UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

FORTRAN PROGRAM FOR SHAPIRO - WILK W TEST FOR NORMALITY
FOR HONEYWELL MULTICS SYSTEM

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COMPILATION LISTING OF SEGMENT sw_test
Compiled by: MR6.1 Multics Old Fortran Compiler
Compiled on: 10/23/78 1631.1 pdt Mon
Options: map table subscript

```
c      W test for normality
c
c    by Robert Mark, 1978
c
c     The program sw_test is written for  the  Honeywell
c     Multics  system,  to  be  compiled  with  the
c     old_fortran  compiler.  It  is  based  upon  the
c     Shapiro  and  Wilk  (1965)  test  for  normality.
c     Unlike  a  chi-squared  test,  no assumption about
c     the  distribution  mean  and  variance  is  needed
c     and  no  cell  size  is  required.  The W-test is
c     roughly equivalent to testing how well the data is
c     fit by a straight line on a probability plot.  Two
c     estimates of variance are compared to generate the
c     W statistic.  The program prompts for the name  of
c     the  input  file which contains one data point per
c     line.  It  calculates  the  data  mean,  standard
c     deviation,  and  W  statistic.  Note  that  small
c     values of the test  statistic  W  are  significant
c     (i.e.  indicate non-normality).
c
c     Implementation:
c     The following link is required:
c     link >sss>read_list_ prompt
c     The  IMSL  subroutine  vsortp  is used to sort the
c     data.  The coefficients used  in  the  calculation
c     are  in  named  common  sw_test_com$ and stored in
c     segment sw_test_com.
c     Precentage points are in sw_table_com.
c
c     Reference:  Shapiro, S.S., and Wilk,  M.B.,  1965,
c     An  analysis  of  variance  test for the normality
c     (complete samples):  Biometrika, 52,  p. 591-611.
c
  common/sw_test_com$/a(50,25)
  common/sw_table_com$/tab(50,9)
  real y(51)
  integer ir(50),icall
  character file*30
  data icall/0/
  if (icall.eq.0) call asr(">iml>imsl","-after","working_dir")
  icall=1
  do 5 i=1,51
  y(i)=0.0
 5 continue
  call prompt("input_file : ",file)
  call io("attach","file10","vfile_",file)
  do 10 i=1,50
```

```
 ir(i)=i
 read(10,100,end=30) y(i)
 ncount=i
10 continue
30  call ioa_("^i data points read",ncount)
 if(ncount.eq.50) call ioa_("Maximum of 50 data points.")
 if(ncount.eq.50) call ioa_("Any additional data not used.")
 endfile 10
 call io("detach","file10")
c sort data with IMSL subroutine
 call vsortp(y,ncount,ir)
 s2=0.0
 aver=0.0
 do 20 i=1,ncount
 s2=s2+y(i)**2
 aver=aver+y(i)
20 continue
 s2=s2-(aver**2)/ncount
 aver=aver/ncount
 call ioa_("mean = ^f, sd = ^f",aver,sqrt(s2/(ncount-1)))
 k=ncount/2
 if(mod(ncount,2).gt.0) k=(ncount-1)/2
 b=0.0
 do 50 i=1,k
 b=b+a(ncount,i)*(y(ncount-i+1)-y(i))
50 continue
 w=(b**2)/s2
 call ioa_("W = ^.3f",w)
 if (ncount.lt.3) goto 60
 i=ncount
 call ioa_("Precentage points of the W test for n=^i",i)
 call ioa_(" 1% ^5.3f   2% ^5.3f   5% ^5.3f",tab(i,1),tab(i,2),tab(i,3))
 call ioa_("10% ^5.3f  50% ^5.3f  90% ^5.3f",tab(i,4),tab(i,5),tab(i,6))
 call ioa_("95% ^5.3f  98% ^5.3f  99% ^5.3f",tab(i,7),tab(i,8),tab(i,9))
60 call ioa_("Small values of W are significant.")
 stop
100 format(v)
 end
```

Example

```
print test_case


                    test_case 10/24/78  0711.9 pdt Tue


6
1
-4
8
-2
5
0


r 711 0.078 0.144 4
sw_test

input_file  test_case
 7 data points read
meán = 2., sd = 4.43471158
w = 0.953
Precentage points of the W test for n=7
 1% 0.730       2% 0.760       5% 0.803
10% 0.838      50% 0.928      90% 0.972
95% 0.979      98% 0.985      99% 0.988
Small values of W are significant.

STOP
r 712 0.665 6.714 101
```

Table 1. Coefficients for W test (common block sw_test_com).

2
0.7071

3
0.7071 0.0000

4
0.6872 0.1677

5
0.6646 0.2413 0.0000

6
0.6431 0.2806 0.0875

7
0.6233 0.3031 0.1401 0.0000

8
0.6052 0.3164 0.1743 0.0561

9
0.5888 0.3244 0.1976 0.0947 0.0000

10
0.5739 0.3291 0.2141 0.1224 0.0399

11
0.5601 0.3315 0.2260 0.1429 0.0695 0.0000

12
0.5475 0.3325 0.2347 0.1586 0.0922 0.0303

13
0.5359 0.3325 0.2412 0.1707 0.1099 0.0539 0.0000

14
0.5251 0.3318 0.2460 0.1802 0.1240 0.0727 0.0240

15
0.5150 0.3306 0.2495 0.1878 0.1353 0.0880 0.0433 0.0000

16
0.5056 0.3290 0.2521 0.1939 0.1447 0.1005 0.0593 0.0196

17
0.4968 0.3273 0.2540 0.1988 0.1524 0.1109 0.0725 0.0359 0.0000

18
0.4886 0.3253 0.2553 0.2027 0.1587 0.1197 0.0837 0.0496 0.0163

19
0.4808 0.3232 0.2561 0.2059 0.1641 0.1271 0.0932 0.0612 0.0303 0.0000

20
0.4734 0.3211 0.2565 0.2085 0.1686 0.1334 0.1013 0.0711 0.0422 0.0140

21
0.4643 0.3185 0.2578 0.2119 0.1736 0.1399 0.1092 0.0804 0.0530 0.0263
0.0000

22
0.4590 0.3156 0.2571 0.2131 0.1764 0.1443 0.1150 0.0878 0.0618 0.0368
0.0122

23
0.4542 0.3126 0.2563 0.2139 0.1787 0.1480 0.1201 0.0941 0.0696 0.0459
0.0228 0.0000

24
0.4493 0.3098 0.2554 0.2145 0.1807 0.1512 0.1245 0.0997 0.0764 0.0539
0.0321 0.0107

25
0.4450 0.3069 0.2543 0.2148 0.1822 0.1539 0.1283 0.1046 0.0823 0.0610
0.0403 0.0200 0.0000

26
0.4407 0.3043 0.2533 0.2151 0.1836 0.1563 0.1316 0.1089 0.0876 0.0672
0.0476 0.0284 0.0094

27
0.4366 0.3018 0.2522 0.2152 0.1848 0.1584 0.1346 0.1128 0.0923 0.0728
0.0540 0.0358 0.0178 0.0000

28
0.4328 0.2992 0.2510 0.2151 0.1857 0.1601 0.1372 0.1162 0.0965 0.0778
0.0598 0.0424 0.0253 0.0084

29
0.4291 0.2968 0.2499 0.2150 0.1864 0.1616 0.1395 0.1192 0.1002 0.0822
0.0650 0.0483 0.0320 0.0159 0.0000

30
0.4254 0.2944 0.2487 0.2148 0.1870 0.1630 0.1415 0.1219 0.1036 0.0862
0.0697 0.0537 0.0381 0.0227 0.0076

31
0.4220 0.2921 0.2475 0.2145 0.1874 0.1641 0.1433 0.1243 0.1066 0.0899
0.0739 0.0585 0.0435 0.0289 0.0144 0.0000

32
0.4188 0.2898 0.2463 0.2141 0.1878 0.1651 0.1449 0.1265 0.1093 0.0931
0.0777 0.0629 0.0485 0.0344 0.0206 0.0068

33
0.4156 0.2876 0.2451 0.2137 0.1880 0.1660 0.1463 0.1284 0.1118 0.0961
0.0812 0.0669 0.0530 0.0395 0.0262 0.0131 0.0000

34
0.4127 0.2854 0.2439 0.2132 0.1882 0.1667 0.1475 0.1301 0.1140 0.0988
0.0844 0.0706 0.0572 0.0441 0.0314 0.0187 0.0062

35
0.4096 0.2834 0.2427 0.2127 0.1883 0.1673 0.1487 0.1317 0.1160 0.1013
0.0873 0.0739 0.0610 0.0484 0.0361 0.0239 0.0119 0.0000

36
0.4068 0.2813 0.2415 0.2121 0.1883 0.1678 0.1496 0.1331 0.1179 0.1036
0.0900 0.0770 0.0645 0.0523 0.0404 0.0287 0.0172 0.0057

37
0.4040 0.2794 0.2403 0.2116 0.1883 0.1683 0.1505 0.1344 0.1196 0.1056
0.0924 0.0798 0.0677 0.0559 0.0444 0.0331 0.0220 0.0110 0.0000

38
0.4015 0.2774 0.2391 0.2110 0.1881 0.1686 0.1513 0.1356 0.1211 0.1075
0.0947 0.0824 0.0706 0.0592 0.0481 0.0372 0.0264 0.0158 0.0053

39
0.3989 0.2755 0.2380 0.2104 0.1880 0.1689 0.1520 0.1366 0.1225 0.1092
0.0967 0.0848 0.0733 0.0622 0.0515 0.0409 0.0305 0.0203 0.0101 0.0000

40
0.3964 0.2737 0.2368 0.2098 0.1878 0.1691 0.1526 0.1376 0.1237 0.1108
0.0986 0.0870 0.0759 0.0651 0.0546 0.0444 0.0343 0.0244 0.0146 0.0049

41
0.3940 0.2719 0.2357 0.2091 0.1876 0.1693 0.1531 0.1384 0.1249 0.1123
0.1004 0.0891 0.0782 0.0677 0.0575 0.0476 0.0379 0.0283 0.0188 0.0094
0.0000

42
0.3917 0.2701 0.2345 0.2085 0.1874 0.1694 0.1535 0.1392 0.1259 0.1136
0.1020 0.0909 0.0804 0.0701 0.0602 0.0506 0.0411 0.0318 0.0227 0.0136
0.0045

43
0.3894 0.2684 0.2334 0.2078 0.1871 0.1695 0.1539 0.1398 0.1269 0.1149
0.1035 0.0927 0.0824 0.0724 0.0628 0.0534 0.0442 0.0352 0.0263 0.0175
0.0087 0.0000

44
0.3872 0.2667 0.2323 0.2072 0.1868 0.1695 0.1542 0.1405 0.1278 0.1160
0.1049 0.0943 0.0842 0.0745 0.0651 0.0560 0.0471 0.0383 0.0296 0.0211
0.0126 0.0042

45
0.3850 0.2651 0.2313 0.2065 0.1865 0.1695 0.1545 0.1410 0.1286 0.1170
0.1062 0.0959 0.0860 0.0765 0.0673 0.0584 0.0497 0.0412 0.0328 0.0245
0.0163 0.0081 0.0000

46
0.3830 0.2635 0.2302 0.2058 0.1862 0.1695 0.1548 0.1415 0.1293 0.1180
0.1073 0.0972 0.0876 0.0783 0.0694 0.0607 0.0522 0.0439 0.0357 0.0277
0.0197 0.0118 0.0039

47
0.3808 0.2620 0.2291 0.2052 0.1859 0.1695 0.1550 0.1420 0.1300 0.1189
0.1085 0.0986 0.0892 0.0801 0.0713 0.0628 0.0546 0.0465 0.0385 0.0307
0.0229 0.0153 0.0076 0.0000

48
0.3789 0.2604 0.2281 0.2045 0.1855 0.1693 0.1551 0.1423 0.1306 0.1197
0.1095 0.0998 0.0906 0.0817 0.0731 0.0648 0.0568 0.0489 0.0411 0.0335
0.0259 0.0185 0.0111 0.0037

49
0.3770 0.2589 0.2271 0.2038 0.1851 0.1692 0.1553 0.1427 0.1312 0.1205
0.1105 0.1010 0.0919 0.0832 0.0748 0.0667 0.0588 0.0511 0.0436 0.0361
0.0288 0.0215 0.0143 0.0071 0.0000

50
0.3751 0.2574 0.2260 0.2032 0.1847 0.1691 0.1554 0.1430 0.1317 0.1212
0.1113 0.1020 0.0932 0.0846 0.0764 0.0685 0.0608 0.0532 0.0459 0.0386
0.0314 0.0244 0.0174 0.0104 0.0035

After Shapiro and Wilk (1965).

Table 2. Percentage points of the W test (common block sw_table_com).

n	1%	2%	5%	10%	50%	90%	95%	98%	99%
3	0.753	0.756	0.767	0.789	0.959	0.998	0.999	1.000	1.000
4	0.687	0.707	0.748	0.792	0.935	0.987	0.992	0.996	0.997
5	0.686	0.715	0.762	0.806	0.927	0.979	0.986	0.991	0.993
6	0.713	0.743	0.788	0.826	0.927	0.974	0.981	0.986	0.989
7	0.730	0.760	0.803	0.838	0.928	0.972	0.979	0.985	0.988
8	0.749	0.778	0.818	0.851	0.932	0.972	0.978	0.984	0.987
9	0.764	0.791	0.829	0.859	0.935	0.972	0.978	0.984	0.986
10	0.781	0.806	0.842	0.869	0.938	0.972	0.978	0.983	0.986
11	0.792	0.817	0.850	0.876	0.940	0.973	0.979	0.984	0.986
12	0.805	0.828	0.859	0.883	0.943	0.973	0.979	0.984	0.986
13	0.814	0.837	0.866	0.889	0.945	0.974	0.979	0.984	0.986
14	0.825	0.846	0.874	0.895	0.947	0.975	0.980	0.984	0.986
15	0.835	0.855	0.881	0.901	0.950	0.975	0.980	0.984	0.987
16	0.844	0.863	0.887	0.906	0.952	0.976	0.981	0.985	0.987
17	0.851	0.869	0.892	0.910	0.954	0.977	0.981	0.985	0.987
18	0.858	0.874	0.897	0.914	0.956	0.978	0.982	0.986	0.988
19	0.863	0.879	0.901	0.917	0.957	0.978	0.982	0.986	0.988
20	0.868	0.884	0.905	0.920	0.959	0.979	0.983	0.986	0.988
21	0.873	0.888	0.908	0.923	0.960	0.980	0.983	0.987	0.989
22	0.878	0.892	0.911	0.926	0.961	0.980	0.984	0.987	0.989
23	0.881	0.895	0.914	0.928	0.962	0.981	0.984	0.987	0.989
24	0.884	0.898	0.916	0.930	0.963	0.981	0.984	0.987	0.989
25	0.888	0.901	0.918	0.931	0.964	0.981	0.985	0.988	0.989
26	0.891	0.904	0.920	0.933	0.965	0.982	0.985	0.988	0.989
27	0.894	0.906	0.923	0.935	0.965	0.982	0.985	0.988	0.990
28	0.896	0.908	0.924	0.936	0.966	0.982	0.985	0.988	0.990
29	0.898	0.910	0.926	0.937	0.966	0.982	0.985	0.988	0.990
30	0.900	0.912	0.927	0.939	0.967	0.983	0.985	0.988	0.990
31	0.902	0.914	0.929	0.940	0.067	0.983	0.986	0.988	0.990
32	0.904	0.915	0.930	0.941	0.968	0.983	0.986	0.988	0.990
33	0.906	0.917	0.931	0.942	0.968	0.983	0.986	0.989	0.990
34	0.908	0.919	0.933	0.943	0.969	0.983	0.986	0.989	0.990
35	0.910	0.920	0.934	0.944	0.969	0.984	0.986	0.989	0.990
36	0.912	0.922	0.935	0.945	0.970	0.084	0.986	0.989	0.990
37	0.914	0.924	0.936	0.946	0.970	0.984	0.987	0.989	0.990
38	0.916	0.925	0.938	0.947	0.971	0.984	0.987	0.989	0.990
39	0.917	0.927	0.939	0.948	0.971	0.984	0.987	0.989	0.991
40	0.919	0.928	0.940	0.949	0.972	0.985	0.987	0.989	0.991
41	0.920	0.929	0.941	0.950	0.972	0.985	0.987	0.989	0.991
42	0.922	0.930	0.942	0.951	0.972	0.985	0.987	0.989	0.991
43	0.923	0.932	0.943	0.951	0.973	0.985	0.987	0.990	0.991
44	0.924	0.933	0.944	0.952	0.973	0.985	0.987	0.990	0.991
45	0.926	0.934	0.945	0.953	0.973	0.985	0.988	0.990	0.991
46	0.927	0.935	0.945	0.953	0.974	0.985	0.988	0.990	0.991
47	0.928	0.936	0.946	0.954	0.974	0.985	0.988	0.990	0.991
48	0.929	0.937	0.947	0.954	0.974	0.985	0.988	0.990	0.991
49	0.929	0.937	0.947	0.955	0.947	0.985	0.988	0.990	0.991
50	0.930	0.938	0.947	0.955	0.974	0.985	0.988	0.990	0.991

After Shapiro and Wilk (1965).

References

Shapiro, S. S., and Wilk, M. B., 1965, An analysis of variance test for normality (complete samples): Biometrika, 52, p. 591-611.

Shapiro, S. S., Wilk, M. B., and Chen, H. J., 1968, A comparative study of various tests for normality: American Statistical Assn. Journal, 63, p. 1343-1372.