

How to Calculate Percentiles Based on Criteria in Excel

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Introduction to Conditional Percentile Calculation in Excel

The ability to perform sophisticated statistical analysis based on specific criteria is essential for modern data management. While Excel offers direct functions for calculating the percentile of an entire dataset, performing a conditional percentile calculation--often referred to as a "Percentile IF" function--requires combining several powerful tools. This technique allows analysts to determine the k th percentile specifically for values that meet a designated condition or belong to a defined group.

This complex calculation is handled by nesting the **IF** logical function within the **PERCENTILE function**. The resulting formula structure is unique because it must be executed as an array formula, demanding a specialized input method. Mastery of this approach opens the door to deeper conditional analysis, enabling users to derive statistically significant insights from segregated subsets of data without manually filtering or restructuring the source data.

The generalized structure for performing a conditional percentile calculation is provided below. This formula is designed to find the specific percentile (designated by the variable k) among the values contained in the **VALUES_RANGE**, only when the corresponding entries in the **GROUP_RANGE** match the specified **GROUP** criterion. Understanding the syntax and proper application of this array formula is the first step toward advanced conditional statistics in Excel.

=PERCENTILE(IF(GROUP_RANGE=GROUP, VALUES_RANGE), k)

As a critical operational note, when entering this complex formula into any cell in Excel, it is mandatory to confirm the entry by pressing the key combination **Ctrl + Shift + Enter**. This specific key combination signifies to Excel that the formula should be handled as an array formula, enabling it to process the conditions and return the conditional set of values required by the **PERCENTILE function**. Failure to use **Ctrl + Shift + Enter** will invariably result in an error or an incorrect calculation.

Understanding the Mechanics of the Array Formula

The true power of the conditional percentile calculation lies in how the **IF** function interacts with the **PERCENTILE function** within the context of an array formula. Normally, **IF** returns a single value. However, when executed as an array formula, the **IF** function evaluates the condition across every cell in the defined range (**GROUP_RANGE**) and generates an array of results.

Specifically, the internal function `IF(GROUP_RANGE=GROUP, VALUES_RANGE)` works by checking each entry in the **GROUP_RANGE**. If a row meets the specified **GROUP** criterion, the corresponding value from the **VALUES_RANGE** is included in the temporary array. If the criterion

is not met, the **IF** function defaults to returning the logical value **FALSE** for that position in the array. This creates a filtered array consisting only of the desired values interleaved with **FALSE** placeholders.

The outer **PERCENTILE function** then receives this temporary array. A crucial feature of nearly all statistical functions in Excel, including **PERCENTILE**, is their automatic ability to ignore logical values and text (such as **FALSE**) when performing calculations. Therefore, **PERCENTILE** effectively calculates the specified kth percentile solely based on the subset of numerical values that satisfied the initial **IF** condition, achieving the desired conditional result efficiently.

Practical Demonstration: Calculating Conditional Percentiles

To solidify the understanding of this technique, we will walk through a comprehensive example using a typical educational dataset. Suppose we are tracking the performance of students across different classes and need to analyze performance metrics, such as the 90th percentile, separately for each class group. This kind of conditional analysis is vital for identifying outliers or setting achievement benchmarks within specific cohorts.

Consider the following dataset, which records the exam scores achieved by 20 students, categorized into either Class A or Class B. This raw data structure is ideal for demonstrating how to isolate and calculate statistics for distinct groups using the conditional PERCENTILE function without any manual sorting or filtering:

	A	B	C	D	E	F	G	H
1	Student	Class	Exam Score					
2	Andy	A	75					
3	Bernard	A	78					
4	Collin	A	82					
5	Doug	B	83					
6	Eric	B	89					
7	Frank	A	93					
8	Greg	B	78					
9	Harry	A	67					
10	Isaiah	A	90					
11	John	B	97					
12	Kent	B	87					
13	Larry	B	83					
14	Michael	B	83					
15	Nate	A	86					
16	Oscar	B	87					
17	Peter	A	90					
18	Quincy	A	95					
19	Russell	B	77					
20	Steve	B	82					
21	Tim	A	88					
22								
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Our primary objective is to determine the 90th percentile of the exam scores exclusively for Class A, and then repeat the process for Class B. This requires a two-step approach: first, identifying the unique groups, and second, applying the array formula for each group.

Step 1: Identifying Unique Group Names Using the UNIQUE function

Before we calculate the conditional percentiles, it is highly beneficial to generate a dynamic list of all unique group criteria present in the dataset. This step ensures that we calculate the metric for every existing category and makes the setup adaptable if new classes are added later. In modern versions of Excel (those supporting dynamic arrays), the UNIQUE function is the most straightforward method for this task.

We will place this dynamic list starting in cell F2. The Class data (our **GROUP_RANGE**) is located in the range B2:B21. We type the following simple formula into cell F2:

=UNIQUE(B2:B21)

Upon pressing Enter (not Ctrl + Shift + Enter, as **UNIQUE** is a standard dynamic array function), Excel automatically spills the results down the column, listing each unique class name only once. This list (F2:F3 in this case) will serve as the reference points for our conditional calculations, allowing us to easily calculate the percentile for each class automatically.

The output confirms that the two distinct groups, Class A and Class B, have been successfully extracted and listed, setting up the subsequent step for the conditional calculation:

	A	B	C	D	E	F	G	H
1	Student	Class	Exam Score			Class		
2	Andy	A	75			A		
3	Bernard	A	78			B		
4	Collin	A	82					
5	Doug	B	83					
6	Eric	B	89					
7	Frank	A	93					
8	Greg	B	78					
9	Harry	A	67					
10	Isaiah	A	90					
11	John	B	97					
12	Kent	B	87					
13	Larry	B	83					
14	Michael	B	83					
15	Nate	A	86					
16	Oscar	B	87					
17	Peter	A	90					
18	Quincy	A	95					
19	Russell	B	77					
20	Steve	B	82					
21	Tim	A	88					
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Step 2: Implementing the Conditional **PERCENTILE** function Array

With the unique classes identified in column F, we can now construct and deploy the core conditional percentile formula in column G. We aim to find the 90th percentile, which corresponds to 0.9 as the *k* value in the **PERCENTILE** function syntax. The core logic hinges on referencing the adjacent cell in column F (our **GROUP** criterion) within the **IF** statement.

The formula is entered into cell G2. Here is a breakdown of the components used in the formula:

GROUP_RANGE (B2:B21): The range containing the class names.

GROUP (F2): The specific criterion we are checking against (Class A).

VALUES_RANGE (C2:C21): The exam scores we want to analyze.

k (0.9): Represents the 90th percentile we wish to calculate.

Type the following formula precisely into cell G2:

=PERCENTILE(IF(B2:B21=F2, C2:C21), 0.9)

Crucially, after typing the formula, you must press **Ctrl + Shift + Enter** simultaneously. This action inserts curly braces surrounding the formula in the formula bar (`{=PERCENTILE(IF(B2:B21=F2, C2:C21), 0.9)}`), confirming that Excel has registered it as an array formula.

Once the formula is correctly entered in G2, it can be dragged down to cell G3. Because the ranges B2:B21 and C2:C21 are relative references, Excel will automatically adjust them. However, since we want the ranges B2:B21 and C2:C21 to remain constant, best practice dictates using absolute references (e.g., `B2:B21`) if you intend to drag the formula extensively, although for this small example, it is less critical. The reference to the criterion cell F2 will change to F3, correctly calculating the conditional percentile for Class B.

Interpreting the Results of the Conditional Analysis

After applying the array formula to both classes, the resulting output clearly shows the specific 90th percentile value achieved by each separate student group. This outcome provides a critical statistical measure for comparing high-end performance between the two cohorts. The image below illustrates the final spreadsheet configuration after the calculations are complete.

	A	B	C	D	E	F	G	H	I	J
1	Student	Class	Exam Score			Class	90th percentile			
2	Andy	A	75			A	=PERCENTILE(IF(B2:B21=F2,C2:C21), 0.9)			
3	Bernard	A	78			B				
4	Collin	A	82							
5	Doug	B	83							
6	Eric	B	89							
7	Frank	A	93							
8	Greg	B	78							
9	Harry	A	67							
10	Isaiah	A	90							
11	John	B	97							
12	Kent	B	87							
13	Larry	B	83							
14	Michael	B	83							
15	Nate	A	86							
16	Oscar	B	87							
17	Peter	A	90							
18	Quincy	A	95							
19	Russell	B	77							
20	Steve	B	82							
21	Tim	A	88							
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The final results, displayed in cells G2 and G3, summarize the findings of our conditional percentile calculation:

The value at the 90th percentile of exam scores in Class A was calculated as **93.2**. This means 90% of students in Class A scored 93.2 or below.

The value at the 90th percentile of exam scores in Class B was calculated as **89.8**. This means 90% of students in Class B scored 89.8 or below.

This comparison immediately reveals a higher top-tier performance threshold in Class A, providing actionable insights for educators or analysts. Without the use of the combined conditional PERCENTILE function and its array formula execution, obtaining these distinct metrics would require multiple manual filtering steps or the use of more complex database tools.

	A	B	C	D	E	F	G	H
1	Student	Class	Exam Score			Class	90th percentile	
2	Andy	A	75			A	93.2	
3	Bernard	A	78			B	89.8	
4	Collin	A	82					
5	Doug	B	83					
6	Eric	B	89					
7	Frank	A	93					
8	Greg	B	78					
9	Harry	A	67					
10	Isaiah	A	90					
11	John	B	97					
12	Kent	B	87					
13	Larry	B	83					
14	Michael	B	83					
15	Nate	A	86					
16	Oscar	B	87					
17	Peter	A	90					
18	Quincy	A	95					
19	Russell	B	77					
20	Steve	B	82					
21	Tim	A	88					
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Variations and Alternatives for Conditional Statistics

It is important to note the versatility of this conditional approach. While we focused on the 90th percentile (0.9), the value of k can be easily modified to calculate any desired percentile. For example, to determine the median (50th percentile) for each class, you would simply replace **0.9** with **0.5** in the array formula. Similarly, the 75th percentile (the third quartile) would use **0.75** as the k value.

Furthermore, users of Excel should be aware of the different versions of the PERCENTILE function available. The standard **PERCENTILE** function uses an inclusive method, corresponding to **PERCENTILE.INC** in newer versions, where the result is inclusive of the 0 and 1 boundaries. If statistical rigor requires an exclusive calculation, meaning the percentile must fall strictly between 0 and 1 (exclusive of the minimum and maximum values), one would substitute **PERCENTILE.EXC** for **PERCENTILE** in the array formula.

For users of modern Excel versions that support the **X-functions**, the need for the **Ctrl + Shift + Enter** array input method is often eliminated through functions like **FILTER**. A non-array alternative for calculating the conditional percentile would involve using **PERCENTILE.INC(FILTER(VALUE_RANGE, GROUP_RANGE=GROUP), k)**. If available, this simpler syntax is preferable as it avoids the complexities and potential errors associated with traditional array formula entry, offering a cleaner and more efficient approach to conditional analysis.

Conclusion

The "Percentile IF" function, implemented as a nested **PERCENTILE(IF(...))** array formula, is an indispensable tool for performing advanced statistical segregation within Excel. By understanding how the **IF** condition dynamically filters the data array and how the **PERCENTILE function** processes the resulting subset, users can extract highly specific and meaningful performance benchmarks from large, unstructured datasets.

The key to successful implementation lies in two critical areas: correctly structuring the conditional logic to match the group criteria, and ensuring the formula is entered correctly using **Ctrl + Shift + Enter** to execute it as an array. Whether analyzing exam scores, financial metrics, or operational data, mastering this technique significantly enhances one's capability to perform rigorous conditional analysis and drive data-informed decision-making.