# Tutorial: Probability and statistics

## Aim

The aim of this tutorial is for students to practise calculating probabilities of events using different distributions.

## Questions

1. Two cards are drawn randomly from a deck of 52 cards. Find the probability that:

    a) both are clubs
    b) one is a club and one is a spade.

2. A survey of Australians living outside of Melbourne or Sydney has found that 25% have not visited Melbourne, 15% have not visited Sydney and 10% have never been to Sydney or Melbourne. A person is selected at random.

    a) If she has not visited Sydney, what is the probability that she has not visited Melbourne?
    b) If she has not visited Melbourne, what is the probability that she has not visited Sydney?
    c) What is the probability that she has not visited either Melbourne or Sydney?

3. A dice is rolled and a coin is tossed.

    a) Enumerate the sample space.
    b) Find the probability that the dice shows an odd number and the coin shows a head.

4. Which of the following combinations of $A$ and $B$ are independent events?

    a) $P(A) = 0.5$, $P(B) = 0.2$, $P(A \cap B) = 0.1$
    b) $P(A) = 0.6$, $P(B) = 0.2$, $P(A \cap B) = 0.2$
    c) $P(A) = 0.4$, $P(B) = 0.4$, $P(A \cap B) = 0.16$

5. On a stopover at Dubai airport, Kerry noticed a charity raffle. The first prize was $100,000 (or a car to the same value), the second prize was $20,000 with a $10,000 third prize. The tickets were very expensive ($2000) but only 1000 were available. This contrasts with the usual situation of selling thousands of tickets for a small nominal amount. Kerry likes supporting charities and the prize on offer appears tempting.

    a) If Kerry buys a ticket, what is his expectation in terms of prize money?
    b) What should be the price of the ticket to make it fair?

6. A company is suffering from severe quality control problems, resulting in 20% of its products being defective. If four products are randomly chosen, what is the probability that:

    a) 2 are faulty
    b) 3 are faulty

c) at least 1 is faulty

7. Consider the possibility that the Carlton Football Club has had a dramatic improvement in its fortunes and now has a probability of 2/3 of winning games. If it plays 4 games, determine the probability that it wins more than half of the games.

8. Sam has been asked to select 6 chocolates from 12 pieces. 10 of the chocolates are "normal" but 2 are "Turkish delight". There is no way of distinguishing between the pieces. What is the probability that Sam will select both Turkish delight chocolates?

9. In a normal summer Melbourne can expect 4 days of temperatures greater than 40 degrees Celsius.

   a) This summer, 8 such days were experienced. What is the probability of this occurring?
   b) Calculate the probability of 8 or more days occurring.

10. You are looking for CS students for a survey and stand outside the ATC building intercepting students. You know that there is a 30% chance of each student being a CS student.

    a) What is the probability that the third person is the first CS student intercepted?
    b) What is the probability of not finding a CS student in the first four people intercepted?

## Extension questions

11. It is observed that 20% of all goods produced by a particular factory have one or more defects. Determine the average number of defects per good, and the proportion of goods that have only one defect.

## Future work

On the exam, you will be provided with tables of probability distributions on the formula sheet. The formula sheet will be released on Canvas ahead of the exam; take another look at the distribution questions and recheck your process and answers using the tables.