

Multi Disciplinary Course (MDC) *Mathematical Science*

MDC-1: Foundation Of Mathematical Science -- I
For FYUGP 1st Semester

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Historical Development of Statistics

The historical development of statistics is a fascinating journey that spans thousands of years, evolving from simple record-keeping to a sophisticated field essential to science, business, policy, and everyday decision-making.

Here's a concise overview divided into major periods:



Summary Timeline

Period

Ancient

Renaissance(1500–1700)

18th century

19th century

Early 20th century

Mid 20th century

Late 20th century

21st century

Key Features

Censuses, record-keeping

Political arithmetic, demographic studies

Birth of probability theory, statistical thinking

Statistical methods for society, correlation, regression

Modern inferential statistics, experimental design

Hypothesis testing, statistical theory

Computer-based statistics, Bayesian resurgence

Big data, data science, AI, machine learning

1. Ancient Times: Origins of Statistics (Before 500 AD)

- **Early Uses:** The word “statistics” comes from the **Latin *status*** (state). In ancient civilizations like **Babylonia, Egypt, China, and Rome**, rulers collected data on **population, land, and taxes**—primitive forms of what we now call descriptive statistics.
- **Censuses:** One of the oldest known statistical tools. For example:
 - **Egyptians collected census data for building pyramids (~3000 BCE).**
 - **Romans used censuses for military and tax purposes.**

5. 19th Century: Emergence as a Discipline

- **Adolphe Quetelet** introduced the idea of the “average man” and applied statistical methods to social sciences.
- **Francis Galton** and **Karl Pearson** developed methods like correlation and regression. Pearson also founded the first university statistics department.
- **Charles Babbage** promoted data collection and statistical thinking for industrial and scientific purposes.
- Statistics began to be recognized as an **independent field**, especially in England and Germany.

6. Early 20th Century: Formalization and Expansion

- **Ronald A. Fisher** revolutionized experimental design and inference with works like "*Statistical Methods for Research Workers*" (1925).
- Developed concepts of:
 - **Analysis of Variance (ANOVA)**
 - **Maximum Likelihood Estimation**
- **Jerzy Neyman** and **Egon Pearson** developed the framework for **hypothesis testing** (Neyman-Pearson Lemma).
- Growth of statistical applications in **agriculture, biology, psychology, and education**

7. **Mid to Late 20th Century: Computational Revolution**

- Widespread use of **computers** transformed statistical practice:
 - Enabled more complex models (e.g., logistic regression, time series).
 - Growth of **Bayesian methods**, simulation (e.g., **Monte Carlo**), and machine learning.
- Development of statistical software: **SPSS, SAS, R, Stata**, etc.
- Expansion into new fields: **economics, epidemiology, social sciences, and environmental science.**

8. **21st Century: Data Science Era**

- Explosion of “**big data**” due to the internet, sensors, and digital records.
- **Statistics merged with computer science to form data science.**
- Increased focus on:
 - **Predictive modeling**
 - **Machine learning & AI**
 - **Bayesian methods**
 - **Causal inference**
- Ethical concerns and reproducibility issues brought renewed interest in transparency and robustness.

Q1: What is the origin of the word “statistics”?

- **A:** The word “statistics” comes from the Latin word *status*, meaning “state.” It originally referred to data collected for state governance, such as censuses and tax records.

Q2: Which ancient civilizations used early forms of statistics, and for what purpose?

- **A:** Ancient civilizations like **Egypt, Babylon, China, and Rome** used statistics primarily for **population censuses, taxation, and resource planning.**

Q3: Who is considered the father of demography, and what was his contribution?

- **A: John Graunt** is considered the father of demography. In 1662, he analyzed London’s Bills of Mortality, identifying patterns in birth and death rates—an early use of statistical analysis in public health.

Q4: How did the development of probability theory influence statistics?

- **A:** Probability theory provided the **mathematical foundation** for statistical inference. It began with gambling problems and evolved with contributions from **Jacob Bernoulli**, **Bayes**, and **Laplace**, enabling predictions based on incomplete data.

Q5: What were Karl Pearson's major contributions to statistics?

- **A:** Karl Pearson developed key statistical tools such as the **correlation coefficient**, **chi-square test**, and **regression analysis**. He also founded the world's first statistics department at University College London.

Q6: How did computers influence the development of statistics in the late 20th century?

- **A:** Computers enabled the analysis of large and complex datasets, making possible the development of **simulation techniques, machine learning, and advanced modeling**, and also led to the creation of **statistical software** like **SPSS, SAS, and R**.

Q7: What is the relationship between statistics and data science in the 21st century?

- **A:** Statistics is a core component of **data science**, which combines statistical methods with **computer science** and **domain knowledge** to extract insights from large-scale and complex data.

Q8: What modern challenges and focuses exist in the field of statistics today?

- **A:** Modern statistics deals with **big data, ethical concerns, reproducibility, AI**, and the need for **causal inference**, all while trying to maintain rigor and transparency in data analysis.

Why Is Statistics Important in Everyday Life?

Purpose	How Statistics Help
Decision Making	Helps us choose the best option (e.g., cheapest phone plan, safest route)
Risk Assessment	Helps assess the chances of an event happening (e.g., catching a disease, winning a lottery)
Understanding Trends	Allows us to track changes over time (e.g., inflation, climate change)
Making Predictions	Based on past data, we can predict future outcomes (e.g., sales trends, exam scores)

Statistics in Everyday Life

1. Health and Medicine

- **Doctors** use statistics to recommend treatments (e.g. “This drug has a 90% success rate”).
- **COVID-19 data**, like infection rates and vaccine effectiveness, are based on statistical analysis.
- Health apps track your steps, calories, and heart rate—then use stats to provide insights.

2. Weather Forecasting

- Forecasts like “60% chance of rain tomorrow” come from statistical models analysing historical and current weather data.

3. Finance and Budgeting

- **Banks** assess credit scores using statistical models.
- **Investors** use stats to analyze stock trends and risks.
- **Personal budgeting** apps analyze your spending habits and predict future expenses.

Statistics in Everyday Life

4. Education

- Schools use statistics to evaluate student performance (e.g. exam averages, pass rates).
- Governments use statistical data to improve education policy and funding allocation.

5. Shopping and Marketing

- **Retailers** track customer behavior using statistics (e.g., what time people shop, which products are popular).
- Personalized ads are shown based on statistical analysis of your browsing and buying history.

6. Social Media

- Platforms like Instagram and YouTube use algorithms based on statistics to suggest content.
- Metrics such as likes, shares, and engagement rates are analyzed statistically.

Statistics in Everyday Life

7. Transportation

- **Google Maps** and ride apps use traffic data and statistical models to estimate travel time.
- Airlines use statistics for overbooking decisions and flight scheduling.

8. Sports

- Teams use **statistics to track player performance**, plan strategies, and predict opponents' moves.
- Fans see stats like win probabilities and player rankings.

Question and Answers

◆ Q1: What is statistics in simple terms?

- **A:** Statistics is the science of collecting, analysing, and interpreting data to make decisions or understand patterns.

◆ Q2: How are statistics used in weather forecasting?

- **A:** Meteorologists use statistical models to analyse past and current weather data to predict future conditions, like saying there's a "60% chance of rain."

◆ Q3: How do doctors use statistics in medicine?

- **A:** Doctors use statistics to evaluate treatment effectiveness, risks, and survival rates. For example, a drug might be said to have a 95% success rate based on clinical trial data.

◆ **Q4: What role do statistics play in budgeting and personal finance?**

- **A:** Budgeting apps use statistics to analyze spending habits, predict future expenses, and help users make informed financial decisions.

◆ **Q5: Give an example of statistics used in education.**

- **A:** Schools use student test scores and grade averages to assess performance and identify areas for improvement. Governments use education statistics for policy decisions.

◆ **Q6: How are statistics used in social media platforms?**

- **A:** Platforms like YouTube and Instagram use statistical algorithms to recommend content, track user engagement, and measure popularity through likes, views, and shares.

◆ **Q7: In what way do retailers use statistics?**

- **A:** Retailers use customer purchase data to track trends, personalize ads, and manage inventory based on consumer behavior patterns.

◆ **Q8: What's a real-life example of statistics in transportation?**

- **A:** Google Maps uses real-time traffic data and past travel patterns to estimate travel times and suggest the fastest routes.

◆ **Q9: How are statistics used in sports?**

- **A:** Coaches and analysts use player statistics (e.g., goals scored, passing accuracy) to plan strategies and evaluate performance.

◆ **Q10: Why is understanding statistics important in everyday life?**

- **A:** Understanding statistics helps us make smarter decisions, evaluate risks, interpret news, and understand trends in health, finance, education, and more.