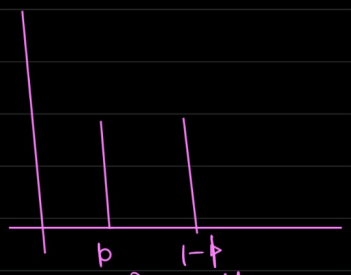
Binomial distribution

Bi → two → two outcomes

toss a coin → Bernoulli trial.



* Binomial distribution is the 'n' Bernoulli trial.

Pmf of Bernoulli trial $= p^k (1-p)^{1-k}$ (Bernoulli: only one event; $1-k$ → one trial)

Pmf of Binomial dist^n $= {}^nC_k\, p^k (1-p)^{n-k}$ ($n-k$ → n trial; p^k → probability of event)

$${}^nC_k \quad \binom{n}{k} = \frac{\lfloor n}{\lfloor n-k \lfloor k} = \frac{!n}{!n-k\,!k}$$

$\lfloor 5 = 5\times4\times3\times2\times1 = 120$

$!4 = 4\times3\times2\times1 = 24$

$\lfloor 3 = 3\times2\times1 = 6$

1st toss 2nd toss ... 10th toss

↳ what is probability of getting k heads out of n trials

n – total no of Bernoulli trial

K – the no of events that you are interested in.

Example:- With 3 tosses what is the probability of getting exactly 2 heads ?

→ $n = 3$, $K = 2$

$$P(X=2) = {}^{n}C_K p^K (1-p)^{n-K}$$

$$= {}^{3}C_2 (0.5)^2 (0.5)^{3-2}$$

$$= \frac{\lfloor 3}{\lfloor 3-2 \cdot \lfloor 2} \cdot (0.5)^2 \cdot 0.5$$

$$= \frac{3 \times \cancel{2}}{1 \times \cancel{2}} \cdot (0.5)^3 = 3 \times (0.5)^3$$

$$= 0.375$$

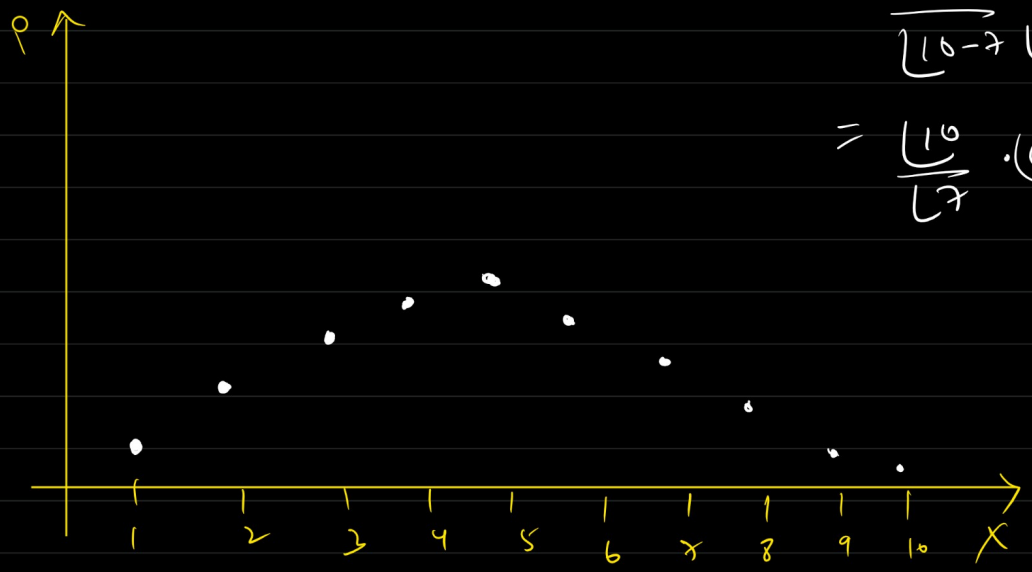
Q. When you toss a coin 10 times. What is the probability that you will get head three times.

→ $n = 10$, $K = 3$ (10/3)

$$P(X=3) = {}^{10}C_3 (0.5)^3 (0.5)^{10-3}$$

$$= \frac{\lfloor 10}{\lfloor 10-7 \lfloor 3} \cdot (0.5)^3 \cdot (0.5)^7$$

$$= \frac{\lfloor 10}{\lfloor 7} \cdot (0.5)^{10} = \frac{10 \times 9 \times 8 \times \cancel{\lfloor 7}}{\cancel{\lfloor 7} \times \lfloor 3} \cdot (0.5)^{10}$$



mean = np

Variance = $np(1-p) = npq$