ASSIGNMENT (Question -2)

Take one Domain and draw the graph (Normal distribution) (Empirical rule)

Introduction

In statistics, the normal distribution is a fundamental concept used to represent how data values are distributed around an average value. It is commonly known as the **bell-shaped curve** because of its symmetric shape. The normal distribution shows that most values are concentrated near the mean, while fewer values occur at the extremes.

The empirical rule, also called the **68–95–99.7 rule**, explains how data is spread in a normal distribution. It describes the percentage of observations that fall within one, two, and three standard deviations from the mean.

Normal distribution is widely used in many real-world domains such as education, healthcare, finance, and business. In this assignment, the selected domain is **human height distribution**, and the empirical rule is used to understand how heights of individuals are distributed in a population.

Domain Selection: Human Height Distribution

Human height is one of the best examples of normal distribution in real life. When measuring the heights of a large group of people, most individuals have heights close to the average, while very tall and very short individuals are less common.

Why Human Height Follows Normal Distribution

- Height is influenced by genetic and environmental factors.
- Most individuals grow around an average range.
- Extremely tall or short individuals are rare.
- Biological characteristics naturally follow symmetric distribution.

Because of these characteristics, height data forms a bell-shaped curve when plotted on a graph.

Understanding Normal Distribution

A normal distribution is defined using two main parameters:

1. Mean (μ)

The mean represents the average value of the dataset. In human height distribution, the mean represents the average height of a population.

For example:

- Average height of adult males ≈ 170 cm
- Average height of adult females ≈ 160 cm

The mean lies at the center of the bell curve.

2. Standard Deviation (σ)

Standard deviation measures how much variation exists from the mean. It indicates how far individual heights differ from the average height.

- Small standard deviation → heights are close to average.
- Large standard deviation → heights vary widely.

Characteristics of Normal Distribution

- Bell-shaped symmetric curve.
- Mean, median, and mode are equal.
- Data evenly distributed on both sides.
- Probability decreases as values move away from the mean.

Empirical Rule (68–95–99.7 Rule)

The empirical rule describes how data values are distributed around the mean in a normal distribution.

1. 68% Rule (One Standard Deviation)

Approximately **68% of individuals** fall within one standard deviation from the mean ($\mu \pm 1\sigma$).

Example in Human Height

If the average height is 170 cm and standard deviation is 10 cm:

- Most people have heights between **160 cm and 180 cm**.
- These represent average height individuals.

This forms the central region of the bell curve.

2. 95% Rule (Two Standard Deviations)

About **95% of individuals** fall within two standard deviations from the mean ($\mu \pm 2\sigma$).

Example

- Height range between **150 cm and 190 cm**.

- Includes almost all individuals except extreme cases.

This region covers the majority of the population.

3. 99.7% Rule (Three Standard Deviations)

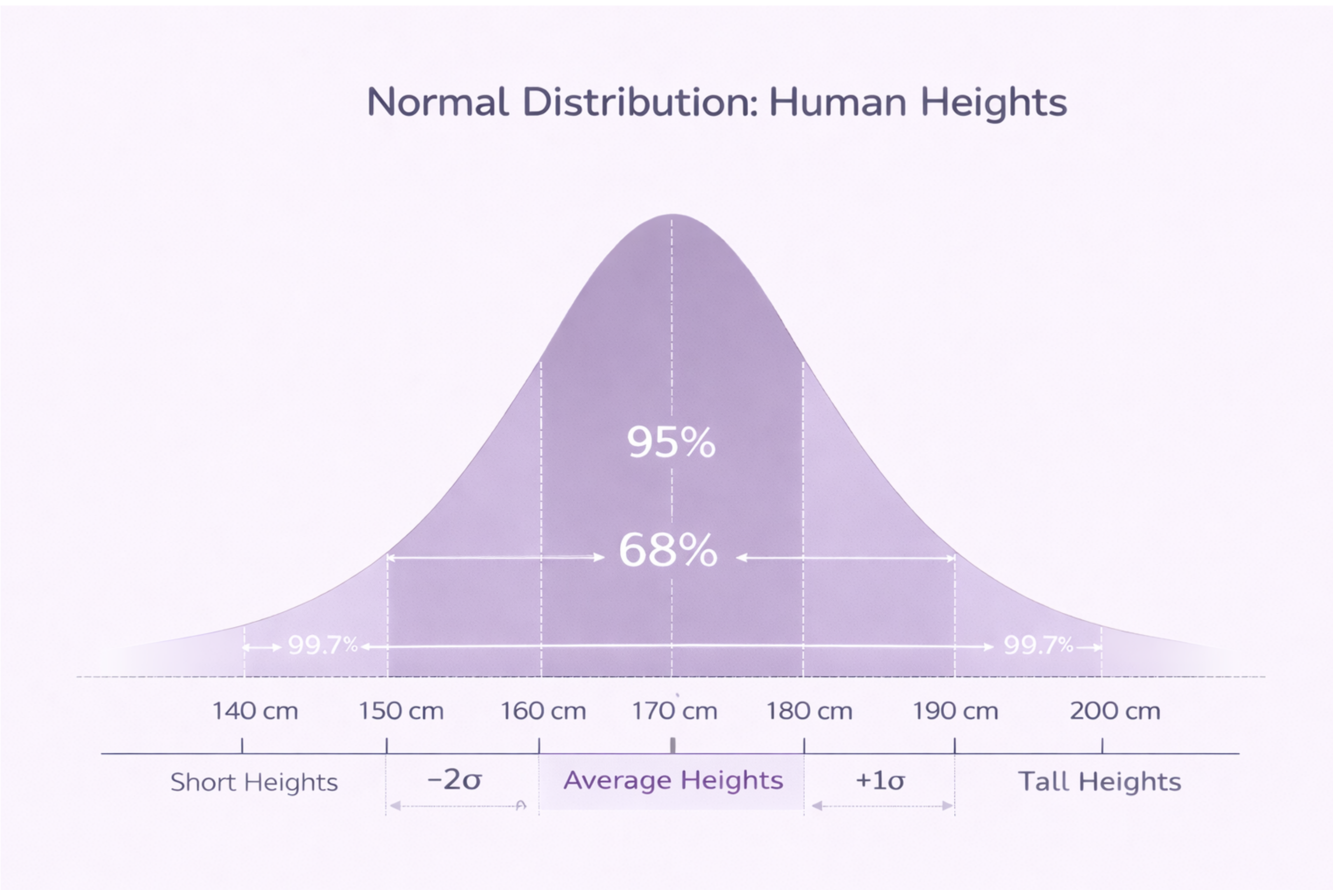
Nearly **99.7% of individuals** fall within three standard deviations from the mean ($\mu \pm 3\sigma$).

Example

- Height range between **140 cm and 200 cm**.
- Only a very small percentage falls outside this range.

This represents nearly the entire distribution.

Graph Representation of Human Height Distribution



The normal distribution graph of human height is represented by a bell-shaped curve.

Components of the Graph

X-axis

Represents height values ranging from short to tall individuals.

Y-axis

Represents number of individuals or frequency.

Mean (μ)

Located at the center of the curve representing average height.

Standard Deviations

Marked as:

- $\mu - 1\sigma$, $\mu + 1\sigma$ → average height range
- $\mu - 2\sigma$, $\mu + 2\sigma$ → above and below average range
- $\mu - 3\sigma$, $\mu + 3\sigma$ → extreme values

The curve is symmetric on both sides.

Interpretation of Height Distribution

Using the empirical rule, height distribution can be categorized as:

Short Height (Below −2σ)

- Very few individuals
- Below average height

Average Height (Between −1σ and +1σ)

- Majority of individuals
- Normal height range

Tall Height (Above +1σ)

- Fewer individuals
- Above average height

Extreme Values (Beyond ±3σ)

- Very rare cases

This classification helps in population studies.

Applications of Normal Distribution in Healthcare and Population Studies

Normal distribution is widely used in healthcare and research.

1. Growth Monitoring

Helps track child growth and development.

2. Health Assessment

Used to evaluate physical development patterns.

3. Medical Research

Helps analyze biological characteristics.

4. Population Analysis

Helps understand physical characteristics of populations.

5. Statistical Predictions

Used for predicting trends in population data.

Advantages of Using Normal Distribution

- Represents real-world biological data accurately.
- Helps in prediction and analysis.
- Easy interpretation of population trends.
- Useful in medical and statistical research.

Limitations of Normal Distribution

- Not all biological data follows perfect normal distribution.
- Extreme values may affect results.
- Requires large datasets for accuracy.

Despite limitations, it is widely used in statistical analysis.

Conclusion

The normal distribution provides an effective method for analyzing real-world data such as human height. The bell-shaped curve shows that most individuals have heights close to the average, while very few individuals fall at extreme values. The empirical rule explains how height values are distributed within one, two, and three standard deviations from the mean.

The study of human height distribution helps researchers understand population characteristics and biological variations. The empirical rule allows accurate interpretation of data and supports decisionmaking in healthcare and population studies. Therefore, normal distribution and the empirical rule play a significant role in statistical analysis and real-world data interpretation.