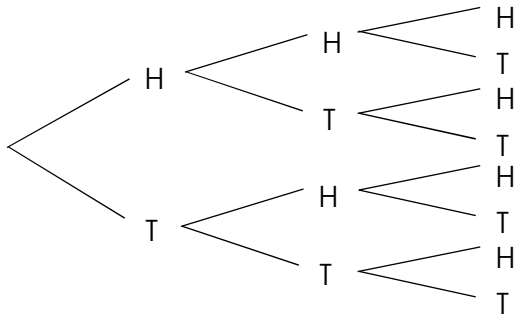
Part 4: Probability Trees

Probability trees are great for when you have more than one event which follow on from each other. There are two types of tree diagrams: one where all the probabilities are equal, and one where they can change. In Level 3 we will usually get situations where the probabilities change.

Example 1 (Probabilities all the Same):
I flip three coins. For each coin we can either get heads (H) or tails (T). The tree would look like this:



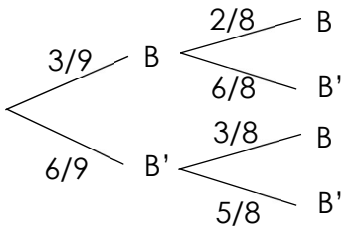
The first split represents the first coin, the second split the second coin, and so on.
Because all the probabilities are the same, and there are 8 different branches, we know each one has a 1/8 chance of occurring. Let's answer some questions about this tree:

a. What is the probability of getting 3 heads?
   There is only one branch with 3 heads (HHH) so would be 1/8

b. What is the probability of getting 2 heads?
   We can get two heads as either HHT, HTH or THH, so there are three ways, so 3/8

c. What is the probability of getting 1 or fewer heads?
   We could have TTT, TTH, THT or HTT, so 4/8 or 1/2

Example 2 (Probabilities Change):
The letters in BUMBLEBEE are written on 9 balls and put into a bag. Two are drawn out, and they are either a "B" or not a "B". In probability we will often write the opposite of an event as the event with a ' (pronounced dash). So in this case we have B and B' (B-dash).The tree would look like this:



The 3/9 on the first branch comes from there being 3 "B" balls in the bag. The 6/9 comes from the fact each branch always needs to add to one.

If we take out one "B" ball, there are only 2 left out of the 8 in total, so we get 2/8 for the top branch on the second, and likewise we get 3/8 for the top branch coming off B'.

Let's answer some questions about this situation:

a. What is the probability of getting two "B"s?
   As it is one event, then another, we times as we go along, so 3/9 x 2/8 = 1/12

b. What is the probability of getting exactly one "B"?
   This can be BB' or B'B, so would be 3/9 x 6/8 + 6/9 x 3/8 = 1/2

c. What is the probability of getting at least one "B"?
   This is either 1 "B" or two "B"s, so the answer from a, plus the answer from b = 1/12 + 1/2 = 7/12

Tip: always draw the tree diagram (or the part you need) you are much less likely to make mistakes!