

Compound Probability

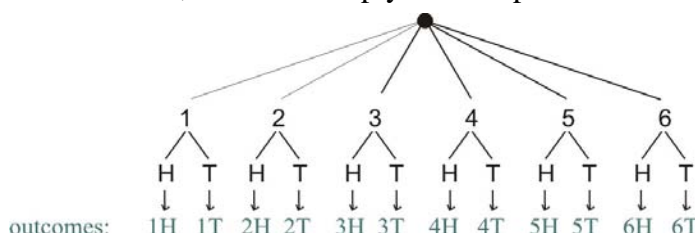
Compound probability means finding the probability where two events both occur. If the outcome of the one event does not affect the outcome of the other, they are said to be **independent**. In that case you can find the probability of two events occurring by multiplying the probabilities of the two events. Examples will make this clear.

Example 1. You toss a coin, and then you roll a die. What is the probability of getting 6 and heads?

P(6) is $\frac{1}{6}$, and P(heads) is $\frac{1}{2}$. Clearly, whether you get heads or tails on the coin does not affect what you get on the roll. The two events are *independent*. Therefore, we can multiply the two probabilities.

$$P(6 \text{ and heads}) = \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$$

You can also see this probability by looking at the tree diagram, because in only one outcome out of the twelve possible ones do we have 6 and heads.

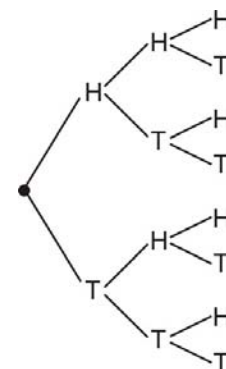


Example 2. You toss a coin three times. What is the probability of getting heads every time?

These three events—toss a coin, toss a coin, toss a coin—are independent. Getting heads on one toss doesn't affect whether you get heads or tails on the next.

$$P(\text{heads}) = \frac{1}{2}. \text{ Therefore, } P(\text{heads and heads and heads}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

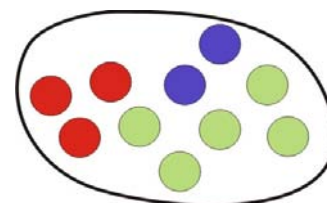
You can also see this from the tree diagram. There is only one outcome with “HHH”, and a total of 8 possible outcomes.



Example 3. The bag has three red marbles, two dark blue marbles, and five light green marbles. You take one marble, and put it back. Then you take a marble again, and put it back. What is the probability of getting first a red marble, then a blue one?

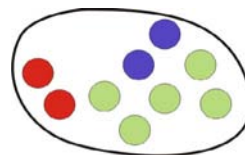
Again, we simply multiply the individual probabilities:

$$P(\text{red, blue}) = \frac{3}{10} \times \frac{2}{10} = \frac{6}{100} = \frac{3}{50}.$$



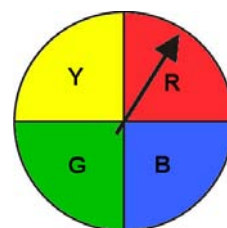
1. You toss a coin three times.
 - a. What is the probability of getting tails, then heads, then tails?
 - b. What is the probability that you get heads on your second toss?
 - c. Use the tree diagram. What is the probability of getting two heads and one tails in three tosses? Note they can be in any order, such as THH or HTH.

2. You take a marble out of the bag and put it back. Then you take another marble. Find the probabilities.



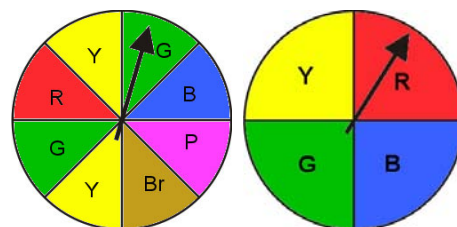
- P(red, then green)
 - P(green, then red)
 - P(not blue, not blue)
 - P(not red, not red)
3. You roll a six-sided die two times. Find the probabilities.
- P(1; 5)
 - P(even; odd)
 - P(2; 5 or 6)
 - P(6; not 6)

4. The spinner is spun two times. Find the probabilities.



- P(blue; blue)
 - P(green; not green)
 - P(not blue; yellow)
 - P(yellow or green; red or blue)
5. The weatherman says that the chance of rain is 20% for each of the next five days, and your birthday is in two days! You also know that the probability of your dad taking you to the amusement park on your birthday is $\frac{1}{2}$.
- What is the probability that you get to go the park, and it doesn't rain?
 - What is the probability that you get to go the park, and it rains?
- Check: The sum of the probabilities in (a) and (b) should be $\frac{1}{2}$.

6. The two spinners are spun. The first spinner has eight regions and the second spinner has four. Find the probabilities:



- P(red, red)
- P(blue, not blue)
- P(yellow or green, yellow or green)
- P(not red, red)