CS 109 Quiz 2 (25 points):

1. [8 points] True or False (2 points correct, 1 point blank, 0 points guess). Note that true means **always** true.
   a. For any random variable X, $E[X^2] = E[X]^2$.
   b. In general, $P(A, B|C) = P(B|C)P(A|B, C)$.
   c. If A and B are independent, so are A and B^C.
   d. If we toss n balls into m bins (uniformly at random), then the number of balls in the first bin is $Binomial\left(n, \frac{1}{m}\right)$.
2. [12 points] Definitions (3 points each).
   a. Cite Bayes Theorem. $\Pr(A|B) =$.
   b. Cite the Law of Total Probability for $\Pr(A)$ in terms of the partition $B_1, \ldots, B_n$. $\Pr(A) =$.
   c. PMF for $X \sim Binomial(n, p)$. $p_X(k) =$
   d. If X is a random variable, $E[g(X)] =$
3. [5 points] Short answer. Let X be the number of flips of a coin with $P(head) = p$ up to and including the first head. What are Ω_X and $\Pr(X = k)$?