Geometric Distribution

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• Geometric distribution is a type of discrete probability distribution that represents the probability of the number of successive failures before a success is obtained in a Bernoulli trial.

• A Bernoulli trial is an experiment that can have only two possible outcomes, ie., success or failure. In other words, in a geometric distribution, a Bernoulli trial is repeated until success is obtained and then stopped.

Geometric Distribution

- The geometric distribution is a probability distribution that models the number of trials required to achieve the first success in a sequence of independent Bernoulli trials, where each trial has a constant probability of success.

i.e., Geometric distribution that is based on three important assumptions. These are listed as follows.

- The trials being conducted are independent.
- There can only be two outcomes of each trial - success or failure.
- The success probability, denoted by p, is the same for each trial.

- Geometric distribution can be defined as a discrete probability distribution that represents the probability of getting the first success after having a consecutive number of failures.

Expression

- P(X=k): Probability of getting 1st success at kth trial
- There were k-1 failures before the success was obtained at kth trail

There are two geometric probability formulas:

- **Geometric distribution PMF:** $P(X = k) = (1 - p)^{k-1}p$
- **Geometric distribution CDF:** $P(X \leq k) = 1 - (1 - p)^{k}$

Details

Probability mass function	$P(X = k) = p(1-p)^{k-1}$
Cumulative Distribution Function	$P(X \leq k) = 1 - (1-p)^k$ $P(X \geq k) = (1-p)^{k-1}$ $P(X > k) = 1 - P(X \leq k) = (1-p)^k$
Mean:	$\mu = E(X) = \dfrac{1}{p}$
Variance:	$\sigma^2 = V(X) = \dfrac{(1-p)}{p^2}$

$p = probability\ of\ success$

$k = \#\ of\ trials$

Examples

- If your probability of meeting an independent voter is 0.2, what is the probability you meet an independent voter on your third try?

- Probability of getting a customer with negative feedback is 0.1. What is the probability of getting the customer with negative feedback on 7th try?