2. Confidence Intervals Concept Checks

Confidence Interval Concept Check 1

1/1 point (graded)

Let $X_1, \ldots, X_n \stackrel{iid}{\sim} P_\theta$, where θ is an unknown parameter. You construct a **confidence interval** $\mathcal{I} = [a, b]$ for θ.

Complete the next sentence with one of the options below. The confidence interval $\mathcal{I}$ is ...

- (x) A random object
- ( ) A deterministic object

✔

Solution:

As defined, a confidence interval $\mathcal{I} = [a, b]$ for an unknown parameter θ is a *random* interval such that the expressions for its endpoints a, b do **not** depend on θ.

Remark 1: Let's write $a = f(X_1, \ldots, X_n)$ and $b = g(X_1, \ldots, X_n)$ for the endpoints of the random interval $\mathcal{I}$. Note that f and g are functions of the random sample that do not depend on θ. In practice, one uses data (e.g. realizations $x_1, \ldots, x_n$ of the i.i.d. observations $X_1, \ldots, X_n$) to compute the *realization* $\mathcal{I}_{\text{real}}$ of the confidence interval $\mathcal{I}$:

$$\mathcal{I}_{\text{real}} := [f(x_1, \ldots, x_n), g(x_1, \ldots, x_n)].$$

Remark 2: For this concept, it is important to distinguish the random variable $\mathcal{I}$ (the confidence interval) from its realization $\mathcal{I}_{\text{real}}$, which can be formed only after collecting data.

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Answers are displayed within the problem

Note: The exercises on the next few pages will be presented in lecture, but we encourage you to attempt these by yourself first.

Confidence Interval Concept Check 2

1/1 point (graded)

Recall that a **realization** of a random variable X is the value that it takes when we observe X. For example, if $X \sim \text{Ber}(1/2)$ and we observe the event $X = 1$, then $x = 1$ is the realization (observed value) of the random variable X.

Let $\mathcal{I}$, $\mathcal{J}$ be some 95$\%$ and 98$\%$ asymptotic confidence intervals respectively for the unknown parameter p. Which of the following statements is true?

- Any realization of $\mathcal{I}$ is a **subinterval** of any realization of $\mathcal{J}$.
- Any realization of $\mathcal{J}$ is a **subinterval** of any realization of $\mathcal{I}$.

None of the above

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Correct (1/1 point)

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