Probability Distributions

Learning Objectives

- - Understand probability distributions
- - Define binomial distribution
- - Define normal distribution
- - Apply each distribution in real examples

What is a Probability Distribution?

- - Describes how probabilities are distributed over values
- - Can be discrete or continuous
- - Used to model real-world random events

Discrete vs Continuous Distributions

- - Discrete: finite/countable outcomes (e.g. binomial)
- - Continuous: infinite possible values (e.g. normal)

Binomial Distribution – Definition

- - Discrete distribution
- - Fixed number of trials (n)
- - Each trial has two outcomes
- - Constant probability of success (p)

Conditions for Binomial Distribution

- - Fixed number of trials
- - Independent trials
- - Two possible outcomes
- - Constant probability

Binomial Distribution Formula

- P(X = k) = nCk p^k (1 − p)^(n − k)
- Used to calculate probability of k successes

Binomial Distribution – Example

- Tossing a coin 10 times
- Probability of getting exactly 6 heads
- p = 0.5

Normal Distribution – Definition

- - Continuous distribution
- - Bell-shaped curve
- - Symmetrical around the mean
- - Mean = Median = Mode

Properties of the Normal Distribution

- - Defined by mean (μ) and standard deviation (σ)
- - Total area = 1
- - Tails extend to infinity

Empirical Rule (68–95–99.7)

- - 68% within 1 SD
- - 95% within 2 SD
- - 99.7% within 3 SD

Normal Distribution – Example

- Heights, blood pressure, exam scores
- Frequently seen in biological data

Comparison: Binomial vs Normal

- - Binomial: discrete
- - Normal: continuous
- - Binomial → Normal when n is large

Applications in Biology & Medicine

- - Success/failure experiments
- - Measurements like weight, height
- - Statistical inference

Summary

- - Binomial: discrete, fixed trials
- - Normal: continuous, bell-shaped
- - Both widely used in statistics