

On Tuesday, February 23rd at 6:00AM EST, UTC-5, we will be conducting a brief database maintenance. The event should last about 5 minutes.



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



Bookmarks

- ▶ Unit 0: Overview
- ▶ Entrance Survey
- ▶ Unit 1: Probability models and axioms
- ▶ Unit 2: Conditioning and independence
- ▶ Unit 3: Counting
- ▼ **Unit 4: Discrete random variables**

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

Unit 4: Discrete random variables > Lec. 6: Variance; Conditioning on an event; Multiple r.v.'s > Lec 6 Variance Conditioning on an event Multiple r v s vertical3



Bookmark

### Exercise: Conditional variance

(2/2 points)

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.,  $\text{var}(X | A) \leq \text{var}(X)$ . 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  $Y$ ?

$\text{var}(Y) =$   ✓ Answer: 0.66667

b) What is the conditional variance  $\text{var}(Y | B)$ ?

$\text{var}(Y | B) =$   ✓ Answer: 1

Answer:

a) The calculation of the variance of  $Y$  is exactly the same as the calculation of  $\text{var}(X | A)$  in the preceding example, yielding  $2/3$ .

b) In the conditional model, the conditional mean is  $\mathbf{E}[Y | B] = 1$ . 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  $(Y - \mathbf{E}[Y | B])^2$  is always equal to 1. It follows that the conditional variance is equal to 1.

Note that in this example,  $\text{var}(Y | B) > \text{var}(Y)$ .

*You have used 1 of 2 submissions*

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

Exercises 7 due Mar  
02, 2016 at 23:59 UTC

**Solved problems****Additional  
theoretical  
material****Problem Set 4**

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

**Unit summary**

© All Rights Reserved



© edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

POWERED BY  
**OPENedX**

