Confidence Intervals   Name:_____

The Bob Barker Foundation, in collaboration with the Stud Dog Union, report that 58% of male dogs are neutered. You decide to taking a random sample of 100 dogs to gather more information.

Questions

1. What is the sampling distribution of $\hat{p}$ for random samples of size $n = 100$?
   hint: $p = 0.58$ and you may assume all conditions are satisfied.

2. If we were to sample repeatedly, between what two proportions would we expect to see 90% of the $\hat{p}$ values? *hint: $z^* = 1.645$*

$$\hat{p}_{\text{lower}} = -z^* \times (SD_{\hat{p}}) + p =$$
$$\hat{p}_{\text{upper}} = +z^* \times (SD_{\hat{p}}) + p =$$

20 random samples from the sampling distribution in problem 1 were generated and the sample proportions, $\hat{p}$ values, are given below.

$$0.48\ ,\ 0.51\ ,\ 0.52\ ,\ 0.54\ ,\ 0.54\ ,\ 0.57\ ,\ 0.58\ ,\ 0.58\ ,\ 0.59\ ,\ 0.59$$
$$0.59\ ,\ 0.60\ ,\ 0.61\ ,\ 0.62\ ,\ 0.62\ ,\ 0.62\ ,\ 0.63\ ,\ 0.64\ ,\ 0.68\ ,\ 0.74$$

3. Which of the 20 sample proportions, $\hat{p}$ values, above are NOT in the 90% interval calculated in question 2?

4. Calculate a 90% confidence interval using the sample proportion, $\hat{p} = 0.68$.

$$\text{90\% confidence interval formula is} \quad \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

5. Does this confidence interval contain the value for the population proportion (the proportion of neutered dogs) claimed by the Bob Barker Foundation?

6. Now consider the case where our sample proportion is one of the $\hat{p}$ values that was in the 90% interval from Question 2. For instance, $\hat{p} = 0.54$. Calculate a 90% confidence interval using this sample proportion.

$$\text{90\% confidence interval formula is} \quad \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

7. Does this confidence interval contain the value for the population proportion (the proportion of neutered dogs) claimed by the Bob Barker Foundation?

8. If I made 90% confidence intervals for all 20 of the sample proportions, $\hat{p}$ values, generated, what proportion of them would contain the population proportion?
   hint: see your answer to question 3.

In the real world we don't know the true value of the population proportion and we only get to take one sample.

8. Complete the interpretation of the confidence interval from Problem 6.

   I am _____ that the _____ *(insert parameter)*

   of all male dogs that are neutered is between _____ and _____.

9. Considering the 90% confidence interval from Problem 6 as being based on our one and only sample, which of the following would we consider plausible values for the population proportion?
   □ $p = 0.42$
   □ $p = 0.49$
   □ $p = 0.58$
   □ $p = 0.61$
   □ $p = 0.80$