

1. (\*) Nick and Penny are independently performing independent Bernoulli trials. For concreteness, assume that Nick is flipping a nickel with probability  $p_1$  of Heads and Penny is flipping a penny with probability  $p_2$  of heads. Let  $X_1, X_2, \dots$  be Nick's results and  $Y_1, Y_2, \dots$  be Penny's results, with  $X_i \sim \text{Bern}(p_1)$  and  $Y_j \sim \text{Bern}(p_2)$ .
  - (a) Find the distribution and expected value of the first time at which they are simultaneously successful. *Hint: Define a new sequence of Bernoulli trials and use the story of the Geometric. Think about what should count as "success" and what should count as "failure".*
2. Suppose a fair 6-sided die is rolled repeatedly, and let  $X$  be the number of rolls required until the first 1 is rolled (including the roll that produced the 1)
  - (a) What is the name of the distribution of  $X$ ? (including the specific parameters)
  - (b) What is the expected number of rolls required until the first 1 is rolled?
  - (c) Use LoTP to condition on the values of  $X$  in order to find the probability that  $X$  is odd. (Previously, you looked at a similar problem, but approached it from the perspective of first step analysis.)