Using tree diagrams

Wednesday, 14 November 2018 4:48 pm

By the end of the lesson I would hope that you have an understanding of the following. I would also hope that you can apply the understanding to a number of different questions and question types

- How to construct a tree diagram
- How to read probabilities from tree diagrams
- How to know the difference between replacement and no replacement and what this does to a tree diagram
- How to tie this into conditional probability

RECAP: Probability

We have been dealing with probabilities since Year 7.
We know that to find the probability of something we simply use the following formula:

$$\Pr(Event) = \frac{Number\ of\ successes}{Number\ of\ outcomes}$$

$\mathcal{E} = \{1,2,3,4,5,6\}$

$P(EVEN) = \frac{3}{6} = \frac{1}{2}$

We were even able to work out probabilities of more than one thing happening at a time.
We used a simple rule:

- AND means times
- OR means add

We now know that this is only true when the events are **independent**.

When two events are independent from each other we have seen that:

$$\Pr(A \cap B) = \Pr(A) \times \Pr(B)$$

$$\Pr(A \cup B) = \Pr(A) + \Pr(B)$$

Tree diagrams are awesome for independent events.

Remember: Independent events are where the outcome of one trial is not influenced by the outcome of another.

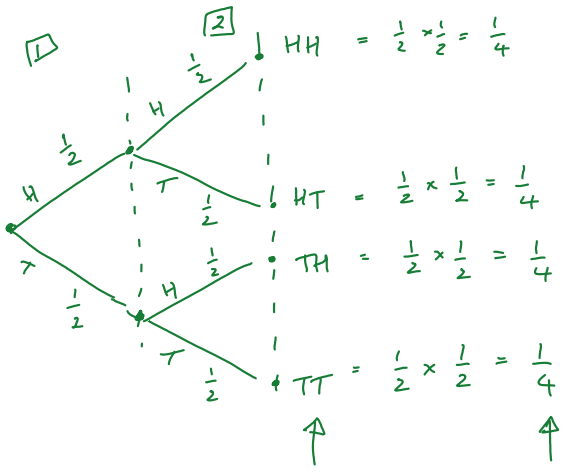
Constructing a tree diagram

Tree diagrams are awesome.
They have a start point.
They deal with outcomes from events.
They are pretty pictures!

The only thing we need to be mindful of is whether the experiment has **replacement** or not.

Let's look at something without replacement.
A simple coin toss.

$\mathcal{E} = \{H, T\}$



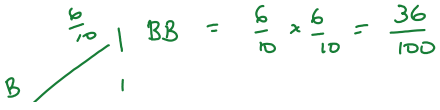
$\mathcal{E} = \{HH, HT, TH, TT\}$

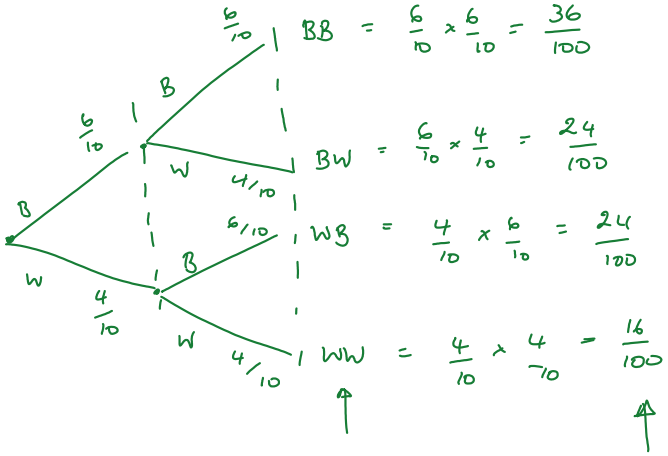
Now lets look at spherical objects in bags ...

There are 6 Blue marbles and 4 white marbles in a bag.
Draw a tree diagram to show the possible outcomes and probabilities when two marbles are drawn from the bag with replacement.

6B
4W

$\mathcal{E} = \{B, W\}$





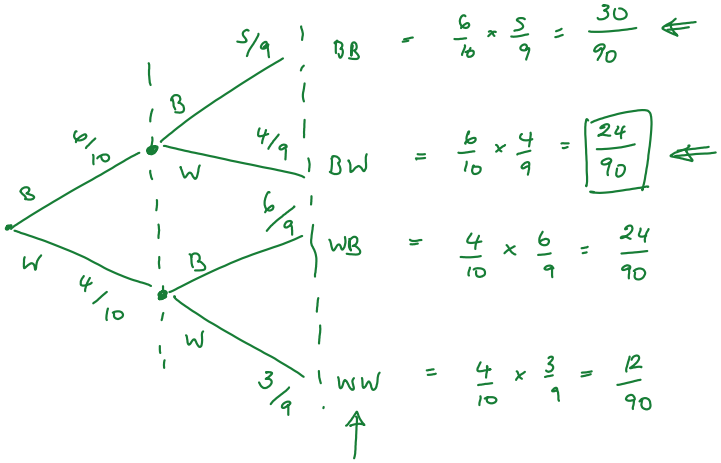
Now let's look at what happens when we don't replace them

There are 6 Blue marbles and 4 white marbles in a bag.

Draw a tree diagram to show the possible outcomes and probabilities when two marbles are drawn from the bag without replacement.

6B, 4W

$\xi = \{B, W\}$



BW + WB = 24/90 + 24/90 = 48/90

P(W) = 24/90 + 24/90 + 12/90 = 60/90

Find the probability of:

- A blue marble followed by a white marble
- Two blue marbles
- Exactly one white marble
- A blue marble given that a white marble has already been drawn

$Pr(B|W) = \frac{Pr(B \cap W)}{Pr(W)} = \frac{24}{60} = \frac{12}{30} = \frac{6}{15} = \frac{2}{5}$

Methods 3 and 4: Looking into the future

We have already done something on conditional probability ... so you might be ready for the following

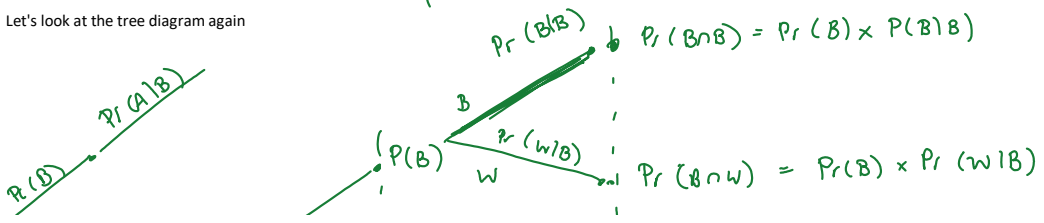
Remember: The probability of something happening **given that** something else has already happened is given by:

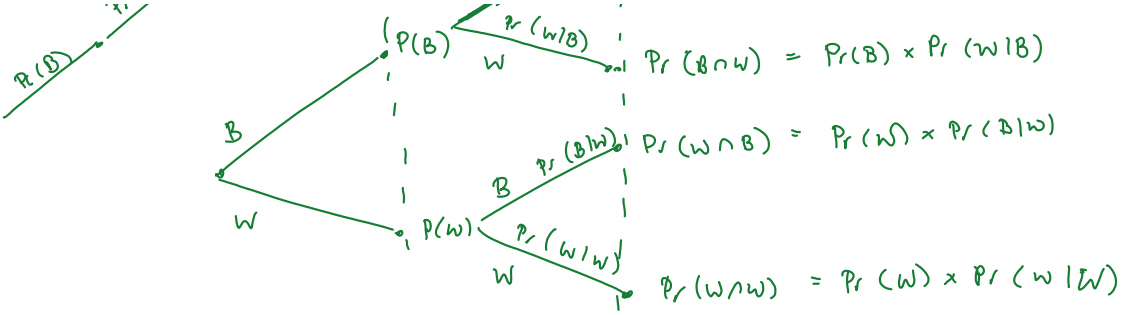
$$\Pr(A|B) = \frac{\Pr(A \cap B)}{\Pr(B)}$$

This can be re-expressed as:

$$\Pr(A \cap B) = \Pr(B) \times \Pr(A|B)$$

Let's look at the tree diagram again





Tree diagrams are really powerful, visual tools to view a sample space.
Remember: Sample space is the total outcomes from an experiment.
When we add all probabilities together we would expect them to add to 1.
This is also true when we add any branches together.