How do I run a Repeated Measures ANOVA in Google Sheets?

Authored by

stats writer

December 18, 2025

Performing advanced statistical analysis often requires specialized software, but for many researchers and analysts, the familiar and accessible interface of Google Sheets provides a viable alternative. This comprehensive guide details the precise procedure for conducting a Repeated Measures ANOVA (RMANOVA) directly within your spreadsheet environment. While the process is streamlined once the necessary tools are in place, understanding the underlying steps--data entry, tool activation, parameter selection, and interpretation--is crucial for generating accurate and actionable insights.

A Repeated Measures ANOVA is fundamentally used to determine if there is a statistically significant difference between the means of three or more related groups. The defining characteristic of this test is that the data points across all groups are derived from the identical subjects or matched units. This design is highly beneficial in longitudinal studies, clinical trials comparing multiple treatments on the same patient, or psychological experiments where participants are exposed to various stimuli.

This tutorial provides a step-by-step example of how to perform a **Repeated Measures ANOVA** in Google Sheets, ensuring you achieve valid and interpretable statistical results.

Understanding Repeated Measures ANOVA Theory

The Repeated Measures ANOVA is a powerful statistical technique designed specifically for within-subject designs. Unlike a standard ANOVA, RMANOVA is employed when the same participants are measured under three or more different conditions or time points. This structure allows researchers to control for individual differences between subjects, thereby increasing the statistical power of the test by removing between-subject variability from the error term.

The core hypothesis tested by RMANOVA involves comparing the population means across the measurement conditions. The test sets up a null hypothesis stating that the means of all measurement conditions are equal (e.g., Drug A = Drug B = Drug C), against the alternative hypothesis that at least one mean is significantly different. By analyzing the variance attributable to the treatment (between conditions) versus the variance attributable to individual subjects (within subjects), RMANOVA offers a nuanced view of treatment effects.

Before proceeding with the calculation, it is important to recognize the assumptions underlying this statistical procedure. Key assumptions include that the dependent variable is measured on a continuous scale, that the errors are normally distributed, and critically, the assumption of sphericity. Sphericity refers to the condition where the variances of the differences between all pairs of repeated measures are equal. While the XLMiner ToolPak provides the required computational power, analysts must be mindful of these statistical prerequisites to ensure the validity and reliability of their results.

Step 1: Installing the XLMiner Analysis ToolPak

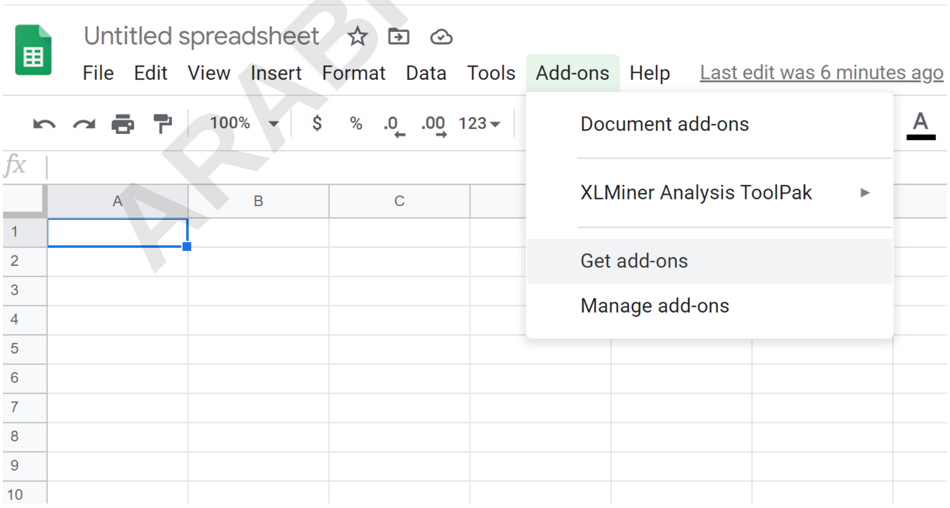
To perform complex statistical analysis like RMANOVA in Google Sheets, we first need to install a robust third-party extension known as the XLMiner Analysis ToolPak. This add-on replicates much of the functionality found in standard desktop statistical packages, making advanced analysis accessible directly within your spreadsheet interface. Installation is a necessary, quick, and one-time process.

To initiate the installation, navigate to the main menu bar in your Google Sheet and click on the "Add-ons" option. From the dropdown menu, select "Get add-ons." This action will open the Google Workspace Marketplace interface where you can search for and install new extensions. It is essential to ensure that you have the correct permissions within your Google account to install third-party add-ons before proceeding.

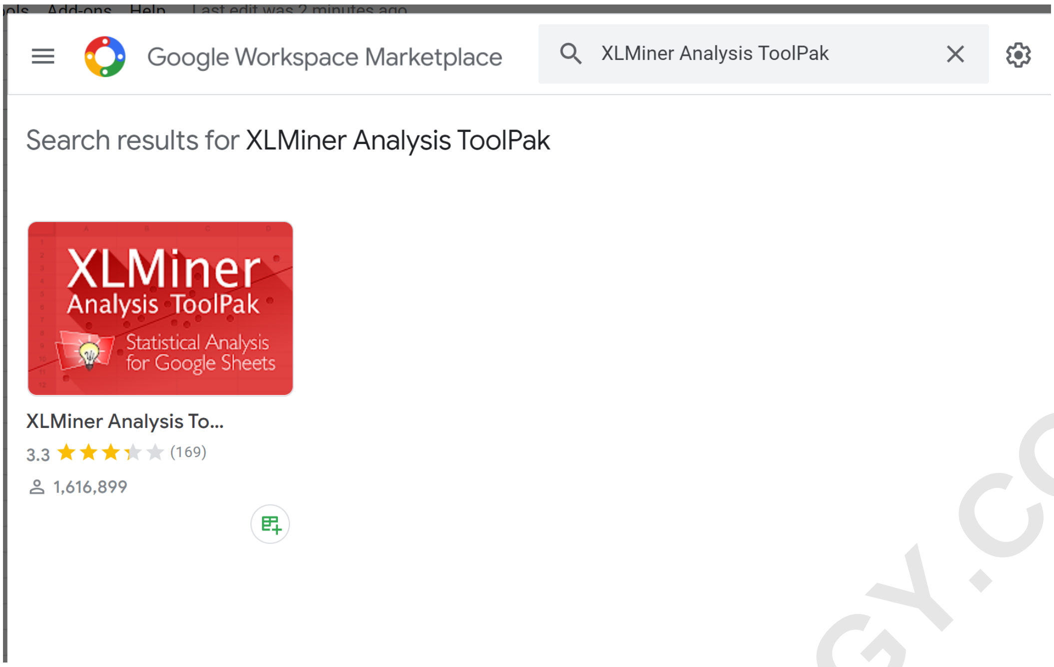
Next, locate the search bar and input the term **XLMiner Analysis ToolPak**. Locate the official add-on icon and click on it to view its details. You will be prompted to confirm the installation and grant the necessary permissions for the tool to interact with your spreadsheet data. Click the **Install** button to finalize the process. Upon successful installation, the XLMiner Analysis ToolPak will be available under the "Add-ons" menu for immediate use, providing the capability to run the RMANOVA calculation.

To perform a one-way ANOVA in Google Sheets, we need to first install the free XLMiner Analysis Toolpak.

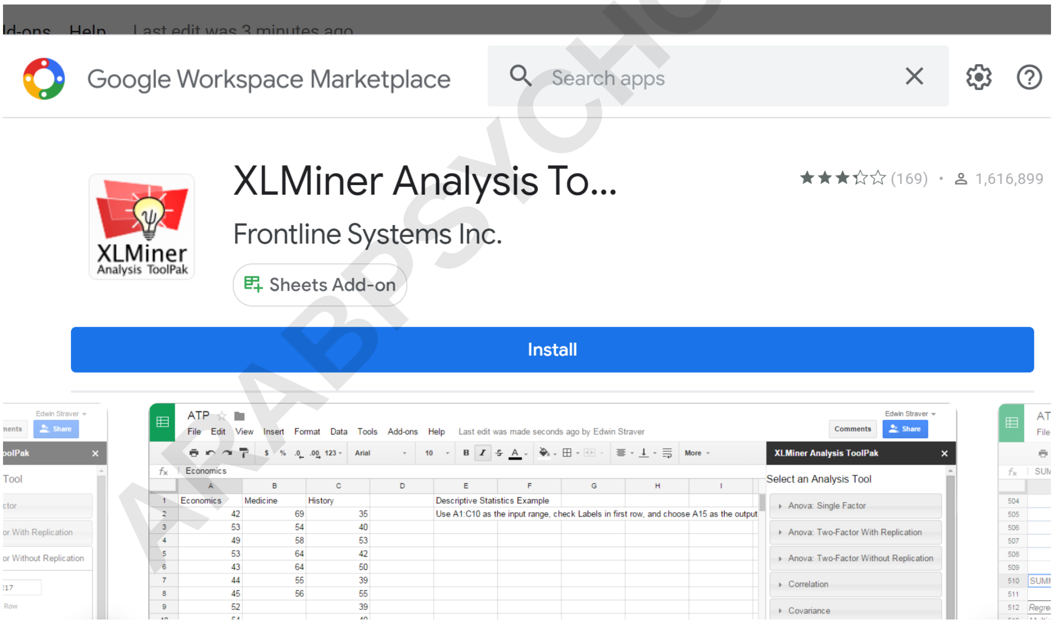
To do so, click **Add-ons > Get add-ons**:



Next, type **XLMiner Analysis ToolPak** in the search bar and click the icon that appears:



Lastly, click the **Install** button.



Step 2: Structuring the Repeated Measures Data

Proper data structuring is paramount for the XLMiner Analysis ToolPak to correctly identify and process the variables in a repeated measures design. The required format for RMANOVA in this tool is the **wide format**. This means that each row must represent a single subject or experimental unit, and the different measurement conditions (the repeated measures) must be placed in separate, adjacent columns across that row.

For the analysis to run smoothly, ensure that all the data columns used for the repeated measures contain only **numerical values**--the recorded scores or measurements, such as reaction times or standardized test scores. Descriptive labels identifying the conditions (e.g., 'Drug 1', 'Drug 2') should be used exclusively as column headers, and not mistakenly included as part of the numerical data input range itself. It is also good practice to include a separate column identifying the subject (e.g., 'Patient ID'), although this subject identification column is typically excluded from the analysis input range for the RMANOVA calculation.

The integrity of your data input range is critical. Before running the analysis, meticulously check for missing values, typographical errors, or non-numeric entries within the range designated for the statistical calculation. Even a single text entry in a numerical column can cause the XLMiner add-on to fail or produce distorted results. Once the data is confirmed to be clean and correctly oriented in the wide format, you are ready to apply the statistical test.

Case Study: Entering Experimental Data

To illustrate the practical application of RMANOVA in Google Sheets, we will use a hypothetical research scenario. Imagine researchers are investigating the efficacy of four distinct pharmaceutical drugs (labeled Drug 1 through Drug 4) on improving reaction time. To rigorously test the effect while minimizing inter-subject variability, five patients are selected, and each patient is tested under all four drug conditions.

The dependent variable measured is the reaction time, recorded in milliseconds, which is a continuous numerical variable suitable for ANOVA. Since the same five patients provide data for four different conditions (drugs), this constitutes a classic within-subjects or repeated measures design. The raw data must be structured such that each patient occupies one row, and the measurements for each drug occupy four distinct, sequential columns.

The reaction times of the five patients across the four drugs are displayed in the image below. This visually represents the required wide format: the column headers identify the treatment levels, and the rows contain the scores for the corresponding patient across those treatments. This clear organization is what enables the RMANOVA calculation to partition the total variance effectively.

Next, we need to enter the data to use for the repeated measures ANOVA.

For this example, suppose researchers want to know if four different drugs lead to different reaction times. To test this, they measure the reaction time of five patients on the four different drugs.

The reaction times are shown below:

	A	B	C	D	E
1	**Patient**	**Drug 1**	**Drug 2**	**Drug 3**	**Drug 4**
2	Patient 1	30	28	16	34
3	Patient 2	14	18	10	22
4	Patient 3	24	20	18	30
5	Patient 4	38	34	20	44
6	Patient 5	26	28	14	30
7					
8					
9					
10					
11					
12					
13					
14					
15					

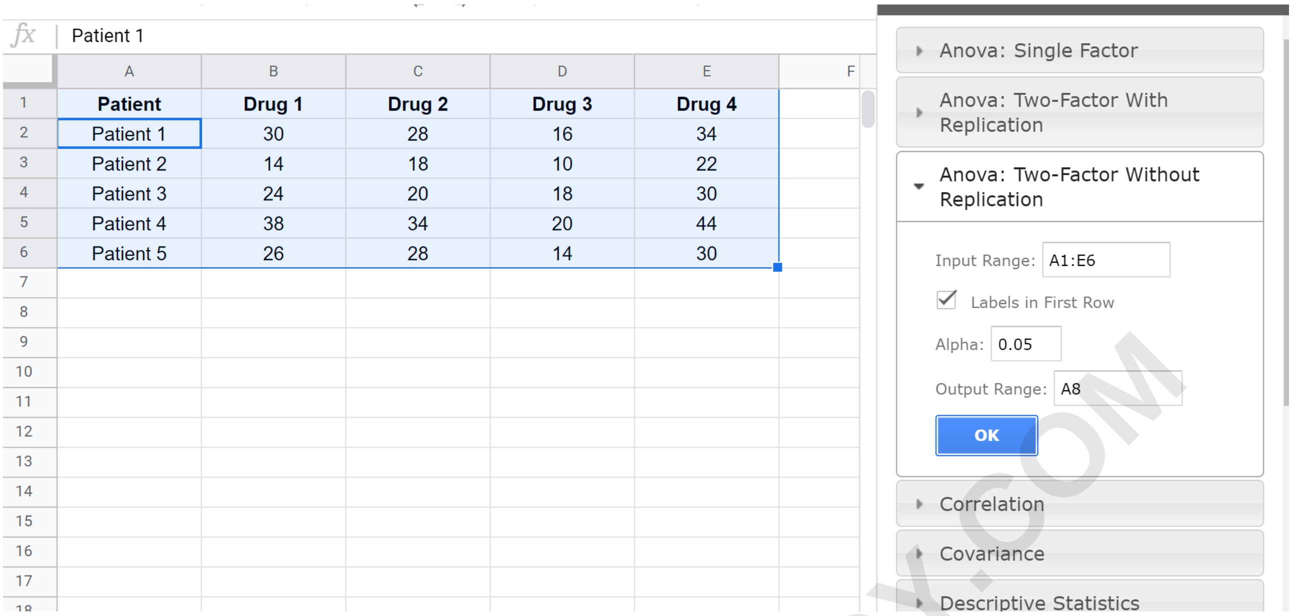
Step 3: Executing the Analysis Using XLMiner

With the data correctly structured, the statistical calculation can be initiated. Access the XLMiner Analysis ToolPak by clicking **Add-ons > XLMiner Analysis ToolPak > Start**. A control panel will appear, usually as a sidebar on the right of your screen, providing a list of available statistical tests.

Within the XLMiner interface, you must select "ANOVA" and then choose the specific test required: **Repeated Measures ANOVA**. The tool will then prompt you to define the necessary parameters. The critical parameter is the **Input Range**, where you specify the exact cell range containing your numerical measurement data, including the column headers if they are present. Ensure the range selected precisely covers the columns representing the repeated measures (the drug conditions in our example) and all the rows containing patient data.

Finally, specify the **Output Range**. This determines the starting cell where the generated ANOVA summary table will be placed in your spreadsheet. Choose an empty area of the sheet to avoid overwriting existing data. Once the input range, output range, and the presence of labels (headers) are confirmed, click **OK** or **Run** to execute the statistical procedure. The XLMiner tool will perform the variance calculations and display the resulting ANOVA table.

To perform a repeated measures ANOVA on this dataset, click **Add-ons > XLMiner Analysis ToolPak > Start**. The Analysis ToolPak will appear on the right side of the screen.



Step 4: Decoding the ANOVA Output Table

Upon execution, the XLMiner generates a detailed summary table that partitions the total variance observed in the dataset. This output is usually categorized by the source of variance: Between Subjects (individual differences), Within Subjects, and the various treatment effects. For a one-way repeated measures design, the two most important rows are those representing the treatment effect (labeled 'Columns' in this output) and the appropriate error term.

The table displays key statistical metrics for each source of variation, including the Sum of Squares (SS), Degrees of Freedom (df), Mean Square (MS), the calculated F test-statistic, and the corresponding p-value. In our drug study example, the row labeled "Columns" is the primary focus, as it quantifies the variability in reaction time specifically attributable to the differences among the four drugs administered.

It is important to note that the row typically labeled 'Rows' (which reflects the difference between the patients' overall mean reaction times) accounts for the between-subject variance. In RMANOVA, this variance is deliberately separated and is not used to calculate the F-ratio for the treatment effect, allowing for a more sensitive test of the drug effects compared to a simple one-way ANOVA. We focus solely on the 'Columns' effect to draw conclusions about the drugs.

Once you click **OK**, the results of the repeated measures ANOVA will appear starting in the cell you specified in **Output Range**. In our case, we chose to display the results starting in cell A8:

8	Anova: Two-Factor Without Replication						
9							
10	*SUMMARY*	*Count*	*Sum*	*Average*	*Variance*		
11	Patient 1	4	108	27	60		
12	Patient 2	4	64	16	26.66666667		
13	Patient 3	4	92	23	28		
14	Patient 4	4	136	34	104		
15	Patient 5	4	98	24.5	51.66666667		
16							
17	Drug 1	5	132	26.4	76.8		
18	Drug 2	5	128	25.6	42.8		
19	Drug 3	5	78	15.6	14.8		
20	Drug 4	5	160	32	64		
21							
22							
23	ANOVA						
24	*Source of Variatio*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
25	Rows	680.8	4	170.2	18.10638298	0.00005068977	3.259166727
26	Columns	698.2	3	232.7333333	24.75886525	0.00001992501	3.490294821
27	Error	112.8	12	9.4			
28							
29	Total	1491.8	19				
30							

In this case we are not interested in the results for the Rows, only for the Columns, which tell us the variation in response time based on the drug.

Interpreting F-Statistic and P-Value for Significance

The decisive step is interpreting the calculated F test-statistic and its associated p-value, both found in the 'Columns' row of the ANOVA summary table. The F-statistic is the ratio of the systematic variance due to the treatment (differences between drug means) to the unsystematic error variance. A larger F-statistic provides stronger evidence against the null hypothesis.

Reviewing our example output under the 'Columns' row, we observe that the F test-statistic is calculated as **24.75887**. This is a substantial value, indicating that the variation in reaction times across the four drugs is considerable relative to the remaining error. More critically, the corresponding p-value is **0.0000199**. The p-value estimates the probability of observing our data if the null hypothesis were true.

To conclude the analysis, we compare this p-value to the pre-established alpha level ($alpha$), typically 0.05. Since 0.0000199 is dramatically smaller than 0.05, we must reject the null hypothesis. The firm statistical conclusion is that there is a statistically significant difference in mean response times between the four drugs. This finding confirms that the type of drug administered has a meaningful effect on patient reaction time, prompting the need for subsequent post-hoc analysis to isolate which drug pairs differ.

From the output we can see that the F test-statistic is **24.75887** and the corresponding p-value is **0.0000199**.

Since this p-value is less than 0.05, we reject the null hypothesis and conclude that there is a statistically significant difference in mean response times between the four drugs.

Conclusion and Next Steps

By successfully installing and utilizing the XLMiner Analysis ToolPak within Google Sheets, we have proven that sophisticated statistical procedures like the Repeated Measures ANOVA are accessible without relying on expensive, dedicated software. This methodology empowers analysts who require collaborative, cloud-based tools for their research, provided they adhere strictly to the data formatting and assumption requirements.

The calculated significant F-statistic confirms that the four drugs do not produce equivalent results. However, RMANOVA is an omnibus test, meaning it only indicates that a difference exists somewhere among the means, not precisely where. The necessary next step in this research process is the application of post-hoc tests--such as Bonferroni correction for paired t-tests or Tukey's HSD--to perform pairwise comparisons between the drugs and identify the specific source of the significant variance.

For those interested in exploring statistics across various platforms, the principles of RMANOVA remain consistent. The resources below offer guidance on executing this powerful analysis using alternative spreadsheet programs or through manual calculation for a deeper theoretical understanding.

How to Perform a Repeated Measures ANOVA in Excel
How to Perform a Repeated Measures ANOVA By Hand
One-Way Repeated Measures ANOVA Calculator