

Section 3.1 Tree diagrams



The possible outcomes of two or more events can be shown in a particular type of diagram called a **tree diagram**. Each branch represents a possible outcome of one event. The probability of each outcome is written on the branch.

Consider this problem:

- A fair coin is tossed three times.
- Determine the probability that exactly 2 heads are obtained.

Here is the sample space of possible outcomes:

HHH, HHT, HTH, HTT, THH, THT, TTH and TTT

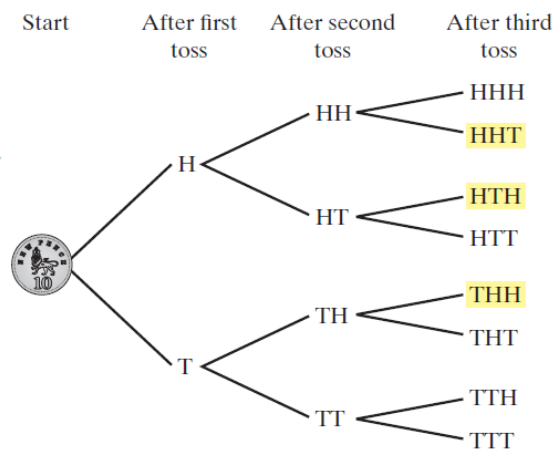
Since 2 heads appear on 3 occasions,

$$P(2\text{heads}) = \frac{3}{8}$$

The same possibilities can be represented in a more structured way on a tree diagram.

The branches that contain 2 heads are highlighted.

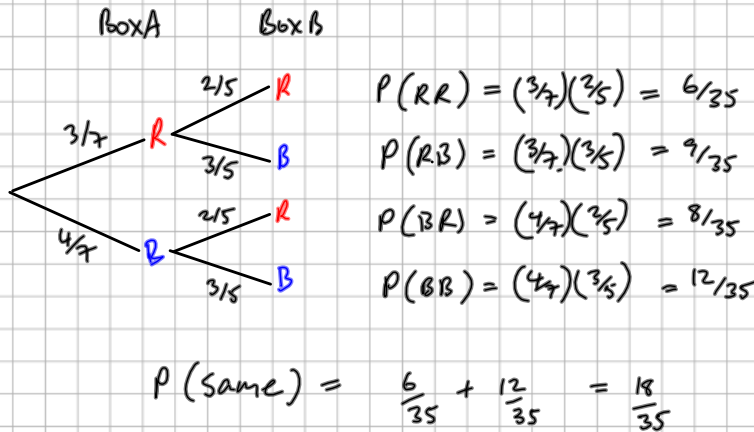
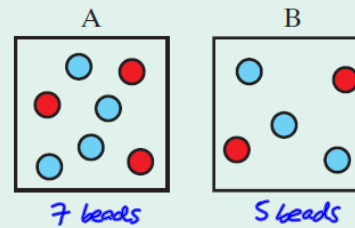
Again $P(2\text{ heads}) = \frac{3}{8}$.



Example 1

Box A contains 3 red beads and 4 blue beads
 Box B contains 2 red beads and 3 blue beads
 One bead is taken at random from each box.

- (i) Draw a tree diagram to show all the outcomes.
- (ii) Work out the probability that they both will have the same colour.



Tree diagrams for events without replacement

The tree diagram in the following example illustrates events that are not independent. The outcome of the first event affects subsequent events.

Example 2

A box contains 12 beads. Five are yellow and the rest are green. A bead is removed from the box and its colour is noted. It is not returned to the box. A second selection is then made and the process is repeated, followed by a third selection.

- (i) Draw a tree diagram outlining this situation
- (ii) Find the probability of selecting exactly two green beads.

