

CBSE CLASS 9 MATHEMATICS

NCERT Curriculum Series — 2026 Reference Edition

CHAPTER 14: STATISTICS

PREMIUM WEBSITE-READY COMPREHENSIVE STUDY NOTES

Complete Analysis of Data Collection Frameworks, Frequency Distributions, Bar Graphs, and Varied-Width Histograms



KEY STRUCTURAL COMPONENTS INSIDE:

- **Strict Curriculum Alignment:** Formulated explicitly around the rationalized NCERT syllabus, focusing on systematic data presentation and graphical structures.
- **Advanced Visual Frameworks:** Comprehensive data collection pipelines, frequency tables, text-based graphs, and algorithmic formula mappings.
- **Mathematical Precision:** In-depth exploration of discrete vs. continuous classification, inclusive vs. exclusive intervals, and unequal width histogram corrections.
- **Revision Toolkit:** Integrated memory heuristics, diagnostic error tables, and a highly structured summary matrix for quick pre-exam reference.

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1. CHAPTER INTRODUCTION

Every day, we encounter a vast amount of information through newspapers, television, the internet, and mobile applications. This information may arrive as cricket batting averages, weather temperature logs, economic inflation figures, or public health trends. These facts or figures, which are numerical or otherwise and collected with a definite purpose, are called **Data**. However, data in its raw form is meaningless unless it is properly analyzed.

Statistics is the branch of mathematics that deals with the collection, organization, presentation, analysis, and interpretation of numerical data. It allows us to extract meaningful patterns from chaotic information. This chapter establishes the foundational techniques of descriptive statistics, showing you how to systematically organize data into frequency tables and translate abstract numbers into clean, visual graphs like Bar Graphs and Histograms.



REAL-LIFE APPLICATIONS OF STATISTICS

- **Public Policy and Demographics:** Governments conduct periodic censuses to collect data on population growth, age distribution, and literacy rates. Statisticians organize this data to plan schools, hospitals, and infrastructure development.
- **Quality Control in Manufacturing:** Industries track product defect rates using frequency distributions. Engineers use histograms to analyze structural variations in machinery, ensuring every component stays within precise safety limits.

2. DETAILED EXPLANATION OF CONCEPTS

1. Collection of Data: Primary vs. Secondary Sources

Data collection is the first step in any statistical study. Depending on how the information is gathered, data is split into two primary categories:

- **Primary Data:** When an investigator collects information firsthand for a specific purpose, the resulting data is called primary data.

Characteristics: It is highly accurate, reliable, and authentic, but requires significant time, money, and labor to gather.

Example: Conducting a personal survey of the heights of 30 students in your classroom.

- **Secondary Data:** When an investigator uses data that has already been collected by someone else or another organization, it is called secondary data.

Characteristics: It is readily available and saves time, but must be checked carefully to ensure it is relevant and reliable.

Example: Using rainfall statistics published by the Meteorological Department for a school project.

2. Raw Data and the Need for Organisation

When data is initially gathered, it is unorganized and often hard to read. This is called **Raw Data**. For example, look at this list of marks scored out of 100 by 10 students:

74, 42, 91, 42, 65, 74, 91, 42, 88, 65

In this format, finding the highest mark, lowest mark, or most common score takes extra time. To extract useful information, data must be structured. The simplest way to organize data is by arranging it in ascending or descending order, which immediately reveals the minimum value, maximum value, and **Range** (the difference between the maximum and minimum values).

3. Frequency and Frequency Distribution Tables

To organize large collections of data efficiently, we use a count called frequency. **Frequency** is the number of times a particular value or observation occurs in a data set.

A **Frequency Distribution Table** is a structured chart that matches data values or intervals with their corresponding frequencies. This table can be constructed in two ways:

A. Ungrouped Frequency Distribution Table

Used for smaller data sets with repeating numbers. Each unique value is listed individually alongside tally marks and its final frequency count.

B. Grouped Frequency Distribution Table

Used when dealing with large volumes of data. The data is broken down into meaningful intervals called **Class Intervals** (e.g., 0–10, 10–20, 20–30).

- **Class Limits:** In the class interval 10–20, 10 is the Lower Class Limit and 20 is the Upper Class Limit.
- **Class Width (Size):** The difference between the upper class limit and the lower class limit. In this case, $20 - 10 = 10$.
- **The Exclusive Standard Rule:** NCERT uses the continuous, exclusive method. An observation that falls exactly on a boundary line is placed in the higher class interval. For example, the number 20 is excluded from the 10–20 interval and counted in the 20–30 interval.

4. Graphical Representation of Data

While tables make data easier to read, charts and graphs make it easy to spot trends and compare information at a glance. The current curriculum focuses on two main types of charts:

A. Bar Graph

A **Bar Graph** is a visual chart used to display discrete categories of data using parallel rectangular bars.

- The widths of the bars are equal, and the spaces between them must be uniform.
- The height of each bar represents the frequency of that category.
- Usually, categories are plotted along the horizontal axis (X-axis), and their frequencies are plotted along the vertical axis (Y-axis).

[Image of a bar graph structure showing categories on x-axis and frequency on y-axis]

B. Histogram

A **Histogram** looks similar to a bar graph, but it is used specifically for continuous grouped data.

- The class intervals are plotted along the horizontal axis, and their frequencies are plotted along the vertical axis.
- The frequencies are represented by the areas of the rectangular bars.
- Because the data is continuous, there are **no spaces** between adjacent bars.

[Image of a histogram with uniform width showing contiguous intervals on x-axis and frequency on y-axis]



HANDLING HISTOGRAMS WITH VARYING CLASS WIDTHS

If a grouped data set has varying class widths, you cannot plot the raw frequencies directly as bar heights. Doing so would distort the graph, because the area of each bar must represent its true proportion of the data. Instead, you must calculate an **Adjusted Frequency** for each interval using this formula:

$$\text{Adjusted Frequency} = (\text{Minimum Class Width} / \text{Current Class Width}) \times \text{Given Frequency}$$

Once calculated, you use these adjusted frequencies as the heights for your bars on the Y-axis, while using the actual unequal class intervals on the X-axis.

3. IMPORTANT TERMS & DEFINITIONS

STATISTICAL TERM	MATHEMATICAL DEFINITION	KEY POINT TO REMEMBER
Data	A collection of numerical or descriptive facts gathered for a specific purpose.	Serves as the raw material for any statistical study.
Primary Data	Information gathered firsthand by an investigator directly from the source.	Highly accurate, but requires more time and effort to collect.
Secondary Data	Information pulled from pre-existing sources like books, websites, or reports.	Saves time, but must be verified for accuracy and relevance.
Range	The difference between the highest value and lowest value in a data set.	Formula: $\text{Range} = \text{Maximum Value} - \text{Minimum Value}$.
Frequency	The total number of times a specific observation occurs in a data set.	Represented visually using tally marks grouped in bunches of 5.
Class Size	The numeric width of a class interval in a grouped table.	Calculated as: $\text{Upper Class Limit} - \text{Lower Class Limit}$.
Histogram	A graph made of adjacent rectangular bars used to display continuous data.	Bars are drawn right next to each other with no gaps in between.

4. NCERT KEY POINTS

- **Strict Graphical Scope:** Based on the latest rationalized NCERT guidelines, measures of central tendency (Mean, Median, Mode) and Frequency Polygons have been removed. Focus your study time entirely on mastering **Frequency Tables, Bar Graphs, and Histograms**.
- **The Axis Break (Kink) Feature:** When plotting graphs where the data intervals start at a large number rather than zero, you must draw a broken line or zigzag symbol (called a **kink**) near the origin on the axis. This shows that the scale is compressed and does not jump straight from zero to a high value.
- **The Upper Limit Exclusion Rule:** In a continuous grouped interval like 20–30, the number 30 is excluded from this group and counted in the next interval (30–40). This prevents values on the boundary from being counted twice.

5. FORMULA SUMMARY TABLE

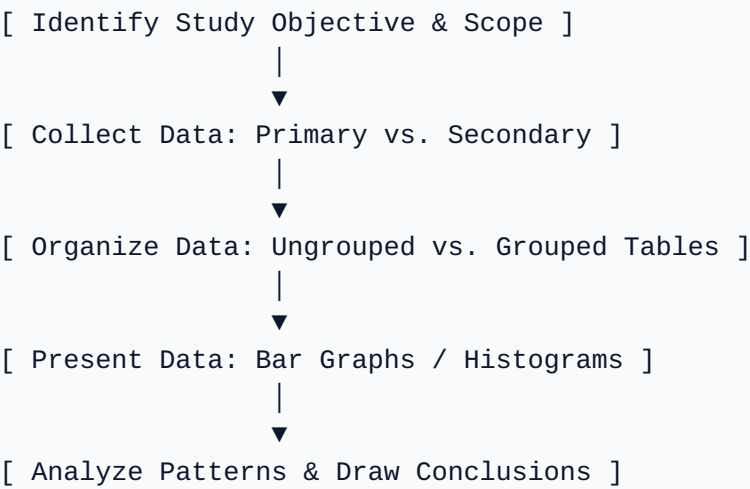
STATISTICAL CONCEPT NAME	GOVERNING FORMULA MATRIX	EXPLANATION OF VARIABLES	ANALYTICAL PURPOSE
Data Range	$\text{Range} = X_{\text{max}} - X_{\text{min}}$	X_{max} : Highest observation score X_{min} : Lowest observation score	Measures the total spread or variability of the data.
Class Width (Size)	$h = \text{Upper Limit} - \text{Lower Limit}$	h : Uniform width interval dimension	Determines the span of a single row in a grouped table.
Adjusted Frequency Height	$\text{Height} = (w_{\text{min}} / w_{\text{current}}) \times f$	w_{min} : Smallest class width w_{current} : Current width f : Raw frequency	Normalizes bar heights for histograms with unequal widths.

6. TABLES & FLOWCHARTS

Data Matrix Structural Comparison

FEATURE COMPARED	BAR GRAPH PRESENTATION	HISTOGRAM PRESENTATION
Underlying Data Type	Best for distinct, separate categories or discrete variables.	Best for continuous data groups grouped into class intervals.
Bar Spacing Rule	Bars must have equal widths with uniform gaps between them.	Bars are drawn right next to each other with no gaps.
Axis Representation	The X-axis displays categories, while the Y-axis displays counts.	The X-axis displays continuous scales, while the Y-axis displays frequencies.

THE CORE PIPELINE OF STATISTICAL ANALYSIS:



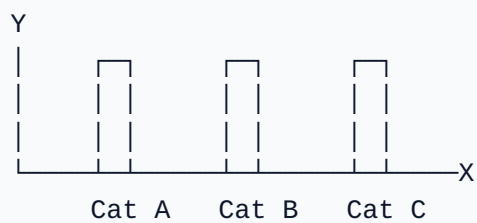
7. DIAGRAMS & LAYOUT STRUCTURES

TEXT-BASED VISUAL LAYOUT OF AN UNGROUPED FREQUENCY TABLE WITH TALLY MARKS:

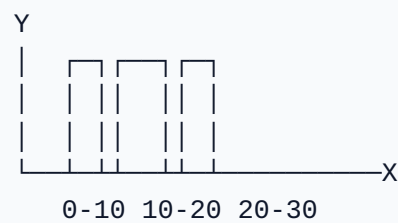
Data Value	Tally Marks	Frequency Count
5	////	4
10	//// /	6
15	//// ////	10

TEXT-BASED VISUALIZATION OF BAR GRAPH VS. HISTOGRAM STRUCTURES:

BAR GRAPH (Discrete Gaps)



HISTOGRAM (Continuous Bars)



8. MEMORY TRICKS (FAST LEARNING TECHNIQUES)

1. The "HIStory" Continuous Memory Tool

Remember this phrase to quickly tell graphs apart: **"A Histogram tells a continuous HIStory with no breaks."** This reminds you that histograms map continuous numbers over time or ranges, meaning there are zero blank spaces or gaps between the vertical bars.

2. Tally Gatekeeping (The Slash-5 Rule)

Think of tallying as building a four-post fence. When you reach the fifth count, don't build a fifth separate post. Instead, draw a diagonal slash across the four posts to close the gate: **////**. This groups counts into sets of 5, making it easy to add up large frequencies quickly at the end.

9. COMMON MISTAKES STUDENTS MAKE

ERROR 1: THE DOUBLE-COUNTING BOUNDARY MISTAKE

The Mistake: Counting a value like 20 twice by placing it in both the 10–20 and 20–30 class intervals of a grouped table.

How to avoid it: Always apply the exclusive standard rule. Boundary numbers belong strictly to the higher class interval. The number 20 belongs exclusively in the 20–30 group.

ERROR 2: FORGETTING TO ADJUST FOR UNEQUAL WIDTHS

The Mistake: Plotting the given frequencies as bar heights on a histogram when the class intervals have varying widths (e.g., 0–10, 10–20, 20–50).

How to avoid it: Check the width of your class intervals before drawing. If the widths vary, calculate the ****Adjusted Frequency**** for each interval first, then use those values for the heights of your bars.

10. QUICK REVISION NOTES

- **Data Basics:** Primary data is collected firsthand by the investigator. Secondary data is gathered from pre-existing records.
- **Range Definition:** The difference between the highest and lowest scores: $\text{Range} = \text{Max} - \text{Min}$.
- **Grouped Intervals:** In the interval 10–20, 10 is the lower limit, 20 is the upper limit, and the class size is 10.
- **Bar Graphs vs. Histograms:** Bar graphs use separated bars to show distinct categories. Histograms use connected bars to display continuous numerical ranges.
- **Varying Width Rule:** For histograms with unequal class widths, calculate adjusted frequencies to determine the correct height of each bar.

11. ONE-PAGE SUMMARY

This chapter provides a complete look at how data is collected, organized, and represented visually:

STATISTICAL ELEMENT	CORE STRUCTURAL FEATURE	IMPORTANT STEP TO VERIFY
Primary Data	Collected directly from the source.	Ensure data is collected accurately and for a clear purpose.
Secondary Data	Sourced from pre-existing records.	Verify that the source is reliable before using the data.
Grouped Table	Organizes data into continuous class intervals.	Place boundary numbers strictly in the higher interval.
Bar Graph	Displays separate categories using separated bars.	Keep bar widths and the gaps between them completely uniform.
Histogram	Displays continuous data ranges using connected bars.	Calculate adjusted frequencies if the interval widths vary.

12. MIND MAP

Statistics Chapter Core Structure

- └─ 1. Data Sourcing Frameworks
 - └─ Primary Data: Gathered directly by the investigator
 - └─ Secondary Data: Pulled from pre-existing sources
- └─ 2. Structural Organisation Tables
 - └─ Ungrouped Tables: Lists unique values with tally marks
 - └─ Grouped Tables: Uses class intervals (e.g., 10-20)
 - └─ Upper Boundary Rule: Numbers match the higher interval
- └─ 3. Graphical Representations
 - └─ Bar Graph: Categorized data drawn with uniform gaps
 - └─ Histogram: Continuous ranges drawn with connected bars
 - └─ Adjusted Frequencies: Used if interval widths vary

13. EXAM-ORIENTED IMPORTANT POINTS

- **Always Remember to Draw a Kink when Needed:** If your X-axis scale starts at a high number instead of zero (e.g., jumping straight from 0 to 120, then following 120, 130, 140), always draw a ****kink**** (zigzag line) near the origin. Skipping this can result in point deductions on exams.
- **Check for Varying Widths Before Drawing:** Do not rush to draw a histogram immediately. Check the width of each class interval first. If the widths are different, calculate the adjusted frequencies first to find the correct bar heights.