Problem Set 6

Phil313Q

Due Nov. 15, 9:30am

For practice problems, see PIL ch. 7, p. 77 #2-5, ch. 8 p. 96 #2 & #6

1   Bayes' Rule

Use Bayes' Rule to solve the following problems.

1. Urn A has 30 red and 70 green balls. Urn B has 80 red and 20 green balls. An urn is chosen by flipping a fair coin.

   (a) Two balls are drawn from this urn with replacement. Both are red. **What is the probability that we have urn A?**

   (b) Two balls are drawn from this urn without replacement. Both are green. **What is the probability that we have urn B?**

2. Suppose that 50% of our bananas come from Guatemala, 20% come from Honduras, and 30% come from Ecuador. 4% of bananas from Guatemala contain tarantulas, 2% of bananas from Honduras contain tarantulas, and 3% of bananas from Ecuador contain tarantulas. A banana is selected randomly and contains a tarantula. **What is the probability that it came from Ecuador?**

3. Suppose that in Logitropolis, 60% of taxis are green and 40% of taxis are blue. There was a hit-and-run accident involving a taxi, and our witness testifies that she saw the taxi responsible and that it was blue. We test her perceptual abilities and find that this witness is correct 90% of the time when presented with a series of green and blue cars under the same conditions of the accident. **What is the probability that the hit-and-run taxi is blue given that the witness testified that it's blue?**

2   Expected Value

4. A storm has 15% probability, and you have to decide between traveling via train or plane.

The train will take at least 3 hours no matter what, plus EITHER (i) 3 additional hours, if there is no storm OR (ii) 5 additional hours, if there is a storm.

The plane will take at least 2 hours no matter what, plus EITHER (i) 1 additional hour, if there is no storm OR (ii) 9 additional hours, if there is a storm.

What's the expected travel time (expected value) of traveling by each?

5. Suppose we run a lottery with 5,001 tickets of equal chance of being drawn. Tickets cost $2.50 each. The prize is $11,000. One quarter of the losers are randomly selected to receive a $3.25 consolation prize. **What is the expected value of buying a ticket in this lottery?**

6. Suppose you are betting on whether a fair coin will lands heads or tails. If you bet correctly, you win back double your bet. (For example, if you bet $10 and are correct, you win $20 so are "up" $10.) You decide to try out the *Martingale betting strategy* (see p. 90 of PIL, or my slide #13) and would like to guarantee that you eventually profit (are "up") $5 total. (Assume you have infinite money, and that there is no maximum bet amount.) **How many times would you have to bet and lose in a row until the next bet is the first one greater than $700?**

Hint: Your first bet should be $5.