RANDOM VARIABLE (R.V):

A random variable is a numerical description of the outcome of a statistical experiment.

→ The probability distribution for a random variable describes how the probabilities are distributed over the values of the random variable.

→ In other or simple way,

Random variable is a variable that can take any outcome of a random experiment.

Example: $X : SS \rightarrow \{0,1,2\}$

R.E → TOSSING TWO COINS

S.S → $[\{H,H\}, \{H,T\}, \{T,H\}, \{T,T\}]$

R.V → 'X'-COUNTING NUMBER OF HEADS

$P(X=2) \rightarrow \{H, H\} = 1/4$

$P(X=1) \rightarrow [\{H, T\}, \{T, H\}] = 1/2$

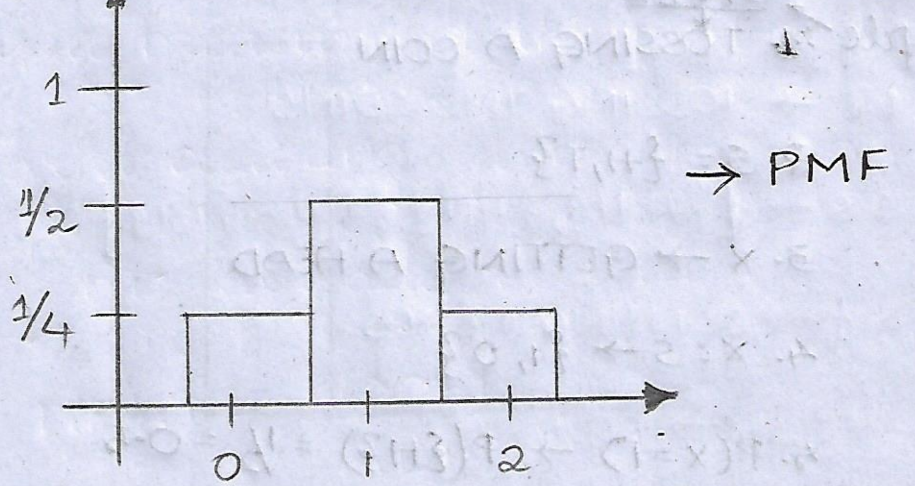
$P(X=0) \rightarrow \{T, T\} = 1/4$

PROBABILITY MASS FUNCTION (PMF):

A function that gives the probability that a discreate random variable is exactly equal to some value.

↳ Some times it is called as the DISCRETE DENSITY FUNCTION.

↳ A PDF must be integrated over an interval to yeild a probability.



BERNOULLI RANDOM VARIABLE:

A random variable is called as a Bernoulli random variable that has only two outcomes usually called a 'SUCCESS' or a 'FAILURE'.

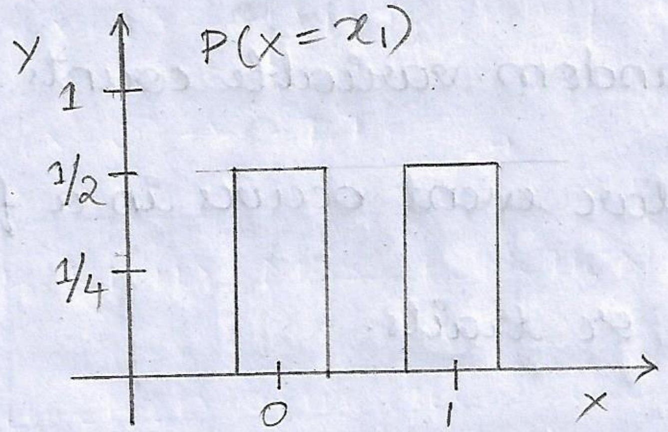
→ The variance of Bernoulli random variable is

$$Var[X] = p(1-p)$$

→ A Bernoulli distribution is a discrete Probability distribution ~~of~~ for a Bernoulli trail - SUCCESS or FAILURE.

Example: STEPS
1. TOSSING A COIN
2. $S = \{H, T\}$
3. $X \rightarrow$ GETTING A HEAD.
4. $X : S \rightarrow \{1, 0\}$
5. $P(X=1) \rightarrow P(\{H\}) = 1/2 = 0.5$
6. $P(X=0) \rightarrow P(\{T\}) = 1/2 = 0.5$

6. Plot the PMF



Example - 2 : STEPS :-

1. ROLLING A DIE, 2. {1, 2, 3, 4, 5, 6} = S

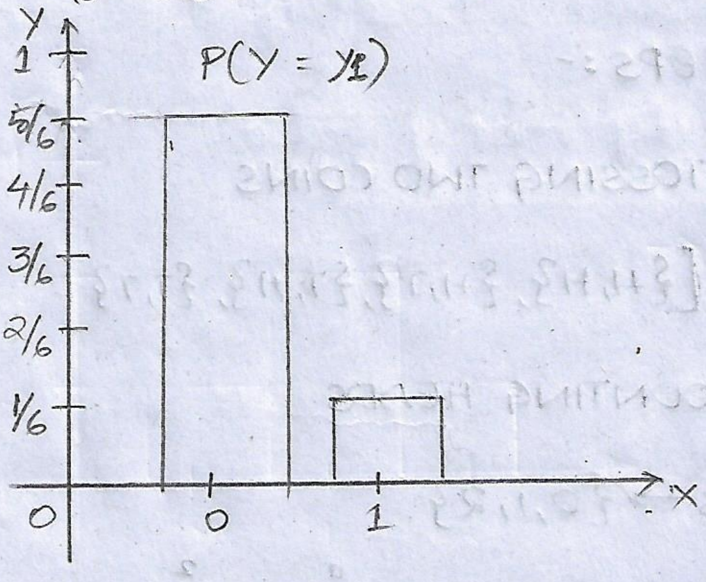
3. Y → GETTING '6'

4. Y : S → {0, 1}

5. P(Y = 0) → P({1, 2, 3, 4, 5}) = 5/6

P(Y = 1) → P({6}) = 1/6

6. Plot the PMF



PMF FOR BERNOULLI :

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

BINOMIAL RANDOM VARIABLE:

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A binomial random variable counts how often a particular event occurs in a fixed number of tries or trails.

→ The probability of occurance (or not) is the same on each trail.

→ Trails are independent of one another.

→ In simple,

Binomial random variable is the collection of a Bernoulli Random Variable.

Example: STEPS:-

1. R.E → TOSSING TWO COINS

2. S.S → [{H,H}, {H,T}, {T,H}, {T,T}]

3. X → COUNTING HEADS

4. X : SS → {0,1,2}

5. $P(X=0) = {}^{2}C_{0}\,(0.5)^{0}(0.5)^{2}$

Probability of success $\left[\because P(X=i) = {}^{n}C_{i} \cdot p^{i}(1-p)^{n-i}\right]$

$$= \frac{2!}{0!\,2!} \times 1 \times 0.25$$

$$= 0.25$$

$$\boxed{{}^{n}C_{i} = \frac{n!}{i!\,(n-i)!}}$$

$$P(x=1) = {}^{2}C_{1}\,(0.5)^{1}\,(0.5)^{2-1}$$

$$= \frac{2!}{1!\,1!} \times (0.5) \times (0.5)$$

$$= 2 \times 0.25$$

$$= 0.5$$

$$P(x=2) = {}^{2}C_{2}\,(0.5)^{2}\,(0.5)^{1-1}$$

$$= {}^{2}C_{2}\,(0.5)^{2}\,(0.5)^{0}$$

$$= \frac{2!}{2!\,0!} \times 0.25 \times 1$$

$$= 0.25$$

DISCRETE RANDOM VARIABLE :

A discrete random variable has a countable number of possible values.

→ The probability of each value of a discrete random variable is between '0' and '1', the sum of all the probabilities is equal to 1.

CONTINUOUS RANDOM VARIABLE:

A continuous random variable is a random variable where the data can take infinitely many values.