

1. To assess the effectiveness of a kindergarten-readiness program, 15 children from a random sample were each given a diagnostic assessment before beginning the program and a follow-up assessment after completing the program. For each child, the difference in the score points between the two assessments was calculated and used to create the 95 percent confidence interval (20.1, 23.9).

Assuming all conditions for inference are met, which of the following is a correct interpretation of the interval?

- (A) For all children in the program, 95 percent of the children will have a mean difference in scores of between 20.1 points and 23.9 points.
- (B) There is a 0.95 probability that the mean difference in scores for all children in the sample is between 20.1 points and 23.9 points.
- (C) There is a 0.95 probability that the mean difference in scores for the children in the program is between 20.1 points and 23.9 points.
- (D) We are 95 percent confident that the mean difference in scores for all children in the program is between 20.1 points and 23.9 points. ✓
- (E) We are 95 percent confident that the mean difference in scores for the children in the sample is between 20.1 points and 23.9 points.

Answer D

Correct. The percent is how much confidence exists that the interval has captured the population mean.

2. Researchers are investigating the effectiveness of leg-strength training on cycling performance. A sample of 7 men will be selected to participate in a training program that lasts for one month. Peak power during cycling will be recorded for each man both before training and after training. The mean difference in times will be used to construct a 95 percent confidence interval for the mean difference in the population.

When all other things remain the same, which of the following statements about the width of the interval is correct?

- (A) The interval will be narrower if 15 men are used in the sample. ✓
- (B) The interval will be wider if 15 men are used in the sample.
- (C) The interval will be narrower if 5 men are used in the sample.
- (D) The interval will be narrower if the level is increased to 99% confidence.
- (E) The interval will be wider if the level is decreased to 90% confidence.

Answer A

Correct. When all other things remain the same, the width of a confidence interval will decrease as the sample size increases (from $n = 7$ to $n = 15$).

3. Animal scientists studied foraging behavior of the scrub lizard, found in central Florida. Foraging is the process of searching for food. To study such behavior, the scientists recorded the number of head movements per minute for a sample of 63 lizards. A 95 percent confidence interval constructed from the sample is given as 2.7 ± 0.62 head movements per minute.

Based on the interval, is a claim of 3 head movements per minute plausible?

- (A) The claim is not plausible because 3 head movements per minute is contained within the interval.
- (B) The claim is not plausible because 3 head movements per minute is not contained within the interval.
- (C) The claim is not plausible because 95 percent of 3 is greater than the sample mean of 2.7.
- (D) The claim is plausible because 3 head movements per minute is not contained within the interval.
- (E) The claim is plausible because 3 head movements per minute is contained within the interval. ✓

Answer E

Correct. The claim is plausible. The interval gives plausible values of the population mean, and the confidence interval extends from 2.08 to 3.32. Because the value 3 is contained in the interval, it is a plausible value for the population mean.

4. To investigate hospital costs for pets in a certain state, researchers selected a random sample of 46 owners of parrots who had recently taken their parrot to an animal hospital for care. The cost of the visit for each parrot owner was recorded and used to create the 95 percent confidence interval $\$62.63 \pm \17.64 .

Assuming all conditions for inference are met, which of the following is a correct interpretation of the interval?

- (A) We are 95 percent confident that the mean cost of a hospital visit for all parrot owners in the state is between \$44.99 and \$80.27. ✓
- (B) We are 95 percent confident that the mean cost of a hospital visit for the parrot owners in the sample is between \$44.99 and \$80.27.
- (C) For all parrot owners in the state, 95 percent of hospital visits for parrot care cost between \$44.99 and \$80.27.
- (D) There is a 0.95 probability that the mean cost of a hospital visit for all parrot owners in the state is between \$44.99 and \$80.27.
- (E) There is a 0.95 probability that the mean cost of a hospital visit for the parrot owners in the sample is between \$44.99 and \$80.27.

Answer A

Correct. The percent is how much confidence exists that the interval has captured the population mean.

5. A manufacturer of piston rings for automobile engines frequently tests the width of the rings for quality control. Last week, a random sample of 15 rings were measured, and the mean and standard deviation of the sample were used to construct a 95 percent confidence interval for the population mean width of the rings.

When all other things remain the same, which of the following conditions would have resulted in a wider interval than the one constructed?

- I. A sample size of 20 with 95 percent confidence
 - II. A sample size of 15 with 99 percent confidence
 - III. A sample size of 12 with 95 percent confidence
- (A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III



Answer E

Correct. Both statements II and III give conditions that increase the width of the interval. With all else remaining the same, the width of a confidence interval increases if sample size decreases or if confidence level increases.

6. Porcupines can cause damage to wood structures by chewing them. Researchers studied a liquid repellent designed to reduce such damage. A sample of 20 wooden blocks of the same size were treated with the repellent and left outside in an area where porcupines are known to live. After a certain amount of time, the blocks were inspected for the number of porcupine teeth marks visible. The data were used to create the 95 percent confidence interval (4.9, 5.8).

Which of the following claims is supported by the interval?

- (A) The expected number of porcupine teeth marks on a wooden block treated with the repellent is less than 5.
(B) The expected number of porcupine teeth marks on a wooden block treated with the repellent is 5.
(C) The mean number of porcupine teeth marks on all wooden blocks treated with the repellent is 6.
(D) The mean number of porcupine teeth marks on all wooden blocks treated with the repellent is greater than 6.
(E) The mean number of porcupine teeth marks on all wooden blocks treated with the repellent is less than 6.



Answer E

Correct. All plausible values for the population mean, 4.9 to 5.8, are less than 6.

7. Engineers at a tire manufacturing company investigated the effect of a new rubber compound on the tire life of a certain brand of tires. From a sample of 16 tires, the engineers constructed a 99 percent confidence interval for the mean tire life, in miles, as $62,550 \pm 2,026$.

Suppose the company intends to claim a maximum tire life for advertising purposes. Based on the interval, of the following, which is the maximum plausible value for the mean tire life, in miles?

- (A) 64,000
- (B) 64,250
- (C) 64,500
- (D) 64,750
- (E) 65,000

**Answer C**

Correct. The confidence interval is (60,524, 64,576). Of the listed tire life values, the maximum value that is contained in the interval is 64,500.

8. An environmental agency frequently samples the water in a region to ensure that the levels of a certain contaminant do not exceed 30 parts per billion (ppb). From 12 randomly selected samples of the water, the agency constructed the 99 percent confidence interval (22.5, 28.7).

Assuming all conditions for inference are met, which of the following is a correct interpretation of the interval?

- (A) For all water in the region, 99 percent of the water contains a level of the contaminant between 22.5 ppb and 28.7 ppb.
- (B) We are 99 percent confident that the mean level of the contaminant in the sample is between 22.5 ppb and 28.7 ppb.
- (C) We are 99 percent confident that the mean level of the contaminant in all the water in the region is between 22.5 ppb and 28.7 ppb.
- (D) There is a 0.99 probability that the mean level of the contaminant in the sample is between 22.5 ppb and 28.7 ppb.
- (E) There is a 0.99 probability that the mean level of the contaminant in all the water in the region is between 22.5 ppb and 28.7 ppb.



Answer C

Correct. The percent is how much confidence exists that the interval has captured the population mean.

9. Two independent random samples were collected from the same population to estimate the population mean. Sample A had a sample size of 25 and a sample mean of 50. The 95 percent confidence interval constructed from sample A had a margin of error of 4.2. Sample B had a sample size of n and a sample mean of \bar{x}_B . The k percent confidence interval constructed from sample B had a margin of error of 3.7. Assume both samples had the same sample standard deviation. Which of the following values from sample B explains why the margin of error for sample A is greater than the margin of error for sample B?
- (A) $n = 25, \bar{x}_B = 50, k = 95$
 - (B) $n = 25, \bar{x}_B = 60, k = 95$
 - (C) $n = 25, \bar{x}_B = 40, k = 95$
 - (D) $n = 20, \bar{x}_B = 50, k = 99$
 - (E) $n = 30, \bar{x}_B = 40, k = 90$

Answer E

Correct. For this response, the size of sample B is greater than the size of sample A and the confidence level of sample B is less than the confidence level of sample A. Both of these would result in a smaller margin of error for the confidence interval constructed from sample B.