

Statistics

complete Statistics Curriculum in English, translated from the previous Urdu version. This is designed **step-by-step** from **basic to advanced** level and is ideal for students, self-learners, or anyone entering Data Science, Research, or Business Analytics.


📖 **Statistics Curriculum – Step-by-Step (Beginner to Advanced)**

✓ **Step 1: Introduction to Statistics**

Objective: Understand what statistics is and why it's important.

- What is Statistics? (Descriptive vs Inferential)
- Importance & Applications (in daily life, business, science, etc.)
- **Types of Data:**
 - Qualitative (categorical)

- Quantitative (numerical)
- **Scales of Measurement:**
 - Nominal
 - Ordinal
 - Interval
 - Ratio

 *Practice:* Identify types and scales of data from examples.

✓ **Step 2: Data Collection & Presentation**

Objective: Learn how to collect and organize data.

- **Methods of Data Collection:**
 - Survey
 - Observation
 - Experiment
- Population vs Sample
- **Sampling Techniques:**
 - Random Sampling
 - Stratified Sampling
 - Systematic Sampling
 - Cluster Sampling
- Frequency Distributions
- **Graphical Representations:**
 - Bar Chart


- Pie Chart
- Histogram
- Line Graph
- Frequency Polygon

 *Practice:* Collect real-life data and create charts (bar/pie/etc.).

✓ **Step 3: Measures of Central Tendency (Averages)**

Objective: Understand the center or typical value of data.

- Mean (Arithmetic, Weighted, Geometric)
- Median
- Mode
- When to use each one

 *Practice:* Calculate mean, median, and mode for sample data.

✓ **Step 4: Measures of Dispersion (Spread of Data)**

Objective: Learn how much the data varies.

- Range
- Variance
- Standard Deviation (SD)


- Coefficient of Variation (CV)
- Interquartile Range (IQR)

 *Practice:* Calculate SD and variance for small datasets.

✓ **Step 5: Probability**

Objective: Learn how to measure uncertainty.

- Basic Concepts of Probability
- Addition and Multiplication Rules
- Conditional Probability
- Independent and Dependent Events
- Bayes' Theorem (introduction)

 *Practice:* Solve probability questions using coins, dice, or cards.

✓ **Step 6: Probability Distributions**

Objective: Understand how random variables behave.

- Discrete vs Continuous Distributions
- Binomial Distribution
- Poisson Distribution
- Normal Distribution (Bell Curve)
- Properties of Normal Distribution

- Z-scores and Standard Normal Table

 *Practice:* Use distribution tables to find probabilities.

✓ **Step 7: Sampling and Sampling Distributions**

Objective: Understand sampling theory and error.

- Central Limit Theorem (CLT)
- Sampling Error
- Standard Error
- Point and Interval Estimation
- Confidence Intervals (95%, 99%)


 *Practice:* Estimate confidence intervals for a given sample.

✓ **Step 8: Hypothesis Testing**

Objective: Learn how to make decisions based on data.

- Null Hypothesis (H_0) vs Alternative Hypothesis (H_1)
- Type I and Type II Errors
- Significance Level (α)
- p-value Concept
- One-tailed vs Two-tailed Tests
- z-test and t-test

- Chi-square Test
- ANOVA (Introduction)

 *Practice:* Perform a t-test on sample data.

✓ **Step 9: Correlation and Regression**

Objective: Understand relationships between variables.

- Scatter Plot
- Pearson Correlation Coefficient (r)
- Spearman Rank Correlation
- Simple Linear Regression
- Regression Line: $y = a + bx$
- Coefficient of Determination (R^2)
- Interpret slope & intercept

 *Practice:* Build and interpret a linear regression model.

✓ **Step 10: Advanced Topics (Optional for Research & Data Science)**

Objective: Explore modern statistical techniques.

- Multiple Linear Regression
- Logistic Regression
- Time Series Analysis (trend, seasonality)

- Non-parametric Tests
- Principal Component Analysis (PCA)
- **Statistical Software:**
 - Excel
 - SPSS
 - R
 - Python (pandas, scipy, statsmodels)

 *Practice:* Apply regression or hypothesis testing in Excel or Python.

Recommended Learning Resources:

| Type | Resource |
|-------------|--|
| Book | <i>Statistics for Dummies</i> |
| Videos | Khan Academy (Statistics), YouTube (Math Antics) |
| Free Course | Coursera – <i>Statistics with Python</i> |
| Tools | Excel, Python (Jupyter), RStudio, SPSS |