Geometric Distribution

- Geometric distributions model (some) discrete random variables.

- Typically, a Geometric random variable is the number of trials required to obtain the first **success**.

- 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

- 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 **success**, whereas a Binomial random variable is the number of successes in n trials.

Geometric Distribution

A discrete random variable X is said to follow a Geometric distribution with parameter p, written

$$X \sim Geo(p),$$

if it has probability distribution

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

where

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

Geometric Distribution

The trials must meet the following requirements:

(i) the total number of trials is potentially infinite;

(ii) there are just two outcomes of each trial; success and failure;

(iii) the outcomes of all the trials are statistically independent;

(iiv) all the trials have the same probability of success.

Geometric Distribution

▶ The Geometric distribution has expected value and variance

$$E(X) = \frac{1}{(1-p)}$$

$$V(X) = \frac{p}{(1-p)^2}$$

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