3. Confidence Intervals Concept Checks Continued
Confidence Interval Review

Start of transcript. Skip to the end.

OK.

So let's start with a few exercises

that we left behind us.
And that will be a good way for us
to refresh our memory in terms of what a confidence interval
is and what it does for us.
So now here's the first question.
Hopefully, you've had a minute to think about it.
I have two confidence intervals, I and J,

0:00 / 0:00 1.50x

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Confidence Interval Concept Check 3

1/1 point (graded)
In a new experiment consisting of 150 couples, 75 couples are observed to turn their heads to the left and the remaining 75 couples turned their heads to the right when kissing. Let p denote the (unknown) parameter which specifies the probability that a couple turns their head to the right.

Which of the following statements are correct regarding this experiment? You are given that **exactly one** but not both of choices 3 and 4 is correct.
(Choose all that apply.)

- [x] $[0, 0.5]$ is a 50% asymptotic confidence interval for p.
- [x] $[0.5, 1]$ is a 50% asymptotic confidence interval for p.
- [x] $[0.466, 0.533]$ is a 50% asymptotic confidence interval for p.
- [ ] $[0.48, 0.52]$ is a 50% asymptotic confidence interval for p.

✔

Solution:

See the next video for presented solution.

The first three answer choices are correct, and the final choice is incorrect.

Let $R_1, R_2, \ldots, R_{150} \overset{iid}{\sim} \text{Ber}(p)$ denote the sampled response (without loss of generality, assume that $R_i = 1$ encodes that the i-th couple turns their heads to the right, and $R_i = 0$ encodes that the couple turns their heads to the left.) Let $P = \text{Ber}(p)$ denote the common distribution of $R_1, \ldots R_{150}$.

Consider the sample mean $\overline{R}_n$. By the central limit theorem,

$$\sqrt{n}\left(\frac{\overline{R}_n - p}{\sqrt{p(1-p)}}\right) \underset{(d)}{\longrightarrow} N(0,1).$$

Now we examine the answer choices in order.

1. Consider the interval $[0, 0.5]$. Since $\overline{R}_n = 0.5$, this interval is a realization of the (random) confidence interval $\mathcal{I} = (0, \overline{R}_n)$. We compute that

$$P(\mathcal{I} \ni p) = P(p \leq \overline{R}_n) = P(\overline{R}_n - p \geq 0).$$

Observe that $\overline{R}_n - p$ is a centered (*i.e.* $\mathbb{E}[\overline{R}_n - p] = 0$) and symmetric (*i.e.*, $\overline{R}_n - p$ and $-(\overline{R}_n - p)$ have the same distribution) random variable. Therefore $P(\mathcal{I} \ni p) = 1/2$. Indeed $[0, 0.5]$ is an asymptotic (in fact, it is even a *non-asymptotic*) confidence interval of level 50%.

2. The interval $[0.5, 1]$ is a realization of the (random) confidence interval $\mathcal{I} = (\overline{R}_n, 1)$. We see that

$$P(\mathcal{I} \ni p) = P(\overline{R}_n \leq p \leq 1) = P(\overline{R}_n - p \leq 0).$$

By the reasoning in the previous part, we must also have that $P(\mathcal{I} \ni p) = 1/2$.

3. Given that either choice 3 or choice 4 is correct but not both, it must be that the wider of the 2 intervals $[0.466, 0.533]$ is a 50% asymptotic confidence interval for p. Otherwise, the narrower interval $[0.48, 0.52]$ being a 50% asymptotic confidence interval for p implies the same for the wider interval.

Submit You have used 2 of 2 attempts

Answers are displayed within the problem

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I don't get it.

discussion posted 4 days ago by **alex_gb**

I compute the 50 percent confidence interval to be between intervals listed in c and d.

So wouldn't you conservatively choose the smaller interval?

This post is visible to everyone.

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3 responses

markweitzman
4 days ago

For questions with checkboxes (instead of check circles) you need to check all the correct answers. This is covered in the unit 0 material.

Add a comment

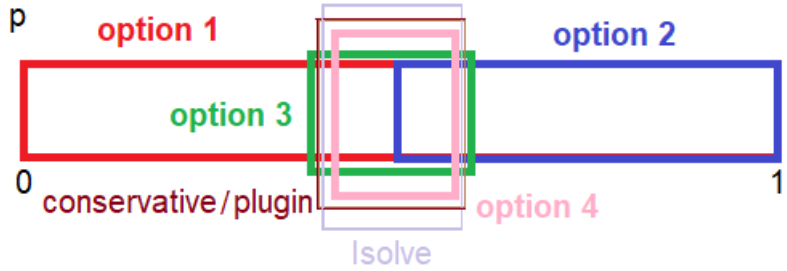
alex_gb
4 days ago

I got my thinking backwards. If you have a 50percent confidence interval, then you would be less confident about would be an interval that is smaller. So you would have a lower percent confidence, that it would like in the smaller interval.

So conservatively, you would choose the larger interval, which you would still be at least 50% confident of (actually slightly more than 50%)..

That's why the third one, not the fourth one.

I found only the interval given by the 3rd option as an interval containing the entire 50% CI (with $q_{\alpha/2} = 0.674489750196082$ obtained with scipy, for 50% level of significance, computed using conservative / plugin or Isolve, as shown below), all the other 3 options have non-empty intersections with the 50% CI but don't contain the 50% CI entirely. But not accepted by the grader, does anyone have similar result / any clue about what I am doing wrong? thank you in advance.



posted about an hour ago by **sandipan_dey**

Suggest you look at and study the answer.

posted about an hour ago by **markweitzman**

@markweitzman I have lost one attempt and have a remaining one to retry, but can't understand where I am doing wrong, used the formulas for computing CI using different methods as in earlier lecture videos and $\bar{R}_n = 75/150 = 1/2$, can you see where it's getting wrong?

posted 13 minutes ago by **sandipan_dey**

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Cool7
a day ago

Basically what it means is you can even call $[0, 1]$ a 50% asymptotic confidence interval for p, as long as it is a superset of 50% CI.

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