



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



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Bookmark

Exercise: CLT for the binomial


(3/3 points)

Let X be binomial with parameters $n = 49$ and $p = 1/10$.The mean of X is: Answer: 4.9The standard deviation of X is: Answer: 2.1The CLT, together with the $1/2$ -correction, suggests that $P(X = 6) \approx$ Answer: 0.1623


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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 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

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


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

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

$$\begin{aligned} \mathbf{P}(X = 6) &= \mathbf{P}(5.5 < X < 6.5) = \mathbf{P}\left(\frac{5.5 - 4.9}{2.1} \leq \frac{X - 4.9}{2.1} \leq \frac{6.5 - 4.9}{2.1}\right) \\ &\approx \Phi(0.76) - \Phi(0.29) \approx 0.7764 - 0.6141 = 0.1623. \end{aligned}$$

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

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

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

[Unit summary](#)

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

You have used 1 of 2 submissions

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