

QUESTIONS:

1. A _____ is a type of estimation that uses a single value, oftentimes a sample statistic, to infer information about the population parameter as a single value or point.
 - Point estimate
 - Confidence level
 - Interval estimate
 - Sample Statistic

2. An _____ is a type of estimation that uses a range (or interval) of values, based on sampling information, to "capture" or "cover" the true population parameter being inferred.
 - Point estimate
 - Confidence level
 - Interval estimate
 - Significant level

3. An _____ is one who's expected value is equal to the population parameter being estimated.
 - Sample statistic
 - Efficient estimate
 - Confidence interval
 - Unbiased estimate

4. Identify all of the statements below that are true:
 - A. The standard error can be computed solely from sample attributes
 - B. The standard error is a measure of central tendency
 - C. There are two types of estimates, Point Estimates & Interval Estimates
 - D. The Expected Value of the sample mean distribution is analogous to the standard deviation in that it is a reflection of the dispersion of sample mean values
 - A, D
 - A, C
 - B, C
 - B, D

5. A "high quality" estimator (point estimate / interval estimate) has which of the two following properties:
 - Unbiased
 - Efficient
 - Low alpha risk
 - Low beta risk

6. Identify the statement below that is correct for the following data set: 2, 4, 6, 6, 4, 2
- Mean = 4, Median = 4
 - Mean = 6, Median = 4
 - Mean = 6, Median = 6
 - Mean = 4, Median = 6
7. Identify the statement below that is correct for the following data set: 1.6, 2.1, 1.9, 2.4, 2.3, 1.7
- Mean = 1.9, Median = 1.80
 - Mean = 1.9, Median = 2.10
 - Mean = 2.0, Median = 2.0
 - Mean = 2.0, Median = 1.80
8. Calculate the point estimate for the sample mean using the following 5 sample data points: 116, 123, 133, 127, 119
- Sample Mean = 123.4
 - Sample Mean = 123.6
 - Sample Mean = 123.5
 - Sample Mean = 123.8
9. Find the sample standard deviation for the following sample data set: 2, 4, 6, 6, 4, 2
- Sample Standard Deviation = 3.20
 - Sample Standard Deviation = 2.16
 - Sample Standard Deviation = 1.79
 - Sample Standard Deviation = 1.47
10. Find the sample standard deviation for the following sample data set: 1.5, 2.1, 1.8, 2.4, 2.3, 1.9
- Sample Standard Deviation = 0.33
 - Sample Standard Deviation = 0.30
 - Sample Standard Deviation = 0.09
 - Sample Standard Deviation = 0.11

11. You're attempting to estimate the weight of the population of men in the U.S. You've sampled 1,000 men and found the mean value to be 175 lbs. and the sample standard deviation to be 10 lbs. What is the standard error of the sample mean distribution?
- 10 lbs
 - 0.32 lbs
 - 0.10 lbs
 - 100 lbs
12. You've taken a sample of 25 units from a population, and you're measuring the length of the part. If the mean value is 1.65in, and the standard deviation is 0.25in. What is the standard error of the sample mean distribution?
- 0.25 in
 - 0.05 in
 - 0.0025 in
 - 0.10 in
13. According to a recent survey 30% of households in the U.S. have a dog. If you were to randomly select 5 houses, what is the likelihood that 3 houses have a dog?
- 6%
 - 10%
 - 13%
 - 17%
14. You work at a manufacturing facility producing a product whose defects follow the Poisson distribution. You build approximately 100 units per day, and the mean number of defects per day is equal to 3. What is the probability that you will experience 5 defects in one day?
- 5%
 - 10%
 - 15%
 - 25%
15. You're attempting to estimate the length of the product you're producing. You sample 100 units and found the sample mean length to be 15.5" and the sample standard deviation to be 1.5". What is the standard error of the sample mean distribution?
- 1.5"
 - 0.15"
 - 0.015"
 - 15.0"

SOLUTIONS:

1. A _____ is a type of estimation that uses a single value, oftentimes a sample statistic, to infer information about the population parameter as a single value or point.
 - **Point estimate**
 - Confidence level
 - Interval estimate
 - Sample Statistic

2. An _____ is a type of estimation that uses a range (or interval) of values, based on sampling information, to "capture" or "cover" the true population parameter being inferred.
 - Point estimate
 - Confidence level
 - **Interval estimate**
 - Significant level

3. An _____ is one who's expected value is equal to the population parameter being estimated.
 - Sample statistic
 - Efficient estimate
 - Confidence interval
 - **Unbiased estimate**

4. Identify all of the statements below that are true:
 - A. The **standard error** can be computed solely from sample attributes - *True, the standard error can be computed from a knowledge of sample attributes - sample size and sample statistics.*
 - B. The standard **error** is a measure of **central tendency (variability)** - **False**
 - C. There are two types of estimates, **Point Estimates & Interval Estimates** - **True**
 - D. The **Expected Value (Standard Error)** of the sample mean distribution is analogous to the standard deviation in that it is a reflection of the dispersion of sample mean values – **False**
 - A, D
 - **A, C**
 - B, C
 - B, D

5. A "high quality" estimator (point estimate / interval estimate) has which of the two following properties:
 - **Unbiased**
 - **Efficient**
 - Low alpha risk
 - Low beta risk

6. Identify the statement below that is correct for the following data set: 2, 4, 6, 6, 4, 2

- Mean = 4, Median = 4
- Mean = 6, Median = 4
- Mean = 6, Median = 6
- Mean = 4, Median = 6

$$\text{Sample Mean: } \bar{X} = \frac{\sum x}{n} = \frac{2 + 4 + 6 + 6 + 4 + 2}{6} = 4$$

Median: ~~2, 2, 4, 4, 6, 6~~, The middle value (Median) is 4.

7. Identify the statement below that is correct for the following data set: 1.6, 2.1, 1.9, 2.4, 2.3, 1.7

- Mean = 1.9, Median = 1.80
- Mean = 1.9, Median = 2.10
- Mean = 2.0, Median = 2.00
- Mean = 2.0, Median = 1.80

$$\text{Sample Mean: } \bar{X} = \frac{\sum x}{n} = \frac{1.6 + 2.1 + 1.9 + 2.4 + 2.3 + 1.7}{6} = 2.0$$

$$\text{Median: } \del{1.5, 1.7, 1.9, 2.1, 2.3, 2.4} = \frac{1.9 + 2.1}{2} = 2.00$$

8. Calculate the point estimate for the sample mean using the following 5 sample data points: 116, 123, 133, 127, 119

- Sample Mean = 123.4
- Sample Mean = 123.6
- Sample Mean = 123.5
- Sample Mean = 123.8

$$\text{Sample Mean: } \bar{X} = \frac{\sum x}{n} = \frac{116 + 123 + 133 + 127 + 119}{5} = 123.6$$

9. Find the sample standard deviation for the following sample data set: 2, 4, 6, 6, 4, 2

x_i	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
2	$(2 - 4) = -2$	4
4	$(4 - 4) = 0$	0
6	$(6 - 4) = 2$	4
6	$(6 - 4) = 2$	4
4	$(4 - 4) = 0$	0
2	$(2 - 4) = -2$	4
		16

$$\text{Sample Standard Deviation: } s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}} = \sqrt{\frac{16}{6 - 1}} = 1.79$$

- Sample Standard Deviation = 3.20
- Sample Standard Deviation = 2.16
- **Sample Standard Deviation = 1.79**
- Sample Standard Deviation = 1.47

10. Find the sample standard deviation for the following sample data set: 1.5, 2.1, 1.8, 2.4, 2.3, 1.9

x_i	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
1.5	$(1.5 - 2.0) = -0.5$	0.25
2.1	$(2.1 - 2.0) = 0.1$	0.01
1.8	$(1.8 - 2.0) = -0.2$	0.04
2.4	$(2.4 - 2.0) = 0.4$	0.16
2.3	$(2.3 - 2.0) = 0.3$	0.09
1.9	$(1.7 - 2.0) = -0.1$	0.01
		0.56

$$\text{Sample Standard Deviation: } s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}} = \sqrt{\frac{0.56}{6 - 1}} = 0.33$$

- **Sample Standard Deviation = 0.33**
- Sample Standard Deviation = 0.30
- Sample Standard Deviation = 0.09
- Sample Standard Deviation = 0.11

11. You're attempting to estimate the weight of the population of men in the U.S. You've sampled 1,000 men and found the mean value to be 175 lbs and the sample standard deviation to be 10 lbs. What is the standard error of the sample mean distribution?

- 10 lbs
- 0.32 lbs
- 0.10 lbs
- 100 lbs

$$\text{Standard Error of The Sample Mean: } S.E. = \sqrt{\frac{\sigma^2}{n}} = \frac{\sigma}{\sqrt{n}}$$

$$S.E. = \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{1000}} = 0.32$$

12. You've taken a sample of 25 units from a population, and you're measuring the length of the part. If the mean value is 1.65in, and the standard deviation is 0.25in. What is the standard error of the sample mean distribution?

- 0.25 lbs
- 0.05 lbs
- 0.0025 lbs
- 0.10 lbs

$$\text{Standard Error of The Sample Mean: } S.E. = \sqrt{\frac{\sigma^2}{n}} = \frac{\sigma}{\sqrt{n}}$$

$$S.E. = \frac{\sigma}{\sqrt{n}} = \frac{0.25}{\sqrt{25}} = 0.05$$

13. According to a recent survey, 30% of households in the U.S. have a dog. If you were to randomly select 5 houses, what is the likelihood that 3 houses have a dog?

- 6%
- 10%
- **13%**
- 17%

We can use the binomial equation to solve this problem.

$$P(x = k) = \binom{n}{k} p^k (1 - p)^{n-k}$$

$$P(x = 3) = \binom{5}{3} \cdot 30^3 (1 - .30)^{5-3}$$

$$\binom{5}{3} = \frac{5!}{3!(5-3)!} = \frac{5!}{3! * 2!} = \frac{5 * 4}{2 * 1} = 10$$

$$P(x = 3) = (10) * (.30)^3 (.70)^2 = 0.1323 = 13.2\%$$

14. Your build approximately 100 units per day, and your process has an average number of defects per day is equal to 3. What is the probability that you will experience 5 defects in one day?

- 5%
- **10%**
- 15%
- 25%

To calculate the probability of occurrence when using the Poisson distribution we use the following equation:

$$f(x) = P(X = x) = \frac{e^{-\lambda} * \lambda^x}{x!}$$

$$f(5) = P(X = 5) = \frac{e^{-3} * 3^5}{5!} = 0.1008 = 10.1\%$$

15. You're attempting to estimate the length of the product you're producing. You sample 100 units and found the sample mean length to be 15.5" and the sample standard deviation to be 1.5". What is the standard error of the sample mean distribution?

- 1.5"
- **0.15"**
- 0.015"
- 15.0"

$$\text{Standard Error of The Sample Mean: } S.E. = \sqrt{\frac{\sigma^2}{n}} = \frac{\sigma}{\sqrt{n}}$$

$$S.E. = \frac{\sigma}{\sqrt{n}} = \frac{1.5}{\sqrt{100}} = 0.15$$