



5. Exercise: The expected value rule with conditioning

Exercises due Feb 28, 2020 05:29 IST Completed

Exercise: The expected value rule with conditioning

6/6 points (graded)

For each of the formulas below, state whether it is true or false.

1) $\mathbf{E}[g(X, Y) \mid Y = 2] = \sum_x g(x, y) p_{X,Y}(x, y)$

False



✓ Answer: False

2) $\mathbf{E}[g(X, Y) \mid Y = 2] = \sum_x g(x, y) p_{X,Y}(x, 2)$

False



✓ Answer: False

3) $\mathbf{E}[g(X, Y) \mid Y = 2] = \sum_x g(x, 2) p_{X,Y}(x, 2)$

False



✓ Answer: False

4) $\mathbf{E}[g(X, Y) \mid Y = 2] = \sum_x g(x, 2) p_{X|Y}(x \mid 2)$

True



✓ Answer: True

5) $\mathbf{E}[g(X, Y) \mid Y = 2] = \sum_x g(x, 2) \frac{p_{X,Y}(x, 2)}{p_Y(2)}$

True



✓ Answer: True



$$6) \mathbf{E} [g(X, Y) \mid Y = 2] = \sum_x \sum_y g(x, y) p_{X,Y|Y} (x, y \mid 2)$$

True



✓ Answer: True

Solution:

1-3) There is no reason for any of the first three formulas to be true.

4) True. This is just the usual expected value rule, in a model in which the event $\{Y = 2\}$ is known to have occurred. Given the information that $Y = 2$, the function $g(x, y)$ is replaced by $g(x, 2)$, and we are dealing with a function $g(x, 2)$ of a single variable x . We apply the expected value rule for a function of a single variable, but since we are within a conditional model, we need to use the conditional PMF of X .

5) True. This is the same as the fourth statement, except that we have substituted in the definition of $p_{X|Y} (x \mid 2)$.

6) True. This is just the expected value rule for a function of two variables, applied within a conditional universe where the event $\{Y = 2\}$ is known to have occurred.

Notice that $p_{X,Y|Y} (x, y \mid 2)$ will be zero for any $y \neq 2$. And for $y = 2$,

$$p_{X,Y|Y} (x, 2 \mid 2) = \mathbf{P}(X = x, Y = 2 \mid Y = 2) = \mathbf{P}(X = x \mid Y = 2) = p_{X|Y} (x \mid 2),$$

so that the sixth formula agrees with the fourth one.

Submit

You have used 1 of 1 attempt

🔒 Answers are displayed within the problem

Discussion

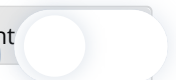
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Topic: Unit 4: Discrete random variables; Lec. 7: Conditioning on a random variable; Independence of r.v.'s / 5. Exercise: The expected value rule with conditioning

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?	<u>Summation</u>	2
	In (6), When the value for Y is fixed to 2, is the second summation over y ignored on the right hand side.	
?	<u>In question 6 the conditioning is misleading</u>	2
	I was confused by 2 at the end of the formula, it should be y=2, that caused me to choose the wrong an...	
?	<u>Question on #6</u>	5
	For my understanding of Q6, would it be possible for me to know whether the same relationship holds ev...	
💬	<u>Really dislike how some of the answers are just swept under the rug</u>	1
	Answers for the questions 1-3 teach bad habits to the students. You can't declare something to be false, si...	
💬	<u>#6 Very confusing notation which requires more clarification</u>	3
💬	<u>#5 Notation</u>	2
✓	<u>Difference between #3 and #4?</u>	6
	I'm not sure why these two are different: isn't the probability that x and y are x and 2 the same as the con...	
💬	<u>Clarity on Notations</u>	6
	Where can I read somewhere to get better clarity on these notations. For example 1. $\sum g(x,2)p_X Y(x 2) <-...$	
💬	<u>6. Ugh, made a mistake. Here is a hint to avoid it (shouldn't violate the honor code)</u>	3
💬	<u>Not much of an explanation...</u>	1
	...in the answer about why 3 is what it is. "Show answer" explanation is a bit glib. Seems a lot like 4 and 6.	
?	<u>$g(x,y)$ and $p_{subXY}(x,y)$</u>	2
	In question 1 (though I have this question elsewhere), we are given that $Y=2$. We sum over all x: $g(x,y) * p_{s...$	
💬	<u>Please update solution to this excellent problem</u>	3
	I received full marks for this gusion, but please update the solution in the place where "there is no reason...	

