**Confidence Interval for a Population Mean, $\mu$:**

$$\bar{x} \pm z^* \frac{\sigma_x}{\sqrt{n}}$$

where z* is the value on the standard normal curve with are C between –*z** and *z**.

| *z** | 1.645 | 1.960 | 2.576 |
|---|---|---|---|
| *C* | 90% | 95% | 99% |

(Table D in the back of the book contains more values, but these are the most common)

**Sample Size, n, for Desired Margin of Error, m:**

$$n = \left( \frac{z^* \sigma_x}{m} \right)^2$$

Note that it is the sample size, *n*, that influences the margin of error. The population size has nothing to do with it.

**Ways to reduce your margin of error:**

1.) Increase sample size
2.) Use a lower level of confidence (smaller C)
3.) Reduce $\sigma_x$

**Be careful!!!!** You can only use the formula $\bar{x} \pm z^* \frac{\sigma_x}{\sqrt{n}}$ under certain circumstances:

- Data must be an SRS from the population.
- Do not use if the sampling is anything more complicated than an SRS.
- Data must be collected correctly (no bias). The margin of error covers only random sampling errors. Undercoverage and nonresponse are not covered.
- Outliers can have a big effect on the confidence interval. (This makes sense because we use the mean and standard deviation to get a CI.)
- You must know the standard deviation of the population, $\sigma_x$.

**EXAMPLE 1:** A questionnaire of spending habits was given to a random sample of college students. Each student was asked to record and report the amount of money they spent on textbooks in a semester. The sample of 130 students resulted in an average of $422 with standard deviation of $57.

a) Give a 90% confidence interval for the mean amount of money spent by college students on textbooks.

b) Is it true that 90% of the students spent the amount of money found in the interval from part (a)? Explain your answer.

c) What is the margin of error for the 90% confidence interval?

d) How many students should you sample if you want a margin of error of $5 for a 90% confidence interval?

**EXAMPLE 2:** A sample of 12 STAT 301 students yields the following Exam 1 scores:

| | | | | | |
|---|---|---|---|---|---|
| 78 | 62 | 99 | 85 | 94 | 53 |
| 88 | 90 | 86 | 92 | 75 | 92 |

Assume that the population standard deviation is 10. The sample mean can be calculated using SPSS or calculator to be 82.83.

(**Note**: Do NOT use any SPSS confidence intervals—they are good only for Chapter 7, not this type of CI. You must get these *Z* confidence intervals by hand.)

a) Find the 90% confidence interval for the mean score $\mu$ for STAT 301 students.

b) Find the 95% confidence interval.

c) Find the 99% confidence interval.

d) How do the margins of error in (b), (c), and (d) change as the confidence level increases? Why?