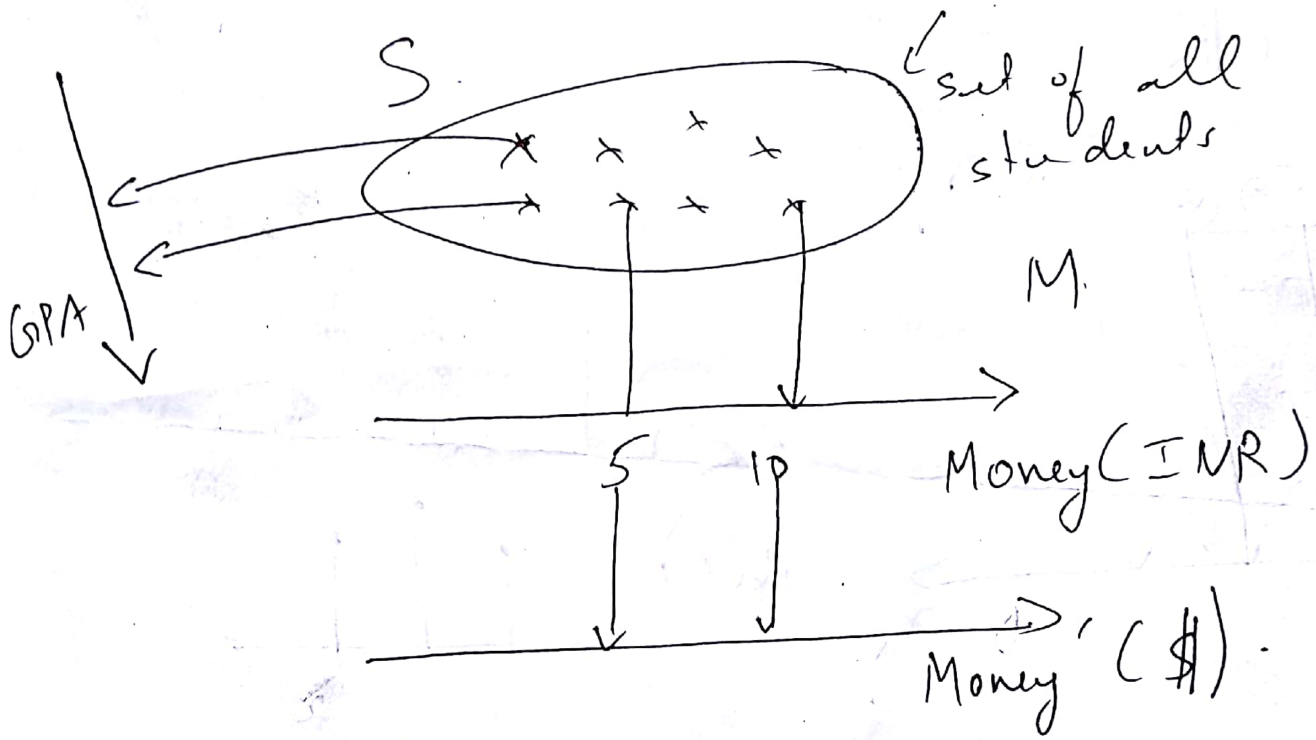
Random Variable
↳ Assign numerical values to the outcome of experiment.

- R.V. is a function from the sample space to the real numbers.



$M' = \frac{M}{\cancel{60}} \times 60$

↳ New random variable.

- There are discrete & continuous RVs.

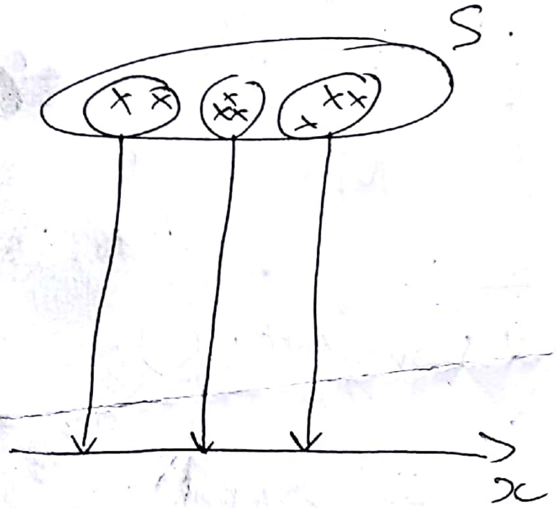
$P(X = x)$

$\downarrow$ RV.

$\hookrightarrow$ some value.

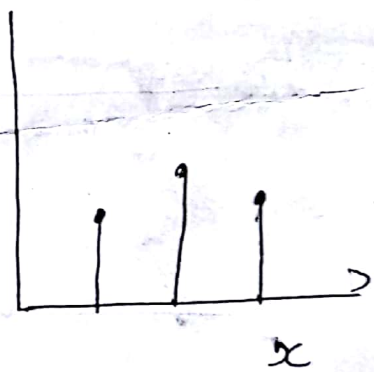
$X : f \quad S \to \mathbb{R}.$

$x : x \in \mathbb{R}.$



$\cancel{P_X(x)}$

$p_X(x)$



$$p_X(x) = P(X = x).$$

$$= P(\omega \in S \text{ such that } X(\omega) = x).$$

$$p_X(x) \geq 0 \qquad \sum_{\forall x} p_X(x) = 1.$$

PMF: PMF is a function that gives the prob. that a RV is exactly equal to some value.

$$f_X(x) \text{ or } p_X(x) = P(X = x)$$
$$= P(\omega \in S : X(\omega) = x).$$

Binomial PMF.

X: no. of heads in n coin tosses

$P(H) = p$

$n = \cancel{8}4$

$$P_X(2) = \cancel{}P(HHTT) + P(THTH) + P(TTHH) + P(THHT) + P(HTHT) + P(THHT).$$

$$= 6p^2(1-p)^2.$$

$$\text{or } \binom{4}{2} p^2 (1-p^2)$$

Example from MIT.

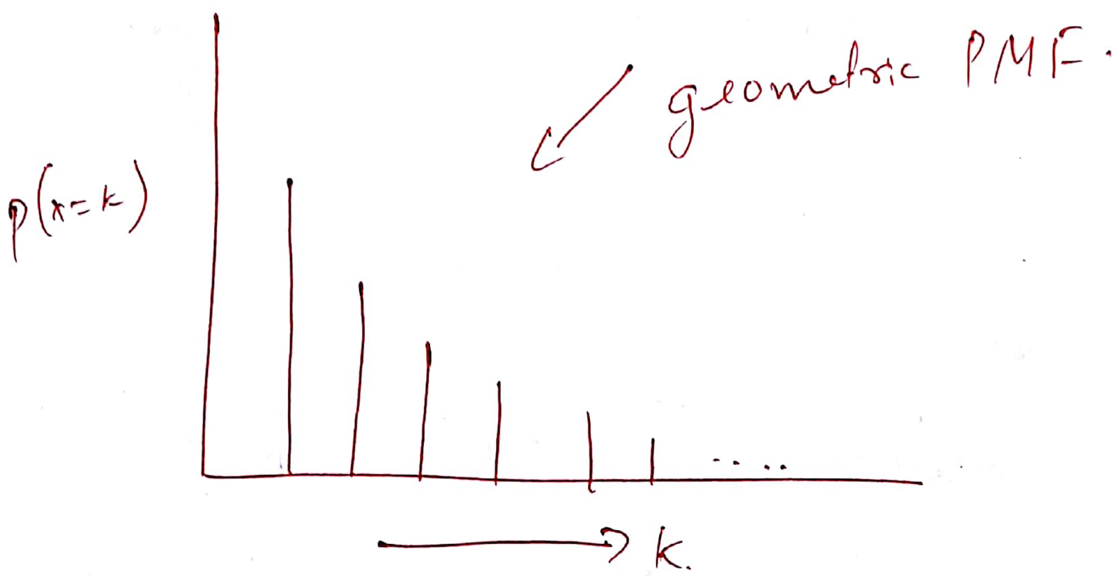
X = # of tosses ~~before~~ until you get a head.

Assumption : Coin tosses are independent.

$$p(X=k) = (1-p)^{k-1} \times p.$$

p : probability of getting a head.

T T T . . . . H.



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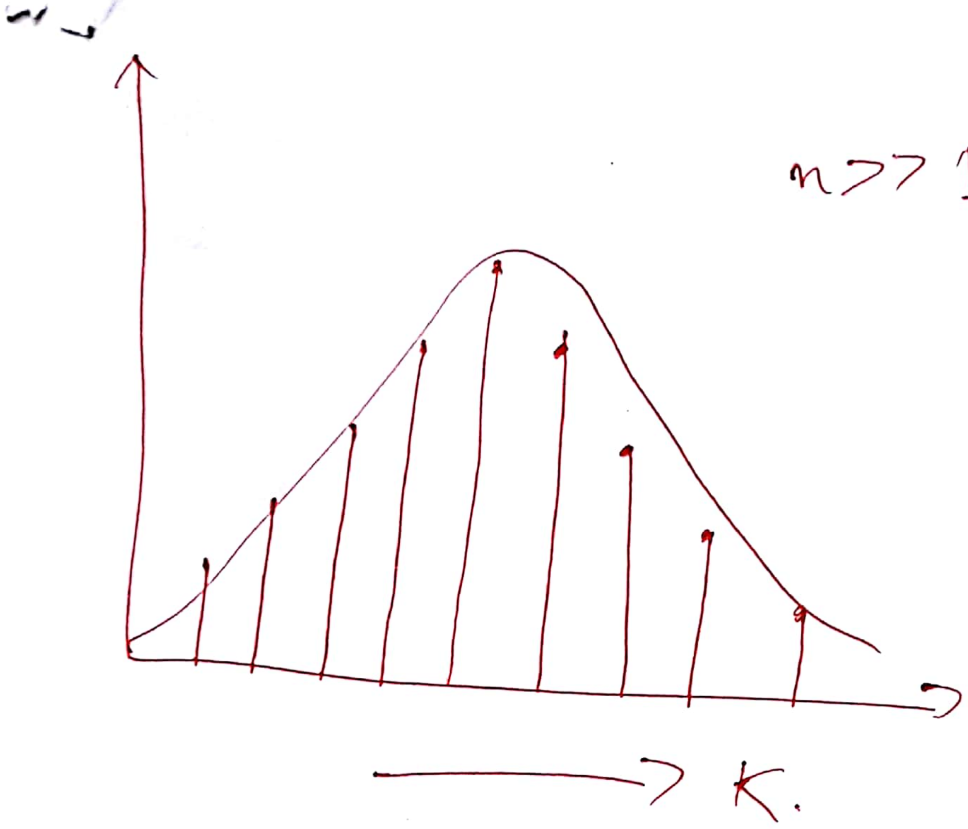

Bernouli PMF.

$$\text{PMF} = \begin{cases} q = 1 - p & \text{for } K = 0 \\ p & K = 1. \end{cases}$$