chapter 3

Probability 2

Section 3.1 Tree diagrams

PROJECT MATHS
Text & Tests 5
LEAVING CERTIFICATE
HIGHER LEVEL
STRAND 1
PROBABILITY & STATISTICS

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

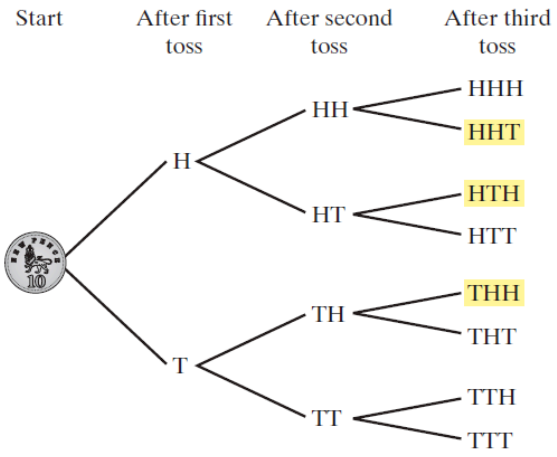
Since 2 heads appear on 3 occasions,

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

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

The branches that contain 2 heads are highlighted.

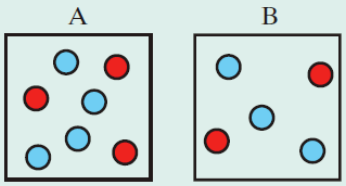
Again $P(\text{ 2 heads}) = \frac{3}{8}$.

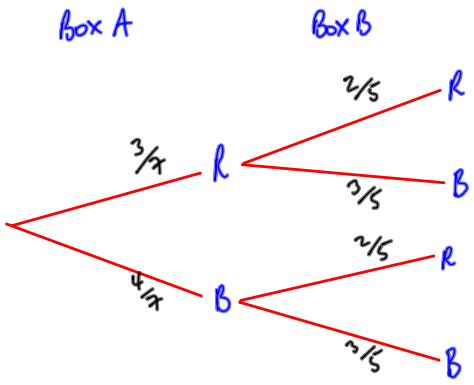


Example 1

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.





$P(RR) = \left(\frac{3}{7}\right)\left(\frac{2}{5}\right) = \frac{6}{35}$ ✓

$P(RB) = \left(\frac{3}{7}\right)\left(\frac{3}{5}\right) = \frac{9}{35}$

$P(BR) = \left(\frac{4}{7}\right)\left(\frac{2}{5}\right) = \frac{8}{35}$

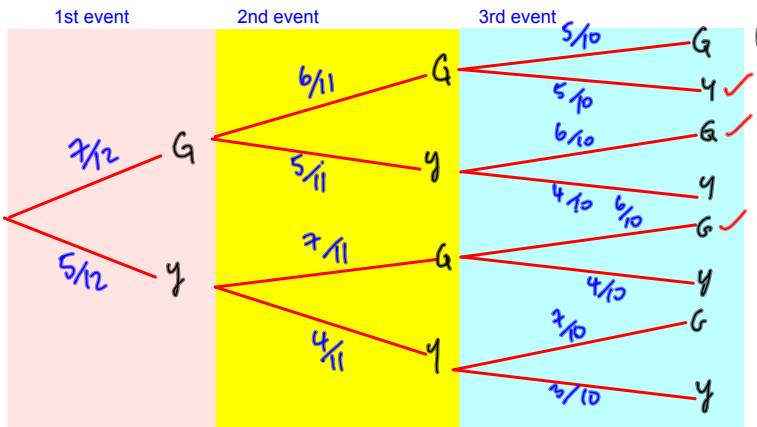
$P(BB) = \left(\frac{4}{7}\right)\left(\frac{3}{5}\right) = \frac{12}{35}$ ✓

$P(\text{same}) = P(RR \text{ or } BB) = \frac{6}{35} + \frac{12}{35} = \frac{18}{35}$

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.



$P(GGG) = \left(\frac{7}{12}\right)\left(\frac{6}{11}\right)\left(\frac{5}{10}\right) = \frac{7}{44}$