Tables Funsheet

Problem 1

Suppose we conduct an experiment where in each trial, we flip a single coin twice, recording for the first and second toss whether the coin landed on heads or tails. For this first experiment, we performed twenty trials and tabulated the results below. The results of the first flip are given as the row, while the columns represent the outcome of the second flip

	N = 20	
	Heads	Tails
Heads	3	5
Tails	6	6

Part A What are the marginal distributions of the first and second coin flips?

Part B What is the *marginal probability* of the first coin flip being heads?

Part C Find the probability that the first coin lands on heads *given* that the second flip landed on heads. Write this probability of the form $P(H_1|H_2) = ...$ Repeat this for $P(H_1|T_2)$ (the first is heads *given* that the second is tails).

Part D Roughly sketch a conditional bar plot, *conditioning on the result for the second flip*

Part E Based on what you found for parts C and D, does it appear as if the coin flips are independent?

Problem 2

We repeat the experiment above, this time performing $N = 50$ trials

	N = 50	
	Heads	Tails
Heads	11	12
Tails	13	14

Part A What are the marginal distributions of the first and second coin flips?

Part B What is the *marginal probability* of the first coin flip being heads?

Part C Find the probability that the first coin lands on heads *given* that the second flip landed on heads. Write this probability of the form $P(H_1|H_2) = ...$ Repeat this for $P(H_1|T_2)$ (the first is heads *given* that the second is tails).

Part D Roughly sketch a conditional bar plot, *conditioning on the result for the second flip*

Part E Based on what you found for parts C and D, does it appear as if the coin flips are independent?

Part F Before conducting any trials with coins, we know that the first and second coin flips will be independent. By our definition of independence, however, the marginal probability should be equal to the conditional probability. Provide a few sentences that address the following:

- Why did neither experiment give us exactly what we expected to see under independence?
- Should we be surprised that the first and second experiments gave us different results?
- Considering the Law of Large Numbers, why do we expect the second experiment to be closer to correct than the first?