Learn How to Perform the Friedman Test in SPSS: A Step-by-Step Guide

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The **Friedman Test** stands as an indispensable and highly valuable statistical tool within the domain of non-parametric methodology. It is specifically designed to function as the robust alternative to the traditional one-way Repeated Measures ANOVA when the underlying assumptions of the latter cannot be met. This powerful procedure is utilized primarily to determine whether statistically significant differences exist among the central tendencies (medians) of three or more related groups, where the critical factor is that the **same subjects** are assessed under every single condition. Since the Friedman Test operates without the restrictive requirement of data normality, it is perfectly suited for analyzing data measured on an ordinal scale or when the distribution of scores severely violates the stringent parametric assumptions typically demanded by ANOVA procedures.

This expert guide offers comprehensive, step-by-step instructions detailing the necessary procedures to correctly set up, execute, and meticulously interpret the statistical results generated by the Friedman Test. We will be utilizing the industry-standard statistical software, SPSS (Statistical Package for the Social Sciences), which is widely adopted across academic and professional research settings. By working through a clear, practical research example, we aim to provide exceptional clarity across the entire analytical workflow, from initial data organization to the final formal reporting of findings.

Foundational Principles of the Friedman Test

The Friedman Test is conceptually vital for researchers employing a **within-subjects design**, a methodology where the independent variable's levels are applied sequentially to the same group of participants. A key distinction of this test, and all non-parametric methods, is that the calculation is performed on the **ranks** of the data, rather than the raw scores themselves, which is typical of parametric tests that rely on estimates of population parameters. This transformation to ranks is not merely a formality; it significantly minimizes the undue influence of extreme outliers and accommodates data sets that exhibit pronounced non-normal distributions, rendering the test exceptionally reliable for diverse data types frequently encountered in complex behavioral, educational, and medical research.

The core objective of the Friedman Test revolves around testing the fundamental null hypothesis. This hypothesis formally asserts that the median values of the measured dependent variable are identical across all the related experimental conditions. Should the statistical calculation yield a sufficiently large test statistic, it implies that the aggregated ranks assigned to the various conditions show a substantial deviation from equality. When this occurs, we reject the null hypothesis, leading to the crucial conclusion that the different treatments or conditions have resulted in statistically significant differences in the observed outcomes. This method is particularly invaluable in controlled longitudinal studies or complex comparative trials where the consistency of measurement within each individual participant is paramount to the research integrity.

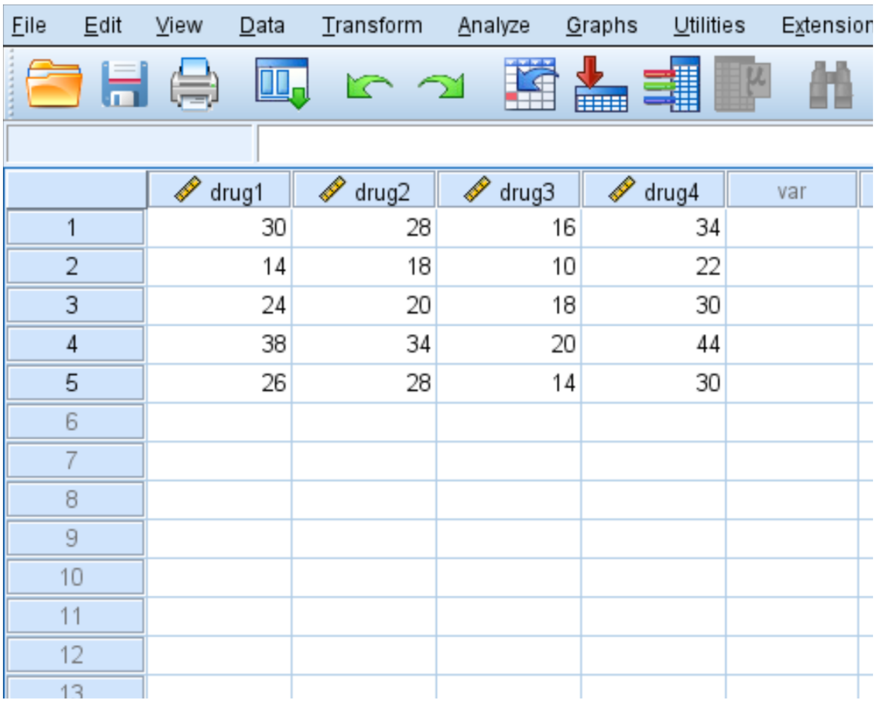
Despite its designation as a non-parametric procedure, the Friedman Test still relies upon several critical assumptions to ensure the validity and reliability of its results. Firstly, the dependent variable must be measured on at least an ordinal scale, which permits the data to be meaningfully ranked within each subject. Secondly, and most importantly, the samples must be inherently related; that is, the measurements obtained for each experimental condition must originate from the identical set of individuals or matched units. Lastly, the test assumes that the errors--the differences between the observed and predicted values--are distributed similarly across all treatment levels. A solid understanding of these foundational requirements is essential before proceeding to the practical implementation of the analysis within SPSS.

Designing the Research and Structuring Data in SPSS

To effectively demonstrate the practical application of the Friedman Test, let us consider a typical scenario: a team of medical researchers is actively investigating the comparative efficacy of four distinct pharmaceutical drugs (labeled Drug 1, Drug 2, Drug 3, and Drug 4) on patient reaction time. The primary research question is whether the average reaction times show significant variation across these four drug conditions. To rigorously control for the substantial influence of individual physiological differences, the researchers have intentionally utilized a repeated measures design, wherein five patients are tested sequentially on all four drugs, ensuring adequate washout periods between each trial to prevent carryover effects.

The initial and most critical phase of this statistical analysis is the accurate and systematic entry of the measured data into the SPSS environment. Given the nature of this experiment as a repeated measures design, the data must be specifically organized in the **wide format**. This organizational principle dictates that every single patient (subject) occupies one dedicated row, and the respective measurements for each of the four drug conditions are distributed across separate, distinct columns. This specific data structure is mandatory as it allows SPSS to correctly recognize and process the inherently related nature of the samples, which is the foundational premise of the Friedman Test.

We now initiate **Step 1: Enter the data.** The following figure illustrates the correct data arrangement, representing the measured response time (in seconds) recorded for the five patients across the four experimental drug conditions. It is imperative that researchers ensure that each column is clearly and accurately labeled within the Variable View of SPSS to precisely reflect the different drug conditions, ensuring traceability and accuracy throughout the analysis.



	drug1	drug2	drug3	drug4	var
1	30	28	16	34	
2	14	18	10	22	
3	24	20	18	30	
4	38	34	20	44	
5	26	28	14	30	
6					
7					
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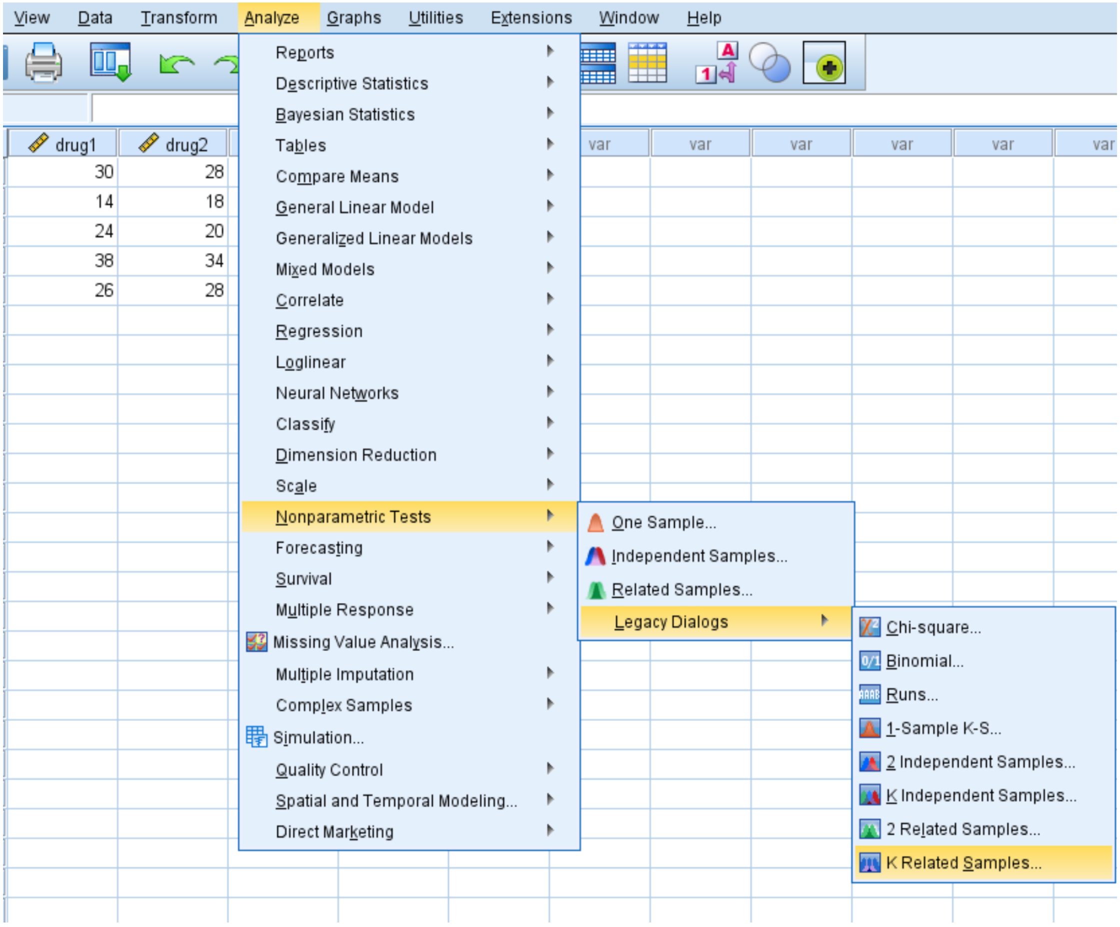
12					
13					

Executing the Friedman Test Procedure in SPSS

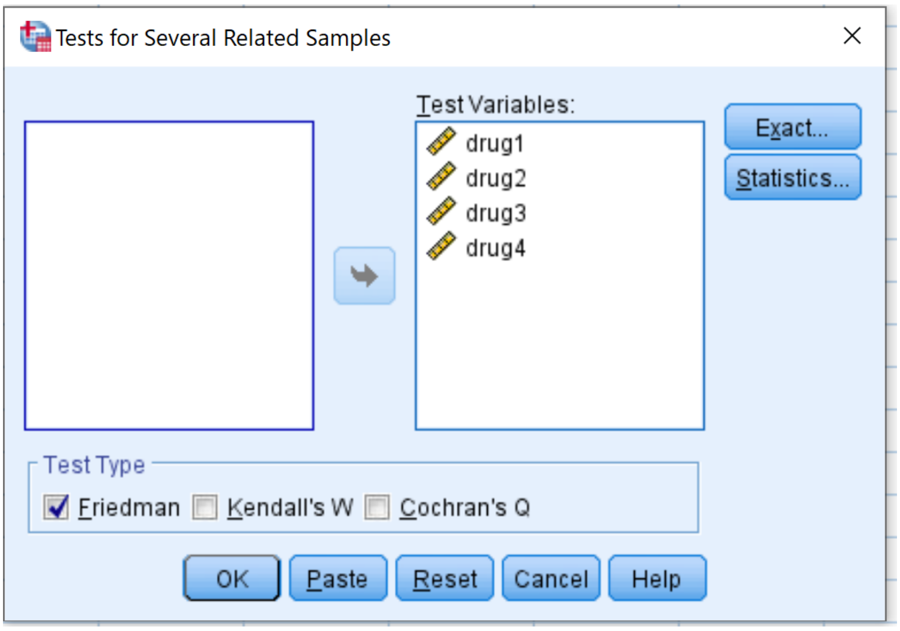
Once the data has been meticulously entered into and verified within the SPSS Data View interface, we are ready to proceed with initiating the statistical analysis. This procedure requires navigating the intricate menu system of SPSS to precisely locate the non-parametric test module designated for handling related samples. Adherence to the following sequential steps ensures that the test is correctly configured to analyze the four interdependent variables (the four drug conditions).

We now execute **Step 2: Perform the Friedman Test.** Follow these sequential menu commands exactly as listed within the SPSS interface:

Click on the **Analyze** tab, which is prominently located in the main menu bar at the top of the window.
Hover the mouse cursor over the **Nonparametric Tests** option in the resulting drop-down menu.
Select **Legacy Dialogs** from the subsequent submenu, which contains the classical test procedures.
Finally, choose **K Related Samples**. This option is selected specifically because our research design compares more than two related samples (k > 2).



The next action triggers the appearance of a new dialog box titled "Tests for Several Related Samples." Within this crucial configuration window, the user must clearly identify the variables that constitute the repeated measures. Proceed by dragging all four of the **drug variables** (Drug 1, Drug 2, Drug 3, and Drug 4) from the source list on the left side into the designated box labeled **Test Variables**. It is absolutely essential to ensure that the checkbox labeled **Friedman** is definitively selected under the Test Type section. This confirms that SPSS will perform the correct non-parametric analysis tailored for related samples. Once all these settings have been rigorously verified, click the **OK** button to command SPSS to generate the output tables.



Interpreting the Statistical Output and Making a Decision

Immediately upon clicking **OK**, SPSS will display the calculated results of the Friedman Test within the specialized Output Viewer window. The primary objective for the researcher's interpretation is concentrated on the "Test Statistics" table, which provides a concise summary of the comparative analysis across the ranked means. This single table contains all the necessary numerical information required to formulate a formal statistical decision concerning the acceptance or rejection of the null hypothesis.

We proceed to **Step 3: Interpret the results.** The three key components presented within the output table are defined and analyzed as follows:

Friedman Test

Ranks

	Mean Rank
drug1	2.60
drug2	2.40
drug3	1.00
drug4	4.00

Test Statistics[a]

N	5
Chi-Square	13.560
df	3
Asymp. Sig.	.004

a. Friedman Test

Chi-Square: This numerical value represents the calculated test statistic derived directly from the Friedman calculation formula. It quantifies the degree to which the observed differences in the aggregated ranks deviate from the theoretical expectation under the null hypothesis (i.e., the expectation of no difference). In our illustrative example, this calculated value is **13.560**.
df (Degrees of Freedom): The degrees of freedom for the Friedman Test are consistently calculated as the number of groups (k) minus one (k - 1). With four distinct drugs (k=4), the calculation is 4 - 1, yielding a value of **3**. This value is fundamentally important as it defines the precise shape of the theoretical Chi-Square distribution used for the statistical comparison.
Asymp. Sig. (Asymptotic Significance): This value constitutes the p-value that is directly associated with the calculated test statistic (chi^2 = 13.560) and 3 degrees of freedom. The p-value quantifies the probability of observing data as extreme as, or more extreme than, our current results, assuming that the null hypothesis were entirely true. In the context of our drug trial, the Asymp. Sig. is strikingly low at **.004**.

The definitive statistical decision rests upon the comparison between the Asymptotic Significance (p-value) and the predetermined alpha level (the significance threshold, conventionally established at 0.05). Since the calculated p-value (.004) is substantially less than the standard conventional alpha level of .05, we possess robust and sufficient statistical evidence to confidently reject the null hypothesis. This pivotal finding leads directly to the conclusion that the specific type of pharmaceutical drug administered exerts a statistically significant differential effect on patient response time. Conversely, if the p-value had exceeded 0.05, we would have been compelled to fail to reject the null hypothesis, suggesting that there were no significant differences in median reaction times attributable to the various drugs.

Reporting Results According to APA Standards

The final and equally crucial stage of any statistical investigation involves the formal documentation and clear communication of the findings in a standardized format. This reporting often adheres to authoritative guidelines, such as those established by the American Psychological Association (APA). Proper reporting necessitates summarizing the specific statistical test conducted, the characteristics of the sample size, the calculated test statistic, the degrees of freedom, and, critically, the associated p-value. This meticulous documentation ensures that the research results are transparent, reproducible, and easily assimilated by the broader scientific community.

We conclude with **Step 4: Report the results.** When formally reporting the Friedman Test, the established practice mandates the inclusion of a comprehensive sample description and a clear, concise statement of the primary finding, followed immediately by the precise statistical notation.

The following example illustrates the appropriate, professional format for reporting the results derived from our pharmaceutical drug trial analysis:

A **Friedman Test** was executed on five participants to evaluate the differential effect of four distinct pharmaceutical drugs on measured patient response time, utilizing a rigorous within-subjects design where every individual was sequentially tested under each drug condition.

The results of the analysis demonstrated that the specific type of drug administered led to statistically significant differences in patient response time (χ^{2} = 13.56, df = 3, p = 0.004). This significant outcome strongly suggests that at least one pair of drugs exhibits a statistically meaningful difference in its impact on the speed of patient reaction. It should be noted that a subsequent post-hoc analysis would be necessary to precisely identify which specific pairs of drugs are responsible for these observed differences.

This conclusion formally validates the existence of differential effects, confirming the researchers' initial suspicions based on the empirical data collected. The strategic use of the Friedman Test was demonstrably appropriate, given the necessary application of a repeated measures design and the potential for non-normal data distribution, ultimately providing a robust and statistically reliable inference for the medical findings.