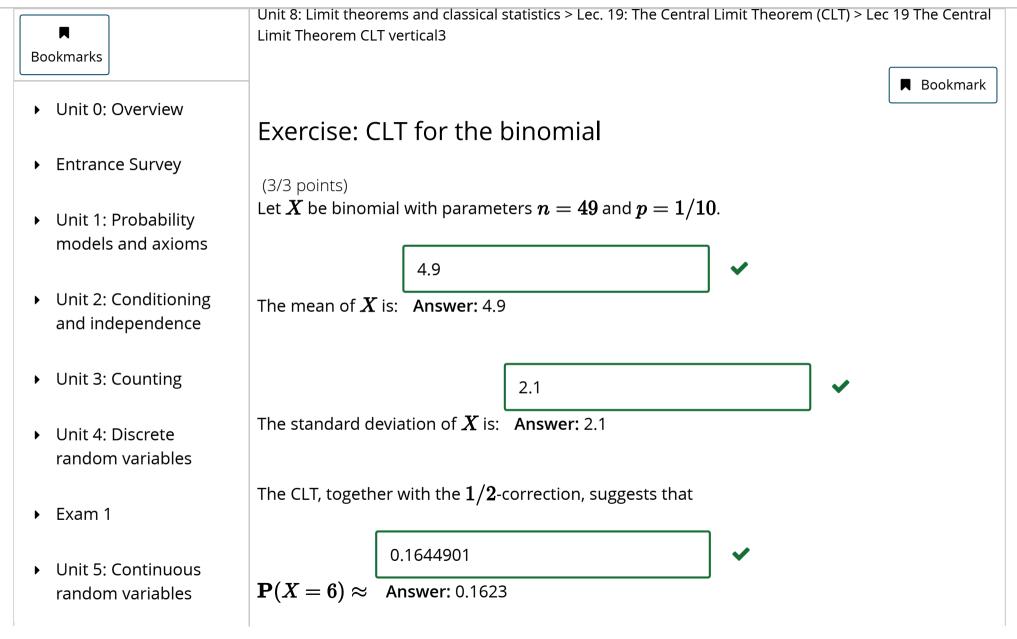


MITx: 6.041x Introduction to Probability - The Science of Uncertainty



- 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

You may want to refer to the normal table.

Note: In this case, the CLT may not provide a great approximation. The range of values that \boldsymbol{X} is likely to take is quite narrow, so that its PMF consists of only a few entries of substantial size. But, regardless, we can still calculate what the CLT suggests.

Answer:

We have $\mathbf{E}[X] = np = 4.9$, and

$$ext{var}(X) = np(1-p) = 49 \cdot rac{1}{10} \cdot rac{9}{10} = rac{49 \cdot 9}{10^2},$$

so that the standard deviation of X is 21/10 = 2.1.

The standardized version of X is (X-4.9)/2.1. Thus,

$$\mathbf{P}(X=6) \; = \; \mathbf{P}(5.5 < X < 6.5) = \mathbf{P}\left(rac{5.5 - 4.9}{2.1} \le rac{X - 4.9}{2.1} \le rac{6.5 - 4.9}{2.1}
ight) \ pprox \; \Phi(0.76) - \Phi(0.29) pprox 0.7764 - 0.6141 = 0.1623.$$

For comparison, the answer calculated by using the binomial PMF directly is

Exercise: CLT for the binomial | Lec. 19: The Central Limit Theorem (CLT) | 6.041x Courseware | edX

Solved problems

Additional theoretical material

Problem Set 8

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

Unit summary

 $\mathbf{P}(X=6) = {49 \choose 6} (0.1)^6 (0.9)^{49-6} pprox 0.1507.$

You have used 1 of 2 submissions

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