Questions

1. Download daily Santa Fe, NM weather data for August 2016 from https://figshare.com/s/de109f378939dfc0ed0b (`santafe-temps.csv`). Define X as a random variable that indicates whether it is hot on any given date (let X=hot when the MaxTemp for the day is greater than or equal to 80 degrees Fahrenheit and X=not-hot otherwise). Define Y as a random variable that indicates whether there is rain on a given date (let Y=rain when Precipitation is greater than 0 and Y=no-rain otherwise). Compute the following information theoretic quantities: I(X), I(Y), I(XY), I(X|Y), I(Y|X), and the mutual information I(X:Y).

2. Seth discussed digital “gates”, which take in a set of binary values as inputs and compute some binary value as output. Consider an AND gate, which takes in two inputs, and then outputs a 1 when both of the input values are 1, and a 0 otherwise. Assume that input values are distributed uniformly. What is the mutual information between the input and the output of this digital gate?