Chapter#04: (Mathematical Expectations)

For Discrete Variable

$\mu = E(X) = \Sigma x f(x)$ (Only for Mean Value)

$\mu = E(X^2) = \Sigma x^2 f(x)$ (Only for Variance Value)

$Var(X) = E(x^2) - (E(x))^2$ (Variance Formula)

For Continuous Variable

$\mu = E(X) = \int_{-\infty}^{\infty} x f(x)$ (Only for Mean Value)

$\mu = E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)$ (Only for Variance Value)

$Var(X) = E(x^2) - (E(x))^2$ (Variance Formula)

Discrete Probability Distributions

Binomial Distribution:

$b(x;n,p) = \binom{n}{x} p^x q^{n-x}$, $x = 0,1,2,3, \dots ,n.$

$\mu = np$ (Mean)

$\sigma = \sqrt{npq}$ (Standard Deviation)

Hypergeometric Distribution:

$h(x;N,n,k) = \frac{\binom{k}{x}\binom{N-k}{n-x}}{\binom{N}{n}}$

$\mu = \frac{nk}{N}$ (Mean)

$\sigma = \frac{nk}{N} \cdot \left(1 - \frac{k}{N}\right) \cdot \left(\frac{N-n}{N-1}\right)$ (Standard Deviation)

Negative Binomial Distribution:

$b^*(x;k;p) = \binom{x-1}{k-1} p^k q^{x-k}$, $x = k, k+1, k+2, \dots$

Geometric Distribution:

$g(x;p) = pq^{x-1}$ $x = 1,2,3, \dots$

$\mu = \frac{1}{p}$ (Mean)

$\sigma = \sqrt{\frac{1-p}{p^2}}$ (Standard Deviation)

Passion Distribution:

$P(x; \lambda t) = \frac{e^{-\lambda t} (\lambda t)^x}{x!}$, $x = 0,1,2,3, \dots$

Both the mean and Variance of Poisson Distribution $p(x; \lambda t)$ are λt

Chapter#06: (Some Continuous Probability Distributions)

Continuous Probability Distributions

Standard Normal Distribution:

$z = \frac{X-\mu}{\sigma}$

Gamma Distribution: $f(x;\alpha,\beta) = \begin{cases} \frac{1}{\beta^{\alpha}\Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}, & x > 0, \\ 0, & elsewhere, \end{cases}$

$\mu = \alpha\beta$ *(Mean)*

$\sigma^2 = \alpha\beta^2$ *(Standard Deviation)*

Exponential Distribution:

$$f(x;\beta) = \begin{cases} \frac{1}{\beta} e^{-x/\beta}, & x > 0, \\ 0, & elsewhere, \end{cases}$$

$\mu = \beta$ *(Mean)*

$\sigma^2 = \beta$ *(Standard Deviation)*

Regression and Correlation:-

$\hat{y} = a + bx$

$\bar{y} = a + b\bar{x}$

$$b = \frac{n\Sigma xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$r = \frac{n\Sigma xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

Ch#04: (Mathematical Expectations) ***For Discrete Variable*** *μ=E(X)= $\Sigma xf(x)$ (Only for Mean Value)* *μ=E(X^2)= $\Sigma x^2 f(x)$ (Only for Variance Value)* *Var(X)= E(x^2) –$(E(x))^2$ (Variance Formula)* $\mu_g(X)=E[g(X)]=\sum g(x)f(x)$	***For Continuous Variable*** *μ=E(X)= $\int_{-\infty}^{\infty} xf(x)$ (Only for Mean Value)* *μ=E(X^2)= $\int_{-\infty}^{\infty} x^2 f(x)$ (Only for Variance Value)* *Var(X)= E(x^2) –$(E(x))^2$ (Variance Formula)* $\mu_g(X)=E[g(X)]=\int_{-\infty}^{+\infty} g(x)f(x)dx$	***Ch#05 Discrete Probability Distr.*** ***Binomial Distribution:*** *$b(x;n,p)= \binom{n}{x}p^x q^{n-x}$, x= 0,1,2,3, … ,n.* *$\mu=np$ (Mean)* *$\sigma=\sqrt{npq}$ (Standard Deviation)*
Hypergeometric Distribution: $h(x;N,n,k)= \frac{\binom{k}{x}\binom{N-k}{n-x}}{\binom{N}{n}}$ *$\mu= \frac{nk}{N}$ (Mean)* *$\sigma= \frac{nk}{N} \cdot \left(1-\frac{k}{N}\right) \cdot \left(\frac{N-n}{N-1}\right)$ (S D)*	***Negative Binomial Distribution:*** *$b^*(x;k;p)= \binom{x-1}{k-1}p^k q^{x-k}$, x= k, k+1, k+2, …* ***Geometric Distribution:*** *$g(x;p)= pq^{x-1}$ x=1,2,3, …* *$\mu= \frac{1}{p}$ (Mean)* *$\sigma= \sqrt{\frac{1-p}{p^2}}$ (Standard Deviation)*	***Passion Distribution:*** *$P(x;\mu)= \frac{e^{-\mu}(\mu)^x}{x!}$, x=0,1,2,3, …* *$\mu=\lambda t$* *Both the mean and Variance of Poisson Distribution $p(x; \lambda t)$ are λt* ***Ch#06: (Some Conti. Probability Distribution)*** ***(Conti. Probability Distribution)*** ***(Stand Norm Distr)*** $z= \frac{X-\mu}{\sigma}$
Gamma Distribution: $f(x;\alpha,\beta) = \begin{cases} \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1}e^{-x/\beta}, & x>0, \\ 0, & elsewhere, \end{cases}$ *$\mu= \alpha\beta$ (Mean)* *$\sigma^2 = \alpha\beta^2$ (Standard Deviation)* ***Exponential Distribution:*** $f(x;\beta) = \begin{cases} \frac{1}{\beta} e^{-x/\beta}, & x>0, \\ 0, & elsewhere, \end{cases}$ *$\mu= \beta$ (Mean)* *$\sigma^2 = \beta$ (Standard Deviation)*	***Regression and Correlation:-*** $\hat{y} = a + bx$ $\bar{y} = a + b\bar{x}$ $b = \frac{n\Sigma xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ $r = \frac{n\Sigma xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$	***Simple Random Sampling:-*** $z= \frac{\bar{X}-\bar{\mu}}{\bar{\sigma}}$