ECE-QE CS1-2015 - Rhea

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ECE Ph.D. Qualifying Exam

Communication, Networking, Signal and Image Processing (CS)

Question 1: Probability and Random Processes

August 2015

Question

Part 1.

If X and Y are independent Poisson random variables with respective parameters λ_1 and λ_2, calculate the conditional probability mass function of X given that $X + Y = n$.

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Part 2.

Let $Z(t), t \geq 0$, be a random process obtained by switching between the values 0 and 1 according to the event times in a counting process $N(t)$. Let $P(Z(0) = 0) = p$ and

$$P(N(t) = k) = \frac{1}{1 + \lambda t} \left(\frac{\lambda t}{1 + \lambda t}\right)^k$$

for $k = 0, 1, \ldots$. Find the pmf of $Z(t)$.

Click here to view student answers and discussions

Part 3.

Let X and Y be independent identically distributed exponential random variables with mean μ. Find the characteristic function of $X + Y$.

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Part 4.

Consider a sequence of independent and identically distributed random variables $X_1, X_2, \ldots X_n$, where each X_i has mean $\mu = 0$ and variance σ^2. Show that for every $i = 1, \ldots, n$ the random variables S_n and $X_i - S_n$, where $S_n = \sum_{j=1}^{n} X_j$ is the sample mean, are uncorrelated.

wers and discussions

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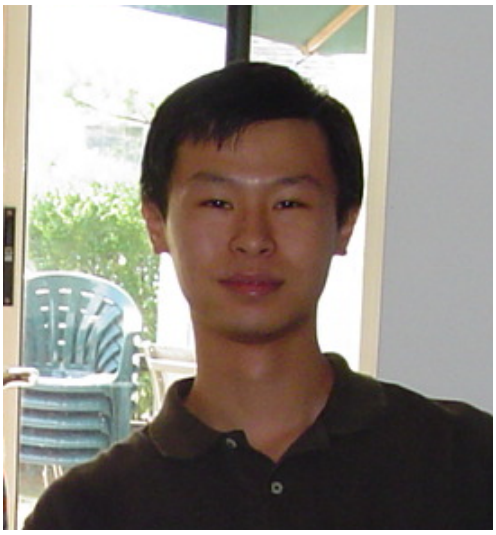

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