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Unit overview

Lec. 11: Derived distributions

Exercises 11 due Mar 30, 2016 at 23:59 UTC

Unit 6: Further topics on random variables > Lec. 13: Conditional expectation and variance revisited; Sum of a random number of independent r.v.'s > Lec 13 Conditional expectation and variance revisited Sum of a random number of independent r v s vertical1



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Exercise: Iterated expectations

(7/8 points)

In this exercise, do not attempt formal mathematical derivations, which would actually involve some subtle issues when we go beyond discrete random variables. Rather, use your understanding of the concepts involved. For each one of the statements below, indicate whether it is true or false.

(a) The law of iterated expectations tells us that $\mathbf{E}[\mathbf{E}[X | Y]] = \mathbf{E}[X]$. Suppose that we want apply this law in a conditional universe, given another random variable Z , in order to evaluate $\mathbf{E}[X | Z]$. Then:

$$\mathbf{E}[\mathbf{E}[X | Y, Z] | Z] = \mathbf{E}[X | Z]$$

True ▾



Answer: True

$$\mathbf{E}[\mathbf{E}[X | Y] | Z] = \mathbf{E}[X | Z]$$

True ▾



Answer: False

$$\mathbf{E}[\mathbf{E}[X | Y, Z]] = \mathbf{E}[X | Z]$$

False ▾



Answer: False

(b) Determine whether each of the following statements about the quantity $\mathbf{E}[g(X, Y) | Y, Z]$ is true or false.

The quantity $\mathbf{E}[g(X, Y) | Y, Z]$ is:

- a random variable

True ▾



Answer: True

- a number

False ▾



Answer: False

Lec. 12: Sums of independent r.v.'s; Covariance and correlation

Exercises 12 due Mar 30, 2016 at 23:59 UTC

Lec. 13: Conditional expectation and variance revisited; Sum of a random number of independent r.v.'s

Exercises 13 due Mar 30, 2016 at 23:59 UTC

Solved problems

Additional theoretical material

Problem Set 6

Problem Set 6 due Mar 30, 2016 at 23:59 UTC

Unit summary

- Unit 7: Bayesian inference

- a function of (X, Y)

False ▼



Answer: False

- a function of (Y, Z)

True ▼



Answer: True

- a function of Z only

False ▼



Answer: False

Answer:

(a) The first statement is correct: it is just the law of iterated expectations where all the expectations now involve the additional conditioning on Z .

The second statement is incorrect because the inner conditional expectation should be evaluated in a conditional universe where Z is given. For a concrete counterexample, suppose that X and Y are independent and zero mean, and that $X = Z$. Because of independence, $\mathbf{E}[X | Y] = \mathbf{E}[X] = 0$, and the left-hand side evaluates to zero. On the other hand, the right-hand side is equal to Z .

For the third statement, note that the left-hand side is a number (the ordinary expectation of the random variable $\mathbf{E}[X | Y, Z]$), whereas the right-hand side is a random variable (a function of Z). Hence the statement is incorrect.

(b) A conditional expectation is generally a random variable, a function of the random variables on which we are conditioning, and so a function of (Y, Z) in this case.

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