Probability Formula

⌂Bernoulli Trials

Bernoulli Trials

Bernoulli trial is also known as binomial trial where only two outcomes of a given experiment is possible. If a flip a coin, only two outcomes are possible, that is, head and tail. Hence, flipping of coin is a Bernoulli trial. If we roll a dice six outcomes are possible, that is, $1, 2, 3, 4, 5, 6$ and hence, rolling of a dice is not a Bernoulli trial. To get the probability of the outcomes of a Bernoulli trial, binomial probability formula is used. Some real life examples of a Bernoulli trial are if a bulb is on or off, if a question is answered correctly or not, if a student has passed or failed.

Definition

A trial where only two outcomes are possible is known as Bernoulli trial. Trials like flipping of coin can be termed as Bernoulli trial.

Suppose, we are flipping a coin 4 times and we want to know the probability of getting a head 3 out of 4 times.

The probability of getting a head, $p = 0.5$

The probability of getting a tail, $q = 0.5$

The probability of getting a head 3 out of 4 times will be $= pppq = 0.5 \times 0.5 \times 0.5 \times 0.5$

But out of 4 times, which trials will give head. For that, we will use combination. The 3 times when head will come out of 4 times can be arranged in C_3^4 ways.

Hence, probability of getting 3 heads out of 4 will be $C_3^4 (0.5)^3 (0.5)^1$

Formula

Suppose, n Bernoulli trials are made then the probability of getting r successes in n trials can be given by the formula,

$$P(r) = C_r^n p^r q^{n-r}$$

The term $\frac{n!}{r!(n-r)!}$ is known as binomial coefficient. For example, if a student is attempting five true or false questions, then find the probability of getting 3 correct answers.

Probability of success, $p = 0.5$

Probability of failure, $q = 0.5$

Probability of getting 3 correct answers = $C_3^5 (0.5)^3 (0.5)^2 = 0.3125$.

Bernoulli Trial Conditions

The characteristics of a Bernoulli trial are:

1) It can have only two outcomes, that can be labelled as success and failure.

2) Probability of success and failure remains same through each trial.

3) The trials are independent of each other.

4) Number of trials are fixed.

If p is the probability of success, then the probability of failure, $q = 1 - p$.

Bernoulli Trial Binomial Distribution

If a trial is done n times, then to find the probability of success happening r times, probability distribution formula is used. The Bernoulli trial binomial distribution formula is given as:
$$P(X = r) = C_r^n p^r q^{n-r}$$ This formula can give solutions to problems like the probability of r success in n trials, probability of at least one success in n trials probability of no success in n trials, probability of at least one failure in n trials and probability of at most r success in n trials.

Topics in Bernoulli Trials

[Bernoulli Trials Examples](#)