THEORY 3

**Q1 What are the key properties of a Normal Distribution?**

* **Bell-shaped and Symmetrical** – The curve is perfectly symmetric about its mean.
* **Mean = Median = Mode** – All three measures of central tendency are equal.
* **Total Area** = 1 – The total area under the curve equals 1, representing the entire probability.

**Q2 Define:**

**Probability Density Function (PDF): -** A Probability Density Function (PDF) is a function that describes the likelihood of a continuous random variable taking on a particular value.

Ex: - what is the probability that a student scores exactly 90.

**Z-Score: -** Z-score is a statistical measure that describes a value's position relative to the mean of a group of values. It is expressed in terms of standard deviations from the mean. The Z-score indicates how many standard deviations an element is from the mean.

Ex: - A Z-score of 2 indicates the value is 2 standard deviations away from the mean.

**Standard Normal Distribution: -** Standard Normal Distribution is a special case of normal distribution where the mean is always zero and the standard deviation is always one.

This standardized form allows any normal distribution to be converted into a common scale using z- scores.

**Formula: -**

**z = (Value of Element - Population Mean) / Population Standard Deviation**

**Q3 Differentiate between:**

**Discrete vs. Continuous Distributions: -**

**Feature**

**Type of Data**

**Example Variables**

**Probability Representation**

**Graph Type**

**Example: -**

**Discrete Distribution**

Consists of countable values (e.g., 0, 1, 2, 3…)

Number of students, dice rolls, cars in a parking lot

Probability Mass Function (PMF) gives the probability of each value

Bar graph (separate bars)

Tossing a coin (P(Head) = 0.5)

**Continuous Distribution**

Consists of uncountable/infinite values within a range

Height, weight, temperature, time

Probability Density Function (PDF) gives probability over an interval

Smooth curve

Measuring the height of people (probability of exactly 170.0 cm = 0, but 169.5–170.5 cm has some probability)

**Binomial vs. Normal Distribution: -**

**Feature**

**Type**

**Nature** **of** **Variable**

**Shape**

**Parameters**

**Range** **of** **Values**

**Example**

**Binomial** **Distribution**

**Discrete** distribution

Counts number of successes in a fixed number of trials

Symmetrical (for p = 0.5) or skewed (if p ≠ 0.5)

(number of trials), (probability of success)

Takes only integer values from 0 to n

Number of heads in 10-coin tosses

**Normal Distribution**

**Continuous** distribution

Describes continuous data like height, weight, etc.

Always symmetrical and bell-shaped

(mean), (standard deviation)

Can take any real value (−∞ to +∞)

Distribution of people’s heights in a population