



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



Bookmarks



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Unit overview

Lec. 5: Probability mass functions and expectations

Exercises 5 due Mar 02, 2016 at 23:59 UTC

Lec. 6: Variance; Conditioning on an event; Multiple r.v.'s

Exercises 6 due Mar 02, 2016 at 23:59 UTC

Lec. 7: Conditioning on a random variable; Independence of r.v.'s

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Solved problems

Additional theoretical material

Problem Set 4

Problem Set 4 due Mar 02, 2016 at 23:59 UTC

Unit summary

- ▶ Unit 5: Continuous random variables

Unit 4: Discrete random variables > Lec. 7: Conditioning on a random variable; Independence of r.v.'s > Lec 7 Conditioning on a random variable Independence of r v s vertical6

Exercise: The hat problem

(2/2 points)

Consider the hat problem, with $n = 10$. What is the expected value of $X_3 X_6 X_7$?

$$\mathbf{E}[X_3 X_6 X_7] =$$



Answer: 0.00139

Answer:

By symmetry, this is the same as $\mathbf{E}[X_1 X_2 X_3]$. Since the product $X_1 X_2 X_3$ is either zero or one, this is the same as

$$\mathbf{P}(X_1 X_2 X_3 = 1) = \mathbf{P}(X_1 = 1) \cdot \mathbf{P}(X_2 = 1 \mid X_1 = 1) \cdot \mathbf{P}(X_3 = 1 \mid X_1 = X_2 = 1)$$

By thinking in terms of the sequential description of the process, we have seen that $\mathbf{P}(X_1 = 1) = 1/10$ and $\mathbf{P}(X_2 = 1 \mid X_1 = 1) = 1/9$. By a similar argument, given that the first two people obtained their own hats, the third person is faced with 8 hats, one of which is his/her own, and has probability

$\mathbf{P}(X_3 = 1 \mid X_1 = X_2 = 1) = 1/8$ of picking it. Thus, the final answer is $(1/10) \cdot (1/9) \cdot (1/8)$.

You have used 1 of 2 submissions

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