. The known population mean is depicted by the solid vertical line (μ=100 in this example). Each horizontal line is one CI (the endpoints of the horizontal line is the CI and the point in the middle is the sample mean). The CIs that do not capture μ are in red. The percentage of CIs that capture μ is shown at the top along with the margin-of-error (m.e.), or half the width of the CI.



In RStudio, this plot will have a gear icon in the upper-left corner that will open a dialog box that allows you to modify n, the level of confidence, and the type of confidence region. Pressing the "rerandomize" button will construct another set of CIs. The plot updates automatically when any item is changed.

The table below can be used to record your results from `ciSim()` for different sample sizes and levels of confidence (*press "rerandomize" twenty times and mentally average the percentages to form a general conclusion.*). Then answer the questions below the table.

	90% Confidence		**95% Confidence**		**99% Confidence**	
n=	**% contain μ**	**m.e.**	**% contain μ**	**m.e.**	**% contain μ**	**m.e.**
10						
25						
50						

1. How did the percentage of CIs that captured μ change with increasing n.
2. How did the percentage of CIs that captured μ change with increasing level of confidence.
3. How did the margin-of-error change with increasing n.
4. How did the margin-of-error change with increasing level of confidence.
5. What two things can you, as a statistician, do to make a confidence interval narrower (i.e., reduce the margin-of-error)? Are there any negative consequences to either of decision?

Assignment II

derekogle.com/NCMTH107/modules/CE/ConfRegions_CE2.html

I urge you to follow these steps when answering all confidence region questions:

a. Identify the level of confidence (i.e., $100(1-\alpha)\%$).
b. Identify whether a lower confidence bound (greater than H_A), upper confidence bound (less than H_A), or confidence interval (not equals H_A) should be constructed.
c. Find Z^* (I suggest including a drawing to illustrate your calculation).
d. Calculate the confidence region values (i.e., $\bar{x}+Z^*SE$).
e. Specifically interpret the confidence region with a complete sentence.

A reminder to use these steps will **NOT** be provided on future quizzes, but you should get in the habit of following them. See here for a demonstration of the steps.

Confidence Region Calculations

For each situation below, calculate and interpret the confidence region.

1. $\alpha=0.10$, H_A: $\mu>75$, $n=50$, $\sigma=12$, $\bar{x}=79.5$.
2. $\alpha=0.05$, H_A: $\mu\neq14$, $n=25$, $\sigma=6$, $\bar{x}=11.2$.
3. $\alpha=0.01$, H_A: $\mu>880$, $n=80$, $\sigma=90$, $\bar{x}=918$.
4. $\alpha=0.10$, H_A: $\mu<15000$, $n=50$, $\sigma=8000$, $\bar{x}=13700$.

Body Temperature

Table 1: Summary statistics for the body temperature of a sample of men and women.

n	mean	sd	min	Q1	median	Q3	max
130.00	36.81	0.41	35.70	36.60	36.80	37.10	38.20

Beetle Size

Researchers examined the size of two different species of beetles. They hypothesized that the thorax length of the *Halticus oleracea* species would be greater than 190 µm. Use their results for the *Halticus oleracea* species in Table 2 and assume that $\sigma=14$ and

α=0.05 to construct and interpret a confidence region for the beetle's mean thorax length.

Table 2: Summary statistics for the thorax length for two species of beetles.

	species	n	mean	sd	min	Q1	median	Q3	max
1	Halticus.carduorum	20	179.55	10.09	158	175.75	180.5	181.75	198
2	Halticus.oleracea	18	194.17	14.03	170	189.75	192.0	200.75	221

This is not a confidence region question, rather it is asking you to compute a sample size given σ, a margin-of-error tolerance, and a level of confidence (which, ultimately, is turned into a Z^*). See here or the appropriate section in the reading for the formula and example calculations.

Internet Usage

Suppose that you are starting a business and it is important for your business plan to have an estimate of the mean weekly Internet usage of households in your city. Assume that you know from previous surveys that the standard deviation of weekly Internet usage is 6.95 minutes.[2]

1. How many households must you randomly select to be 95% sure that the sample mean is within 1 minute of the population mean.
2. How many households must you randomly select to be 90% sure that the sample mean is within 1 minute of the population mean.
3. How many households must you randomly select to be 95% sure that the sample mean is within 0.5 minutes of the population mean.