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15. Exercise: Sections of a class

Exercises due Mar 25, 2020 05:29 IST Completed

Exercise: Sections of a class

4/4 points (graded)

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 ${\sf Var}\,(X\,|\,Y=y)$ turned out to be equal to 5y for each section (y=1,2,3).

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

(b)
$$\mathbf{E}ig[\mathsf{Var}ig(X\,|\,Yig)ig] = ig[\mathsf{10}$$

Solution:

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



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

- (b) The random variable ${\sf Var}\,(X\,|\,Y)$ 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.

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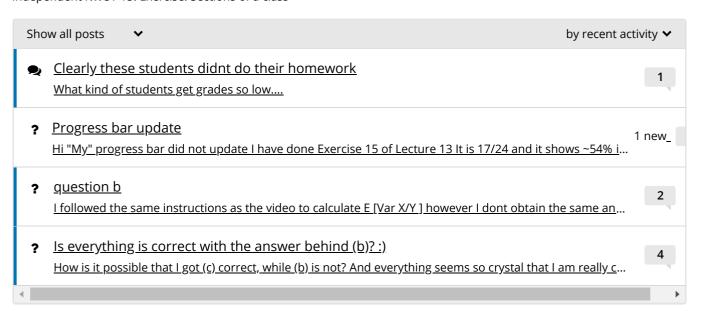
You have used 2 of 3 attempts

1 Answers are displayed within the problem

Discussion

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Topic: Unit 6: Further topics on random variables:Lec. 13: Conditional expectation and variance revisited; Sum of a random number of independent r.v.'s / 15. Exercise: Sections of a class



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