1. [33 points] The mean breaking strength of a sample of \( n=121 \) metal beams is \( \bar{x} = 56,311 \) pounds per square inch. We know from past experience that the standard deviation of one single measurement is \( \sigma = 457 \) pounds per square inch. Find the 95% confidence interval for the population mean \( \mu \).

2. [33 points] The sample mean and sample standard deviation of a random sample of \( n=100 \) ACT average scores are 27.89 and 2.71 respectively. Find the 99% confidence interval for the population mean \( \mu \).

3. [33 points] A random sample of \( n=36 \) tires is taken from a population for which the lifetime of a tire in miles is known to be normally distributed. The sample mean and sample variance are 38,751 miles and 9,312,876 respectively. Find the 90% confidence interval for the population mean \( \mu \).

4. Suppose that you own a movie theater and that you have purchased a filling machine for candy bags which, according to the manufacturer, is supposed to fill each bag with 16 oz. of candy. You want to find out if the (population) mean \( \mu \) is actually 16 oz.: so, you take a random sample of 16 bags which yields the following data (in oz.):

15.89 16.05 15.79 15.94 15.69 15.81 15.99 15.82 15.92 15.82 15.90 15.70 15.88 15.80 15.90 15.83

(a) [25 points] Find the 95% confidence interval for the population mean \( \mu \). Assume that the weights of filled bags are approximately normally distributed.

(b) [25 points] On the basis of these data, what do you conclude about the claim that the population mean fill weight is 16 oz.? Give your reasoning. Begin your reasoning with whether or not 16 is in the 95% confidence interval.
5. Assume that everything is as described in problem 1 except that you took a random sample of 49 bags. Assume that the sample mean and sample variance are the same as the sample mean and sample variance you calculated for 16 bags in problem 1.

(a) [25 points] Find the 95% confidence interval for the population mean $\mu$. (Do you need to assume that the weights of filled bags are approximately normally distributed?)

(b) [25 points] On the basis of these data, what do you conclude about the claim that the population mean fill weight is 16 oz.? Give your reasoning. Begin your reasoning with whether or not 16 is in the 95% confidence interval.