



<u>Course</u> > <u>Unit 4:</u> ... > <u>Lec. 6:</u> ... > 8. Exer...

8. Exercise: Conditional variance

Exercises due Feb 28, 2020 05:29 IST Completed

Exercise: Conditional variance

2/2 points (graded)

In the last example, we saw that the conditional distribution of X, which was a uniform over a smaller range (and in some sense, less uncertain), had a smaller variance, i.e.,

 $\mathsf{Var}(X\mid A) \leq \mathsf{Var}(X)$. Here is an example where this is not true. Let Y be uniform on $\{0,1,2\}$ and let B be the event that Y belongs to $\{0,2\}$.

a) What is the variance of Y?

$$Var(Y) = \boxed{2/3}$$
 \checkmark Answer: 0.66667

b) What is the conditional variance $Var(Y \mid B)$?

$$\mathsf{Var}\left(Y\mid B
ight)= egin{bmatrix} 1 & & & \\$$

Solution:

- a) The calculation of the variance of Y is exactly the same as the calculation of $\mathsf{Var}(X\mid A)$ in the preceding example, yielding 2/3.
- b) In the conditional model, the conditional mean is $\mathbf{E}\left[Y\mid B\right]=1$. Since Y is either 0 or 2 in the conditional model, the difference between Y and the conditional mean is either 1 or -1, so that $\left(Y-\mathbf{E}\left[Y\mid B\right]\right)^2$ is always equal to 1. It follows that the conditional variance is equal to 1.

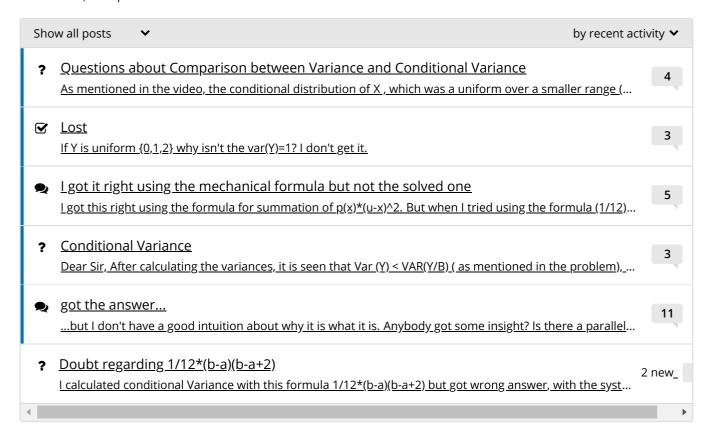
Note that in this example, $Var(Y \mid B) > Var(Y)$.

1 Answers are displayed within the problem

Discussion

Hide Discussion

Topic: Unit 4: Discrete random variables:Lec. 6: Variance; Conditioning on an event; Multiple r.v.'s / 8. Exercise: Conditional variance



© All Rights Reserved

