Bernouilli Trial

- Now consider an experiment with only two outcomes. Independent repeated trials of such an experiment are called ***Bernoulli trials***, named after the Swiss mathematician Jacob Bernoulli (1654?1705).
- The term ***independent trials*** means that the outcome of any trial does not depend on the previous outcomes (such as tossing a coin).
- We will call one of the outcomes the "success" and the other outcome the "failure".
- Let p denote the probability of success in a Bernoulli trial, and so $q = 1 - p$ is the probability of failure. A binomial experiment consists of a fixed number of Bernoulli trials, which we denote as n.
- We would denote a binomial random variable X with n trials and probability p of success as follows

$$X \sim Bin(n, p)$$

Examples

Consider the following statistical experiment. You flip a coin five times and count the number of times the coin lands on heads. This is a binomial experiment because:

- The experiment consists of repeated trials. We flip a coin five times.
- Each trial can result in just two possible outcomes: heads or tails. We call one of these outcomes a success and the other, a failure, depending on the question asked.
- The probability of success, denoted by p is constant : 0.5 on every trial for a fair coin.
- The probability of success, denoted by P, is the same on every trial.
- The trials are independent; that is, getting heads on one trial does not affect whether we get heads on other trials.

What is a Success

- The word "success" implies that the outcome is the outcome of interest.
- If the outcome of interest is something like a flat tire, using the word "Success" is counter intuituive.
- Typically the success event is the less likely of the two events.

Binomial Experiment

- A binomial experiment with n trials and probability p of success will be denoted by

$$B(n, p)$$

- Frequently, we are interested in the ***number of successes*** in a binomial experiment, not in the order in which they occur.
- Furthermore, we are interested in the probability of that number of successes.

The Binomial Probability Distribution

- The number of successes X in n trials of a binomial experiment is called a binomial random variable.
- The number of independent trials is denoted n.
- The probability of a 'success' is p
- The expected number of 'successes' from n trials is $E(X) = np$