CSCI 5454 Problem Set 2
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1. *Probability boot camp*

   (a) *Prove Markov's inequality:* $Pr[X \geq c] \leq E[X]/c$

   The formula for the probability of a continuous random variable $X$ with probability density function $f(x)$ is

   $$Pr[x_1 \leq X \leq x_2] = \int_{x_1}^{x_2} f(x)dx$$

   And the formula for the expected value of a continuous random variable $X$ with probability density function $f(x)$ is

   $$E[x_1 \leq X \leq x_2] = \int_{x_1}^{x_2} xf(x)$$

   so for $Pr[X \geq c]$ we have

   $$Pr[X \geq c] = \int_{c}^{\infty} f(x)dx$$

   and since $X$ is a nonnegative random variable we have

   $$E[X] = \int_{0}^{\infty} xf(x)dx$$

   (b) *Prove Chebyshev's inequality*

   (c) *Show that for any discrete random variables* $X, X', E[X] = E[E[X|X']]$.

   (d) *Prove by induction that* $E[X_t] = 0$.