1. [5 pts + bonus] A plastic injection molding process for a steel part that has a critical width dimension with a historic standard deviation of 8. Periodically, clogs form in one of the feeder lines, causing the mean width to change. As a result, the operator periodically takes random samples of size four.
   a. A random sample yielded a sample mean of 101.4. Construct a 99% confidence interval for the true mean width.
   b. Find the sample size required to estimate the true mean width to within ±2 units using a 99% confidence interval.
   c. [bonus - 2pts] Give interpretation for this confidence interval.

2. [5 pts + bonus] The modulus of rupture (MOR) for a particular grade of pencil lead is known to have a standard deviation of 250 psi.
   a. A random sample of 16 pencil leads yielded a sample mean of 6490. Construct a 90% confidence interval for the true mean MOR.
   b. Find the sample size required to estimate the true mean MOR to within ±100 using a 90% confidence interval.
   c. [bonus - 2pts] Explain the meaning of the confidence interval you obtained in (a) in the context of the question.
3. [5 pts + bonus] The chemical-etching process etches the layer of silicon dioxide until the layer of metal beneath is reached. AlKimia electronics company monitors the thickness of the silicon oxide layer because thicker layers require longer etching times. A random sample of four wafers yielded a sample mean of 1.134 microns and a standard deviation of 0.65.
   a. Construct a 95% confidence interval for the true mean thickness.
   b. Construct a 99% confidence interval for the true mean thickness.
   c. [bonus - 2pts] Explain in words the meaning of the 95% confidence interval obtained in (a) given the above context.

4. [6 pts + bonus] The chemical-etching process etches the layer of silicon dioxide until the layer of metal beneath is reached. AlKimia electronics company monitors the thickness of the silicon oxide layer in manufacturing because thicker layers require longer etching times. Historically, the layer has a true mean thickness of 1 micron and standard deviation of 0.6 micron.
   (a) A random sample of sixteen wafers yielded a sample mean of 1.15 micron. Find the probability of observing such a mean or something smaller.
   (b) Another recent random sample of sixteen wafers yielded a sample mean of 0.75325 micron. Find the probability of observing such a mean or something smaller.
   (c) [bonus - 2pts] Explain in 1 sentence why you can have different sample means in (a) and (b).
5. [4 pts + bonus] The length of an injected-molded plastic case that holds magnetic tape is normally distributed with a length of 90.15 millimeters and a standard deviation of 0.1 millimeters manufactured by machine A at AtTaweel manufacturing company. The length of similar plastic case manufactured by machine B is also normally distributed with a length of 90.45 millimeters and a standard deviation of 0.1 millimeters.

(a) What is the probability that a random sample of 9 plastic cases from machine A is 0.2 millimeter longer than a random sample of 9 plastic cases produced by machine B?

(b) [bonus - 2pts] What is the shape of the distribution of the sample means in (a)?

6. [4 pts + bonus] The time that a service clerk at Aramco spends on a customer is a random variable with mean 2.6 minutes and a standard deviation of 1.4 minutes. At AlBilad Company the time spent is a random variable with mean 2.9 minutes and a standard deviation of 1.5 minutes. A random sample of 49 customers at Aramco and another random sample of 36 customers at AlBilad are observed.

(a) Find the probability that the mean time spent by these customers is at most 0.5 minutes longer at Aramco.

(b) [bonus - 2pts] What is the shape of the distribution of sample mean difference in (a)?

STOP
You should check your work before the time is up.