INTEGRATED TRAINING AREA MANAGEMENT
ITAM Learning Module
Helpful Note

Calculating Confidence Intervals

A confidence-interval estimate for the population mean, based on sample data, provides information about the precision of the estimate. The confidence level of a confidence interval for a population mean signifies the confidence of the estimate. That is to say, it expresses the confidence we have that the estimated mean value actually lies within the confidence interval. The width of the confidence interval indicates the precision of the estimate; wide confidence intervals indicate poor precision (or high variability), while narrow confidence intervals indicate good precision. For a fixed sample size, the greater the required level of confidence, the greater the width of the confidence interval. Commonly-used levels of confidence are 80%, 90%, 95%, and 99%. For natural resources management purposes, confidence levels of more than 95% are generally impractical, expensive, and unnecessary. The confidence level chosen should be reflective of the amount of risk you are willing to accept in making a false conclusion based on a confidence interval (i.e., the confidence interval does not in fact contain the true population mean).

Calculating Confidence Intervals

The confidence interval for the estimated population mean is calculated using the following equation:

$$\overline{X} \pm t_{a,v} SE$$

where:
t = the critical t value for a confidence level of 1-α and n-1 degrees of freedom
v = number of degrees of freedom = n-1
SE = standard error of the mean

A two-tailed t table is used. In words, we can say that we are 1-α confident that the confidence interval contains the true mean. When referring to a confidence interval, the quantity 1-α (e.g., 1-0.1 = 0.90 or 90%) is referred to as the confidence level. Note that as the standard deviation of the mean becomes smaller, the confidence interval also becomes smaller. Also, as sample size n increases, standard deviation of the mean typically gets smaller. As the confidence level increases (i.e., as α gets smaller), the confidence interval becomes larger. A large α produces a more narrow confidence interval.

In Excel we take advantage of the =TINV() function to return the critical t value used in the equation above. Recall, the function returns the value of a two-tailed distribution. The standard error is calculated as:

$$SE = \sqrt{\frac{s^2}{n}} \text{ or } \frac{s}{\sqrt{n}}$$

where:
s^2 = sample variance
s = standard deviation
n = number of observations

Variance is a common value returned in Excel's data analysis tools. Use the =SQRT() function to return the square root. For example, the following Excel equation would give the standard error given A1 is the cell reference of the sample variance and 8 is the number of observations.

=SQRT(A1/8)

The full equation, for a 90% confidence level ½ width would be:

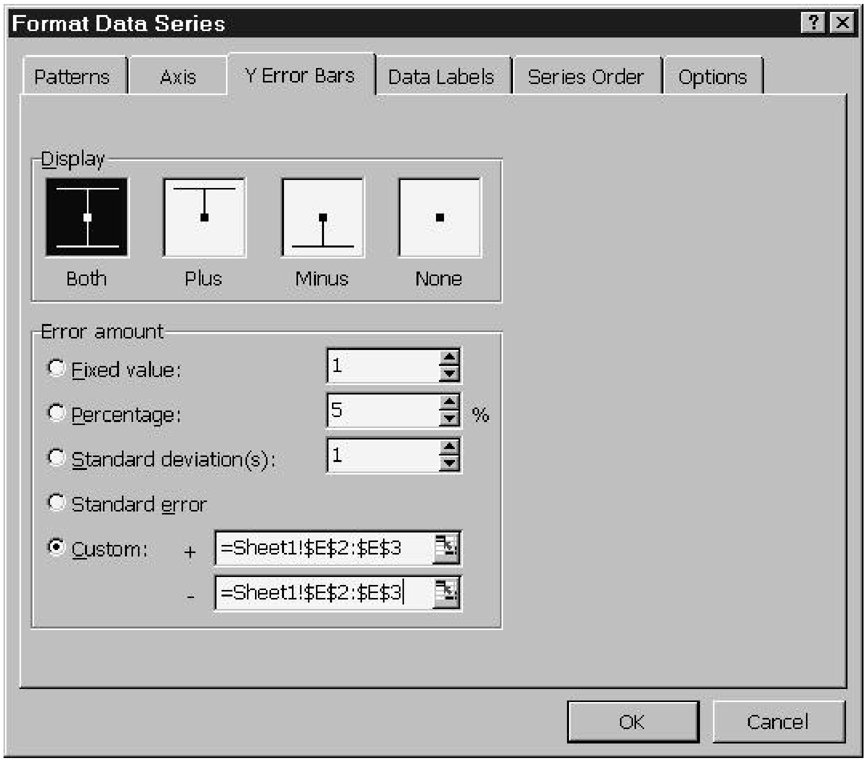
=TINV(0.1,7)* SQRT(A1/8)

where:
0.1 = alpha
7 = degrees of freedom
A1 = cell reference of the sample variance
8 = number of observations

A confidence interval is calculated for each bar of the graph.

Adding Confidence Intervals to Histogram Charts

Double click one of the histogram bars. Select the Y Error Bars tab in the dialog box. Select the Both error bars display option. Fill in the range of the standard errors for the Custom Error Amount option. Place the cursor in the first field marked (+) and highlight the confidence interval cells. Do the same for the field marked (-). Note that every mean will have its own confidence interval value.



The confidence intervals will appear on the graph as shown below.