Bayesian Data Analysis
PHY/CSI/INF 451/551
HW4w
Show all work

In this Assignment, we explore the application of Bayes Theorem.

1. Bayes Theorem and the Weather
You awoke this October morning to see dark clouds rolling in from the west and wonder whether it will or will not rain. Historically, there is a 29% chance of rain on any given day in October.

On days when it does rain, 90% of the time there are dark clouds that roll in during the morning. However, on days when it does *not* rain, 25% of the time there are dark clouds that roll in during the morning.

a. What is the hypothesis, and what is the data?

b. Write Bayes Theorem for this problem.

c. Write an expression for the evidence.

d. Solve Bayes Theorem to find the probability that it will rain given that there are dark clouds rolling in.

2. You are a laptop repair person. When a laptop stops working, it is due to a failed power supply 30% of the time. If a laptop's power supply has failed, there is a 45% probability that plugging it in will produce smoke. If a laptop's power supply is OK, but something else is wrong, there is only a 5% chance that plugging it in will produce smoke. A customer brings you a malfunctioning laptop. You plug in the laptop and find that it produces smoke. What is the probability that a smoke-producing laptop has a failed power supply?
(apply the same steps as listed in problem 1)

3. The blue M&M was introduced in 1995. Before then, the color mix in a bag of plain M&Ms was (30% Brown, 20% Yellow, 20% Red, 10% Green, 10% Orange, 10% Tan). Afterward it was (24% Blue, 20% Green, 16% Orange, 14% Yellow, 13% Red, 13% Brown).

A friend of mine has two bags of M&Ms, and he tells me that one is from 1994 and one from 1996. He won't tell me which is which, but he gives me one M&M from each bag. One is yellow and one is green. What is the probability that the yellow M&M came from the 1994 bag?