

Summary Notes: Statistics, Data Types & Levels of Measurement

1. Descriptive Statistics

- Summarizes and describes data you have.
 - Examples: mean, median, mode, range, standard deviation.
 - Helps understand data distribution: center, spread, shape (e.g., skewness).
 - Visual tools: histograms, boxplots.
 - **Does NOT** make predictions or generalizations beyond the data.
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2. Inferential Statistics

- Uses sample data to make predictions or draw conclusions about a larger population.
 - Examples: hypothesis testing, confidence intervals, regression.
 - Based on probability.
 - Allows generalization **beyond the immediate data**.
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3. Difference Between Descriptive and Inferential Statistics

Aspect	Descriptive Statistics	Inferential Statistics
Purpose	Describe and summarize data	Make predictions/generalizations
Scope	Data at hand (sample/population)	Sample to population
Use of probability	No	Yes
Examples	Mean, median, charts	Hypothesis tests, confidence intervals

4. Understanding Distribution (via Descriptive Statistics)

- Distribution shows how data values are spread or arranged.
- **Measures used:**
 - Central tendency: mean, median, mode.
 - Spread: range, variance, standard deviation.
 - Shape: skewness (symmetry), kurtosis (peakedness).

- Visualizations: histograms, boxplots help see distribution shape.
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5. Ordinal Data

- A type of categorical data with a meaningful order or rank.
 - You know **which is higher or lower**, but not **by how much**.
 - Examples: satisfaction ratings (poor, fair, good), education level.
 - Differences between ranks are **not consistent or measurable**.
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6. Four Levels of Measurement

Level	Description	Characteristics	Examples
Nominal	Categories/labels only	No order, no math; just naming	Gender, eye color, blood type
Ordinal	Categories with order	Order known, but intervals unequal	Satisfaction ratings, class rank
Interval	Numeric, equal intervals, no true zero	Addition/subtraction allowed, no meaningful zero	Temperature (°C, °F), IQ scores
Ratio	Numeric, equal intervals, true zero	All math allowed (add, subtract, multiply, divide)	Height, weight, age, income

7. Summary Table of Measurement Levels

Feature	Nominal	Ordinal	Interval	Ratio
Categorizes variables	✓	✓	✓	✓
Ranks categories in order	✗	✓	✓	✓
Has equal intervals	✗	✗	✓	✓
Has true or meaningful zero	✗	✗	✗	✓
Math operations allowed	Count, Mode	Rank, Median	+, -, ×, ÷	

- **Sum of Deviations:** The sum of deviations from the mean is always zero:
- $\sum(x_i - \bar{x}) = 0$
- **Adding a Constant:** If a constant is added to each observation, the new mean becomes:
 $x' = \bar{x} + a$
- **Subtracting a Constant:** If a constant is subtracted from each observation, the new mean becomes: $x' = \bar{x} - a$
- **Multiplying by a Constant:** If each observation is multiplied by , the new mean becomes:
 $x' = \bar{x} \times a$
- **Dividing by a Constant:** If each observation is divided by , the new mean becomes:
 $x' = \bar{x} / a$