

How to Calculate Spearman Rank Correlation in SPSS: A Step-by-Step Guide

Authored by
stats writer

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Introduction to Spearman Rank Correlation

The Spearman Rank Correlation coefficient, often denoted as ρ (rho), stands as a vital statistical measure employed to quantify the strength and directional nature of the association between two variables. Unlike the Pearson correlation, which assesses linear relationships between interval or ratio data, Spearman's coefficient is specifically designed for situations where the data consists of ranked values or where the relationship between the variables is expected to be monotonic. This makes it a robust alternative when assumptions for parametric tests are violated or when the variables are inherently measured using rankings.

In essence, the Spearman correlation evaluates how well the relationship between two variables can be described using a monotonic function. A positive Spearman coefficient indicates that as the ranks of one variable increase, the ranks of the second variable also tend to increase. Conversely, a negative coefficient suggests that as the ranks of one variable increase, the ranks of the other variable consistently decrease. The magnitude of the coefficient, ranging from -1 (perfect inverse relationship) to +1 (perfect positive relationship), reflects the strength of this monotonic association.

Calculating the Spearman Rank Correlation is a common task in various fields, especially social sciences, psychology, and educational research, where data frequently appears on an ordinal scale. The widely used statistical software package, SPSS (Statistical Package for the Social Sciences), provides an intuitive interface for performing this analysis quickly and efficiently, allowing researchers to accurately assess complex relationships in their datasets.

Essential Assumptions and Data Requirements

Before proceeding with the calculation of the Spearman correlation, it is crucial to ensure that the dataset meets the underlying statistical assumptions. The fundamental prerequisite for using this non-parametric test is that the data must be measured on at least an ordinal scale, meaning the data can be meaningfully ranked (e.g., first place, second place, third place). While continuous data can also be used, in which case SPSS automatically converts the raw scores into ranks for calculation, the test is specifically designed to handle non-normally distributed data or ranked scores.

A second, critical assumption is that the relationship between the two variables must be monotonic. A monotonic relationship is one where the variables move consistently in the same direction, either increasing together (positively monotonic) or one increasing while the other decreases (negatively monotonic). Unlike linear correlation, a monotonic relationship does not require the points to fall on a perfectly straight line, but rather that the overall direction of the relationship remains consistent.

If the relationship between the two variables is non-monotonic (e.g., the relationship is U-shaped or inverted U-shaped), the Spearman correlation coefficient may misrepresent the true nature of the

association. Therefore, it is highly recommended to first generate a scatterplot of the two variables. Visual inspection of the scatterplot helps confirm that the relationship appears monotonic before running the formal correlation test in SPSS, thereby ensuring the validity and interpretability of the results.

The Step-by-Step Procedure in SPSS

Calculating the Spearman Rank Correlation in SPSS is a straightforward process managed through the correlation analysis menus. This method is the easiest and most common way to generate the required coefficient and the associated significance level (p-value). The primary navigation path involves accessing the correlation calculation tool designed for comparing pairs of variables simultaneously.

To begin, you must have your data loaded into the SPSS Data View window, with the two variables intended for analysis properly defined in the Variable View. The general steps are initiated from the main toolbar:

Open the SPSS program and load your dataset.

Click on the **Analyze** option in the main toolbar.

Hover over **Correlate** in the drop-down menu.

Select **Bivariate** from the subsequent submenu.

This sequence opens the Bivariate Correlations dialog box, which is the control center for setting up the analysis parameters, selecting the variables, and specifying the desired correlation coefficient (in this case, Spearman Rank Correlation). The following sections detail how to configure this dialog box correctly to execute the non-parametric correlation test.

Practical Example: Analyzing Student Exam Scores

To demonstrate the application of the Spearman Rank Correlation, consider a hypothetical dataset containing information regarding the performance of ten students in a particular class. This dataset includes scores for both a math exam and a science exam. Our objective is to determine if there is a statistically significant monotonic relationship between the scores students received in these two distinct subjects.

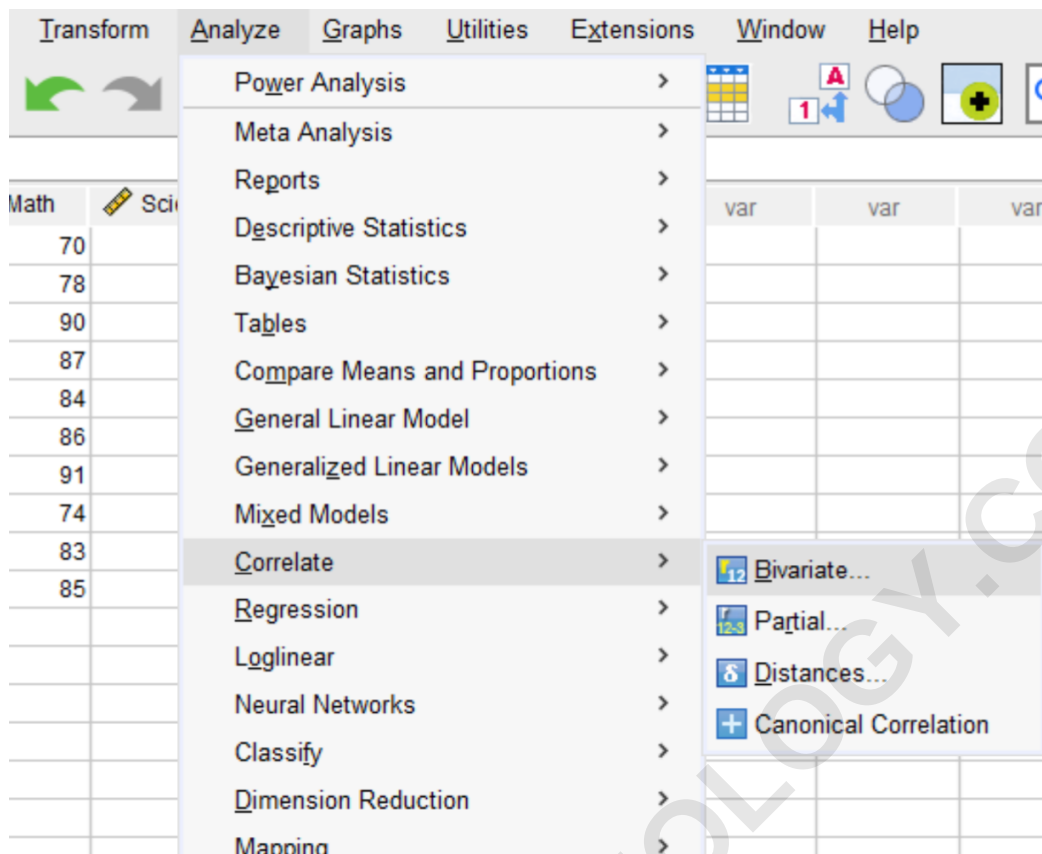
The dataset, as entered into the SPSS Data View, appears as follows. Since raw scores are being used, SPSS will automatically rank these scores internally before calculating the Spearman coefficient. The focus here is on understanding the association between the relative performance in mathematics compared to science among this group of students.

	 Student	 Math	 Science	var	var	
1	A	70	90			
2	B	78	94			
3	C	90	79			
4	D	87	86			
5	E	84	84			
6	F	86	83			
7	G	91	88			
8	H	74	92			
9	I	83	76			
10	J	85	75			
11						
12						
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14						
15						
16						
17						

Our primary statistical goal is twofold: first, to calculate the Spearman correlation coefficient to determine the strength and direction of the relationship; and second, to perform a correlation test to ascertain if this calculated coefficient is statistically significant, meaning we can reject the null hypothesis that no correlation exists in the broader population.

Executing the Correlation Analysis

The process of executing the test begins by initiating the Bivariate Correlation dialog box, which is accessible via the main menu path: **Analyze > Correlate > Bivariate**. This action opens the primary window where the variables are specified and the type of correlation is selected.



Once the Bivariate Correlations window is displayed, the user must select the variables of interest. In this example, both the **Math** and **Science** variables are moved from the left-hand variable list into the central **Variables** box. This action tells SPSS which pair of variables should be included in the correlation matrix calculation. It is essential to ensure that only the variables intended for rank correlation are selected at this stage to avoid generating unnecessary output.

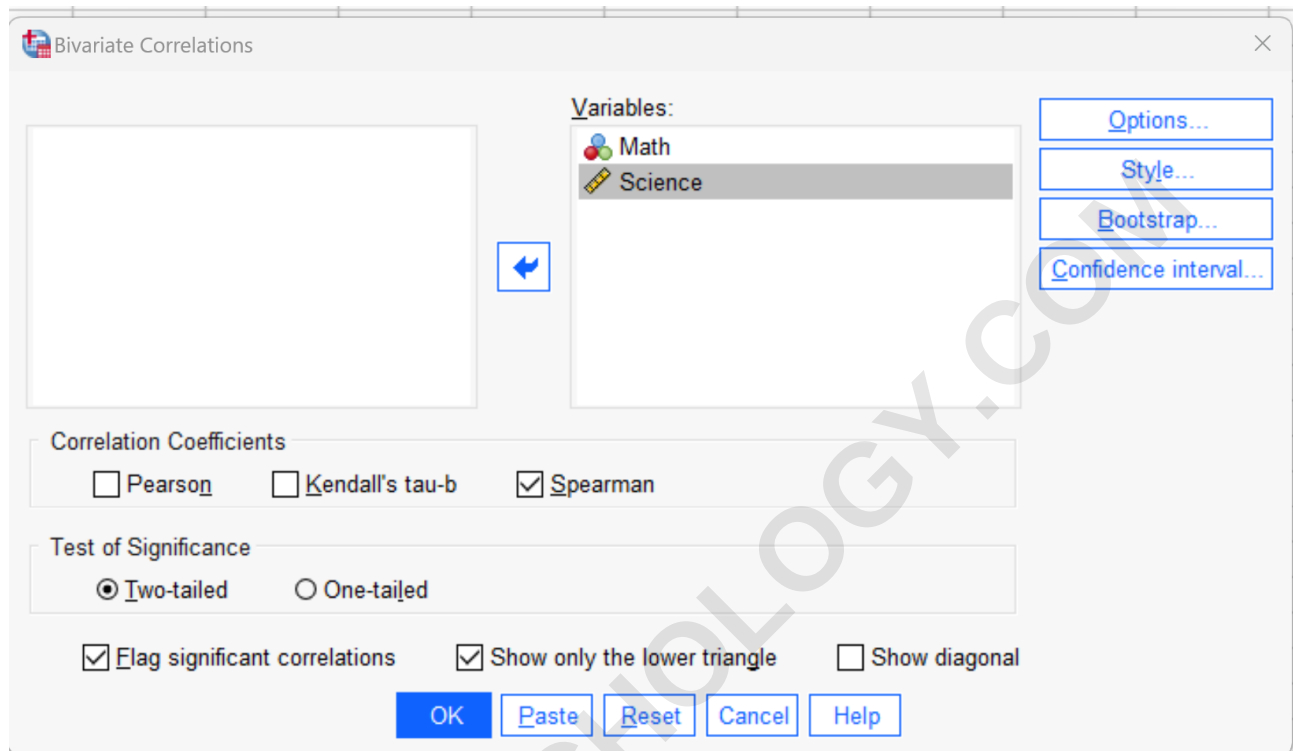
The final step before configuration is to confirm the navigation path was followed correctly, as the Bivariate menu is the appropriate location for both Pearson (parametric) and Spearman (non-parametric) correlation tests.

Configuring Correlation Coefficients and Display Options

The Bivariate Correlations dialog box offers several critical options that must be correctly set to perform the Spearman Rank Correlation. Under the section labeled **Correlation Coefficients**, the default selection is typically Pearson. For our analysis, we must actively select the **Spearman** checkbox, ensuring the software uses the rank transformation method. It is often beneficial to uncheck the Pearson option if only the non-parametric result is required.

Furthermore, SPSS provides options to customize the appearance of the output matrix. To simplify the results table, especially when correlating only two variables, it is recommended to check the

box next to **Show only the lower triangle**. Additionally, to keep the output clean and focused solely on the relationship between the two distinct variables, the box next to **Show diagonal** should be unchecked. This minimizes redundancy in the correlation matrix display.



After verifying that **Spearman** is selected, the desired display options are checked, and the variables are properly placed in the **Variables** box, the user simply clicks **OK**. SPSS will then execute the calculation, generating the output table in the designated output viewer.

Interpreting the Correlation Output Table

Upon clicking **OK**, the SPSS Output Viewer displays the results in a correlation matrix format. Since we opted to show only the lower triangle and suppress the diagonal, the table is streamlined, focusing exclusively on the calculated relationship between the Math and Science scores.

➔ Nonparametric Correlations

Correlations

		Math
Spearman's rho	Science	Correlation Coefficient
		-.418
		Sig. (2-tailed)
		.229
	N	10

The output table provides three crucial pieces of information necessary for drawing conclusions:

Spearman Correlation Coefficient (\$rho\$): This is the calculated correlation value, which in this example is **-.481**.

Sig. (2-tailed) (p-value): This value represents the probability of observing the data, or data more extreme, if the null hypothesis (no correlation) were true. Here, the p-value is **.229**.

N (Number of pairs): This confirms the sample size used in the calculation, which is **10** students.

The coefficient of **-.481** indicates a moderately negative association between the ranks of the Math and Science exam scores. Specifically, students who ranked higher in Math tended to rank slightly lower in Science, and vice versa. However, to determine if this observed correlation is statistically meaningful, we must examine the p-value.

To reject the null hypothesis of no correlation, the p-value must typically be less than the predetermined significance level (\$alpha\$), conventionally set at .05. In this case, the calculated p-value of **.229** is significantly greater than .05. Consequently, we must conclude that the negative correlation observed between the Math and Science scores is not statistically significant based on this sample size. The evidence is insufficient to claim a monotonic relationship exists between the two subject scores in the broader population from which this sample was drawn.

Summary of Calculation Steps

For quick reference, the entire sequence of operations required to calculate the Spearman Rank Correlation in SPSS is summarized below. Adhering to these steps ensures a correct and

interpretable output for any dataset meeting the ordinal or continuous scale criteria and the assumption of monotonicity.

Load the dataset into SPSS.

Navigate to **Analyze**, then select **Correlate**, and finally click **Bivariate**.

Move the two variables of interest into the **Variables** box.

Under **Correlation Coefficients**, ensure the **Spearman** option is selected (and Pearson is deselected, if appropriate).

Optionally, check **Show only the lower triangle** and uncheck **Show diagonal** for cleaner output.

Click **OK** to generate the results table.

Interpret the output by noting the coefficient value (ρ) and comparing the **Sig. (2-tailed) p-value** to the chosen significance level (α).