

CSE1202 – Mathematics and Statistics for Computer Science

Tutorial Sheet #9

1. Consider a pack of 52 playing cards. A card is selected at random. What is the probability that the card is either a diamond or a ten?
2. A bag contains 20 balls, 3 are coloured red, 6 are coloured green, 4 are coloured blue, 2 are coloured white and 5 are coloured yellow. One ball is selected at random. Find the probabilities of the following events:
 - a. the ball is either red or green
 - b. the ball is not blue
3. A card is drawn at random from a deck of 52 playing cards. What is the probability that it is an ace or a face card (i.e., King, Queen, Jack)?

The general multiplication rule states that when we calculate probabilities involving one event AND another event occurring, we multiply their probabilities. In some cases, the first event happening impacts the probability of the second event. We call these **dependent** events. In other cases, the first event happening does not impact the probability of the seconds. We call these **independent** events.

Now, answer the following questions:

4. Suppose you take out two cards from a standard pack of cards one after another, without replacing the first card. What is probability that the first card is the ace of spades, and the second card is a heart?
5. A coin is tossed and a die is rolled. What is the probability of getting a head and a 4?
6. A card is drawn from a deck of 52 cards and then replaced and a second card is drawn. Find the probability of getting a King and then a Queen of Hearts.

Use Bayes' Theorem to answer the following questions:

7. A company audit reveals that 4% of department budgets contain errors. A program is developed to analyse budgets and, in a test, identifies errors in 98% of budgets with errors and 5% of those without. If a budget is marked by the program as possibly having an error, what is the probability that the budget actually does have an error?
8. Approximately 1% of women aged 40-50 have a certain disease. A woman with the disease has a 90% chance of testing positive for the disease, while a woman without the disease has a 10% chance of a false positive result. What is the probability a woman has the disease given that she just has a positive test?
9. While it is known that in a criminal trial, it must be shown that a defendant is guilty beyond a reasonable doubt (i.e., innocent until proven guilty), let's assume that in a criminal trial by jury, the probability the defendant is convicted, given they are guilty, is 82%. The probability that the defendant is acquitted, given innocence, is 80%. And, suppose that 85% of all defendants are indeed guilty. Now, suppose a particular defendant is convicted of a crime. Find the probability they are innocent.
10. Assume a new test is developed for cancer detection with sensitivity 0.79 and specificity 0.95, with prevalence 0.04. Determine the likelihood that an individual has cancer if their test result is positive.