Chapter 2 Conclusion

Discrete Random variables

- Take discrete values such as:

$X = \cdots,-2,-1,0,1,2,\cdots$
$X = 1,2,3,\cdots$
$X = 1,2,3,\cdots,n$

- We define on X a Probability Mass Function (PMF) denoted by $p(x)$.
- $p(x)$ satisfies the following axioms
  1) $p(x) \ge 0$
  2) $\sum_{\forall x} p(x) = 1$
- Expectation, Mean $\mu = E(x)$

$$E(x) = \sum_{\forall x} x p(x)$$

Also

$$E(x^2) = \sum_{\forall x} x^2 p(x)$$

- Variance $V(x) = \sigma^2$

  $V(x) = E(x^2) - (E(x))^2$

- Stander Deviation σ

$$\sigma = \sqrt{V(x)}$$

Continuous Random variables

- Take Continuous values such as:

$a \le X \le b$
$-1 \le X \le 6$
$X \ge 0$

- We define on X a Probability Density Function (PMF) denoted by $f(x)$.
- $f(x)$ satisfies the following axioms
  1) $f(x) \ge 0$
  2) $\int_{\forall x} f(x)dx = 1$
- Expectation, Mean $\mu = E(x)$

  $E(x) = \int_{\forall x} x f(x)dx$

  Also

  $E(x^2) = \int_{\forall x} x^2 f(x)dx$

- Variance $V(x) = \sigma^2$

  $V(x) = E(x^2) - (E(x))^2$

- Stander Deviation σ

  $\sigma = \sqrt{V(x)}$

Examples of the discrete distributions

1- Binomial Distribution

Its PMF given by:

$$P(x)=\binom{n}{x}p^{x}q^{n-x}, \qquad x=0,1,2,\cdots,n$$

And

$$E(x)=np \qquad V(x)=npq$$

2- Poisson Distribution

Its PMF given by:

$$P(x)=\frac{\lambda^{x}e^{-\lambda}}{x!}, \qquad x=0,1,2,\cdots$$

And

$$E(x)=\lambda \qquad V(x)=\lambda$$

Examples of the Continuous distributions

1- Standard Normal Distribution

Its PDF given by:

$$f(Z)=\frac{1}{\sqrt{2\pi\sigma}}e^{\frac{-z^{2}}{2}}, \qquad -\infty<Z<\infty$$

Where

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