o Independent Events

Events can be " Independent ", meaning each event is **not affected** by any other events. Two events are independent when the outcome of the first event does not affect the outcome of the second event.
To find the probability of an independent event we are using this rule:

$$P(XandY)=P(X)\cdot P(Y)$$

Example: Tossing a coin.
Each toss of a coin is a perfect isolated thing. What it did in the past will not affect the current toss. The chance is simply 1 – in-2, or50%, just like ANY toss of the coin. So each toss is an **Independent Event**.

***Question 1*:** If one has three dice what is the probability of getting three 4s?

Solution:

The probability of getting a 4 on one dice is 1/6
The probability of getting 3 4s is:

$$P(4 \text{ and } 4 \text{ and } 4) = \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{216}$$

o Dependent Events

Events can also be "dependent", which means they **can be affected by previous events**, where two events are dependent when the outcome of the first event influences the outcome of the second event. The probability of two dependent events is the product of the probability of X and the probability of Y **AFTER** X occurs.

$$P(XandY)=P(X)\cdot P(Y \text{ after } X)$$

$$P(XandY)=P(X)\cdot P(Y|X)$$

Example: Marbles in a bag. 2 blue and 3 red marbles are in a bag, what are the chances of getting a blue marbles?

The chance is **2 in 5**

But after taking one out the chances change! So the next time:

- if we got a **red** marble before, then the chance of a blue marble next is **2 in 4**
- if we got a **blue** marble before, then the chance of a blue marble next is **1 in 4**

See how the chances change each time? Each event **depends on** what happened in the previous event, and is called **dependent**.

So here is the **notation** for probability:

P(A) means "Probability Of Event A"

In our marbles example Event A is "get a Blue Marble first" with a probability of

P(A) = 2/5

And Event B is "get a Blue Marble second" ... but for that we have 2 choices:

- If we got a **Blue Marble first** the chance is now **1/4**
- If we got a **Red Marble first** the chance is now **2/4**

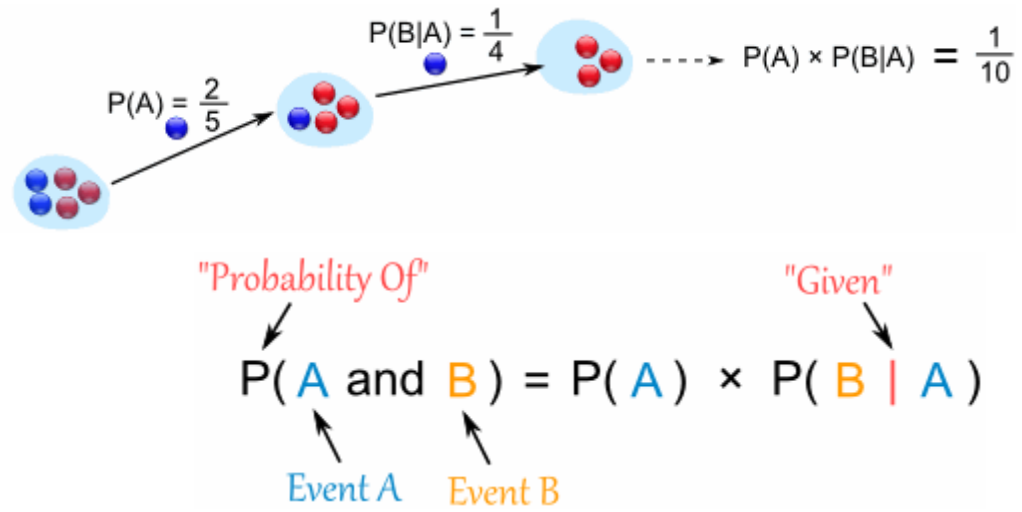
So we have to say **which one we want**, and use the symbol "|" to mean "given":

P(B|A) means "Event B given Event A"

In other words, event A has already happened, now what is the chance of event B?
P(B|A) is also called the "**Conditional Probability**" of B given A.And in our case:

P(B|A) = 1/4

So the probability of getting **2 blue marbles** is:



And we write its as:

Probability of **event A and event B** equals the probability of **event A** times the probability of **event B given event A.**

Question : What is the probability for you to choose two red cards in a deck of cards?

Solution**:** A deck of cards has 26 black and 26 red cards. The probability of choosing a red card randomly is:

$$P(red) = \frac{26}{52} = \frac{1}{2}$$

The probability of choosing a second red card from the deck is now:

$$P(red) = \frac{25}{51}$$

P(X and Y) = P(X) * P(Y | X)

$$P(2\ red) = \frac{1}{2} \cdot \frac{25}{51} = \frac{25}{102}$$

- **Inclusive Events**

  Inclusive events are events that can happen at the same time. To find the probability of an inclusive event we first add the probabilities of the individual events and then subtract the probability of the two events happening at the same time.

$$P(\text{ X or Y }) = P(\text{ X }) + P(\text{ Y}) - P(\text{ X} \cap \text{ Y })$$

$$P(\text{ X or Y }) = P(\text{ X }) + P(\text{ Y}) - P(\text{ X and Y })$$

Question **:**What is the probability of drawing a black card or a ten in a deck of cards?

There are 4 tens in a deck of cards P(10) = 4/52
There are 26 black cards P(black) = 26/52
There are 2 black tens P(black and 10) = 2/52
P(black or ten) = 4 / 52 + 26 / 52 – 2 /52
= 30 / 52 – 2 / 52
= 28 / 52
= 7 / 13