8. Exercise: Total probability theorem II

Exercise: Total probability theorem II

2/2 points (graded)

On any given day, mail gets delivered by either Alice or Bob. If Alice delivers it, which happens with probability $1/4$, she does so at a time that is uniformly distributed between 9 and 11. If Bob delivers it, which happens with probability $3/4$, he does so at a time that is uniformly distributed between 10 and 12. The PDF of the time X that mail gets delivered satisfies

a) $f_X(9.5) =$ 1/8 ✔ **Answer:** 0.125

b) $f_X(10.5) =$ 1/2 ✔ **Answer:** 0.5

Solution:

The PDF is $1/4$ times a uniform on $[9, 11]$ (of height $1/2$) plus $3/4$ times a uniform on $[10, 12]$ (again of height $1/2$).

a) At time 9.5, only the first uniform is nonzero, yielding $f_X(9.5) = (1/4) \cdot (1/2) = 1/8$.

b) At time 10.5 both uniforms are nonzero, yielding $f_X(10.5) = (1/4) \cdot (1/2) + (3/4) \cdot (1/2) = 1/2$.

提交 You have used 2 of 3 attempts

Answers are displayed within the problem

讨论

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PDF(9.5) +

question posted 9 days ago by **SureshSatya**

Though I got the answers correct to the exercise - I have a question, in what does PDF(9.5) mean in relation to mail arrival time? Since a continuous RV has 0 probability at an exact value - do we interpret 9.5 as infinitesimally small interval (delta) around 9.5?

此帖对所有人可见。

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2 responses

BlackColt
9 days ago

$f_X(9.5)$ can be thought of as instantaneous rate of change/increase of probability at $X = 9.5$.
If $f_X(x)$ is relatively high, you may think of the probability of a certain event happening increases "fast" at (& around) $X = x$, so the probability of that event happening in a small interval at $X = x$ is relatively high.
Compare the values of $f_X(9.5)$ & $f_X(10.5)$ to get an idea on the relative likelihoods of the event happening in a small interval at $X = 9.5$ and at $X = 10.5$.

I disagree. fX(9.5) = 0. Period.

Subhenduchat 在8 days ago前发表

Nope. $f_X(9.5) \neq 0$ in this problem.

BlackColt 在8 days ago前发表

The probability at a single point is zero, but the probability density can certainly be non-zero. The problem statement gives us the times when the density is non-zero for each of the couriers, and asks us to compute the appropriate combination at times that are in one or both of these regions.

David

davidstuartbruce 在7 days ago前发表

Exactly. One shouldn't confuse $0 = P(X = 9.5)$ with $f_X(9.5) \neq 0$. This is a crucial difference (as @jdjelic mentions below), and that often gets overlooked, between a PMF for which $p_X(a) = P(X = a)$ and a PDF for which $f_X(a) \neq P(X = a)$.

mrBB (Community TA) 在7 days ago前发表

If fX(x) was zero for all values of x, the graph would have no height for any continuous random variable.

EricaMdeCarvalho 在5 days ago前发表

@EricaMdeCarvalho If $f_X(x) = 0$ for all values of x, then $f_X(x)$ is not a pdf. This is because it does not satisty $\int_x f_X(x)dx = 1$.

QiaominXie (Staff) 在5 days ago前发表

@QiaominXie, that was exactly my point. That if the pdf was zero for all specific values X = x. Then it wouldn't have height and, consequently, it wouldn't be a pdf. I think people are mistaking density for probability.

EricaMdeCarvalho 在a day ago前发表

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jdjelic
8 days ago

Note that PDF is not the same as PMF. Whereas PMF gives the probability of a point, it is not true for PDF. Remember that PDF can even be > 1 at certain points! For continuous r.vs, probability is only calculated on intervals, by integration on those.

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