1.1 Theoretical Probability, Sample Space, Tree Diagrams

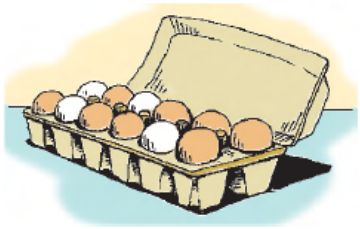
1 Illustrate on a tree diagram the sample space for:

- **a** tossing a 5-cent and a 10-cent coin simultaneously
- **b** tossing a coin and twirling an equilateral triangular spinner labelled A, B and C
- **c** twirling two equilateral triangular spinners labelled 1, 2 and 3 and X, Y and Z
- **d** drawing two tickets from a hat containing a number of pink, blue and white tickets.

2 A marble is randomly selected from a box containing 5 green, 3 red and 7 blue marbles. Determine the probability that the marble is:

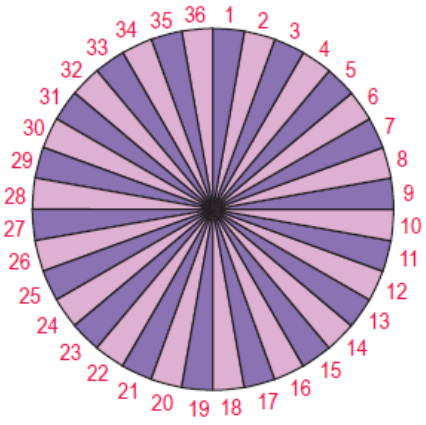
- **a** red **b** green **c** blue
- **d** not red **e** neither green nor blue **f** green or red

3 A carton of a dozen eggs contains eight brown eggs. The rest are white.



- **a** How many white eggs are there in the carton?
- **b** What is the probability that an egg selected at random is: **i** brown **ii** white?

4 A dart board has 36 sectors labelled 1 to 36. Determine the probability that a dart thrown at the centre of the board hits:

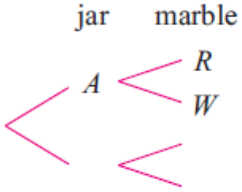


- **a** a multiple of 4
- **b** a number between 6 and 9 inclusive
- **c** a number greater than 20
- **d** 9 **e** a multiple of 13
- **f** an odd number that is a multiple of 3
- **g** a multiple of 4 and 6
- **h** a multiple of 4 or 6.

5 What is the probability that a randomly chosen person has his or her next birthday:

- **a** on a Tuesday **b** on a weekend **c** in July **d** in January or February?

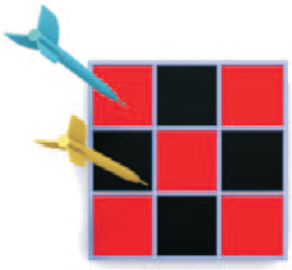
6 Jar A contains 2 white and 3 red marbles, whereas Jar B contains 4 red and 1 white marble. A jar is randomly selected and one marble is taken from it.



- **a** Copy and complete the branches on the tree diagram shown.
- **b** Determine the probability that the marble is red.

7 A square dartboard is made up of nine smaller squares. Five are painted red and the remainder are black.

R is "landing on red" B is "landing on black"



dart 1 dart 2

a Evaluate: **i** $P(R)$ **ii** $P(B)$

b Copy and complete the tree diagram illustrating two darts being thrown at the board.

c Using **b**, determine the probability that:

- **i** both darts land on black
- **ii** both darts land on red
- **iii** dart 1 lands on red and dart 2 lands on black
- **iv** one dart lands on red and the other lands on black.

8 The probability of rain tomorrow is estimated to be $\frac{1}{5}$. If it does rain, the Mudlarks football team will have an 80% probability of winning. If it is fine they have a 50% chance of winning. Display the sample space of possible results of the football match on a tree diagram.

Determine the probability that the Mudlarks will win tomorrow.

9 A factory produces bottles of fruit juice. Machine A fills 60% of the bottles produced and machine B fills the rest. Machine A underfills 1% of the bottles, while Machine B underfills 0.5%. Determine the probability that the next bottle inspected at this factory is underfilled.

These questions are tricky …. If you try them without listing out the sample space. Try to figure out the theoretical probabilities without the sample space. Just use logic.

10 List the six different orders in which Antti, Kai and Neda may sit in a row. If the three of them sit randomly in a row, determine the probability that:

a Antti sits in the middle **b** Antti sits at the left end

c Antti sits at the right end **d** Kai and Neda are seated together

11 **a** List, in systematic order, the 24 different orders in which four people A, B, C and D may sit in a row.

b Determine the probability that when the four people sit at random in a row:

- **i** A sits on one end
- **ii** B sits on one of the two middle seats
- **iii** A and B are seated together
- **iv** A, B and C are seated together, not necessarily in that order.