## Shapiro-Wilk Original Test

We present the original approach to the performing the Shapiro-Wilk Test. This approach is limited to samples between 3 and 50 elements. By clicking here you can also review a revised approach using the algorithm of J. P. Royston which can handle samples with up to 5,000 (or even more).

The basic approach used in the **Shapiro-Wilk** (SW) test for normality is as follows:

- Rearrange the data in ascending order so that $x_1 \leq \ldots \leq x_n$.
- Calculate $SS$ as follows:

$$SS = \sum_{i=1}^{n}(x_i - \bar{x})^2$$

- If $n$ is even, let $m = n/2$, while if $n$ is odd let $m = (n-1)/2$
- Calculate $b$ as follows, taking the $a_i$ weights from the Table 1 (based on the value of $n$) in the Shapiro-Wilk Tables. Note that if $n$ is odd, the median data value is not used in the calculation of $b$.

$$b = \sum_{i=1}^{m} a_i(x_{n+1-i} - x_i)$$

- Calculate the test statistic $W = b^2/SS$
- Find the value in the Table 2 of the Shapiro-Wilk Tables (for a given value of $n$) that is closest to $W$, interpolating if necessary. This is the p-value for the test.

For example, suppose $W = .975$ and $n = 10$. Based on Table 2 of the Shapiro-Wilk Tables the p-value for the test is somewhere between .90 ($W = .972$) and .95 ($W = .978$).

**Example 1**: A random sample of 12 people is taken from a large population. The ages of the people in the sample are given in column A of the worksheet in Figure 1. Is this data normally distributed?

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Test for Normality - Shapiro-Wilks | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | Age | Sorted | | n | 12 | | | | |
| 4 | 65 | 35 | | | | | | diff | a*diff |
| 5 | 61 | 45 | | a1 | 0.5475 | | x12 - x1 | 51 | 27.9225 |
| 6 | 63 | 55 | | a2 | 0.3325 | | x11 - x2 | 29 | 9.6425 |
| 7 | 86 | 58 | | a3 | 0.2347 | | x10 - x3 | 17 | 3.9899 |
| 8 | 70 | 61 | | a4 | 0.1586 | | x9 - x4 | 12 | 1.9032 |
| 9 | 55 | 63 | | a5 | 0.0922 | | x8 - x5 | 7 | 0.6454 |
| 10 | 74 | 65 | | a6 | 0.0303 | | x7 - x6 | 2 | 0.0606 |
| 11 | 35 | 68 | | | | | | | 44.1641 |
| 12 | 72 | 70 | | | | | | | |
| 13 | 68 | 72 | | SS | 2008.667 | | | | |
| 14 | 45 | 74 | | b | 44.1641 | | | | |
| 15 | 58 | 86 | | W = b²/SS | 0.971026 | | | | |
| 16 | | | | 0.5 | 0.943 | | | | |
| 17 | | | | 0.9 | 0.973 | | | | |
| 18 | | | | p-value | 0.873681 | | | | |

**Figure 1 – Shapiro-Wilk test for Example 1**

We begin by sorting the data in column A using **Data > Sort & Filter|Sort** or the **QSORT** supplemental function, putting the results in column B. We next look up the coefficient values for $n = 12$ (the sample size) in Table 1 of the Shapiro-Wilk Tables, putting these values in column E.

Corresponding to each of these 6 coefficients $a_1,\ldots,a_6$, we calculate the values $x_{12} - x_1, \ldots, x_7 - x_6$, where $x_i$ is the $i$th data element in sorted order. E.g. since $x_1 = 35$ and $x_{12} = 86$, we place the difference 86 – 35 = 51 in cell H5 (the same row as the cell containing $a_1$). Column I contains the product of the coefficients and difference values. E.g. cell I5 contains the formula =E5*H5. The sum of these values is $b$ = 44.1641, which is found in cell I11 (and again in cell E14).

We next calculate $SS$ as DEVSQ(B4:B15) = 2008.667. Thus $W = b^2/SS$ = 44.1641^2/2008.667 = .971026. We now look for .971026 when $n$ = 12 in Table 2 of the Shapiro-Wilk Tables and find that the p-value lies between .50 and .90. The $W$ value for .5 is .943 and the $W$ value for .9 is .973.

Interpolating .971026 between these value (using linear interpolation), we arrive at p-value = .873681. Since p-value = .87 > .05 = $\alpha$, we retain the null hypothesis that the data are normally distributed.

**Example 2**: Using the SW test, determine whether the data in Example 1 of Graphical Tests for Normality and Symmetry are normally distributed.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | Test for Normality - Shapiro-Wilks | | | | | | | |
| 2 | | | | | | | | |
| 3 | Data | | n | 15 | | | | |
| 4 | 1.2 | | | | | | diff | a*diff |
| 5 | 1.6 | | a1 | 0.5150 | | x15 - x1 | 6.4 | 3.296 |
| 6 | 1.8 | | a2 | 0.3306 | | x14 - x2 | 5.0 | 1.653 |
| 7 | 1.9 | | a3 | 0.2495 | | x13 - x3 | 3.8 | 0.9481 |
| 8 | 1.9 | | a4 | 0.1878 | | x12 - x4 | 2.9 | 0.54462 |
| 9 | 2.0 | | a5 | 0.1353 | | x11 - x5 | 2.1 | 0.28413 |
| 10 | 2.2 | | a6 | 0.0880 | | x10 - x6 | 1.5 | 0.132 |
| 11 | 2.6 | | a7 | 0.0433 | | x9 - x7 | 0.8 | 0.03464 |
| 12 | 3.0 | | | | | | | 6.89249 |
| 13 | 3.5 | | | | | | | |
| 14 | 4.0 | | SS | 54.35733 | | | | |
| 15 | 4.8 | | b | 6.89249 | | | | |
| 16 | 5.6 | | $W = b^2/SS$ | 0.873965 | | | | |
| 17 | 6.6 | | 0.02 | 0.855 | | | | |
| 18 | 7.6 | | 0.05 | 0.881 | | | | |
| 19 | | | p-value | 0.041883 | | | | |

**Figure 2 – Shapiro-Wilk test for Example 2**

As we can see from the analysis in Figure 2, p-value = .0419 < .05 = $\alpha$, and so we reject the null hypothesis and conclude with 95% confidence that  that the data are not normally distributed, which is quite different from the results using the KS test that we found in Example 2 of Kolmogorov-Smironov Test.

**Real Statistics Function**: The Real Statistics Resource Pack contains the following supplemental functions where R1 consists only of numeric data without headings:

**SHAPIRO**(R1, FALSE) = the Shapiro-Wilk test statistic $W$ for the data in the range R1

**SWTEST**(R1, FALSE, $h$) = p-value of the Shapiro-Wilk test on the data in R1

**SWCoeff**($n$, $j$, FALSE) = the $j$th coefficient for samples of size $n$

**SWCoeff**(R1, C1, FALSE) = the coefficient corresponding to cell C1 within sorted range R1

**SWPROB**($n$, $W$, FALSE, $h$) = p-value of the Shapiro-Wilk test for a sample of size $n$ for test statistic $W$

The functions SHAPIRO and SWTEST ignore all empty and non-numeric cells. The range R1 in SWCoeff(R1, C1, FALSE) should not contain any empty or non-numeric cells.

When performing the table lookup, the default is to use harmonic interpolation (*h* = TRUE). To use linear interpolation, set *h* to FALSE. See Interpolation for details.

For example, for Example 1 of Chi-square Test for Normality, we have SHAPIRO(A4:A15, FALSE) = .874 and SWTEST(A4:A15, FALSE, FALSE) = SWPROB(15,.874,FALSE,FALSE) = .0419 (referring to the worksheet in Figure 2 of Chi-square Test for Normality).

It is important to note that SHAPIRO(R1, TRUE), SWTEST(R1, TRUE), SWCoeff(*n, j*, TRUE), SWCoeff(R1, C1, TRUE) and SWPROB(*n, W,* TRUE) refer to the results using the Royston algorithm, as described in Shapiro-Wilk Expanded Test.

For compatibility with the Royston version of SWCoeff, when $j \le n/2$ then SWCoeff(*n, j*, False) = the negative of the value of the *j*th coefficient for samples of size *n* found in the Shapiro-Wilk Tables. When $j = (n+1)/2$, SWCoeff(*n, j*, FALSE) = 0 and when $j > (n+1)/2$, SWCoeff(*n, j*, FALSE) = -SWCoeff(*n*, *n–j*+1, FALSE).

### 77 Responses to *Shapiro-Wilk Original Test*

**Mai78** *says:*
October 24, 2018 at 4:49 pm

Worked like a charm! Thanks for the explanation and resources!

Reply

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**Martina** *says:*
September 23, 2018 at 6:39 pm

Hi,
I don't know how to calculate b. There is a specific formula in excel?
Thanx!

Reply

**Charles** *says:*
September 24, 2018 at 9:23 pm

Martina,
=SUM(I5:I10)
Charles

Reply

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**Fernando lopes** *says:*
August 20, 2018 at 3:59 am

Hi Dear from brazil ,

My name is Fernando , thaks for explanation about normality test shapiro wilk , I use it for methods validation in phamaceutical industry ,

I´d like to know how you found the p- value in excel for shapiro wilk ?

best regarding Thank you for your help in this matter

Reply

**Charles** *says:*
August 20, 2018 at 9:02 am

Fernando,
Thank you for your kind remarks.
The p-value comes from the table shown on the following webpage:
http://www.real-statistics.com/statistics-tables/shapiro-wilk-table/
This based on the work done by Shapiro-Wilk.
Charles

Reply

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**Daniel** *says:*
August 14, 2018 at 11:31 pm

Hi,

I am attempting to use the SWTEST and/or SWPROB functions described above after installing your RealStatistics add-in. Unfortunately, I am receiving errors (The SHAPIRO function works fine, though). I have screenshots of the errors, however, I am unable to paste them into this message. Please advise.

Reply

**Charles** *says:*
August 15, 2018 at 9:18 am

Daniel,
If you send me an Excel file with your data and test results (at least until you get the error message), I will try to figure out what is going on.
Charles

Reply

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**Sundar** *says:*
July 3, 2018 at 10:29 am

Sir,
I have result Shapiri-wilk test analysis statistics and P-value . My result is 0.-19 and P-value is 0.18. Then what solution is this result. Please kindly reply to How is write interpretation.

Reply

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**Sundar rajan** *says:*
July 3, 2018 at 9:16 am

Sir,
I have result Shapiri-wilk test analysis statistics and P-value . My result is 0.-19 and P-value is 0.18. Then what solution is this result. Please kindly reply

Reply

**Charles** *says:*
July 3, 2018 at 9:54 am

Sundar,
As explained in Example 1, since p = .19 > .05 = alpha, the result indicates that the normality assumption is satisfied.
In your comment you say that you got a result of 0.-19. I don't understand what this means.
Charles

Reply

**Sundar** *says:*

July 3, 2018 at 10:31 am

How is write interpretation. Thant only sir

Reply

**Sundar** *says:*

July 3, 2018 at 10:37 am

Dear sir, run test value -1.39 and p- value 0.16 . Each value -4.95, -5.72. Sir i want this details. Run test value minus value correct or incorrect. Please tell me sir

Reply

**Charles** *says:*

July 3, 2018 at 11:05 am

Sundar,
Sorry, but I don't understand your messages. If you send me an Excel file with your data and analysis, I will try to help you further.
Charles

Reply

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**ananas** *says:*

June 21, 2018 at 9:15 pm

Hi,

Can you help me interpret this Shapiro-Wilk Statistic df Sig.
,918** 51 ,002
by age?

Reply

**Charles** *says:*

June 22, 2018 at 12:11 am

Sorry, but I don't know what ,918** 51 ,002 is referring to. How to interpret the results from the Shapiro Wilk test carried out by Real Statistics is explained on the webpage.
Charles

Reply

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**Giovanni** *says:*

May 12, 2018 at 4:32 pm

Hi: Can I fixe a p-value=0.001 for to proof normality?

Reply

**Charles** *says:*

May 12, 2018 at 6:33 pm

Giovanni,
You can use alpha = .001, but generally alpha = .05 is used.
Charles

Reply

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**Patricia Padula Lopes** *says:*

May 10, 2018 at 4:40 am

Could you tell the references you used?

Reply

**Charles** *says:*

May 10, 2018 at 7:25 am

Patricia,
The reference is to the Shapiro-Wilk paper. See the Bibliography webpage.
Charles

Reply

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**Julian Kaljuvee** *says:*

March 30, 2018 at 12:54 pm

Hi Charles,

If one gets a value for W = b2/SS = 0.837 < 0.884 (with n=24) which is not in p-value tables, how would you handle that situation? Would this imply that there has been a calculation error or is automatically a reject? Many thanks for putting together this helpful web site!

Reply

**Charles** *says:*

March 30, 2018 at 3:30 pm

Julian,
Since the smallest value for n = 24 is .884 (at alpha = .01), this means that p-value < .01, which is usually interpreted as significantly different from normality. Charles

Reply

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**Giacomo Tabarelli** *says:*

July 22, 2017 at 9:43 am

Hi, could you explain me why you use that b formula instead of the "standard" formula used on wikipedia for calculate W? Is there any difference? Thanks

Reply

**Charles** *says:*

July 22, 2017 at 9:57 am

Giacomo,
It should be equivalent to formula shown in Wikipedia. I can't recall whether I used the version in the original Shapiro-Wilk paper or elected to use the approach that I did to emphasize the symmetry aspect of the calculation.
Charles

Reply

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**Stefan S.** *says:*

July 18, 2017 at 10:53 am

Dear Charles,
first I would like to say that the Add-in seems great however I did fail to follow your example by calculating it with the RealStat Add-in for Excel 2016.

I´m using the the "example 1" data set "age".

Using the add-in I got:

W 0.971066437
p-value 0.921648864
alpha 0.05
normal yes

These results are different from your manual calculations which I could follow and got the same results.

Do you have any idea what the reason is?
I would love to use the add-in but I need to be sure it is working the right way.

Best regards,
Stefan

Reply

**Charles** *says:*
July 18, 2017 at 3:06 pm

Stefan,
There are two versions of the Shapiro-Wilk test: the original version, which is described on the referenced webpage, and Royston's version, which is described on the webpage http://www.real-statistics.com/tests-normality-and-symmetry/statistical-tests-normality-symmetry/shapiro-wilk-expanded-test/
The add-in value that you describe uses the Royston' version. Actually, if you look at the output for W from the add-in, it will contain the formula =SHAPIRO(A4,A15). If you change the formula to =SHAPIRO(A4:A15,FALSE) you will get the value of W as calculated by Shapiro-Wilk's original algorithm (the same is true for the p-value, which is calculated by SWTEST).
The original version works well for smaller samples, but doesn't support larger samples. This is the advantage of the Royston version.
Charles

Reply

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**Jared** *says:*
March 15, 2017 at 8:15 pm

My W value is 1.273573913 for 22 samples. I can't find a table that goes that high, and an online calculator gave me an error. What does this mean?

Reply

**Charles** *says:*
March 15, 2017 at 10:12 pm

Jared,
It could mean that you made an error in calculating W. What is the data in your sample?
Charles

Reply

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**Ulrike Kaiser** *says:*
February 15, 2017 at 1:32 pm

Hi, Charles,

thank-you for your very helpful side.
My sample consists of 5 cases (i.e 37;105;110;150;216), resulting W = 0,9762. I want to do the SW-Test with a probability of error of 5%.
Do I have to compare my calculated W with W(p=0,95)=0,986 or with W(p=0,05)=0,762?
Thank you very much for your answer!

Ulrike

Reply

**Charles** *says:*
February 16, 2017 at 9:25 am

Ulrike,
As described on the referenced webpage, if W =.971, then p = .874 (via interpolation between .5 and .9). Since .874 > .05, then we conclude that we don't have evidence to reject the hypothesis that the data is normally distributed.
Another way to look at this is that if W =.971 >= .762 (the W value at .05), then the data is considered to be normally distributed.
Charles

Reply

**Ulrike Kaiser** *says:*
February 16, 2017 at 9:46 am

Thank you very much for your answer!
Meanwhile I downloaded also your AddIn for Excel; that will help me a lot for my work! What a great offer!

Best regards,

Ulrike

Reply

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**Moutaz** *says:*
January 3, 2017 at 7:57 pm

Hi admin

This is an excellent explanation for the Shairo-Wilk's test. This saved lots of time. However, I still have a questions in this test; how are the weight values calculated? What do the mean?

Thank you

Reply

**Charles** *says:*
January 4, 2017 at 8:19 am

Moutaz,
You need to read the original Shapiro-Wilk paper. See Bibliography.
Charles

Reply

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**Denis** *says:*
November 26, 2016 at 9:39 pm

Thank you very much for the excellent explanation!

Reply

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**Marissa** *says:*
November 7, 2016 at 9:25 pm

For n=4, my calculated value of W is 0.677. The smallest critical value for 0.01 when n=4 is 0.687. How do I interpret this result given that my W value isn't even within any range given? I've double checked my data and don't see any typos in my data recording or calculations.

Reply

**Charles** *says:*
November 8, 2016 at 7:03 am

Marissa,
This means that the p/value is less than .01
Charles

Reply

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**Marthen R Pellokila** *says:*
October 27, 2016 at 4:16 pm

Thank you. It is really helpful

Reply

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**Magnus Friborg** *says:*
June 17, 2016 at 3:06 pm

I tried this on a sample of 41. I got a W = 0,90728. According to the table, the closest value is 0,92 (p = 0,01) – none are lower with the same sample size. Do I just use this value or should some measure be taken?
Also, I need to make sure that I understand the method correctly. The p-value i get from interpolating is the actual p-value and has to be lower than a threshold value (say p = 0,05) in order to reject the null hypothesis – correct?

Thanks in advance

Reply

**Charles** *says:*
June 17, 2016 at 3:29 pm

Magnus,
Yes, the approach you are using is correct. Since .90728 < .92, you can deduce that p < .01. In fact, if you sue the Real Statistics formula =PROB(41,.90728) you get the p-value = .002739. Since this is much lower than .05, you do indeed reject the null hypothesis that the data is normally distributed. Charles

Reply

**Magnus Friborg** *says:*
June 21, 2016 at 12:26 pm

Thank you very much.
I have another issue though. What is more reliable (and under what conditions), QQ plot or SW-test? I seem to get a rejection of the null hypothesis using SW, but the QQ show very small devations – or so it appears to me. Is the SW test very sensitive to large (e.g. n = 40) samples?

Reply

**Charles** *says:*
June 21, 2016 at 1:56 pm

Magnus,
I find it easier to use the SW test since it is easier to interpret its results, but both are fairly accurate. Also, since most tests are fairly robust to violations of normality, either test can show whether the data is really departing from normality. Both tests can be sued with large samples.
Charles

Reply

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**JohnM** *says:*
May 10, 2016 at 1:11 am

My entire population is just 30 values. Can the Shapiro-Wilk test also be applied to a population rather than just a sample? Am I correct in assuming that it is simply a test for symmmetry? My situation is that I have hundreds of datasets of 30 values and I find that even if the dataset is symmetrical the distribution of the values can be a long way from the 68-95-99.7 probability bell-curve.
For example, for one dataset, the number of entries in 1Sd bins from -2sd to 2sd is … 7,4,13,5, which produces a SW p-value of 0.43. In contrast to this distribution the "68-95-99.7" probability curve suggests that a population of 30 should be either 5, 10, 10, 4 or 4, 10, 10, 5.
Is it good practice to identify those datasets where the distribution is a long way from 68-95-99.7? If so, how is that done?

Thanks in advance.

Reply

**Charles** *says:*
May 10, 2016 at 12:24 pm

John,
You can use the Shapiro-Wilk test for a population. Shapiro-Wik tests for normality not just symmetry.
Charles

Reply

**JohnM** *says:*
May 12, 2016 at 5:29 am

Thanks Charles.
Another question that might interest other readers. I'm using your Excel method and I've written a Fortran subroutine to calculate the p_value. With the same input data they give the same results (as they should).
When I put the same data into http://contchart.com/goodness-of-fit.aspx I get a different p-value for the Shapiro-Wilks test.
Before I contact that website to ask them to check their processing, do you have any thoughts on the matter?

Reply

**Charles** *says:*
May 12, 2016 at 8:16 am

John,
I have also checked my results with other programs and they match.
Charles

Reply

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**Salman Ahmed** *says:*
March 12, 2016 at 11:10 am

Can I get the idea how to do the below :
Interpolating .971026 between these value (using linear interpolation)

Reply

**Charles** *says:*
March 12, 2016 at 12:10 pm

Salman,
Please look at the following webpage:
Interpolation
Charles

Reply

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**Kevin L** *says:*
March 6, 2016 at 12:00 am

Thank you very much for your excellent explanation and excel workbooks!

Reply

**Stefano** *says:*
February 20, 2016 at 11:47 am

Dear Dr. Zaionts,

Thank you very much for your great tool.
I recently downloaded the latest Release (3.5.3) for the Mac version of Excel. In this one, the SWTEST function apparently gives a #VALUE! output with range size greater than 3. Is there a way to fix this? If not, where may I find and download a previous Release?
I thank you in advance for your attention.

Stefano

Reply

**Charles** *says:*
February 25, 2016 at 10:11 pm

Dear Stefano,
I don't think I made any changes to this function since the previous release. In any case, if you send me an Excel file with your data and function results I will try to figure out what is causing this. You can send the file to my email address, which you can find at Contact Us.
Charles

Reply

**Pri** *says:*
January 26, 2016 at 11:17 am

These are the W values I have got from a raw data of response times for n=18.
1,012157199 0,996684879 0,824085184 0,960953212 1,006536182
Most of these values of W are out of range from the (n/p)table. Does that mean I have some calculation errors? If not, then how do I interpret the data?

Reply

**Charles** *says:*
January 27, 2016 at 10:45 am

Pri,

Since W = 0,824085184 is less than the smallest value in the table for n = 18 and p = .01, it just means that p < .01 Actually, I calculate that the p-value = 0,003394 using the Royston approximation that is described elsewhere on the website. This means that your data is likely not normally distributed. Similarly, W = 0,9609532124 is greater than the largest value in the table for n = 18 and p = .99. This just means that the p-value is larger than .99. This means that your data is probably normally distributed. The value W = 0,9609532124 is not in the table, but you know that it occurs between the values p = .5 and p = .9. You can interpolate (as described on the referenced webpage) to come up with an approximate p-value of .59, but in any case the value is much higher than .05, and so the random sample probably comes from a population that is normally distributed. Now the cases where W > 1 are causes for concern since I believe the value for W can't exceed 1. There is a good chance that you have made a calculation error.

Charles

Reply

**Soira** *says:*
November 21, 2015 at 6:37 pm

Hello Dr. Zaiontz,
I really appreciate your examples and web page on real statistics using excel. I tried Shapiro-Wilk test on my data (n=10),however, I have got many variables, so I am testing the normality for each of the variables. So for one of the data, I got W=0.5679 and I referred the Wilk Test sheet, I could not get the P-values. Could something be wrong with my data itself? Or is there an extended table? Please help.
Thanks

Reply

**Charles** *says:*
November 24, 2015 at 10:55 am

Soira,

Since the value for W is less than the critical value at p = .01, you can conclude from the table that p-value is less than .01

Alternatively, you can use the Royston version of Shapiro-Wilk test. See the webpage
http://www.real-statistics.com/tests-normality-and-symmetry/statistical-tests-normality-symmetry/shapiro-wilk-expanded-test/

In this case, you can calculate the p-value as SWPROB(10,.5679) = 2.3E-05.

Charles

Reply

**Soira** *says:*
November 25, 2015 at 11:19 am

thank you Charles

Reply

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**Joana** *says:*
October 23, 2015 at 1:34 pm

Hi Charles,

Thanks for the information on the website. It is really useful. However when I applied the Shapiro test to my data it gave me an error. This error does not happen for larger samples (mine is 4) like 5 or 6. Is there a limitation to the excel function that does not allow small samples to be tested with this function?

Thanks

Reply

**Charles** *says:*
October 23, 2015 at 3:21 pm

It looks like it should work for samples of size at least 5.
Charles

Reply

**Joana** *says:*
December 1, 2015 at 2:17 pm

Hi Charles,

I tried again the Shapiro test on my data and surprisingly it work for a sample size 3 but still not 4… Just thought I should let you know.

Thanks for the website

Joana

Reply

**Charles** *says:*
December 2, 2015 at 10:06 am

Joana,
Thanks for finding this bug.
The original test for sample size of 4 does work (setting the second argument in the SHAPIRO or SWTEST function to False). The Royston version of the test has the bug when the sample size is 4.
I will provide a fix in the next release.
Thanks again for helping me improve the accuracy of the software.
Charles

Reply

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**Tony O** *says:*
August 18, 2015 at 10:19 pm

I have gone through your explanation and I found very rewarding and useful. However, will appreciate an example for sample that is odd and not even like your two examples.

Regards

Reply

**Charles** *says:*
August 23, 2015 at 7:51 am

Tony,
The sample in the second example has an odd number of elements. The middle element is not used.
Charles

Reply

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**Jerry Oppong Adutwum** *says:*
March 13, 2015 at 4:55 pm

I want to know what happens if data fails the SW test?
Is there any way out?

Reply

**Charles** *says:*
March 13, 2015 at 10:04 pm

Jerry,
If data is not normally distributed, then for tests that assume normality you can
1. use a nonparametric test that doesn't require normality
2. transform the data so that the resulting data is sufficiently normal
In addition, some tests that require normality (e.g. the t test) are sufficiently robust that as long as the data is symmetric the test will usually be ok (although even in these cases, the Mann-Whitney nonparametric test should give similar results).
Charles

Reply

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**Gurumani** *says:*
January 11, 2015 at 3:29 am

Thank you Dr. I am learning a lot from your useful website. When I tried Real Stat for Shapiro-Wilk test for the two data given in the two examples, I get different W and p values from those given in the examples, as follows:
W=b^2/SS 0.971025924 W 0.971122526
0.5 0.943 p-value 0.922200674
0.9 0.973 alpha 0.05
p-value 0.873679 normal yes

W=b^2/SS 0.873965213 W 0.874012
0.02 0.855 p-value 0.03866
0.05 0.881 alpha 0.05
p value 0.041882692 normal no
Could you please explain why the difference? Have I committed any mistake in the calculations?

Reply

**Charles** *says:*
January 14, 2015 at 11:04 am

I don't know why you get different results. If you send me a spreadsheet with your calculations I will try to understand why there is a difference.
Charles

Reply

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**sundar** *says:*
December 8, 2014 at 6:43 am

how is analysis durbin watson test using excel or spss software. Please tell step by step sending my email id

Reply

**Charles** *says:*
December 8, 2014 at 3:12 pm

Sundar,
The following webpage has the description of the Durbin-Watson test: http://www.real-statistics.com/multiple-regression/autocorrelation/
I am updating the Durbin-Watson webpage, and so you will find additional information in a day or two.
Charles

Reply

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**Swanand Rishi** *says:*
October 18, 2014 at 8:35 am

The example 1 is well explained. However, my linearly interpolated value of Wc (p-value) comes out to be 0.89999 instead of 0.876681. The interpolation coeffcient is 0.075 per probability of .1, between 0.5 and 0.9. Hence for approx. diff. of 0.002 in W (0,973-0,971), p value = 0.89999. Pl. correct me if wrong.

Reply

**Charles** *says:*
October 20, 2014 at 8:22 pm

The calculation I used was to interpolate between the table values .973 – .943 = .03 and .9 – .5 = .4. So the answer is .9 – .002/.03 * .4 = .873.
In any case, the value is far more than .05. Note that you can get a more exact value (which doesn't require interposlation) by using the Royston approximation, as described on the webpage http://www.real-statistics.com/tests-normality-and-symmetry/statistical-tests-normality-symmetry/shapiro-wilk-expanded-test/
Charles

Reply

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**Shreya** *says:*
October 16, 2014 at 7:54 am

Hi Charles,
I found this webpage is very useful and it guided me so well. Thank you very much. But I would like to know something..How will you rank this test with respect to A-D and K-S test?
Shreya

Reply

**Charles** *says:*
October 16, 2014 at 10:54 am

Hi Shreya,
I would use SW over KS. I have not used AD and so don't have an opinion.
Charles

Reply

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**Julien** *says:*
July 7, 2014 at 10:39 pm

Hi Charles,
Thanks a lot for this web page!!

You said that the function SWTEST ignore all empty and non-numeric cells. Sure? Because if I add empty cells at the end of the range R1, the p-value is different.

Also, what is the difference between the original Shapiro-Wilk test and the Royston algorithm, and when do you one or the other? (Meaning that I don't know if in the SWTEST I have to write "FALSE" or "TRUE".

Thank you very much!
Julien

Reply

**Charles** *says:*
July 8, 2014 at 7:41 am

Hi Julien,

I just retested the SWTEST and SHAPIRO functions by adding empty and non-numeric cells at the beginning, end and in the middle of the range. The results are all the same. Which version of Excel are you using?

If the values you are looking for are found in the table then you might as well use the original algorithm (although the results using the Royston algorithm are quite similar). Otherwise you should use the Royston algorithm. I tend to use the Royston algorithm always since in that case I don't need to make any decisions.

Charles

Reply

**Julien** *says:*
July 8, 2014 at 2:06 pm

I use Microsoft Excel for Mac 2011 in English

Reply

**Charles** *says:*
July 8, 2014 at 2:58 pm

Julien,
Which version of the Real Statistics Resource Pack do you have? You can find this out by entering =VER() in any cell. If it is not one of the latest releases (Release 2.15) then this could account for the problem.
Charles

Reply

**Julien** *says:*
July 9, 2014 at 11:38 pm

Hi Charles,

It's the release 2.10.1

**Charles** *says:*
July 10, 2014 at 1:13 pm

Julien,
This is the latest version of the software for the Mac, but it doesn't contain some of the features that I have added for Windows. In particular WTEST only returns the one-tailed version of the test. You just need to double the value to get the p-value for the two-tailed test. I hope to get a new version for the Mac out soon (as soon as I can get a Mac computer to test it on).
Charles

**Charles** *says:*
July 9, 2014 at 6:46 am

Julien,
Now I understand the problem. I have not yet updated the Mac version of the software with the latest features. This is why some of the arguments don't work and why some of the functions don't handle missing data the same way. My problem is that I don't have a Mac myself and need to borrow one to test and update the software.
Charles

Reply