Introduction & Renewal processes

Quiz, 6 questions

1 point

1. Let η be a random variable with distribution function F_η. Define a stochastic process $X_t = \eta + t$. Compute the distribution function of a finite-dimensional distribution $(X_{t_1}, ... X_{t_n})$, where $t_1, ..., t_n \in \mathbb{R}_+$:

- none of above
- $\mathbb{F}_\eta\{min(x_1 - t_1, ..., x_n - t_n)\}$
- $\mathbb{F}_\eta\{min(x_1, ..., x_n)\}$
- $\mathbb{F}_\eta\{min(t_1, ..., t_n)\}$

1 point

2. Let S_n be a renewal process such that $\xi_n = S_n - S_{n-1}$ takes the values 1 or 2 with equal probabilities $p = 1/2$. Find the mathematical expectation of the counting process N_t at t=3:

- $1/8$
- $7/8$
- $15/8$
- 3
- none of above

1 point

3. Let $S_n = S_{n-1} + \xi_n$ be a renewal process and $p_\xi(x) = \lambda e^{-\lambda x}$. Find the mathematical expectation of the corresponding counting process N_t:

- $\frac{1}{\lambda}$
- none of above
- λ^2
- λ
- $\frac{1}{\lambda^2}$

1 point

4. Let η be a random variable with distribution function F_η. Define a stochastic process $X_t = e^\eta t^2$. What is the distribution function of $(X_{t_1}, ..., X_{t_n})$ for positive $t_1, ..., t_n$?

- $\mathbb{F}_\eta\{\min(\ln(x_1/t_1^2), ..., \ln(x_n/t_n^2)\}$
- $\mathbb{F}_\eta\{\min(\ln(x_1/t_1), ..., \ln(x_n/t_n)\}$
- none of above
- 0

1 point

5. Let N_t be a counting process of a renewal process $S_n = S_{n-1} + \xi_n$ such that the i.i.d. random variables $\xi_1, \xi_2, ...$ have a probability density function

$$p_\xi(x) = \begin{cases} \frac{1}{2}e^{-x}(x+1), & x \geq 0 \\ 0, & x < 0. \end{cases}$$

Find the mean of N_t:

- none of above
- $-\frac{1}{9} + \frac{2}{3}t + \frac{1}{9}e^{-(3/2)t}$
- $-\frac{1}{9} + \frac{4}{3}t + \frac{1}{9}e^{-(3/2)t}$
- $-\frac{1}{9} + \frac{2}{3}t + \frac{1}{9}e^{3/2t}$

1 point

6. Let ξ and η be 2 random variables. It is known that the distribution of η is symmetric, that is, $\mathbb{P}\{\eta > x\} = \mathbb{P}\{\eta < -x\}$ for any $x > 0$, and moreover $\mathbb{P}\{\eta = 0\} = 0$. Find the probability of the event that the trajectories of stochastic process $X_t = \xi^2 + t(\eta + t)$, $t \geq 0$ increase:

- 1

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- $\frac{1}{2}$
- 0
- $\frac{1}{4}$
- none of above

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