How to Calculate the Median of Grouped Data: A Step-by-Step Guide

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November 30, 2025

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RECOMMENDED CITATION

stats writer (2025). *How to Calculate the Median of Grouped Data: A Step-by-Step Guide*. PSYCHOLOGICAL SCALES. Retrieved from https://scales.arabpsychology.com/?p=102370

Calculating the median for a standard, ungrouped dataset is straightforward: we arrange the values in ascending order and identify the central point. If the number of observations (N) is odd, the median is the single middle value. If N is even, the median is the average (mean) of the two central values.

However, when dealing with grouped data, where observations are compiled into class intervals rather than individual scores, determining the exact median is impossible. Instead, we must use a specialized statistical formula to estimate the value of the median.

Understanding the Necessity of Estimation for Grouped Data

In practical statistical applications, data is frequently organized into a frequency distribution, where values are consolidated into defined ranges, or classes. This aggregation simplifies large datasets but fundamentally obscures the raw individual scores. Since the precise location of every observation is unknown--we only know how many observations fall into a certain range--we must employ an estimation technique to find the measure of central tendency.

The median, as a measure of position, is defined as the point that divides the distribution exactly in half, meaning 50% of the observations fall below it and 50% fall above it. When working with grouped data, our primary goal is to locate the class interval where this pivotal 50% mark is crossed, thereby establishing the range in which the median must lie.

Consider the following example of grouped data, which illustrates how observations are summarized into specific class boundaries:

Range	Frequency
1-10	2
11-20	7
21-30	10
31-40	3
41-50	1

Because we do not have the original, raw data points, calculating the exact median is not feasible. Consequently, statistical methodology provides a robust interpolation formula that allows us to estimate the central value within the identified class.

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The Interpolation Formula for Grouped Data Median

The estimation of the median for grouped data relies on the crucial assumption that the scores within the median class are uniformly distributed. This allows us to use interpolation to pinpoint the exact location of the middle value relative to the lower limit of that specific class interval. The foundational formula used for this calculation is:

Median of Grouped Data = L + W

A clear understanding of each component is vital for accurate calculation:

L: Represents the **Lower limit** of the median class. This is the starting value of the interval containing the median.
W: Denotes the **Width** (or size) of the median class interval. This is the difference between the class boundaries.
N: Stands for the **Total Frequency**, calculated by summing the frequencies of all classes in the distribution.
C: Refers to the **Cumulative frequency** of the class immediately preceding (or below) the median class.
F: Represents the **Frequency** of the median class itself.

Step 1: Identifying the Median Class

The most critical first step is accurately identifying the **median class**. This interval is determined by finding the median position, which is calculated as N/2. Since the median represents the 50th percentile, we locate the point halfway through the total number of observations (N).

To find this position, calculate N/2. Next, consult the cumulative frequency column of your frequency table. The median class is the first class interval whose cumulative frequency value is greater than or equal to the calculated N/2 position.

For instance, if a dataset has N = 23 total values, the median position is 23 / 2 = 11.5. If the class 21-30 is the first class whose cumulative frequency surpasses 11.5, then 21-30 is the median class. This identification is the foundation for extracting L, W, C, and F necessary for the formula.

The subsequent examples detail how this method is used in two different empirical datasets.

Example 1: Calculating Median for Student Exam Scores

We analyze the distribution of exam scores for 40 students, presented in the following frequency distribution table:

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Exam Score	Frequency
51-60	4
61-70	8
71-80	15
81-90	8
91-100	5

The total number of observations is N = 40. The median position is calculated as N/2 = 40 / 2 = 20. By examining the cumulative frequencies, we determine that the 20th score falls within the class interval **71-80**. This class is our median class.

Based on the 71-80 median class, we extract the necessary variable values:

L: Lower limit of median class: **71**
W: Width of median class: **9**
N: Total Frequency: **40**
C: Cumulative frequency up to the class preceding 71-80: **12**
F: Frequency of the median class: **15**

Substituting these values into the estimation formula for grouped data:

Median = L + W
Median = 71 + 9
Median = 71 + 9
Median = 71 + 4.8
Median = **75.8**

The estimated median exam score is calculated to be **75.8**.

Example 2: Estimating Median Points Scored by Basketball Players

In this second example, we examine a frequency distribution showing the number of points scored per game by 60 basketball players:

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Points Scored	Frequency
1-10	8
11-20	25
21-30	14
31-40	9
41-50	4

With a total frequency of N = 60, the median position is N/2 = 60 / 2 = 30. We locate the 30th value, which, according to the cumulative frequency, places the median within the class interval **11-20**.

We identify the following parameters for the calculation:

L: Lower limit of median class (11-20). L = **11**.
W: Width of median class. W = **9**.
N: Total Frequency. N = **60**.
C: Cumulative frequency up to the class preceding 11-20: **8**.
F: Frequency of the median class: **25**.

We substitute these values into the median formula:

Median = L + W
Median = 11 + 9
Median = 11 + 9
Median = 11 + 7.92
Median = **18.92**

We estimate that the median number of points scored per game by these players is **18.92**.

Further Topics in Grouped Data Analysis

The process of finding the median for grouped data is an indispensable technique in descriptive statistics, providing a reliable measure of central tendency even when raw data is unavailable. This interpolation method is crucial for handling summarized datasets efficiently.

The following tutorials explain how to perform other common operations with grouped data:

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