Question 1:
Suppose that a random sample of 50 bottles of a particular brand of cough syrup is selected and the alcohol content of each bottle is determined. Let $\mu$ denote the average alcohol content for the population of all bottles of the brand under study. Suppose that the resulting 95% confidence interval is $(7.8, 9.4)$.

a. Would a 90% confidence interval calculated from this same sample have been narrower or wider than the given interval. Explain your reasoning.

b. Consider the following statement: There is a 95% chance that $\mu$ is between 7.8 and 9.4. Is this statement correct? Why or why not?

c. Consider the following statement: We can be highly confident that 95% of all bottles of this type of cough syrup have an alcohol content that is between 7.8 and 9.4. Is this statement correct? Why or why not?

d. Consider the following statement: If the process of selecting a sample of size 50 and computing the corresponding 95% interval is repeated 100 times, 95 of the resulting intervals will include $\mu$. Is this statement correct? Why or why not?
Question 2:
The article "Measuring and Understanding the Aging of Kraft Insulating Paper in Power Transformers", IEEE electrical Insul. Mag. 1996:28-34) contained the following observations on degree of polymerization for paper specimens for which viscosity time concentration fell in a certain middle range:

418 421 421 422 425 427 431 434 437 439 446 447 448 453 454 463 465

a. Construct a boxplot of the data (using MINITAB) and comment on interesting features.
b. It is plausible that the given sample observations were selected from a normal distribution?
c. Calculate a two-sided 95% confidence interval for true average degree of polymerization (as did the authors of the article). Does the interval suggest that 440 is a plausible value for true average degree of polymerization. What about 450?
Question 3:
A random sample of 110 lightning flashes in a certain region resulted in a sample average radar echo of .81 sec. and a sample standard deviation of .34 sec. ("Lightning Strikes to an Airplane in a Thunderstorm," *Journal of Aircraft*, 1984:607-611). Calculate a 99% (two-sided) confidence interval for the true average echo duration \( \mu \), and interpret the resulting interval.

Question 4:
The amount of lateral expansion (mils) was determined for a sample of \( n = 9 \) pulsed-power gas metal arc welds used in LNG ship containment tanks. The resulting sample standard deviation was \( s = 2.81 \) *mils*. Assuming normality, derive a 95% CI for \( \sigma^2 \) and \( \sigma \).
Question 5:
Light bulbs of a certain type are advertised as having an average lifetime of 750 hours. The price of these bulbs is favorable, so a potential customer has decided to go ahead with a purchase arrangement unless it can be conclusively determined that the true average lifetime is smaller than what is advertised. A random sample of 50 bulbs was selected, the lifetime of each bulb determined, resulting in the following output: \( \bar{x} = 738.44, \ s = 38.20 \). What conclusion would be appropriate at a significance level of .05, A significance level .01? Calculate the \( p \)-value of the hypothesis test. What significance level and conclusion would you recommend?

Question 6:
The melting point of each of 16 samples of a certain brand of hydrogenated oil was determined, resulting in \( \bar{x} = 94.32, \ s = 1.20 \). Assume that the distribution of melting point is normal distributed.

a. Test: \( H_0 : \mu = 95 \) versus \( H_a : \mu \neq 95 \) using a two-tailed level .01 test.

b. If a level .01 test is used, what is the probability of type II error when \( \mu = 94 \) (denoted \( \beta(94) \)).

c. What value of \( n \) is necessary to ensure that \( \beta(94) = .1 \) when \( \alpha = .01 \).