



## 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
- ▶ Exam 1
- ▶ Unit 5: Continuous random variables
- ▼ Unit 6: Further topics on random variables

Unit overview

Lec. 11: Derived distributions

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

Unit 6: Further topics on random variables > Lec. 12: Sums of independent r.v.'s; Covariance and correlation > Lec 12 Sums of independent r v s Covariance and correlation vertical6



Bookmark

## Exercise: Correlation coefficient

(1/1 point)

It is known that for a standard normal random variable  $X$ , we have  $\mathbf{E}[X^3] = 0$ ,  $\mathbf{E}[X^4] = 3$ ,  $\mathbf{E}[X^5] = 0$ ,  $\mathbf{E}[X^6] = 15$ . Find the correlation coefficient between  $X$  and  $X^3$ . Enter your answer as a number.

0.7745967



Answer: 0.77460

Answer:

Since  $\mathbf{E}[X] = \mathbf{E}[X^3] = 0$ , we have


$\text{cov}(X, X^3) = \mathbf{E}[X \cdot X^3] = \mathbf{E}[X^4] = 3$ . Furthermore, since  $\text{var}(X) = 1$  and  $\text{var}(X^3) = \mathbf{E}[X^6] = 15$ , we obtain

$$\rho(X, X^3) = \frac{3}{\sqrt{1} \cdot \sqrt{15}} = \sqrt{3/5}.$$


Interestingly, even though the random variables are strongly dependent (the value of one determines the value of the other), the value of the correlation coefficient is moderate.

*You have used 1 of 2 submissions*

**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

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