# Bernoulli Distribution

A random Variable X is said to have a Bernoulli Distribution if its Probability mass function (P.M.F.) is given by

$$P(X=x) = p(x) = \begin{cases} P^{x}(1-P)^{1-x} & ; \; x = 0, 1 \\ 0 & ; \text{ otherwise} \end{cases}$$

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

$P(X=1) = P$

$P(X=0) = P^{0}(1-P)^{1-0}$

$P(X=0) = (1-P)$

$P$ = probability of success

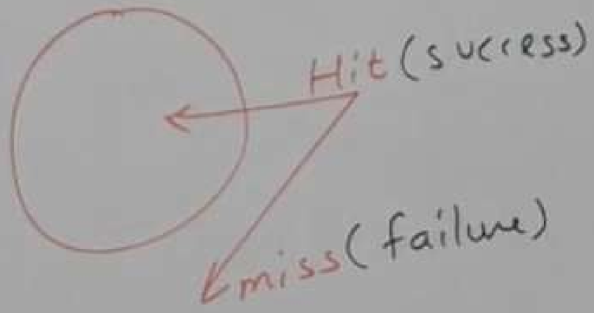
$1-P = q$ = probability of failure

no. of trial = one
- Success $(P)$ $\quad P^{x}$
- failure $(1-P)$ $\quad (1-P)^{1-x}$

# BINOMIAL DISTRIBUTION

$X = 0, 1, 2, \ldots$
Discrete Prob. dist.

10 trials




Prob. of success, $P(S), p = \frac{1}{2}$ (constant)

Prob. of failure, $q(S), q = \frac{1}{2}$

$p + q = 1$

$p\,p\,q\,q\,p\,p\,q\,q\,p\,p$

10 trials

6 times success  10−6 times failure

${}^{10}C_6\, p^6\, q^{10-4}$

$P(X=x) = {}^{10}C_6\, p^6\, q^{10-4}$; $x = 0, 1, 2, \ldots 10$

$p\,p\,q\,q\,p\,p\,p \ldots p\,q\,p$

n trials

'x' times success  $(n-x)$ times failure

${}^{n}C_x\, p^x\, q^{n-x}$

$P(X=x) = {}^{n}C_x\, p^x\, q^{n-x}$; $x = 0, 1, \ldots n$

Binomial Prob. dist.  $p + q = 1$

# Poisson Distribution

$X = 0, 1, 2, ---$ rare event

discrete

no. of trials, $n \to \infty$ (very large)

Probability of success, $p \to 0$ (very small)

$$P(X=x) = \frac{e^{-m} m^x}{x!} \; ; x = 0, 1, 2, ---$$

Constant of Poisson distribution

mean = $m$

Variance = $m$

S.D. = $\sqrt{m}$

$$\boxed{X \sim P(m)}$$

$$\sum_{x=0}^{\infty} P(X=x) = \sum_{x=0}^{\infty} \frac{e^{-m} m^x}{x!} = \frac{e^{-m} m^0}{0!} + \frac{e^{-m} m}{1!} + \frac{e^{-m} m^2}{2!} + ---$$

$$= e^{-m}\left[1 + m + \frac{m^2}{2!} + ---\right]$$

$$= e^{-m} e^{m} = e^0 = 1$$