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

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

a mean of: 50 ✔ **Answer:** 50

a variance of: 200/3 ✔ **Answer:** 66.66667

(b) $\mathbf{E}\big[\mathsf{Var}(X \mid Y)\big] =$ 10 ✔ **Answer:** 10

(c) $\mathsf{Var}(X) =$ 230/3 ✔ **Answer:** 76.66667

**Solution:**

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

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

(b) The random variable $\mathsf{Var}\left(X \mid Y\right)$ 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.

Submit You have used 2 of 3 attempts

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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| | | |
|---|---|---|
| Clearly these students didnt do their homework<br>What kind of students get grades so low.... | | 1 |
| Progress bar update<br>Hi "My" progress bar did not update I have done Exercise 15 of Lecture 13 It is 17/24 and it shows ~54% i... | 1 new | |
| question b<br>I followed the same instructions as the video to calculate E [Var X/Y ] however I dont obtain the same an... | | 2 |
| Is everything is correct with the answer behind (b)? :)<br>How is it possible that I got (c) correct, while (b) is not? And everything seems so crystal that I am really c... | | 4 |