Example #1
A sample of size $n = 50$ is taken from the production of lightbulbs at a certain factory. The sample mean is found to be $\bar{x} = 1570$ hours. Assume that the population standard deviation is $\sigma = 120$ hours.

a. Construct a 95% confidence interval for $\mu$.

b. Construct a 99% confidence interval for $\mu$.

c. What sample size is needed so that the length of the interval is 30 hours with 95% confidence?

Example #2
The UCLA housing office wants to estimate the mean monthly rent for studios around the campus. A random sample of size $n = 36$ studios is taken from the area around UCLA. The sample mean is found to be $\bar{x} = 900$. Assume that the population standard deviation is $\sigma = 150$.

a. Construct a 95% confidence interval for the mean monthly rent of studios in the area around UCLA.

b. Construct a 99% confidence interval for the mean monthly rent of studios in the area around UCLA.

c. What sample size is needed so that the length of the interval is $60$ with 95% confidence?

Example #3
We want to estimate the population proportion of students that are Democrats at UCLA. A sample of size $n$ is selected. There are $p$ Democrats in the sample.

a. Construct a 95% confidence interval for the population proportion $p$ of students that are Democrats at UCLA. What do you observe?

b. What is the sample size needed in order to obtain a $\pm 2\%$ margin of error?

Example #4
A precision instrument is guaranteed to read accurately to within 2 units. A sample of 4 instrument readings on the same object yielded the measurements 353, 351, 351, and 355. Find a 90% confidence interval for the population variance. What assumptions are necessary? Does the guarantee seem reasonable?

Example #5
A chemical process must produce, on the average, 800 tons of chemical per day. The daily yields for the past week are 785, 805, 790, 793, and 802 tons. Do these data provide evidence that the average production of this chemical is not 800 tons? Use 90% confidence level.

Example #6
A chemist has prepared a product designed to kill 60% of a particular type of insect. What sample size should be used if he desires to be 95% confident that he is within 0.02 of the true fraction of insects killed?

Example #7
Suppose that two independent random samples of $n_1$ and $n_2$ observations are selected from normal populations with means $\mu_1, \mu_2$ and variances $\sigma_1^2, \sigma_2^2$ respectively. Find a confidence interval for the variance ratio $\frac{\sigma_1^2}{\sigma_2^2}$ with confidence level $1 - \alpha$.

Example #8
The sample mean $\bar{X}$ is a good estimator of the population mean $\mu$. It can also be used to predict a future value of $X$ independently selected from the population. Assume that you have a sample mean $\bar{x}$ and a sample variance $s^2$, based on a random sample of $n$ measurements from a normal population. Construct a prediction interval for a new observation $x$, say $x_p$. Use $1 - \alpha$ confidence level. Hint: Start with the quantity $X_p - \bar{X}$ and then use the definition of the $t$ distribution.