

## Introduction to Probability

### Tutorial 5

1. An item of clothing is picked at random from one of two drawers in a dark room. The first drawer contains 6 socks and 6 ties, and the other contains 2 socks and 4 handkerchiefs. What is the probability that the item comes from the first drawer if it turns out to be a sock?
2. Suppose it is known that 1% of the population suffers from a particular disease. A blood test has a 97% chance of identifying the disease for diseased individuals, but also has a 6% chance of falsely indicating that a healthy person has the disease.
  - (a) What is the probability that a person will have a positive blood test?
  - (b) If your blood test is positive, what is the chance that you have the disease?
  - (c) If your blood test is negative, what is the chance that you do not have the disease?
3. The weather on a particular day is classified as either cold, warm or hot. There is a probability of 0.15 that it is cold and a probability of 0.25 that it is warm. In addition, on each day it may either rain or not rain. On cold days there is a probability of 0.3 that it will rain, on warm days there is a probability of 0.4 that it will rain, and on hot days there is a probability of 0.5 that it will rain. If it is not raining on a particular day, what is the probability that it is cold?
4. You have two coins, a fair one with probability of heads  $\frac{1}{2}$  and an unfair one with probability of heads  $\frac{1}{3}$ , but otherwise identical. A coin is selected at random and tossed, falling heads up. How likely is it that it is the fair one?
5. Are the following statements true or false?
  - (a) If a fair coin is tossed three times, the probability of obtaining two heads and one tail is the same as the probability of obtaining one head and two tails.
  - (b) If a card is drawn at random from a deck of cards, the probability that it is a heart increases if it is conditioned on the knowledge that it is an ace.
  - (c) If two events are independent, then the probability that they both occur can be calculated by multiplying their individual probabilities.
  - (d) It is always true that  $P(A|B) + P(A'|B) = 1$ .
  - (e) It is always true that  $P(A|B) + P(A|B') = 1$ .
  - (f) It is always true that  $P(A|B) \leq P(A)$ .