7.98

Preventing production of defective items. It costs more to produce defective items–since they must be scrapped or reworked–than it does to produce non-defective items. This simple fact suggests that manufacturers should ensure the quality of their products by perfecting their production processes instead of depending on inspection of finished products (Deming, 1986). In order to better understand a particular metal stamping process, a manufacturer wishes to estimate the mean length of items produced by the pro- cess during the past 24 hours.

a. How many parts should be sampled in order to estimate the population mean to within .2 millimeter (mm) with 95% confidence? Previous studies of this machine have indicated that the standard deviation of lengths produced by the stamping operation is about 2 mm.
b. Time permits the use of a sample size no larger than 100. If a 90% confidence interval for μ is constructed with $n = 100$, will it be wider or narrower than would have been obtained using the sample size determined in part **a**? Explain.

→ This is confusing: should we use the confidence level of 90% or 95%?

a. $$CI_{95\%}(\mu) = \left(\bar{x} \mp \underbrace{z_{0.025}}_{1.96} \frac{s}{\sqrt{n}}\right)$$

$$0.2 > 1.96 \frac{s}{\sqrt{n}} = 1.96 \frac{2}{\sqrt{n}} \Rightarrow n > 1.96^2 \frac{2^2}{0.2^2} = 384.2$$

b. $$CI_{90\%}(\mu) = \left(\bar{x} \mp \underbrace{z_{0.05}}_{1.645} \frac{s}{\sqrt{n}}\right)$$

$$z_{0.05} \frac{s}{\sqrt{n}} = 1.645 \frac{2}{\sqrt{100}} = 0.329 > 0.2$$