How to Easily Perform a Wilcoxon Signed Rank Test in Excel

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December 6, 2025

The Wilcoxon Signed Rank Test is a non-parametric test used to compare two related samples or repeated measurements on a single sample. To perform this test in Excel, one must first organize the data into two columns, one with the pre-test scores and the other with the post-test scores. Then, the Data Analysis tool should be used to select the Wilcoxon Signed Rank Test option. This will generate a result table which should be interpreted to determine whether there is a significant difference between the two samples.

The is the non-parametric version of the .

It is used to test whether or not there is a significant difference between two population means when the distribution of the differences between the two samples cannot be assumed to be .

This tutorial provides a step-by-step example of how to conduct a Wilcoxon Signed-Rank Test in Excel.

Step 1: Create the Data

Suppose an engineer want to know if a new fuel treatment leads to a change in the average miles per gallon of a certain car. To test this, he measures the mpg of 12 cars with and without the fuel treatment.

We'll create the following data in Excel to hold the mpg values for each car with the fuel treatment (group1) and without the fuel treatment (group 2):

	A	B	C	D	E	F
1	**group1**	**group2**				
2	20	24				
3	23	25				
4	21	21				
5	25	22				
6	18	23				
7	17	18				
8	18	17				
9	24	28				
10	20	24				
11	24	27				
12	23	21				
13	19	23				
14						
15						
16						
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23						

Step 2: Calculate the Difference Between the Groups

Next, we'll calculate the difference between the groups:

	A	B	C	D	E	F
1	**group1**	**group2**	**difference**			
2	20	24	=A2-B2			
3	23	25	-2			
4	21	21	0			
5	25	22	3			
6	18	23	-5			
7	17	18	-1			
8	18	17	1			
9	24	28	-4			
10	20	24	-4			
11	24	27	-3			
12	23	21	2			
13	19	23	-4			
14						
15						
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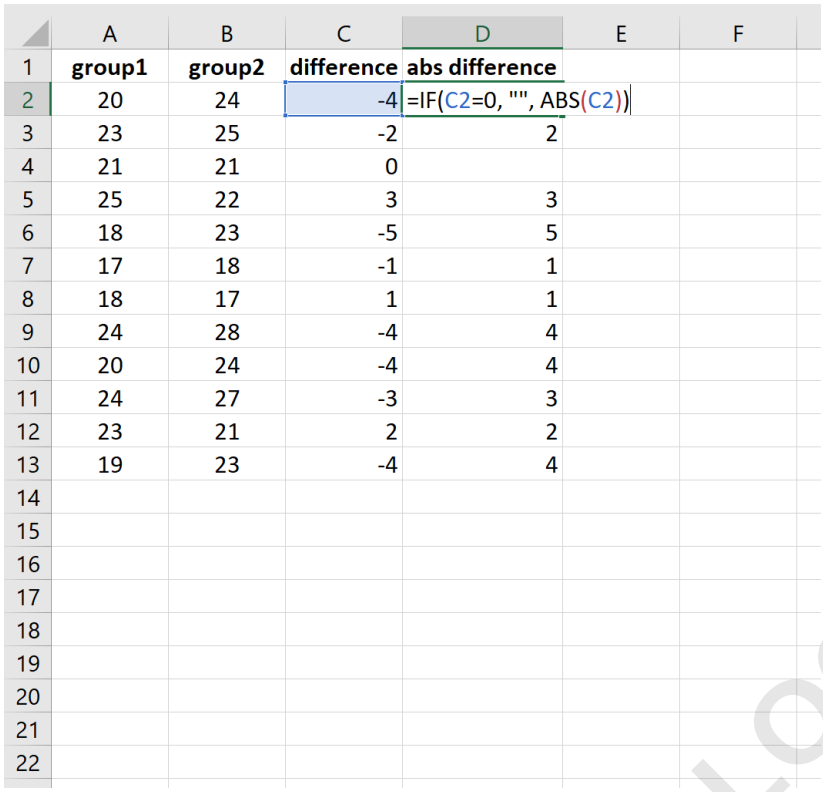
Step 3: Calculate the Absolute Differences

Next, we'll calculate the absolute difference between the groups, returning a blank if the absolute difference is zero:



	A	B	C	D	E	F
1	**group1**	**group2**	**difference**	**abs difference**		
2	20	24	-4	=IF(C2=0, "", ABS(C2))		
3	23	25	-2	2		
4	21	21	0			
5	25	22	3	3		
6	18	23	-5	5		
7	17	18	-1	1		
8	18	17	1	1		
9	24	28	-4	4		
10	20	24	-4	4		
11	24	27	-3	3		
12	23	21	2	2		
13	19	23	-4	4		
14						
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Step 4: Calculate the Rank of the Absolute Differences

Next, we'll use the **RANK.AVG()** function to calculate the rank of the absolute differences between the groups, returning a blank if the absolute difference is zero:

	A	B	C	D	E	F	G
1	group1	group2	difference	abs difference	rank of abs difference		
2	20	24	-4	4	=IF(C2=0, "", RANK.AVG(D2, $D$2:$D$13, 1))		
3	23	25	-2	2	3.5		
4	21	21	0				
5	25	22	3	3	5.5		
6	18	23	-5	5	11		
7	17	18	-1	1	1.5		
8	18	17	1	1	1.5		
9	24	28	-4	4	8.5		
10	20	24	-4	4	8.5		
11	24	27	-3	3	5.5		
12	23	21	2	2	3.5		
13	19	23	-4	4	8.5		
14							
15							
16							
17							
18							
19							
20							
21							

Step 5: Calculate the Positive & Negative Ranks

	A	B	C	D	E	F
1	group1	group2	difference	abs difference	rank of abs difference	positive ranks
2	20	24	-4	4	8.5	=IF(C2>0, E2, "")
3	23	25	-2	2	3.5	
4	21	21	0			
5	25	22	3	3	5.5	5.5
6	18	23	-5	5	11	
7	17	18	-1	1	1.5	
8	18	17	1	1	1.5	1.5
9	24	28	-4	4	8.5	
10	20	24	-4	4	8.5	
11	24	27	-3	3	5.5	
12	23	21	2	2	3.5	3.5
13	19	23	-4	4	8.5	
14						
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And we'll calculate the negative ranks:

	A	B	C	D	E	F	G
1	group1	group2	difference	abs difference	rank of abs difference	positive ranks	negative ranks
2	20	24	-4	4	8.5		=IF(C2<0, E2, "")
3	23	25	-2	2	3.5		3.5
4	21	21	0				
5	25	22	3	3	5.5	5.5	
6	18	23	-5	5	11		11
7	17	18	-1	1	1.5		1.5
8	18	17	1	1	1.5	1.5	
9	24	28	-4	4	8.5		8.5
10	20	24	-4	4	8.5		8.5
11	24	27	-3	3	5.5		5.5
12	23	21	2	2	3.5	3.5	
13	19	23	-4	4	8.5		8.5
14							
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22							

Step 6: Calculate the Test Statistic & Sample Size

Lastly, we'll calculate the test statistic which is simply the smaller of the sum of the positive ranks or the sum of the negative ranks:

	A	B	C	D	E	F	G	H
1	group1	group2	difference	abs difference	rank of abs difference	positive ranks	negative ranks	
2	20	24	-4	4	8.5		8.5	
3	23	25	-2	2	3.5		3.5	
4	21	21	0					
5	25	22	3	3	5.5	5.5		
6	18	23	-5	5	11		11	
7	17	18	-1	1	1.5		1.5	
8	18	17	1	1	1.5	1.5		
9	24	28	-4	4	8.5		8.5	
10	20	24	-4	4	8.5		8.5	
11	24	27	-3	3	5.5		5.5	
12	23	21	2	2	3.5	3.5		
13	19	23	-4	4	8.5		8.5	
14								
15						smaller sum	=MIN(SUM(F2:F13), SUM(G2:G13))	
16								
17								
18								
19								
20								
21								

And we'll calculate the sample size, which is the total number of ranks that aren't equal to zero:

	A	B	C	D	E	F	G
1	group1	group2	difference	abs difference	rank of abs difference	positive ranks	negative ranks
2	20	24	-4	4	8.5		8.5
3	23	25	-2	2	3.5		3.5
4	21	21	0				
5	25	22	3	3	5.5	5.5	
6	18	23	-5	5	11		11
7	17	18	-1	1	1.5		1.5
8	18	17	1	1	1.5	1.5	
9	24	28	-4	4	8.5		8.5
10	20	24	-4	4	8.5		8.5
11	24	27	-3	3	5.5		5.5
12	23	21	2	2	3.5	3.5	
13	19	23	-4	4	8.5		8.5
14							
15						smaller sum	10.5
16						sample size	=COUNT(F2:G13)
17							
18							
19							
20							

The test statistic turns out to be **10.5** and the sample size is **11**.

In this example, the Wilcoxon Signed-Rank Test uses the following null and alternative hypotheses:

H0: The mpg is equal between the two groups

HA: The mpg is *not* equal between the two groups

To determine if we should reject or fail to reject the null hypothesis, we can find the critical value that corresponds to $\alpha = .05$ and a sample size of 11 in the following Wilcoxon Signed Rank Test Critical Values Table:

	Alpha value				
n	**0.005**	**0.01**	**0.025**	**0.05**	**0.10**
5	-	-	-	-	0
6	-	-	-	0	2
7	-	-	0	2	3
8	-	0	2	3	5
9	0	1	3	5	8
10	1	3	5	8	10
11	3	5	8	10	13
12	5	7	10	13	17
13	7	9	13	17	21
14	9	12	17	21	25
15	12	15	20	25	30
16	15	19	25	29	35
17	19	23	29	34	41
18	23	27	34	40	47
19	27	32	39	46	53
20	32	37	45	52	60
21	37	42	51	58	67
22	42	48	57	65	75
23	48	54	64	73	83
24	54	61	72	81	91
25	60	68	79	89	100
26	67	75	87	98	110
27	74	83	96	107	119
28	82	91	105	116	130
29	90	100	114	126	140
30	98	109	124	137	151

The critical value that corresponds to $\alpha = .05$ and a sample size of 11 is **10**.

Since the test statistic (10.5) is not less than the critical value of 10, we fail to reject the null hypothesis.

We do not have sufficient evidence to say that the mean mpg is not equal between the two groups.

Bonus: Feel free to use this to automatically calculate the test statistic for a Wilcoxon Signed-Rank Test.