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WiSe 2022
29.11.2022

Exercise Sheet 5

Stochastics (AAI)

Exercise 5.1 (H)

Compute the expected value and the variance of the following distributions:

a) $X \sim \mathrm{U}(a, b)$, $a < b$,

b) $X \sim \mathrm{Exp}(\lambda)$, $\lambda > 0$,

c) $X \sim \mathrm{N}(\mu, \sigma^2)$, $\mu \in \mathbb{R}$, $\sigma > 0$.

Exercise 5.2 (H)

For $a \in \mathbb{R}$ let $f_a \colon \mathbb{R} \to \mathbb{R}$ be given by

$$f_a(x) = \begin{cases} ax + a, & \text{if } x \in [-1, 0], \\ a - ax, & \text{if } x \in [0, 1], \\ 0, & \text{else.} \end{cases}$$

a) Determine all $a \in \mathbb{R}$ such that f_a is a probability density.

b) Let X be an absolutely continuous random variable with density f_1. Compute $\mathrm{E}(|X| - X^2)$ and $P(\{X \leq x\})$ for $x \in \mathbb{R}$.

Exercise 5.3 (H)

The mean lifetime of an electronic component is 2000 days.

a) Specify an appropriate model for the lifetime.

b) Compute the probability of the lifetime being longer than 500 days and of the lifetime being at most 300 days.

Exercise 5.4 (H)

Let X, Y be independent random variables with $X \sim \mathrm{Exp}(1)$ and $Y \sim \mathrm{B}(1, 3/4)$.

a) Is $X \cdot Y$ discrete or absolutely continuous?

b) Compute $P(\{X \cdot Y \leq x\})$ for $x \in \mathbb{R}$.