

1. Let X, Y be independent $\text{Binomial}(2, \frac{1}{2})$ random variables.
 - (a) What is the conditional PMF of X conditioned on $X \neq Y$?
 - (b) Are X and Y independent conditioned on $(X \neq Y)$ AND $(Y \neq X)$?
2. Alice and Bob decide to meet somewhere. Alice's arrival time A is uniform between 12:00 and 12:45. Bob's arrival time B is uniform between 12:15 and 1:00. Their arrival times are independent.
 - (a) Let f_{A-B} be the PDF of $A - B$. What is $f_{A-B}(0)$?
 - (b) What is the probability that Bob arrives before Alice?
3. Let $Y = AX + B$ where A, B, X are independent $\text{Normal}(0, 1)$ random variables.
 - (a) What is $\text{Var}[E[Y|X]]$?
 - (b) What is $E[\text{Var}[Y|X]]$?
4. Boys and girls arrive independently at a meeting point at a rate of one boy per minute and one girl per minute, respectively. Let T be the first time at which both a boy and a girl have arrived.
 - (a) Find the cumulative distribution function (CDF) of T .
 - (b) What is the expected value of T ? (**Hint:** You don't *have* to use calculus.)
5. A deck of cards is divided into 26 pairs. Let X be the number of those pairs in which both cards are of the same suit. (A deck of cards has 4 suits and each suit has 13 cards.)
 - (a) What is the expected value of X ?
 - (b) What is the variance of X ?
 - (c) Is the probability that $X = 0$ more or less than 20%? Justify your answer.