1. Confidence Intervals for Curved Gaussian Family

(a)

1/1 point (graded)

Let $X_1, \ldots, X_n$ be i.i.d. random variables with distribution $\mathcal{N}(\theta, \theta)$, for some unknown parameter $\theta > 0$.

True or False: The sample average $\overline{X}_n$ follows a normal distribution for any integer $n \geq 1$.

- (●) True
- ( ) False

✔

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

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(b)

2/2 points (graded)

What is the expectation and the variance of $\overline{X}_n$?

$\mathbb{E}[\overline{X}_n] =$ theta ✔

θ

$\text{Var}(\overline{X}_n) =$ theta/n ✔

$\frac{\theta}{n}$

STANDARD NOTATION

Submit You have used 1 of 2 attempts

✔ Correct (2/2 points)

(c)

2/2 points (graded)

Find an interval $\mathcal{I}_\theta$ (that depends on θ) centered about $\overline{X}_n$ such that

$$\mathbf{P}(\mathcal{I}_\theta \ni \theta) = 0.9 \qquad \text{for all } n (\text{i.e, not only for large } n).$$

(Write barX_n for $\overline{X}_n$. Use the estimate $q_{0.05} \approx 1.6448$ for best results.)

$\mathcal{I}_\theta = [A_\theta, B_\theta]$ for

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$A_\theta =$ barX_n-1.6448*sqrt(theta/n) ✔

$B_\theta =$ barX_n+1.6448*sqrt(theta/n) ✔

STANDARD NOTATION

Submit You have used 2 of 2 attempts

✔ Correct (2/2 points)

(d)

2/2 points (graded)

Again, use the estimate $q_{0.05} \approx 1.6448$ for best results.

Now, find a confidence interval $\mathcal{I}_{\text{plug-in}}$ with **asymptotic** confidence level 90% by plugging in $\overline{X}_n$ for all occurrences of θ in $\mathcal{I}_\theta$.

$\mathcal{I}_{\text{plug-in}} = [A_{\text{plug-in}}, B_{\text{plug-in}}]$ for

$A_{\text{plug-in}} =$ barX_n-1.6448*sqrt(barX_n/n) ✔ $B_{\text{plug-in}} =$

barX_n+1.6448*sqrt(barX_n/n) ✔

STANDARD NOTATION

Submit You have used 1 of 2 attempts

Generating Speech Output ct (2/2 points)

(e)

2/2 points (graded)

Finally, find a confidence interval $\mathcal{I}_{\text{solve}}$ for θ with **nonasymptotic** level 90% solving the bounds in $\mathcal{I}_\theta$ for θ.

$\mathcal{I}_{\text{solve}} = [A_{\text{solve}}, B_{\text{solve}}]$ for

$A_{\text{solve}} =$ barX_n+2.7053/(2*n)-1.6448/(2*n)*sqrt(2.7053+4*n*barX ✔

$B_{\text{solve}} =$ barX_n+2.7053/(2*n)+1.6448/(2*n)*sqrt(2.7053+4*n*barX ✔

STANDARD NOTATION

Submit You have used 1 of 3 attempts

✔ Correct (2/2 points)

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e) solving for theta

discussion posted 2 days ago by **nbourbon**

I'm sure the problem must be easier than the way I'm trying to do so just checking... I'm assuming that I_solve is where we expect to rearrange the numbers in the limit expression so as to have "theta" in the center. But it is just that we also have the sqrt(theta) in another term in the limit [illegible] manipulation becomes harder.

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Any simpler trick, advise?

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1 response

JennD14
2 days ago

I haven't submitted my answer and have no idea if it is correct, but that's what I did. I ended up with a very messy quadratic equation and no real way to simplify it since we don't have values for the sample average or the number of samples. I'm not sure whether Asolve and Bsolve are supposed to be long, complicated, and messy, but that's what I got when I solved the quadratic.

I already submitted and got green ticks and, indeed, Asolve an Bsolve are long, complicated and messy. Just follow the procedure outlined in Lecture 4 - Tab 10.

posted 2 days ago by **daniel-miranda**

I was hoping this was not the long way to solve it ... :(

Maybe someone comes to this post with an easier way :) but I'll go through the lecture you indicated

posted a day ago by **nbourbon**

Okay. I went ahead and submitted and got the green ticks. For anyone else doing this problem, the correct answer is really ugly and messy. Don't let that psych you out.

posted a day ago by **JennD14**

ok... we'll go the hard way then. thanks

a day ago by **nbourbon**

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Argh, that was ugly! Thank you for the post... really helped re-assure I was on the right track.

posted about 19 hours ago by **corderfj**

@Daniel-miranda exactly, following that chapter I got the green ticks as well

posted about 19 hours ago by **nbourbon**

Just need to use the fact that the solution of the quadratic equation $a.x^2 + b.x + c = 0$ is $\frac{-b \pm \sqrt{b^2 - 4.a.c}}{2.a}$ (Sridharacharya's formula, https://en.wikipedia.org/wiki/Sridhara)

posted less than a minute ago by **sandipan_dey**

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