5. Exercise: Linear functions of continuous r.v.'s

Exercises due Mar 25, 2020 05:29 IST *Completed*

Exercise: Linear functions of continuous r.v.'s

2/2 points (graded)

(a) Let X be an exponential random variable and let $Y = aX + b$. The random variable Y is exponential if and only if (choose one of the following statements):

- ◯ always.
- ◯ $a \neq 0$.
- ◯ $a \neq 0$ and $b = 0$
- ◯ $a > 0$
- ◉ $a > 0$ and $b = 0$
- ◯ $a = 1$

✔

(b) Let X be a continuous random variable, uniformly distributed on some interval, and let $Y = aX + b$. The random variable Y will be a continuous random variable with a uniform distribution if and only if (choose one of the following statements):

- ◯ always.

- ○ $a > 0$.
- ◉ $a \neq 0$
- ○ $a \neq 0$ and $b = 0$

✔

Solution:

(a) For Y to be exponential, its range must be $[0, \infty)$. This will be the case only if $a > 0$ and $b = 0$. And if indeed $a > 0$ and $b = 0$, and X has parameter λ, then, for $y \geq 0$, $f_Y(y) = (1/a) f_X(y/a) = (\lambda/a) e^{-\lambda y/a}$, which is exponential (with parameter λ/a).

(b) A scaled and shifted uniform is uniform, except that if $a = 0$, then Y is a constant random variable, and therefore no longer continuous.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

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- ? In (a), why does the coefficient a have to be positive? — The formula for the derived distribution of a continuous variable includes 1/(absolute value of a), so if a i... — 5
- ? Shouldn't this question be after video 6? — Shouldn't this question be after video 6? — 7
- ☑ Why a constant random variable not continuous? — 4
- ? Essential condition for an Exponential function? — 3
- ? For part A, if b is a number that is not 0, why is it not exponential anymore?

Given that Y=aX+b , If aX = λe^-λZ, then why by adding a constant b to it makes it not exponential anymo... 3

Isn't the shape of Y the same as X?

I got the answer to the first part. But I am still puzzled - isn't the shape of Y the same as X, just scaled ver... 5