CS 109 Quiz 3 (35 points):

1. [10 points] True or False (2 points correct, 1 point blank, 0 points guess). Note that true means **always** true.
   a. For a continuous random variable X and some $x \in \mathbb{R}$, $P(X = x) = 0$.
   b. If X is continuous, then $0 \leq f_X(x) \leq 1$ for all $x \in \mathbb{R}$.
   c. For any $a \in \mathbb{R}$, $\Phi(a) = P(X > -a)$.
   d. If $X \sim N(\mu, \sigma^2)$, then $\frac{X-\mu}{\sigma^2} \sim N(0,1)$.
   e. Suppose there are n people at a party, and the hat-check person messes up and returns hats randomly. If X is the number of people who get their hat back, then $X \sim Binomial\left(n, \frac{1}{n}\right)$.
2. [15 points] Definitions (3 points each).
   a. Cite the Chain Rule. $\Pr(A \cap B \cap C) =$.
   b. Cite the definition of E, F conditionally independent given G:
   c. $Var(aX + b) =$
   d. A formula for $F_X(t)$ depending on the pdf f_X. $F_X(t) =$
   e. Marginal distribution of X given joint PMF $p_{X,Y}$: $p_X(x) =$.
3. [10 points] Short answer. Match the following to the most appropriate distribution, including parameters. Suppose there are B blue fish, R red fish, G green fish in a pond, where $B + R + G = N$.
   a. How many of the next 10 fish I catch are blue, if I catch and release
   b. How many fish I had to catch until my first green fish, if I catch and release
   c. How many red fish I catch in the next five minutes, if I catch on average r red fish per minute
   d. How long it takes in minutes until I catch my first red fish, if I catch on average r red fish per hour
   e. Whether or not my next fish is blue