Homework is due by 5:00 PM on the due date in my office. You can always hand in your homework at the end of lecture on Monday.

You may talk with others about the homework problems but please write your solutions up independently. Please answer homework questions in complete sentences. Make sure to staple the pages of your assignment together. **Be sure to indicate your lab section on your paper.**

You will have an opportunity to get help on homework during lab.

**Reading:**

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**Assignment:**

1. Read pages 296-318 and do exercises 6.4, 6.12, and 6.22 in the text.

2. Scores on the first Stat 101 exam (75 point maximum, for all sections) have a left skewed distribution. These scores have a mean $\mu=57$ and a standard deviation $\sigma=14$.

   (a) Why is the normal distribution assumption inappropriate for describing the shape of the individual exam scores?

   (b) What does the Central Limit Theorem indicate about the sampling distribution of the sample mean for random samples of $n=25$ first exam scores?

   (c) What values contain the central 95% of sample means ($n=25$)?

   (d) With 95% confidence, what is the margin of error associated with a sample mean of 25 scores?

3. The Environmental Protection Agency (EPA) evaluates new car models to determine if their exhaust contains safe levels of emissions. Naturally their equipment is not perfectly precise so that repeated measurements of carbon monoxide have a standard deviation of $\sigma = 0.7$. The maximum allowed level of carbon monoxide is 1.8.

   (a) Suppose that 49 measurements are taken on a car and the sample mean of these measurements is $\bar{X} = 1.66$ ppm. Construct a 95% confidence interval for the true mean value $\mu$ ($\mu$ can be thought of as the population mean - the average that would be found in a long sequence of repeated measurements on the car).

   (b) Based on the 49 measurements can the EPA be confident that the car is below the maximum level? Justify your answer by referring to your interval in (a).

   (c) The car manufacturer does not believe the calculation because according to him; “Some measurements of carbon monoxide levels are below 1.0 and your interval doesn’t include them.” Explain how the manufacturer has misinterpreted the confidence interval.

   (d) The EPA has the opportunity to buy a new machine which will provide more precise measurements, the standard deviation is $\sigma = 0.35$. Suppose a random sample of 49 measurements on the new machine finds $\bar{X} = 1.66$ ppm. Construct a 95% confidence interval.
interval for $\mu$. What effect does lowering the variability of individual measurements have on the confidence interval. Can the EPA now be confident that the car is below the maximum allowed level?

4. Child development researchers would like to be able to construct a 98% confidence interval for the mean reading ability of the population of third graders. They would like to be able to get a sample mean reading ability score that is within 5 points of the true population mean reading ability score, i.e. a margin of error of 5 points. They assume that reading ability scores are normally distributed with $\sigma = 12$.

(a) If the researcher’s used all of their budget on data collection, they could obtain reading scores for a random sample of $n = 100$ third graders. Calculate the margin of error (98% confidence) for a sample of this size. Is this less than their goal of a 5 point margin of error?

(b) There are other demands on the research budget (e.g. salaries, computer time, trips to meetings in the Bahamas). If all of these demands were met, there would be enough funds to obtain reading scores for a random sample of only $n = 10$ third graders. Calculate the margin of error for a 98% confidence interval based on $n = 10$ scores. Is this less than their goal of a 5 point margin of error?

(c) Find the smallest value of $n$ (remember $n$ must be a whole number, you can’t chop third graders into pieces) that would satisfy the researcher’s goal of a 98% confidence interval with a margin of error of 5 or less. Is this value of $n$ within the limits of the budget in (b)?

(d) Repeat part (c) only this time reduce your confidence to 80%.

5. Birth weights of full term healthy babies are normally distributed with a mean $\mu=3,500$ grams and a standard deviation $\sigma=410$ grams. A pediatric nurse is going over records of birth weights at a large metropolitan hospital and finds a sample of 16 babies that had a mean birth weight of 3,200 grams.

(a) What is the chance that a random sample of 16 full term healthy babies would have a mean birth weight less than or equal to 3,200 grams?

(b) Based on your calculation in (a), is it likely or unlikely that the sample of 16 babies with a mean birth weight of 3,200 grams is a random sample of healthy full term babies?

(c) Babies born to cocaine-dependent women tend to have lower birth weights. Specifically, the birth weights are normally distributed with a mean $\mu=3,000$ grams and a standard deviation $\sigma=350$ grams. What is the chance that a random sample of 16 babies born to cocaine-dependent mothers would have a mean birth weight less than or equal to 3,200 grams?

(d) Based on your calculation in (c), is it likely or unlikely that the sample of 16 babies with a mean birth weight of 3,200 grams is a random sample of babies born to cocaine-dependent mothers?

(e) Based on the probability calculations above, what type of babies, normal full term or born to cocaine-dependent mothers, make up the sample of 16 with a mean birth weight of 3,200 grams? Explain briefly.