Risk, chance and probability

Risk, chance and probability all refer to how likely an event is of happening. Risk is usually used for negative events, such as accidents or disasters, whereas chance is used for positive events, such as winning in a lottery. Probability is the neutral term and can be used for all types of random events.

Take a dice for example, what is the probability of you rolling a 6 on your first try (given a fair six-sided dice)? Well, the dice has six sides that are all equally likely to end up on top, but only one of them is the one you want. So, there are six alternative outcomes (1, 2, 3, 4, 5, and 6), five of them are "bad" (1, 2, 3, 4 and 5) and one of them is "good" (6). That means that the probability of you getting a 6 on your first try is 1 in 6, or 1/6 (1 "good" outcome out of "6" possible outcomes).

In the previous example I wrote the probability as a fraction, which is usually the most intuitive way of writing it. However, it is also common to write it as decimals or percentages instead. A 1/6 probability is then ~0.167 (just write 1/6 on you calculator to get this number) or ~16.7% (multiply the previous number by 100). These different ways of writing are all correct, so unless a specific style has been stated you can use the one you consider easiest or best.

What happens if we instead take an event that we know will happen? For example the probability that if we roll a normal six-sided dice, one of the numbers 1, 2, 3, 4, 5 or 6 will come up. Then we still have six different outcomes but this time all of them will be good. This will give us a 6 in 6 or 6/6 chance of a good outcome. Written as a decimal we get a probability of 1, and in percentage it is 100%. If we instead take an impossible event, such as rolling a 7 with a normal dice, we have 0 "good" outcomes out of 6 possible outcomes, that is 0/6 = 0, or 0%.

Some observations

- When we state the probability as a fraction we write it like this
$$\frac{\textit{Number of ``good'' outcomes}}{\textit{Number of possible outcomes}}$$
- When we write it in decimal form we calculate the decimal value of the fraction above. This will always give us a value between 0 and 1, where 0 indicate that an even is impossible (e.g. rolling a 7 on a normal dice), whereas 1 means that something is certain to happen. The closer to 1 we get, the more likely it is that the event will happen.
- The probability as percentage is calculated by multipling the decimal value by 100. An impossible event is then 0%, whereas an event that is certain to happen will happen with a probability of 100%.
- Even though you can't predict the result of an individual random event, such as your next dice roll, you can predict that if you roll the dice a lot of times roughly 1/6 of those rolls will be a "6".

Lets take another example, this time imagine a deck of card. If you draw a random card from it, what is the probability of it being a queen? Well, there are 52 cards in the deck, 4 of them are queens, so the probability is 4 in 52, or 4/52 (4 "good" outcomes out of "52" possible outcomes). Try writing the probability in decimal form and as a percentage (Answer at the bottom of the next page).

Risk assessment

How is all this talk about dice rolls and card decks useful? Well, unless you are gambling it isn't, but the same type of calculations work for all kinds of random events, and are highly useful for e.g. various types of risk assessment. An example is the so called 100-year floods, that is floods that have a 1 in 100 chance of happening each year. We can think of it as rolling a dice with 100 sides, where 1 side correspond to a 100 year flood or larger, whereas all the other sides will give a smaller flood. Every year the risk of getting one (or several) floods of a 100 year flood size (or larger) is 1 in 100, whereas the chance of getting a smaller flood is 99 in 100.

Yearly risk of a...	Fraction	Decimal	%
100-year flood	1/100	0.01	1%
200-year flood	1/200	0.005	0.5%

In a similar way we can calculate the risk (or chance) of all sorts of events, land slide risk, traffic accidents, plane crashes, corona deaths, lottery wins, any kind of random events as long as we have enough data to estimate the probability.

Why is it useful to calculate probablities?

- Because our intuition works rather poorly when it comes to estimating risks. We are often more worried about unusual but dramatic risks, such as terror attacks or crashing air planes, than we are about more mundane risks, such as traffic accidents, despite the fact that the probability of dying in a traffic accident is much higher. Estimating a probability is a way to get around this problem.
- It helps us avoid misunderstandings. What we consider "high risk" or "low risk" varies between different people, a daredevil and a very cautios person will have very different ideas on what kind of activities that are "high risk". The daredevil may consider a 1 in 1000 risk of dying to be a low risk activity, while the cautious person would consider it unacceptably high, but they can both agree that the probability is 1 in 1000.

Answer: Fraction 4/52. Decimal form: ~0.077. Percentage: ~7.7%