How can I perform a t-test with unequal variances in Excel?

Authored by

stats writer

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Performing a t-test with unequal variances in Excel is a statistical analysis technique used to compare the means of two groups with unequal variances. This can be achieved by using the built-in function "TTEST" in Excel, which allows the user to specify the unequal variances option. This will calculate the t-statistic and p-value, which can then be used to determine if there is a significant difference between the two groups. Additionally, the result of the t-test can be graphically represented using a box and whisker plot to visualize the difference between the means. This method is commonly used in research and data analysis to determine the significance of differences between groups, and Excel provides a convenient and user-friendly platform to perform this analysis.

Perform t-Test with Unequal Variances in Excel

A two sample t-test is used to determine whether or not two are equal.

There are two versions of the two sample t-test you can use:

t-test with equal variancest-test with unequal variances

We use a t-test with unequal variances when the variances in the two samples are not equal.

The easiest way to determine if the variances between the two samples are equal is to use the variance rule of thumb.

As a rule of thumb, if the ratio of the larger variance to the smaller variance is less than 4 then we can assume

the variances are approximately equal.

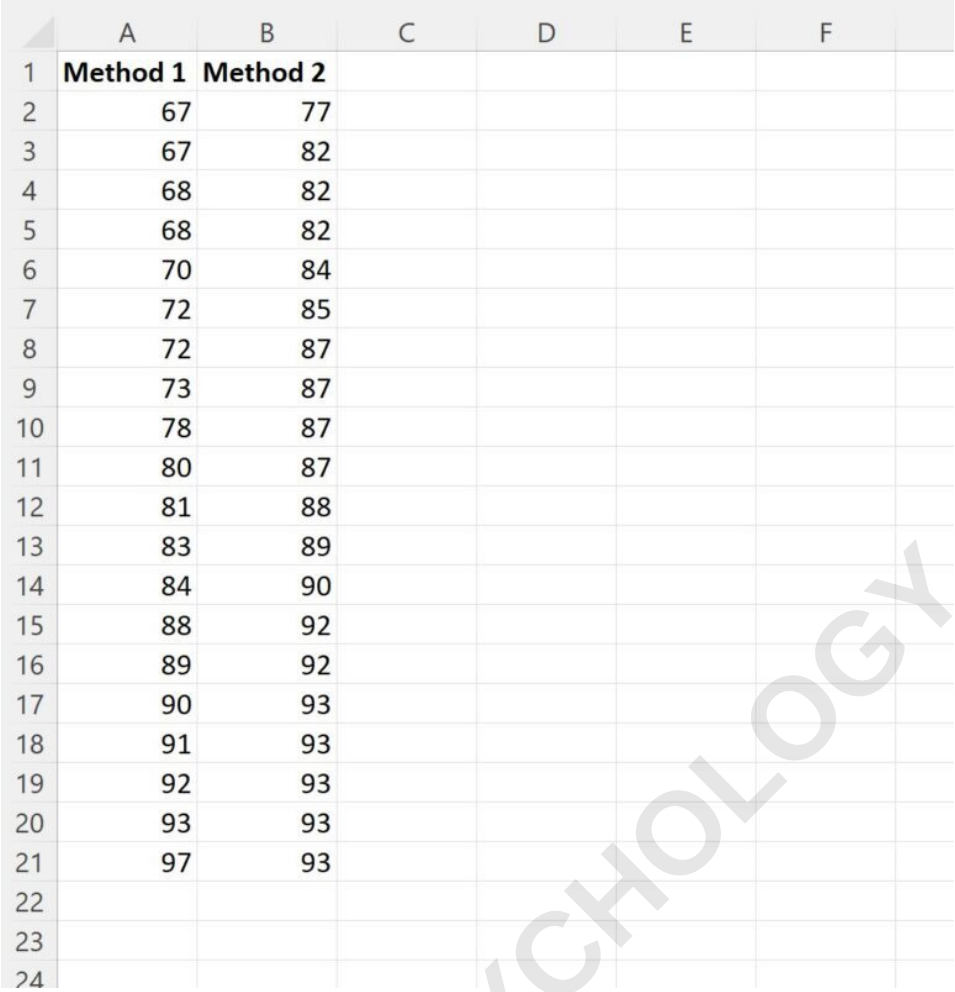
Otherwise, if the ratio is equal to or greater than 4, we assume that the variances are not equal.

The following step-by-step example shows how to perform a two sample t-test with unequal variances in Excel.

Step 1: Enter the Data

Suppose we would like to determine if two different studying methods lead to different mean exam scores among students at some university.

We select a random sample of 20 students to use each studying method and record their exam scores:



	A	B	C	D	E	F
1	**Method 1**	**Method 2**				
2	67	77				
3	67	82				
4	68	82				
5	68	82				
6	70	84				
7	72	85				
8	72	87				
9	73	87				
10	78	87				
11	80	87				
12	81	88				
13	83	89				
14	84	90				
15	88	92				
16	89	92				
17	90	93				
18	91	93				
19	92	93				
20	93	93				
21	97	93				
22						
23						
24						

Step 2: Determine Equal or Unequal Variance

Next, we can calculate the ratio of the sample variances:

	A	B	C	D	E	F
1	**Method 1**	**Method 2**		**Variance Method 1**	100.0289	
2	67	77		**Variance Method 2**	22.06316	
3	67	82		**Ratio**	4.533755	
4	68	82				
5	68	82				
6	70	84				
7	72	85				
8	72	87				
9	73	87				
10	78	87				
11	80	87				
12	81	88				
13	83	89				
14	84	90				
15	88	92				
16	89	92				
17	90	93				
18	91	93				
19	92	93				
20	93	93				
21	97	93				
22						
23						
24						
25						

Here are the formulas we typed into each cell:

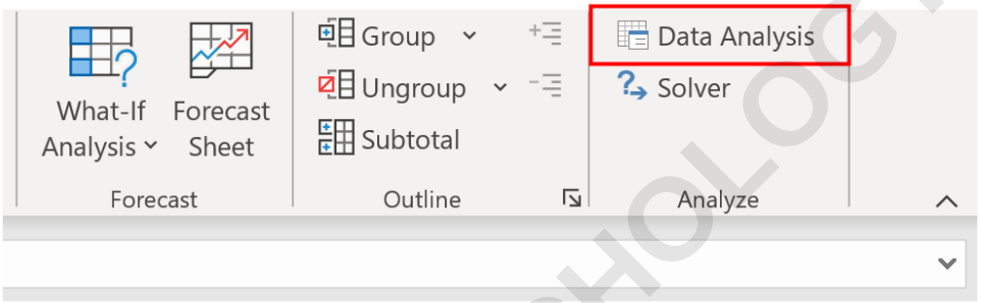
Cell E1: =VAR.S(A2:A21)Cell E2: =VAR.S(B2:B21)Cell E3: =E1/E2

Since this value is greater than or equal to 4, we assume that the variances between the two samples are not equal.

Step 3: Perform Two-Sample t-Test with Unequal Variance

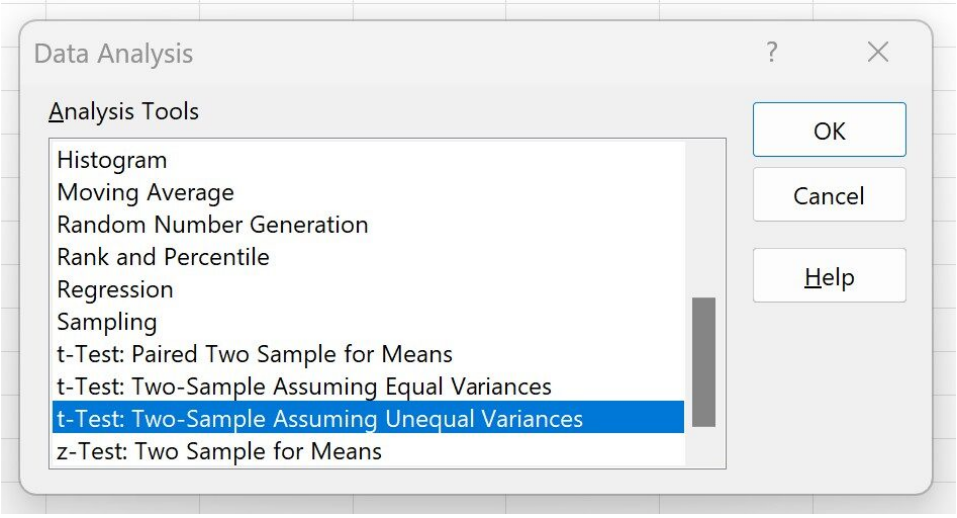
Next, we can perform a two sample t-test with unequal variances to determine if the mean exam score between the two samples is equal.

To do so, click the Data tab along the top ribbon, then click the Data Analysis button in the Analyze group:

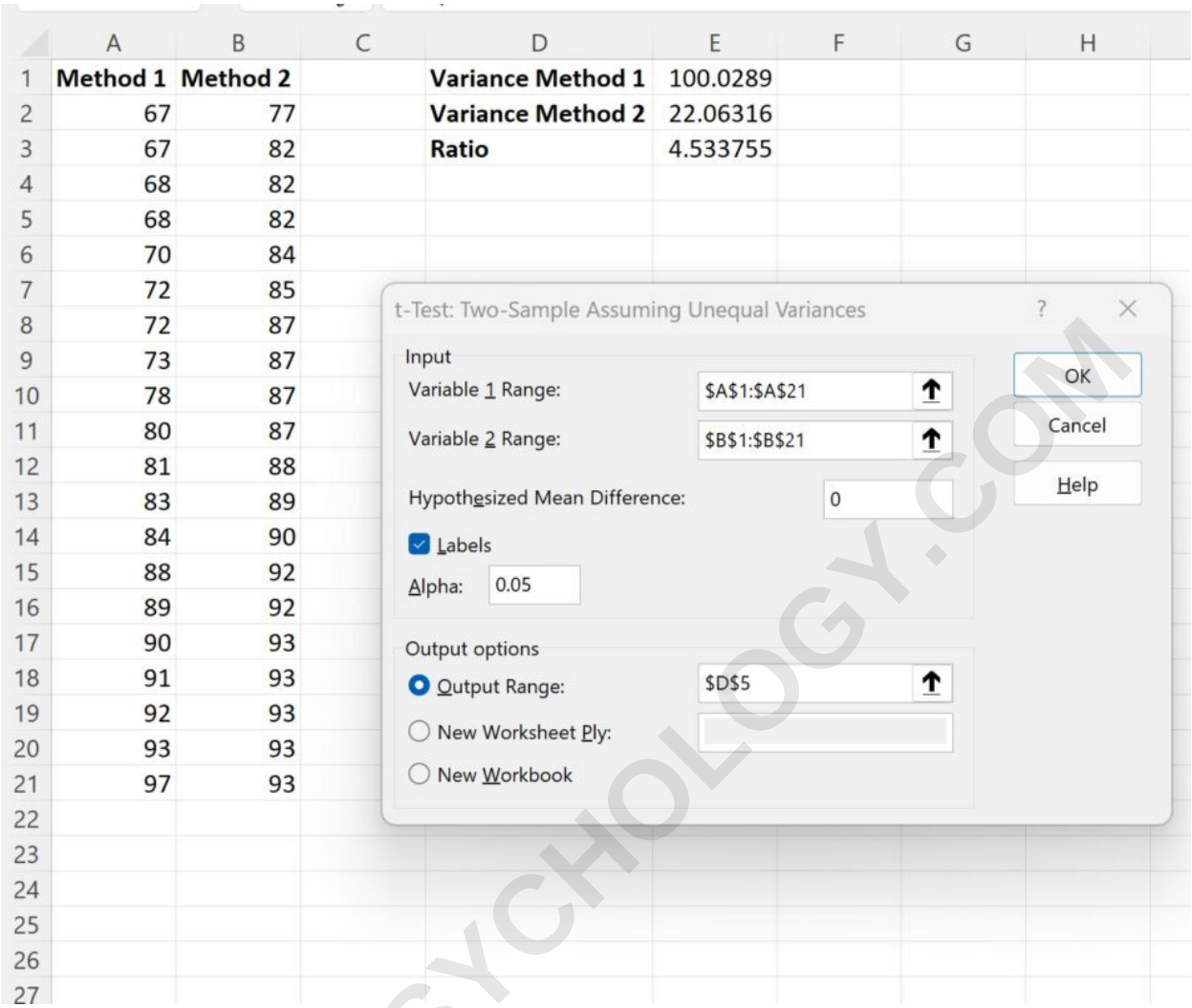


If you don't see this button, you need to first .

In the new window that appears, click t-test: Two-Sample Assuming Unequal Variances, then click OK:



In the new window that appears, fill in the following information, then click OK:



Once you click OK, the results of the two sample t-test will appear:

	A	B	C	D	E	F	G
1	**Method 1**	**Method 2**		**Variance Method 1**	100.0289		
2	67	77		**Variance Method 2**	22.06316		
3	67	82		**Ratio**	4.533755		
4	68	82					
5	68	82		t-Test: Two-Sample Assuming Unequal Variances			
6	70	84					
7	72	85			*Method 1*	*Method 2*	
8	72	87		Mean	80.15	87.8	
9	73	87		Variance	100.0289	22.06316	
10	78	87		Observations	20	20	
11	80	87		Hypothesized Mean	0		
12	81	88		df	27		
13	83	89		t Stat	-3.09623		
14	84	90		P(T<=t) one-tail	0.002266		
15	88	92		t Critical one-tail	1.703288		
16	89	92		P(T<=t) two-tail	0.004532		
17	90	93		t Critical two-tail	2.051831		
18	91	93					
19	92	93					
20	93	93					
21	97	93					
22							
23							
24							
25							

Step 4: Interpret the Results

From the output we can see:

The mean exam score for method 1 was 80.15.The mean exam score for method 2 was 87.8.The t test-statistic was -3.09623.The corresponding two-tailed p-value was 0.004532.

Since this p-value is less than .05, we can conclude that there is a statistically significant difference in the mean exam scores between the two studying methods.

The following tutorials explain how to perform other common tasks in Excel: