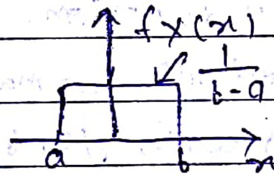
Distribution functions for Random Variables

These functions are in the form of probability Distribution function. These determine the behaviour of Random Variables in probabilistic Manner and follow the basic property of the pdf.

1. uniform distribution function
2. Binomial " "
3. poisson " "
4. Gaussian " "
5. Rayleigh " "

uniform distribution function.



$$f_X(x) \begin{cases} \frac{1}{b-a} & a \le x \le b \\ 0 & \text{otherwise.} \end{cases}$$

$$m_X = \int_a^b x f_X(x)\,dx = \frac{1}{b-a}\left[\frac{x^2}{2}\right]_a^b = \frac{b^2-a^2}{2(b-a)} = \frac{b+a}{2}$$

$$\Rightarrow \frac{a+b}{2}$$

$$\sigma_x^2 = E[X^2] - m_X^2$$

$$\int_a^b x^2 f_X(x)\,dx$$

$$= \frac{1}{3(b-a)}(b^3-a^3) \Rightarrow \frac{b^2+ab+a^2}{3}$$

$$\Rightarrow \sigma_x^2 = E[X^2] - m_X^2$$

$$= \frac{b^2+ab+a^2}{3} - \frac{(a+b)^2}{4}$$

$$= \frac{4b^2+4ab+4a^2-3a^2-3b^2-6ab}{12}$$

$$\frac{a^2+b^2-2ab}{12} = \frac{(a-b)^2}{12}$$

Binomial Distribution.

$$^nC_k\, p^k (1-p)^{n-k}$$

~~poisson~~ poisson distribution.

when probability of Error is very much small & No. is very large. than to find k bit to be in Error than Approximation is used which is given by poisson distribution.

$$= \frac{m^k e^{-k}}{k!}$$

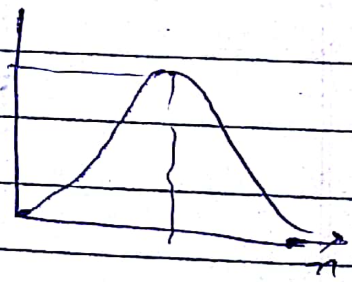
$$m = np$$

Gaussian Distribution : It is most commonly type of distribution function. This observe In our day today life. also called as normal distribution function. waveshape matches with the bell shape & very much in Symmetry in nature.

$$f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-m_x)^2/\sigma^2}$$

$$x = m_x$$

$$f_X(m_x) = \frac{1}{\sqrt{2\pi\sigma^2}}$$



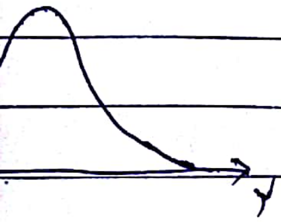
The cdf for the Gaussian function comes out to be error function.

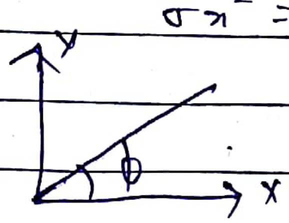
Rayleigh Distribution

$R = \sqrt{x^2+y^2}$ } where x & y are Rayleigh Distribution Random variables.

$m_y = m_x = m$

$\sigma_x^2 = \sigma_x^2 = \sigma^2$





$\phi = \tan^{-1}(y/x)$

$$\boxed{f_R(r) = \frac{r}{\sigma^2} e^{-r^2/2\sigma^2}}$$