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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 vertical3

Bookmark

## Exercise: Conditional variance II

(3/3 points)

The random variable  $Q$  is uniform on  $[0, 1]$ . Conditioned on  $Q = q$ , the random variable  $X$  is Bernoulli with parameter  $q$ .

(a) The conditional variance,  $\text{var}(X | Q)$ , is equal to:

☐  $1/4$ ☐  $q(1 - q)$ ☒  $Q(1 - Q)$  ✓☐  $q^2$ ☐  $Q^2$ 

(b) Recall that a uniform random variable on  $[0, 1]$  has a variance of  $1/12$  and also satisfies  $\mathbf{E}[Q^2] = 1/3$ . Then:

$\text{var}(\mathbf{E}[X | Q]) =$   ✓ Answer: 0.08333

$\mathbf{E}[\text{var}(X | Q)] =$   ✓ Answer: 0.16667

Answer:

(a) We know that  $\text{var}(X | Q = q) = q(1 - q)$ , for all  $q \in [0, 1]$ , which translates into the abstract statement  $\text{var}(X | Q) = Q(1 - Q)$ .

(b) Since  $\mathbf{E}[X | Q] = Q$ , we have  $\text{var}(\mathbf{E}[X | Q]) = \text{var}(Q) = 1/12$

**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

Since  $\text{var}(X | Q) = Q(1 - Q)$ , we have

$$\mathbf{E}[\text{var}(X | Q)] = \mathbf{E}[Q(1 - Q)] = \mathbf{E}[Q] - \mathbf{E}[Q^2] = \frac{1}{2} - \frac{1}{3} = \frac{1}{6}.$$

*You have used 1 of 2 submissions*

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