1. Suppose we are interested in studying how much chocolate is consumed by Coursera students, measured in grams per week. After surveying 500 students, we calculate an average of 175 grams per week with a standard deviation of 195 grams per week. Which of the following is **not necessarily true**?

- ○ A point estimate for the population standard deviation is 195.
- ○ $\bar{x} = 175, s = 195$
- ○ A histogram of the samples will be skewed to the right.
- ◉ $\mu = 175, \sigma = 195$

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 $\mu = 175, \sigma = 195$.

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

- ○ Standard error computed based on a sample standard deviation will always be lower than the standard deviation of that sample.
- ○ In order to reduce the standard error by half, sample size should be increased by a factor of 4.
- ◉ Standard error measures the variability in means of samples of the same size taken from different populations.
- ○ As the sample size increases, the variability of the sampling distribution decreases.

Correct

This question refers to the following learning objective(s): Calculate the sampling variability of the mean, the standard error, as $SE = \sigma/\sqrt{n}$.

Referring to the formula $SE = \sigma/\sqrt{n}$, standard error is calculated using samples from the **same** population (which has population standard deviation σ).

3. The ages of pennies at a particular bank follow a nearly normal distribution with mean 10.44 years with standard deviation 9.2 years. Say you take random samples of 30 pennies, find the mean age in each sample, and plot the distribution of these means. Which of the following are the **best** estimates for the center and spread of this distribution?

- (selected) mean = 10.44,

  standard error = $9.2/\sqrt{30} = 1.68$

- mean = 10.44,

  standard error = 9.2/30 = 0.31

- mean = 10.44,

  standard error = 9.2

- mean = 10.44/30 = 0.348,

  standard error = $(9.2/30)^2 = 0.094$

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.

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

4. Which of the following is **true** about sampling distributions?

- Shape of the sampling distribution is always the same shape as the population distribution, no matter what the sample size is.
- (selected) Sampling distributions get closer to normality as the sample size increases.
- Sampling distributions are always nearly normal.
- Sampling distribution of the mean is always right skewed since means cannot be smaller than 0.

Correct

The Central Limit Theorem states that the sampling distribution (distribution of sample means) will be nearly normal if the population distribution is nearly normal **or** if not, the sample size is large, and a larger sample size results in a more normal sampling distribution.

5. To get an estimate of consumer spending in the U.S. following the Thanksgiving holiday, 436 randomly sampled American adults were surveyed. Their daily spending for the six-day period following Thanksgiving averaged $84.71. A 95% confidence interval based on this sample is ($80.31, $89.11). Which of the following are true?

   I. We are 95% confident that the average spending of the 436 American adults in this sample is between $80.31 and $89.11.

   II. If we collected many random samples of the same size and calculated a confidence interval for daily spending for each sample, then we would expect 95% of the intervals to contain the true population parameter.

   III. We are 95% confident that the average spending of all American adults is between $80.31 and $89.11.

   - ○ I and II
   - ○ I and III
   - ◉ II and III
   - ○ I, II, and III
   - ○ None

6. Which of the following is **false** about confidence intervals?All else held constant.

   - ○ as the standard deviation of the sample increases, the width increases.
   - ◉ as the confidence level increases, the width decreases.
   - ○ as the sample mean increases, the margin of error stays constant.
   - ○ as the sample size increases, the margin of error decreases.

   ✓ **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. $z^\star \times SE$.

   This is false: To understand why, you could think about the most extreme case: increasing the confidence level to 100% would mean your confidence intervals (calculated under repeated samples) would capture the true parameter 100% of the time! So increasing the confidence level should increase the width of the confidence interval.