1. Let X, Y, Z be independent Binomial$(2, \frac{1}{2})$ random variables.

    (a) What is the conditional PMF of X conditioned on $X \neq Z$?

    (b) Are X and Y independent conditioned on $(X \neq Z)$ AND $(Y \neq Z)$?

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 Normal$(0, 1)$ random variables.

    (a) What is $\mathrm{Var}[\mathrm{E}[Y|X]]$?

    (b) What is $\mathrm{E}[\mathrm{Var}[Y|X]]$?

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 <u>have</u> 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.~~