Handout 1.9: Confidence Intervals

1. A company that produces white bread is concerned about the distribution of the amount of sodium in its bread. The company takes a simple random sample of 100 slices of bread and computes the sample mean to be 103 milligrams of sodium per slice.

   Construct a 99% confidence interval for the unknown mean sodium level assuming that the population standard deviation is 10 milligrams.

2. Fill in the blanks with one of the following: *increases*, *decreases* or *stays the same* where $E = \frac{z^* \sigma}{\sqrt{n}}$ (Hint: try creating your own values and see what happens.)
   a. As the sample size (n) increases, the margin of error (E) _____.
   b. As the confidence interval (C) increases, the margin of error (E) _____.
   c. As the standard deviation (σ) increases, the margin of error (E) _____.

3. You work for consumer advocate agency and want to find the mean repair cost of a washing machine. In the past, the standard deviation of the cost of repairs for washing machines has been $17.50. As part of your study, you randomly select 40 repair costs and find the mean to be $100.00.

   Calculate a 90% confidence interval for the population mean.

4. The actual time it takes to cook a ten pound turkey is normally distributed. Suppose that a random sample of 35 ten pound turkeys is taken.

   Given an average of 2.9 hour and a standard deviation of 0.24 hours was found for a sample of nineteen turkeys, calculate a 90% confidence interval for the average cooking time of a ten pound turkey.

Handout 1.9 Confidence Intervals

$CI = \bar{x} \pm \frac{z^* \sigma}{\sqrt{n}}$

Confidence Level	z^* Value
80%	1.282
85%	1.440
90%	1.645

(1) $\bar{x} = 103$ $\sigma = 10$ $n = 100$ $99\% \rightarrow z^* = 2.576$

$E = \frac{2.576(10)}{\sqrt{100}} = 2.576$

$CI = 103 - 2.576 = 100.424$
and $103 + 2.576 = 105.576$

I can say with 99% confidence that the true mean sodium level in the company's bread is between 100.424 and 105.576 grams.

(2) a) As the sample size (n) increases, the margin of error (E) decreases.
★ This is because you are dividing by a larger number. ★

b) As the confidence interval (C) increases, the margin of error (E) increases.
★ This is because the numerator gets larger ★

c) As the standard deviation (σ) increases, the margin of error (E) increases.
★ Same reasoning ★

(3) $\bar{x} = 100$ $\sigma = 17.50$ $n = 40$ $90\% \rightarrow z^* = 1.645$

$E = \frac{1.645(17.50)}{\sqrt{40}} = 4.55$

$CI = 100 - 4.55 = 95.45$
and $100 + 4.55 = 104.55$

I can say with 90% confidence that the true mean cost of repair for washing machines is between \$94.45 and \$104.55.

(4) $\bar{x} = 2.9 \quad \sigma = 0.24 \quad n = 35 \quad 90\% \rightarrow z^* = 1.645$

$$E = \frac{1.645(0.24)}{\sqrt{35}} = .07$$

CI = 2.9 - 0.07 = 2.83
and 2.9 + 0.07 = 2.97

I can say with 90% confidence that the true mean cook time for a ten pound turkey is between 2.83 and 2.97 hours.