1. We flip a fair coin with probability of heads $\frac{1}{2}$ 20 times. Let X be the number of heads in the first 10 coin flips and let Y be the number of heads in the last 10 coin flips. Find the conditional probability that $X = 5$, given that $X + Y = 12$.
   Pitman 6.1.4

2. Let X_1 and X_2 be independent and uniformly distributed on $\{1, 2, \ldots, n\}$. Let X be the minimum and Y be the maximum of X_1 and X_2. Find:

   a) $E(Y|X = x)$

   b) $E(X|Y = y)$
   Pitman 6.2.2

3. Suppose that N is a Poisson random variable with parameter μ. Suppose that given $N = n$, random variables $X_1, X_2, \ldots, X_n$ are independent with uniform (0,1) distribution. So there are a random number of X's.

   a) Given $N = n$, what is the probability that all the X's are less than some $t \in [0, 1]$?

   b) What is the (unconditional) probability that all the X's are less than some $t \in [0, 1]$?

   c) Let $S_N = X_1 + X_2 + \cdots + X_N$ denote the sum of the random number of X's. Find $P(S_N = 0)$.

   d) Find $E(S_N)$
   Pitman 6.2.6