CLASS(9) :- Probability, Permutation & Combination

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→ Bayes Theorem :-

- Theorem state that the updated probability of A given B is directly proportional to probability of evidence B given A is true, multiplied by prior probability of A. [and inversely proportional to normalization factor(B).]

$$P(A|B) = \frac{P(B|A) * P(A)}{P(B)}$$

Likelihood, Prior, Marginal / Evidence, Posterior

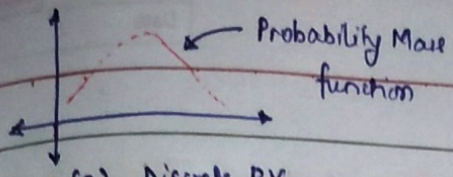
→ Probability Distribution function :- (PDF)

- It describe the likelihood of different outcomes in random experiment.
- There are several type of PDF :- Discrete Probability Distribution function, C-PDF, Cummulative PDF etc.
- Random Variable :- It is mathematic function that assigns a numerical value to each possible outcome of random experiment.
  - Random variable can be more than one.
  - Eg :- Coin (H,T), Dice (1,2,3,4,5,6)

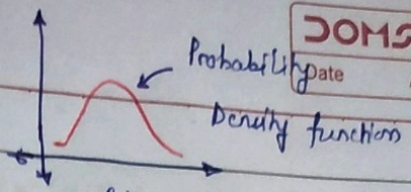
① Discrete Variable (Random) → Takes distinct values - The probability of discrete random variable is described as probability mass function (PMF).

② Continuous Random Variable - It is described by probability density function
It takes values given in range

→ Graph of Discrete RV & Continuous RV :-



(a) Discrete RV



(b) Continuous RV

- Example of PD :-

① Coin Toss :-

Coin/Toss	H	T
Prob	1/2	1/2

② Dice :-

(a) One Dice :-

Dice	1	2	3	4	5	6
Prob.	1/6	1/6	1/6	1/6	1/6	1/6

(b) Two Dice :-

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Sum of two probabilities of two dice

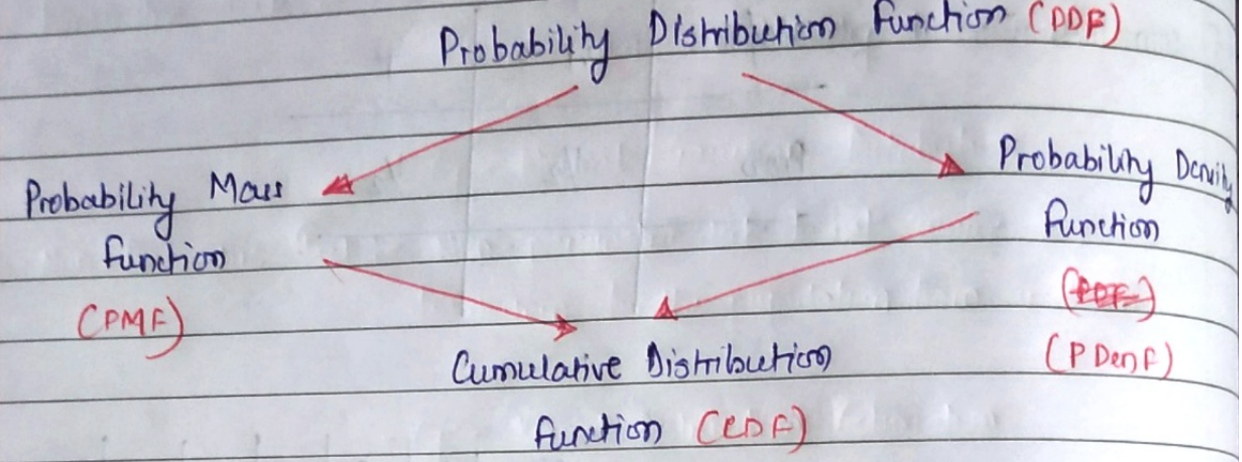
Probability of getting Sum	
2	1/36
3	2/36
4	3/36
5	4/36
6	5/36
7	6/36
8	5/36
9	4/36
10	3/36
11	2/36
12	1/36

So, to find this probabilities, we use a function;

Pure maths

$$y = f(x)$$

Flow chart PDF :-



→ Probability Mass function :- (Discrete Random Variable)

- It distribu probability of distribution of discrete random variable.
- Mathematically, $P(X = x)$
- Rule to remember :- ① The probability assigned to each value must be non-negative.
  ② The sum of the probability assigned to all possible value must be equal 1.

Eg :- Rule ① ⇒ Probability Mass function :-

When we roll two dice :→

Probability getting Sum 2 = $1/36 \simeq 0$, but non negative

Rule ② ⇒ when we toss a coin,

$P(H) = 1/2$ $P(T) = 1/2$

$P(E) = \frac{1}{2} + \frac{1}{2} = 1$

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→ Cummulative Distribution function (CDF) of PMF :-

It gives probability that the random value taku in a value less than or equal to a specific value.
Denoted by F(x).

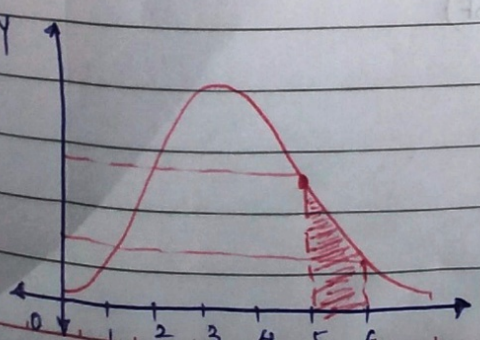
- Mathematically, $F(x) = P(X <= x)$

- Eg :- If we roll dice ;

	PMF	CDF
1	1/6	1/6
2	1/6	2/6
3	1/6	3/6
4	1/6	4/6
5	1/6	5/6
6	1/6	6/6

→ Probability Density function :- (PDF) (Continuous Random Variable)

- It describu the likelihood of a continuous random variable taking on particular value.
- denoted by f(x).

- 

$$P(a \le x \le b) = \int_{x_1}^{x_2} f(x)\,dx$$

- There are two types of test in (PDF) :-

① Parametric Test :- - Parametric test assume that the data are drawn from a specific probability distribution.

- Eg:- Normal / Gaussian Distribution

② Non-Parametric Test :- Non-parametric test do not assume any specific distribution for the population from are drawn.

- Eg:- Kernal Distribution Estimation

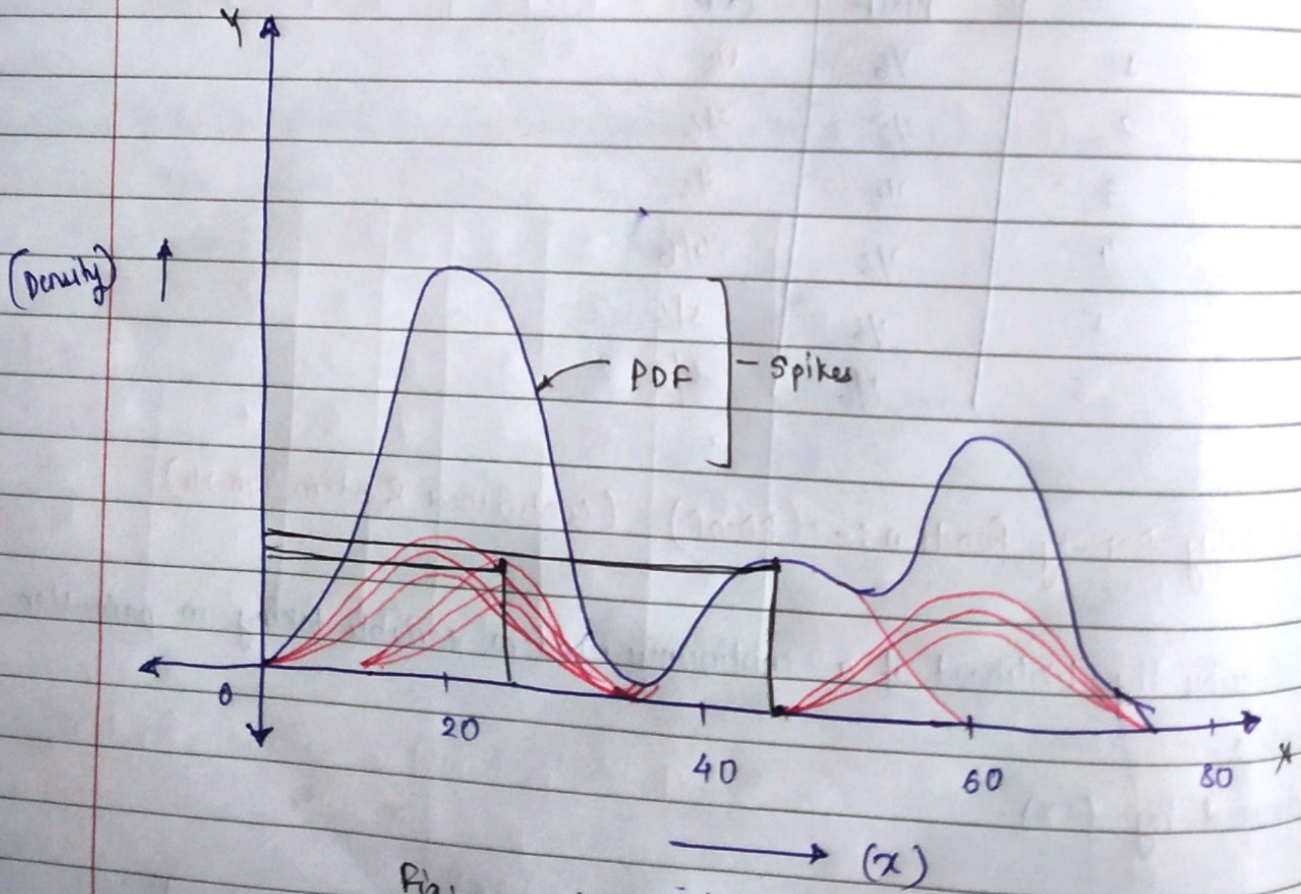


Fig:- KDE - (PDF)