

## Interval Estimation – Quiz

Probability & Statistics

## Question 1

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- B. A range of plausible values for a parameter
- C. The exact population parameter
- D. The sample size needed

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**Answer: B**

A confidence interval gives a range of values that is likely to contain the true population parameter, along with a confidence level.

## Question 2

**The structure of a confidence interval for the mean is:**

- A. Sample mean only
- B. Sample mean plus/minus margin of error
- C. Population mean plus/minus variance
- D. Median plus/minus standard deviation

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**Answer: B**

CI = point estimate (sample mean) plus/minus margin of error. Margin of error = critical value times standard error.

## Question 3

**For a 95% CI, the z-value is approximately:**

- A. 1.645
- B. 1.96
- C. 2.576
- D. 3.0

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**Answer: B**

For 95% confidence,  $z = 1.96$ . This captures the middle 95% of the standard normal distribution.

## Question 4

**When population sigma is unknown, we use:**

- A. Standard normal (z) distribution
- B. Student's t-distribution
- C. Chi-square distribution
- D. F-distribution

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**Answer: B**

When sigma is unknown and estimated by  $s$ , we use the t-distribution which has heavier tails to account for the additional uncertainty.

## Question 5

**The t-distribution has heavier tails than normal because:**

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- B. It accounts for uncertainty in estimating sigma
- C. It has no mean
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**Answer: B**

The t-distribution has fatter tails because using  $s$  instead of  $\sigma$  introduces additional uncertainty, especially for small samples.

## Question 6

Degrees of freedom for a one-sample t CI for the mean is:

- A.  $n$
- B.  $n - 1$
- C.  $n + 1$
- D.  $2n$

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**Answer: B**

$df = n - 1$  because we lose one degree of freedom when estimating the mean from the sample.

## Question 7

**The correct interpretation of a 95% CI is:**

- A. There is a 95% probability  $\mu$  is in this interval
- B. 95% of the data falls in this interval
- C. If we repeated sampling many times, 95% of the intervals would contain  $\mu$
- D. The sample mean is 95% accurate

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- D. The sample mean is 95% accurate

**Answer: C**

95% confidence means the procedure works 95% of the time - if repeated, 95% of intervals would capture  $\mu$ . Any specific interval either contains  $\mu$  or doesn't.

## Question 8

**To increase confidence from 95% to 99%, the CI will:**

- A. Become narrower
- B. Become wider
- C. Stay the same width
- D. Disappear

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- A. Become narrower
- B. Become wider
- C. Stay the same width
- D. Disappear

**Answer: B**

Higher confidence requires a wider interval. You need to cast a wider net to be more confident of catching the parameter.

## Question 9

**To cut the margin of error in half, you must:**

- A. Double the sample size
- B. Quadruple the sample size
- C. Halve the sample size
- D. Keep the same sample size

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**Answer: B**

ME is proportional to  $1/\sqrt{n}$ . To halve ME, you need  $\sqrt{n}$  to double, meaning  $n$  must quadruple.

## Question 10

The margin of error formula is:

- A.  $z \times \sigma$
- B.  $z \times \sigma / \sqrt{n}$
- C.  $z \times n / \sigma$
- D.  $\sigma / z$

## Question 10

The margin of error formula is:

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- C.  $z \times n / \sigma$
- D.  $\sigma / z$

**Answer: B**

$ME = z_{(\alpha/2)} \times (\sigma / \sqrt{n})$ . It combines the critical value with the standard error of the mean.

## Question 11

**As sample size  $n$  increases, the CI width:**

- A. Increases
- B. Decreases
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**Answer: B**

Larger  $n$  reduces standard error, which reduces margin of error, making the CI narrower (more precise).

## Question 12

**For large  $n$  (e.g.,  $n \geq 30$ ), the t-distribution:**

- A. Becomes very different from normal
- B. Approaches the standard normal distribution
- C. Has thicker tails
- D. Cannot be used

## Question 12

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- B. Approaches the standard normal distribution
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- D. Cannot be used

**Answer: B**

As df increases, the t-distribution approaches the standard normal. For  $n \geq 30$ , they are nearly identical.

## Question 13

**A prediction interval differs from a confidence interval because it:**

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- B. Includes individual variability, making it wider
- C. Uses a different confidence level
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**Answer: B**

Prediction intervals are for individual future observations and include both sampling uncertainty and individual variability, making them wider than CIs for the mean.

## Question 14

**Bootstrap confidence intervals are useful when:**

- A. We know the population distribution
- B. We cannot assume normality and want to use the data itself to estimate variability
- C. Sample size is extremely large
- D. We want narrower intervals

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**Bootstrap confidence intervals are useful when:**

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**Answer: B**

Bootstrap resamples from the data to approximate the sampling distribution without assuming any particular population distribution.

## Question 15

**The chi-square distribution is used for CI on:**

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- B. The variance
- C. The median
- D. The mode

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- B. The variance
- C. The median
- D. The mode

**Answer: B**

The chi-square distribution is used for inference on variance because  $(n-1)S^2/\sigma^2$  follows a chi-square distribution.

## Question 16

**Coverage probability refers to:**

- A. The width of the interval
- B. The fraction of intervals that contain the true parameter in repeated sampling
- C. The sample size
- D. The point estimate

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**Coverage probability refers to:**

- A. The width of the interval
- B. The fraction of intervals that contain the true parameter in repeated sampling
- C. The sample size
- D. The point estimate

**Answer: B**

Coverage probability is the proportion of confidence intervals that would contain the true parameter if we repeated the procedure many times.

## Question 17

If  $\sigma = 10$ ,  $n = 25$ , and  $z = 1.96$ , what is the margin of error?

- A. 3.92
- B. 1.96
- C. 0.392
- D. 19.6

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- C. 0.392
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**Answer: A**

$$ME = 1.96 \times (10 / \sqrt{25}) = 1.96 \times (10/5) = 1.96 \times 2 = 3.92.$$

## Question 18

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- A. Sample size
- B. Confidence level
- C. Population variability
- D. Population mean

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**Which factor does NOT affect CI width?**

- A. Sample size
- B. Confidence level
- C. Population variability
- D. Population mean

**Answer: D**

The population mean affects where the CI is centered, not its width. Width depends on  $n$ , confidence level, and variability.

## Question 19

**A 90% CI will be \_\_\_\_\_ than a 95% CI (same sample):**

- A. Wider
- B. Narrower
- C. The same width
- D. Cannot determine

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- C. The same width
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**Answer: B**

Lower confidence = narrower interval. 90% CI uses  $z = 1.645$  instead of 1.96, giving a smaller margin of error.

## Question 20

**The statement '95% CI: (8, 12)' means:**

- A. The true mean is definitely between 8 and 12
- B. 95% of the data is between 8 and 12
- C. We are 95% confident the true mean is between 8 and 12
- D. There is a 95% chance the next observation is between 8 and 12

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**Answer: C**

We say we are '95% confident' that the interval (8, 12) contains the true population mean. This reflects the long-run reliability of the procedure.