Statistics

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	*Statistics for Dummies*
Videos	Khan Academy (Statistics), YouTube (Math Antics)
Free Course	Coursera – *Statistics with Python*
Tools	Excel, Python (Jupyter), RStudio, SPSS