# Geometric Distribution

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Geometric distributions model (some) discrete random variables. Typically, a Geometric random variable is the number of trials required to obtain the first failure, for example, the number of tosses of a coin untill the first 'tail' is obtained, or a process where components from a production line are tested, in turn, until the first defective item is found.

# Geometric Distribution

A discrete random variable X is said to follow a Geometric distribution with parameter p, written $X \sim Ge(p)$, if it has probability distribution

$$P(X = x) = p^{x-1}(1-p)^x$$

where

- $x = 1, 2, 3, \ldots$
- p = success probability; $0 < p < 1$

# Geometric Distribution

The trials must meet the following requirements:

**(i)** the total number of trials is potentially infinite; there are just two outcomes of each trial; success and failure;

**(ii)** the outcomes of all the trials are statistically independent;

**(iii)** all the trials have the same probability of success.

# Geometric Distribution

The Geometric distribution has expected value and variance

$$E(X) = 1/(1-p)$$

$$V(X) = p/(1-p)^2$$

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The Geometric distribution is related to the Binomial distribution in that both are based on independent trials in which the probability of success is constant and equal to $p$. However, a Geometric random variable is the number of trials until the first failure, whereas a Binomial random variable is the number of successes in n trials.