ECE-QE CS1-2016 - Rhea

Print

ECE Ph.D. Qualifying Exam

Communication, Networking, Signal and Image Processing (CS)

Question 1: Probability and Random Processes

August 2016

Question

Part 1.

A friend tossed two fair coins, You asked "Did a coin land heads?" Your friends answers "yes." What is the probability that both coins landed heads? Justify your answer.

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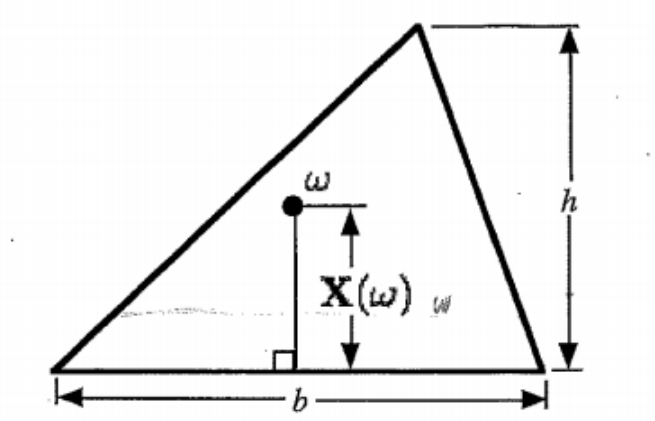
Part 2.

A point ω is picked at random in the triangle shown below (all points are equally likely.) let the random variable $X(\omega)$ be the perpendicular distance from ω to be base as shown in the diagram.



(a) Find the cumulative distribution function (cdf) of $\mathbf{X}$.
(b) Find the probability distribution function (pdf) of $\mathbf{X}$.
(c) Find the mean of $\mathbf{X}$.
(d) What is the probability that $\mathbf{X} > h/3$.

wers and discussions

Part 3.

Let X and Y be independent, jointly-distributed Poisson random variables with means with mean λ and μ. Let Z be a new random variable defined as
$Z = X + Y$
(a) Find the probability mass function (pmf) of $\mathbf{Z}$.
(b) Show that the conditional probability mass function (pmf) of X conditioned on the event $Z = n$ is binomially distributed, and determine the parameters of the binomial distribution (recall that there are two parameters " n " and " p ") required to specify a binomial distribution $b(n, p)$).

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Part 4.

Let $X(t)$ be a wide-sense stationary Gaussian random process with mean μ_x and autocorrelation function $R_x x(\tau)$. Let
$Y(t) = c_1 X(t) - c_2 X(t - T)$,
where c_1, c_2 and T are real numbers. What is the probability that $Y(t)$ is less than or equal to a real number $/\gamma$? Express your answer in terms of $c_1, c_2, \mu_x, \sigma_x^2$, and $R_x x(\tau), \gamma$ and the "phi function"
$\Phi(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} dz$

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