

## 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  $\text{Binomial}\left(n, \frac{1}{m}\right)$ .
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  $B_1, \dots, B_n$ .  $\Pr(A) =$ .
  - c. PMF for  $X \sim \text{Binomial}(n, p)$ .  $p_X(k) =$
  - 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  $P(\text{head}) = p$  up to and including the first head. What are  $\Omega_X$  and  $\Pr(X = k)$ ?

<https://courses.cs.washington.edu/courses/cse312/18sp/sections/04/section04.pdf>

<https://courses.cs.washington.edu/courses/cse312/18sp/sections/04/section04-solutions.pdf>