Week 1 Quiz

Quiz, 7 questions

6/7 points (85.71%)

Congratulations! You passed!

Next Item

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point

1.
We want to estimate the average coffee intake of Coursera students, measured in cups of coffee. A survey of 1,000 students yields an average of 0.55 cups per day, with a standard deviation of 1 cup per day. Which of the following is **not necessarily true**?

- The sample distribution is right skewed.
- 0.55 is a point estimate for the population mean.
- $\mu = 0.55, \sigma = 1$

Correct
This question refers to the following learning objective(s): Define sample statistic as a point estimate for a population parameter, for example, the sample mean is used to estimate the population mean, and note that point estimate and sample statistic are synonymous.

Just because the sample statistics are these values doesn't mean the population values will be exactly equal to them, therefore it's not necessarily true that $\mu = 0.55, \sigma = 1$.

- $\bar{x} = 0.55, s = 1$

1 / 1
point

2.
Which of the following is **false**?

- As the sample size increases, the variability of the sampling distribution decreases.
- Standard error computed based on a sample standard deviation will always be lower than the standard deviation of that sample.

Standard error measures the variability in means of samples of the same size taken from the same population.

In order to reduce the standard error by half, sample size should be doubled.

Correct
Since n is underneath a square root in the denominator of the formula for standard error. Because of the square root, to reduce the standard error by half you would actually need a sample size four times (2^2) as high.

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1 / 1
point

3.
The standard error measures:

the variability of sample statistics

Correct
This question refers to the following learning objective(s): Distinguish standard deviation (σ or s) and standard error (SE): standard deviation measures the variability in the data, while standard error measures the variability in point estimates from different samples of the same size and from the same population, i.e. measures the sampling variability.

the variability in the population

the variability of population parameters

the variability of the sampled observations

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0 / 1
point

4.
Which of the following is false about the central limit theorem (CLT)?

As the sample size increases, the sampling distribution of the mean is more likely to be nearly normal, regardless of the shape of the original population distribution.

This should not be selected
This question refers to the following learning objective(s):

Recognize that the Central Limit Theorem (CLT) is about the distribution of point estimates, and that given certain conditions, this distribution will be nearly normal.

- In the case of the mean the CLT tells us that if

(1a) the sample size is sufficiently large $(n \geq 30)$ and the data are not extremely skewed or

(1b) the population is known to have a normal distribution, and

(2) the observations in the sample are independent,

then the distribution of the sample mean will be nearly normal, centered at the true population mean and with a standard error of $\frac{\sigma}{\sqrt{n}}$.

$$\bar{x} \sim N\left(mean = \mu, SE = \frac{\sigma}{\sqrt{n}}\right)$$

- When the population distribution is unknown, condition (1a) can be checked using a histogram or some other visualization of the distribution of the observed data in the sample.
- The larger the sample size (n), the less important the shape of the distribution becomes, i.e. when n is very large the sampling distribution will be nearly normal regardless of the shape of the population distribution.

Review the associated learning objective.

- ○ If the population distribution is normal, the sampling distribution of the mean will also be nearly normal, regardless of the sample size.
- ○ The CLT states that the sampling distribution will be centered at the true population parameter.
- ○ If we take more samples from the original population, the sampling distribution is more likely to be nearly normal.

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1 / 1
point

5.
A random sample of 100 runners who completed the 2012 Cherry Blossom 10 mile run yielded an average completion time of 95 minutes. A 95% confidence interval calculated based on this sample is 92 minutes to 98 minutes. Which of the following is false based on this confidence interval?

- ○ We are 95% confident that the true average finishing time of all runners who completed the 2012 Cherry Blossom 10 mile run is between 92 minutes and 98 minutes.
- ○

Based on this 95% confidence interval, we would reject a null hypothesis stating that the true average finishing time of all runners who completed the 2012 Cherry Blossom 10 mile run is 90 minutes.

- The margin of error of this confidence interval is 3 minutes.

- 95% of the time the true average finishing time of all runners who completed the 2012 Cherry Blossom 10 mile run is between 92 minutes and 98 minutes.

Correct
This question refers to the following learning objective(s):

- Interpret a confidence interval as “We are XX% confident that the true population parameter is in this interval”, where XX% is the desired confidence level.
- Define margin of error as the distance required to travel in either direction away from the point estimate when constructing a confidence interval.

The "true average finishing time" is a fixed number whose exact value we do not know. So it does not make sense to talk about the true average finishing time being between two numbers "95\% of the time".

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1 / 1
point

6.
All but one of the following confidence intervals has a margin of error of 0.7. Which is the confidence interval with the different margin of error?

- (−0.5,0.9)

- (1.6,4.4)

Correct
This question refers to the following learning objective(s):

- Recognize that when the sample size increases we would expect the sampling variability to decrease.
- Define margin of error as the distance required to travel in either direction away from the point estimate when constructing a confidence interval, i.e. $z^\star \times SE$.

The width of a confidence interval is 2 times the margin of error, since we add and subtract the same margin of error to the sample statistics to obtain the bounds of the confidence interval. To solve this question we need to calculate the margin of error using this rule for each choice:

$$|(1.6 - 4.4)/2| = 1.4$$

(20.3,21.7)

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(−4.7,−3.3)

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7.
A company offering online speed reading courses claims that students who take their courses show a 5 times (500%) increase in the number of words they can read in a minute without losing comprehension. A random sample of 100 students yielded an average increase of 415% with a standard deviation of 220%.

Calculate a 95% confidence interval for the average increase in number of words students can read in a minute without losing comprehension. Choose the closest answer.

(378.7, 451.3)

(411.37, 418.63)

(371.88, 458.12)

Correct
This question refers to the following learning objective(s): Recognize that the nearly normal distribution of the point estimate (as suggested by the CLT) implies that a confidence interval can be calculated as

$$point\ estimate \pm z^\star \times SE,$$

where $z^\star$ corresponds to the cutoff points in the standard normal distribution to capture the middle XX\% of the data, where XX\% is the desired confidence level.

- For means this is: $\bar{x} \pm z^\star \frac{s}{\sqrt{n}}$
- Note that $z^\star$ is always positive.

The 95% confidence interval can be calculated as follows:

$$\begin{aligned} \bar{x} \pm z^\star se(\bar{x}) &= 415 \pm 1.96 \times \frac{220}{\sqrt{100}} \\ &= 415 \pm 43.12 \\ &= (371.88, 458.12) \end{aligned}$$

(412.09, 417.91)

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