



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 vertical5

Bookmark

Exercise: Natural estimators

(3/3 points)

The random variables X_i are i.i.d. and satisfy $\mathbf{E}[X_i^2] = \theta$. Use a natural estimator to calculate an estimate of θ based on the values $X_1 = 1, X_2 = 3, X_3 = -1, X_4 = 2, X_5 = 0$.



Answer: 3

In order to calculate confidence intervals around your estimator, you need information on the variance of your estimator. This variance is determined by $\mathbf{E}[X_i^2]$ and $\mathbf{E}[X_i^a]$ for some other power a . What is the value of a ?


 $a =$ Answer: 4

If you do not have any prior knowledge about the value of $\mathbf{E}[X_i^a]$, can you estimate it based on the available data?


- ▶ 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 

Yes ▼



Answer: Yes

Answer:

A natural estimator is


$$\frac{1}{5} \sum_{i=1}^5 X_i^2 = \frac{1}{5} (1 + 9 + 1 + 4 + 0) = 3.$$

To find the variance of the estimator, you need the variance of X_i^2 . Since $\text{var}(X_i^2) = \mathbf{E}[X_i^4] - (\mathbf{E}[X_i^2])^2$, you need to know $\mathbf{E}[X_i^4]$. This quantity can be estimated using the natural estimator

$$\frac{1}{n} \sum_{i=1}^n X_i^4.$$

You have used 2 of 2 submissions

[Solved problems](#)[Additional theoretical material](#)[Problem Set 8](#)

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

[Unit summary](#)

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