Lab Assignment #16

This lab is due at 9:35 AM on Wednesday, 3/27 and is worth 6 points. This may be done individually, or in a group of 2 or 3 people.

Write each probability answer as a fraction, or a decimal to at least 3 significant digits, or a percent to at least 3 significant digits. Show work.

1) Gather up five 6-sided dice. (Or one 6-sided die and roll it 5 times. Or use a die-rolling simulation from the Internet or something.) Write down the 5 numbers, and calculate the sample mean of the 5 numbers. Do this a total of 18 times. (Eighteen samples of 5 die rolls.) Record the 5 rolls and sample mean for each of the 18 times.

1a) Make a histogram of the 18 sample means using these classes. Notice that none of your sample means will be at a class boundary.

0.5-1.5   1.5-2.5   2.5-3.5   3.5-4.5   4.5-5.5   5.5-6.5

1b) Describe the shape of your distribution.

1c) Find the average value of your 18 sample means. Write it here:

1d) Find the sample standard deviation of your 18 sample means. Write it here:

If you were to do this many more than 18 times, you would expect that the average of all of the possible sample means, $\mu_{\bar{x}}$, would equal $\mu = 3.5$, which is the average of a single die roll.

1e) Was the average of your 18 sample means close to 3.5?

If you were to do this many more than 18 times, you would expect that the standard deviation of all of the possible sample means, $\sigma_{\bar{x}}$, would equal $\dfrac{\sigma}{\sqrt{n}} = \dfrac{1.707^*}{\sqrt{5}} = 0.763$.

1f) Was the standard deviation of your 18 sample means close to 0.763?

*In case you are curious, the 1.707 is the population standard deviation of the list of numbers 1, 2, 3, 4, 5, 6, which, of course, are the possible outcomes from rolling one die.)

2) The average weight of baseballs is 5.11 ounces with a standard deviation of 0.05 ounces. Assume the weights are normally distributed.

a) What fraction of balls weigh between 5.10 and 5.14 ounces?

b) What fraction of balls weigh more than 5.20 ounces?

c) For a sample of 6 balls, explain why you can assume that sample means are normally distributed.

d) In a sample of 6 balls, what is the probability that the average weight is between 5.10 and 5.14 ounces?

e) In a sample of 6 balls, what is the probability that the average weight is more than 5.20 ounces?

f) Explain in words the relationship between your answers in (a) and (d). Why is one number bigger than the other?

g) Explain in words the relationship between your answers in (b) and (e). Why is one number bigger than the other?

3) The average amount of money won in a game of "Jeopardy!" is $12,750, with a standard deviation of $5,100. In a two-month period, there are 45 Jeopardy! games played.

a) Explain why you can assume that the sample means of 45 Jeopardy! games will be normally distributed.

b) Find $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$.

c) What is the probability that the average money won in this sample of 45 games is less than $12,000?

d) What is the probability that the average money won in this sample of 45 games is less than $11,000?