SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Department of Computer Science and Engineering

Course Code & Title : 23ADO201 - Data Science Fundamentals
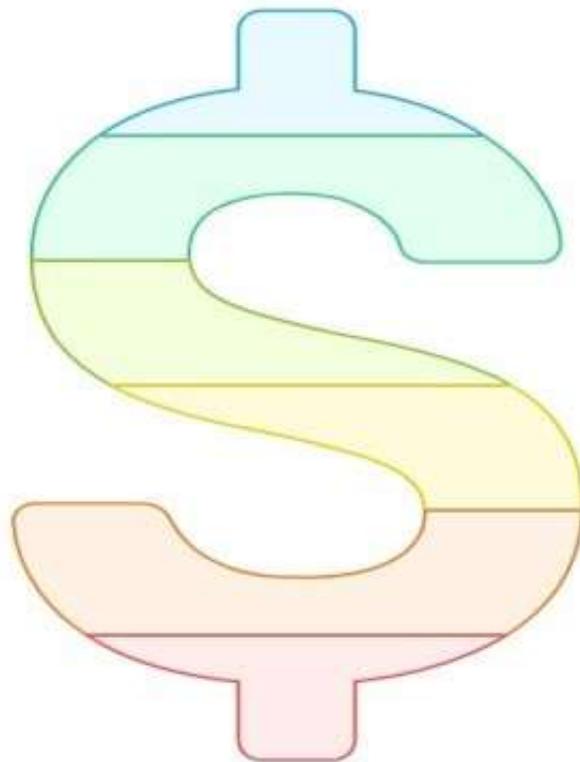
III YEAR / VI SEMESTER - EEE

Unit 2 - DESCRIPTIVE ANALYTICS

Topic : Normal distributions

Mr.K.Karthikeyan AP /CSE

Comprehensive Overview of Normal Distributions

Definition
A continuous probability distribution characterized by its symmetrical bell shape

Properties
Key characteristics including mean, median, mode, and standard deviation

Characteristics
Features like symmetry, unimodality, and asymptotic tails

Applications
Real-world uses in various fields like science, engineering, and finance
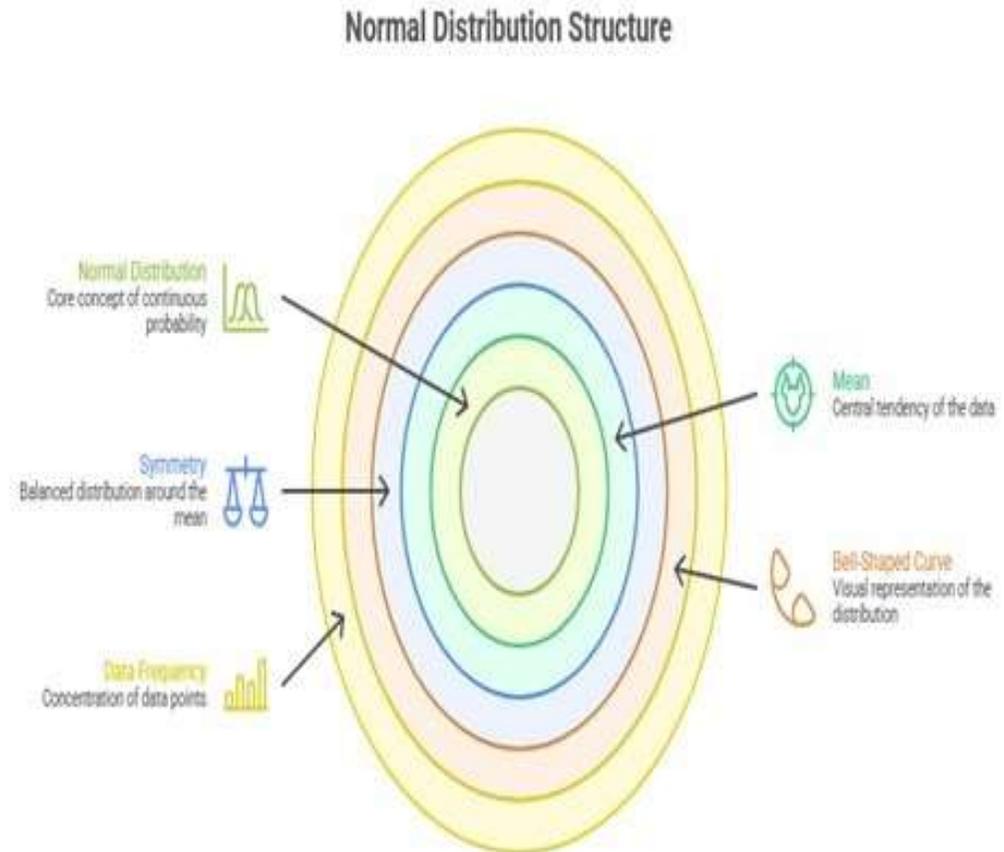
Examples
Practical illustrations of normal distributions in action

Considerations
Important factors to keep in mind when working with normal distributions

- A **normal distribution**, also known as a Gaussian distribution, is a continuous probability distribution that is symmetrical around its mean.
- It is characterized by its bell-shaped curve, where the majority of the data points cluster around the mean, and the frequency of data points decreases as you move away from the mean in either direction.

Normal Distribution Structure

Normal Distribution
Core concept of continuous probability

Symmetry
Balanced distribution around the mean

Data Frequency
Concentration of data points

Mean
Central tendency of the data

Bell-Shaped Curve
Visual representation of the distribution

Key Properties of Normal Distributions

Symmetry

Perfectly balanced around the mean

Mean, Median, Mode

All equal and at the center

Unimodal

Single peak at the mean

Asymptotic

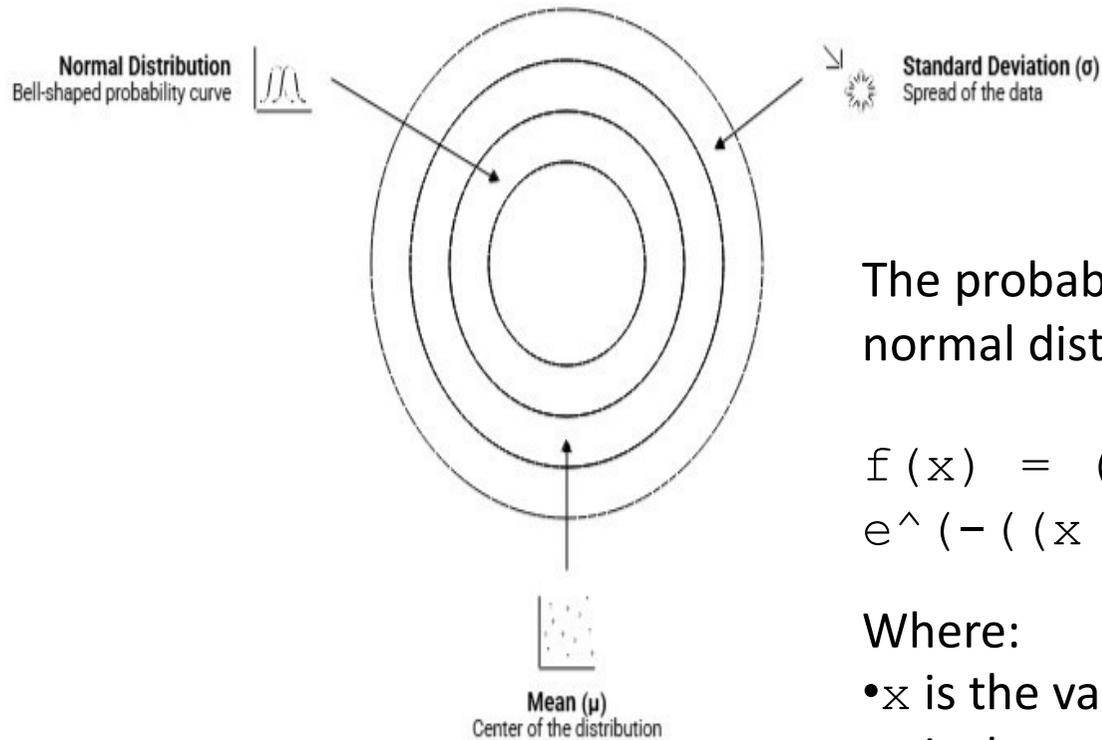Tails extend infinitely without touching the axis

Area Under the Curve

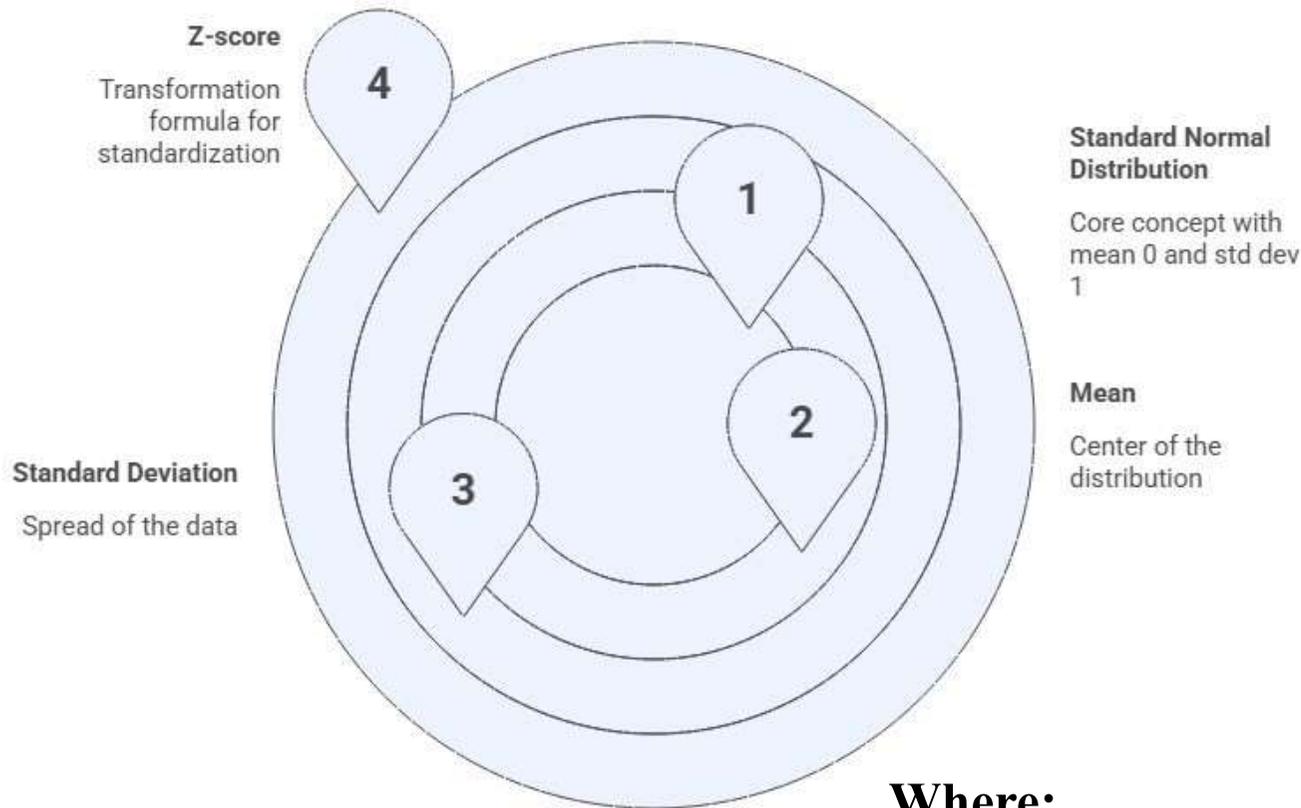Total area equals 1, representing total probability

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Normal Distribution Parameters

Normal Distribution
Bell-shaped probability curve

Standard Deviation (σ)
Spread of the data

Mean (μ)
Center of the distribution

The probability density function (PDF) of a normal distribution is given by:

```
f(x) = (1 / (σ * sqrt(2π))) *
e^(-((x - μ)^2) / (2σ^2))
```

Where:
- x is the value of the variable
- μ is the mean
- σ is the standard deviation
- π is approximately 3.14159
- e is approximately 2.71828

Standard Normal Distribution

Z-score

Transformation formula for standardization

Standard Deviation

Spread of the data

Standard Normal Distribution

Core concept with mean 0 and std dev 1

Mean

Center of the distribution

Standard Normal Distribution

$$z = (x - \mu) / \sigma$$

Where:
- z is the z-score (number of standard deviations from the mean)
- x is the value of the variable
- μ is the mean
- σ is the standard deviation

🎯 Fun Activity

68–95–99.7 Rule Challenge 🎯

Time: 10 mins

Mode: Groups

Steps:

Draw a bell curve on the board.

Mark μ (mean).

Ask students to shade:
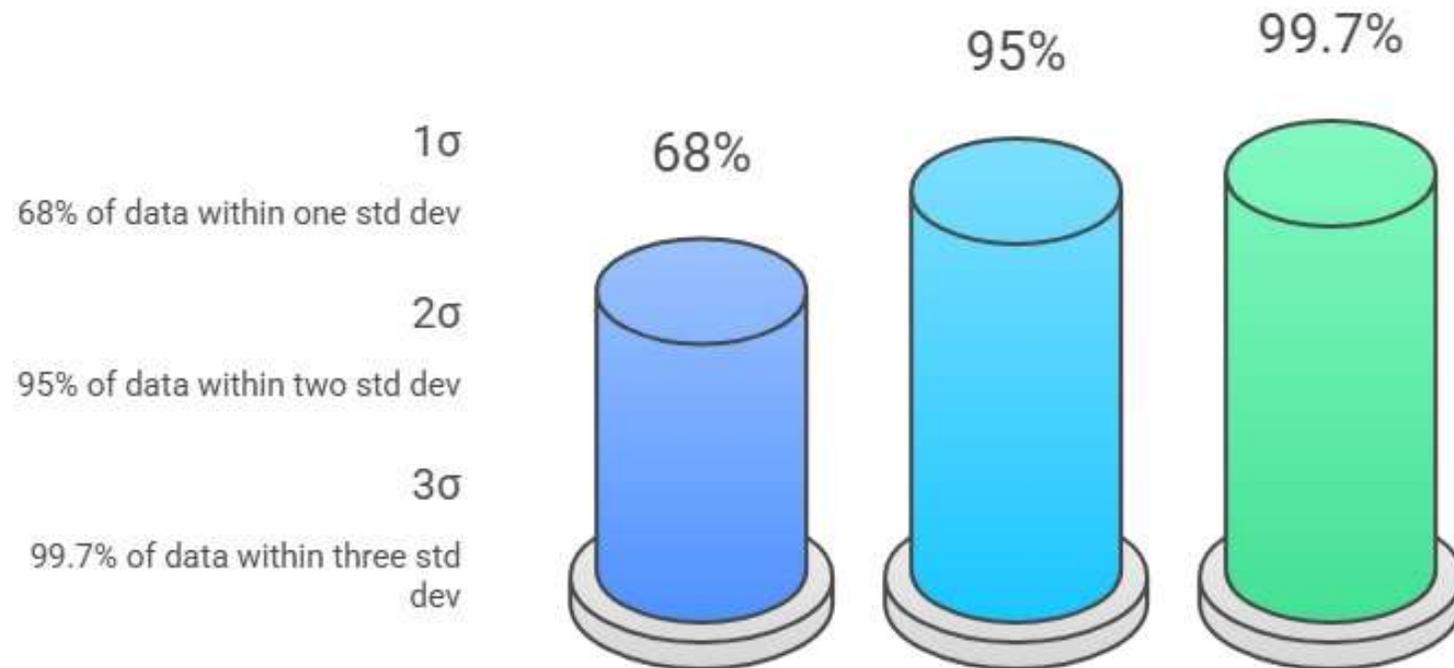
$1\sigma \rightarrow 68\%$
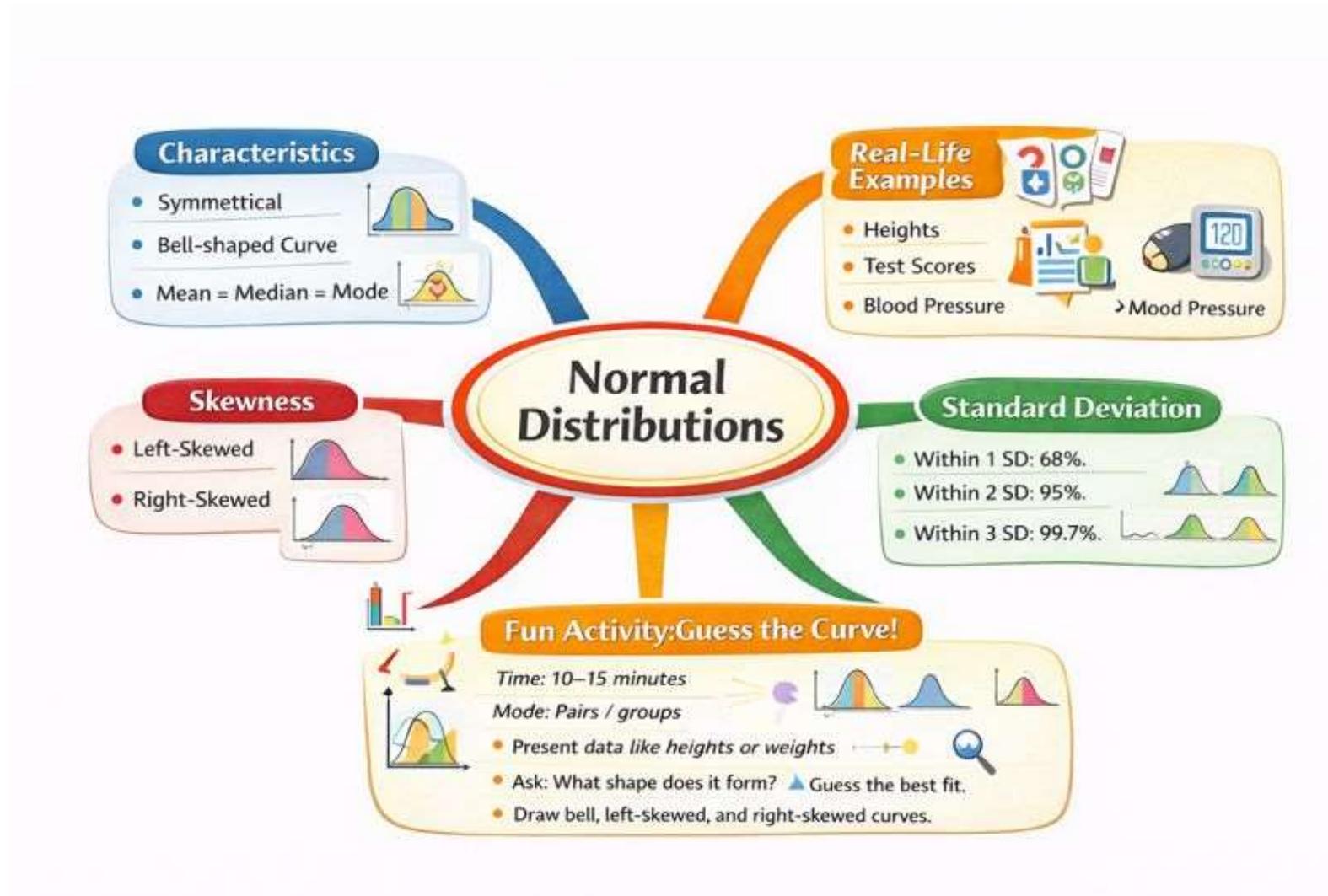
$2\sigma \rightarrow 95\%$

$3\sigma \rightarrow 99.7\%$

Give quick MCQs based on the rule.

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Empirical Rule for Normal Distributions

1σ

68% of data within one std dev

2σ

95% of data within two std dev

3σ

99.7% of data within three std dev

68%

95%

99.7%

Made with 🍃 Napkin

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MIND MAP

ASSESSMENT

NORMAL DISTRIBUTIONS – MCQs

1. Basics of Normal Distribution

1. A normal distribution is also known as:

A. Uniform distribution

B. Skewed distribution

C. Bell-shaped distribution

D. Random distribution

✅ **Answer:** C

2. In a perfectly normal distribution:

A. Mean > Median > Mode

B. Mean < Median < Mode

C. Mean = Median = Mode

D. Mean ≠ Median ≠ Mode

✅ **Answer:** C

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2.Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.

3.Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.

4.Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", A press, 2021.