Experiment-5

Aim: To study PDF & CDF functions of different Discrete Random Variables and the effects of Parametric changes.

Theory:- A random variable X is a function defined on sample space S of an experiment. Its value are real numbers. For every number 'a' the probability $P(x=a)$, with which X assumes 'a' is defined. Similarly $P(x \in I)$, with which X assumes any value $\in I$ is defined.

Discrete Random Variable:

By definition, a random variable and its distribution are discrete if X assumes only finitely many or at most countably many values x_1, x_2, x_3 - called the possible values of X. Discrete Distribution of X is also determined by the probability function $f(x)$ of x; defined by

$$f(x) = \begin{cases} p_j & \text{if } x = x_j \\ 0 & \text{otherwise} \end{cases} \quad (j = 1, 2, \ldots).$$

From this we get the values of the distribution function.

$$F(x) = \sum_{x_j \leq x} f(x_j) = \sum_{x_j \leq x} p_j$$

Bernoulli Random Variable:

It is Discrete Probability distribution of a random variable which takes the value 1 with prob. P & value 0, $q = 1-P$

pdf $\rightarrow f_x(x) = \begin{cases} (1-P)\delta(x) + P\delta(x-1) & x = 1 \\ 0 & x = 0 \end{cases}$

cdf $\rightarrow F_x(x) = (1-P)u(x) + P\,u(x-1)$

mean = P Variance = $P(1-P)$

Binomial Distributions

PDF $f_x(x) = \sum_{k=0}^{n} {}^nC_k P^k (1-P)^{n-k} \delta(x-k)$

CDF $F_x(x) = \sum_{k=0}^{n} {}^nC_k P^k (1-P)^{n-k} u(x-k)$

Mean $\bar{x} = nP$ Variance $\sigma_x^2 = nP(1-P)$

The Binomial distribution occurs in game of chance, opinion polls, medicine, & so on.

Poisson Distribution:

The discrete distribution with infinitely many possible

$$f(x) = \frac{\mu^x}{x!} e^{-\mu}$$

is called Poisson distribution. Special case of Binomial distribution for $n \to \infty$, $p \to 0$ || $\rightarrow np = \lambda$.

PDF $f_x(x) = \sum_{k=0}^{\infty} \frac{e^{-\lambda}}{k!} \lambda^k \delta(x-k)$

Mean $\bar{x} = \lambda$

Variance $\sigma_x^2 = \lambda$ //