Measures of Central Tendency and Dispersion

Central Tendency: It refers to the statistical measures that identify the center or typical value of a dataset. The main measures are Mean, Median, and Mode.

Dispersion: It refers to the statistical measures that describe the spread or variability of the data. The main measures are Variance, Standard Deviation, and Interquartile Range (IQR).

1. Mean (Average)

Definition: The sum of all values divided by the number of values.
Formula: Mean = (Σxi) / n
Example: Data = [2, 4, 6, 8, 10] → Mean = 30 / 5 = 6

2. Median

Definition: The middle value when data is arranged in ascending order.
If n is odd → median is the middle value. If n is even → median = average of two middle values.
Example: Data = [2, 4, 6, 8, 10] → Median = 6
Example: Data = [1, 3, 5, 7] → Median = (3+5)/2 = 4

3. Mode

Definition: The most frequently occurring value in the dataset.
Example: Data = [2, 4, 4, 6, 8, 8, 8, 10] → Mode = 8

4. Variance

Definition: The average of the squared differences from the mean.
Formula (Population): $\sigma^2 = \Sigma(xi - \mu)^2 / N$
Formula (Sample): $s^2 = \Sigma(xi - x■)^2 / (n-1)$
Example: Data = [2, 4, 6, 8], Mean = 5, Variance = 20/3 = 6.67

5. Standard Deviation

Definition: Square root of variance; measures spread of data around the mean.
Formula: $s = \sqrt{s^2}$
Example: From variance above, $s = \sqrt{6.67} \approx 2.58$

6. Interquartile Range (IQR)

Definition: Difference between the third quartile (Q3 = 75th percentile) and the first quartile (Q1 = 25th percentile).
Formula: IQR = Q3 - Q1
Example: Data = [2, 4, 6, 8, 10, 12, 14, 16] → Q1 = 4.5, Q3 = 12.5, IQR = 8

Summary Table

Measure	Definition	Formula	Example
Mean	Average of data values	$x\blacksquare = \Sigma x / n$	Mean of [2,4,6,8,10] = 6
Median	Middle value of ordered data	-	Median of [2,4,6,8,10] = 6
Mode	Most frequent value	-	Mode of [2,4,4,8,8,8] = 8
Variance	Avg. squared deviation	$s^2 = \Sigma(x - x\blacksquare)^2 / (n-1)$	6.67
Std. Dev.	Spread from mean	$s = \sqrt{s^2}$	2.58
IQR	Spread of middle 50%	Q3 - Q1	8