3. Exercise: Conditional expectation

Exercises due Mar 25, 2020 05:29 IST *Completed*

Exercise: Conditional expectation

0/1 point (graded)

Let X and Y be zero-mean independent random variables. Which one of the following statements is correct? *Hint:* You can take for granted the intuitive fact that $\mathbf{E}[X \mid X = x] = x$.

- ◯ $\mathbf{E}[X + Y \mid X] = 0.$
- ◉ $\mathbf{E}[X + Y \mid X] = x.$
- ◯ $\mathbf{E}[X + Y \mid X] = X.$ ✔
- ◯ $\mathbf{E}[X + Y \mid X] = X + Y.$

✖

Solution:

Using linearity of expectations, and then the independence assumption, we have

$$\mathbf{E}[X + Y \mid X = x] = \mathbf{E}[X \mid X = x] + \mathbf{E}[Y \mid X = x] = x + \mathbf{E}[Y] = x.$$

Translating this statement into abstract notation, we obtain $\mathbf{E}[X + Y \mid X] = X.$

Submit You have used 2 of 2 attempts

Answers are displayed within the problem

Discussion

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Topic: Unit 6: Further topics on random variables:Lec. 13: Conditional expectation and variance revisited; Sum of a random number of independent r.v.'s / 3. Exercise: Conditional expectation

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- [STAFF] Given the answer presented, shouldn't the second and third options be considered correct? — 2
- Deadline not adjusted! — 2
- Nothing about this problem or its solution makes sense. — 3
- $\mathbf{E}[X+Y|X]$ and $\mathbf{E}[X+Y|X=x]$ — 2
- Notation is confusing, suggestion — 4
  The exercise would be clearer if stated as: E[(X+Y)/X]. I got confused thinking about the conditional X=x O...
- it helps to... — 1
  ...remember where we started. Don't get tripped up on these theoretical questions because the notation...
- Random question — 2
  Is E(E(X|Y)|Y) = E(X|Y)?
- ? [STAFF] Can we use functional form directly — 2
  Can we use linearity and independence to functional form directly?
- Why are the second and third options different? — 11
  Given the solution, they seem the same, if E[X|X=x] = x
- Not clear about the notation — 3