



MITx: 6.041x Introduction to Probability - The Science of Uncertainty



Bookmarks

- ▶ Unit 0: Overview
- ▶ Entrance Survey
- ▶ Unit 1: Probability models and axioms
- ▶ Unit 2: Conditioning and independence
- ▶ Unit 3: Counting
- ▶ Unit 4: Discrete random variables
- ▶ Exam 1
- ▶ Unit 5: Continuous random variables

Unit 8: Limit theorems and classical statistics > Lec. 20: An introduction to classical statistics > Lec 20 An introduction to classical statistics vertical2

Bookmark

Exercise: Confidence interval interpretation

(4/4 points)

Every day, I try to estimate an unknown parameter using a fresh data set. I look at the data and then I use some formulas to calculate a 70% confidence interval, $[\hat{\Theta}^-, \hat{\Theta}^+]$, based on the day's data.

Are the following statements accurate?

Over the next 100 days, I expect that the unknown parameter will be inside the confidence interval about 70 times.

Yes ▾



Answer: Yes

If today's confidence interval is $[0.41, 0.47]$, there is probability **70%** that the unknown parameter is inside this confidence interval.

No ▾




Answer: No


- ▶ Unit 6: Further topics on random variables
- ▶ Unit 7: Bayesian inference
- ▶ Exam 2
- ▼ **Unit 8: Limit theorems and classical statistics**

Unit overview


Lec. 18: Inequalities, convergence, and the Weak Law of Large Numbers

Exercises 18 due Apr 27, 2016
at 23:59 UTC 

Lec. 19: The Central Limit Theorem (CLT)

Exercises 19 due Apr 27, 2016
at 23:59 UTC 

Lec. 20: An introduction to classical statistics

Exercises 20 due Apr 27, 2016
at 23:59 UTC 

Out of 100 days on which the confidence interval happens to be $[0.41, 0.47]$, I expect that the unknown parameter will be inside the confidence interval about 70 times.



Answer: No

Today, I decided to use a Bayesian approach, by viewing the unknown parameter, denoted by Θ , as a continuous random variable and assuming a prior PDF for Θ . I observe a specific value x , calculate the posterior $f_{\Theta|X}(\cdot | x)$, and find out that

$$\int_{0.41}^{0.47} f_{\Theta|X}(\theta | x) d\theta = 0.70.$$

Am I allowed to say that there is probability **70%** that the unknown parameter is inside the (Bayesian) confidence interval $[0.41, 0.47]$?




Answer: Yes

Answer:

The first statement is true. The confidence interval is a random interval and has probability 0.70 of capturing the true value of the unknown parameter. Using the frequency interpretation of probabilities, we expect about 70 successful captures.

Solved problems**Additional theoretical material****Problem Set 8**

Problem Set 8 due Apr 27, 2016
at 23:59 UTC 

Unit summary

The second statement is false. The value of the parameter is not random. Conditional on the confidence interval being $[0.41, 0.47]$, the event “the unknown parameter is inside the confidence interval” does not involve anything random, and so its probability cannot be 0.70.

The third statement may appear to be closer to the first one rather than the second one. However, the same explanation as for the second statement applies.

The fourth case involves the conceptually different setting of Bayesian inference. Here, Θ is a random variable, and

$$0.70 = \int_{0.41}^{0.47} f_{\Theta|X}(\theta | x) d\theta = \mathbf{P}(\Theta \in [0.41, 0.47] | X = x),$$

is indeed the (conditional) probability that Θ belongs to the interval $[0.41, 0.47]$.

You have used 1 of 1 submissions

© All Rights Reserved



© edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

POWERED BY
OPENedX

