Poisson processes & Queueing theory

Quiz, 7 questions

1 point

1. Compute the mathematical expectation of a Poisson Process N_t with intensity λ:

- t
- λ
- λt
- λx

1 point

2. Find the moment generating function for a random variable with binomial distribution, $\mathbb{P}\{\xi = k\} = C_n^k p^k (1-p)^{n-k}, \quad k = 0, 1, .., n, \qquad p \in (0, 1)$:

- $(up + (1-p))^k$
- $\left(\frac{1-p}{1-pu}\right)^r$
- $\frac{p}{1-(1-p)u}$
- $(up + (1-p))^n$

1 point

3. Find the limit $\lim_{h \to 0} \mathbb{P}\{N_h = 0\}$:

- λh
- $1 - \lambda h$
- λ
- 0

1 point

4. 2 people are chating: one has a messaging speed equals to 3 messages per minute, another - 2 messages per minute. Assuming that for every person the message writing is modeled with Poisson Process and these processes are independent, find the probability that there will be sent only 2 messages per one minute.

- $e^{-3} \frac{6t^k}{k!}$
- $e^{-5} \frac{25}{2}$
- $e^{-2} \frac{6t^k}{k!}$
- $e^{-5t} \frac{25t}{k!}$

1 point

5. Purchases in a shop are modelled by the homogeneous Poisson process: 30 purchases are made on average during an hour after the opening of the shop. Find the probability that the interval between k and $k+1$ purchases will be less than 4 minutes, given that the purchase number k was in the time moment s:

- $e^{-30(s+1/15)+30s}$
- $e^{-60(s+1/20)+60s}$
- $1 - e^{-30(s+1/15)+30s}$
- $1 - e^{-60(s+1/30)+60s}$

1 point

6. The amount of claims to an insurance company is modelled by the Poisson process, and the claim sizes are modelled by an exponential distribution. On average there are 100 claims per day, and the mean value of 1 claim is 5000 USD.

Find the variance of X_t, which is equal to the total amount of claims till time t :

- $t \times 10^9$
- 5×10^9
- $5t \times 10^9$
- 10^9

1 point

7. Purchases in a shop are modelled with non-homogeneous Poisson process: $30t^{5/4}$ purchases are made on average during t hours after the opening of the shop. Find the probability that the interval between k and $k+1$ purchases will be less than 2 minutes, given that the purchase number k was in the time moment s:

- $1 - e^{-30(s+1/30)^{5/4}+30s^{5/4}}$
- $1 - e^{-30(s+1/60)^{5/4}+30s^{5/4}} - e^{-30(s+1/20)^{5/4}+30s^{5/4}}$
- $e^{-30(s+1/60)^{5/4}+30s^{5/4}} - e^{-30(s+1/20)^{5/4}+30s^{5/4}}$
- $e^{-30(s+1/30)^{5/4}+30s^{5/4}}$

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