Math 342 —Joint probability mass functions

Problem 1. Suppose you have the following data on pet ownership in a town with 1000 households.

	Has 0 cats	Has 1 cat	Has 2 cats	total
Has 0 dogs	400	150	150	700
Has 1 dog	50	5	40	95
Has 2 dogs	150	15	40	205
total	600	170	230	1000

Suppose a household is chosen at random, and we let X denote the number of dogs in the household and let Y denote the number of cats in the household.

a. Make a table for the joint probability mass function of X and Y.

b. Find the marginal probability mass functions of X and Y.

c. Find $E[X]$ and $E[Y]$.

Problem 2. Suppose we draw two numbers, one at a time without replacement, from the set $\{1, 2, 3, 4\}$. Let X denote the first number drawn, and let Y denote the second number drawn.

a. For each value of x and y, compute $P(X = x, Y = y)$ by computing $P(Y = y \mid X = x)P(X = x)$. Write your answers in a table.

b. Find the marginal probability mass functions of X and Y.

c. Find $E[X]$ and $E[Y]$.

d. Compute $E[XY]$. How does it compare to $E[X]E[Y]$? Is this surprising?

e. How does $E[X + Y]$ compare to $E[X] + E[Y]$?