



Bookmarks

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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 vertical5



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## Exercise: Sections of a class

(4/4 points)

A class consists of three sections with 10 students each. The mean quiz scores in each section were 40, 50, 60, respectively. We pick a student, uniformly at random. Let  $X$  be the score of the selected student, and let  $Y$  be the number of his/her section. The quantity  $\text{var}(X | Y = y)$  turned out to be equal to  $5y$  for each section ( $y = 1, 2, 3$ ).

(a) The random variable  $\mathbf{E}[X | Y]$  has:

a mean of:

50



Answer: 50

a variance of:

200/3



Answer: 66.66667

(b)  $\mathbf{E}[\text{var}(X | Y)] =$

10



Answer: 10

(c)  $\text{var}(X) =$

230/3



Answer: 76.66667

Answer:

(a)  $\mathbf{E}[X | Y = y]$  is the mean of the scores in section  $y$ . Thus,  $\mathbf{E}[X | Y]$  is a random variable that takes the values 40, 50, and 60, with equal probability. Its mean is 50 and its variance is

$$\frac{1}{3} \left( (40 - 50)^2 + (50 - 50)^2 + (60 - 50)^2 \right) = \frac{200}{3}.$$

(b) The random variable  $\text{var}(X | Y)$  takes the values 5, 10, and 15, with equal probability. Its mean is 10.

(c) From the law of total variance, we just need to add the results from the previous two parts.

**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

*You have used 1 of 2 submissions*

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