Friedman Two Way ANOVA

Imagine an experiment using, say, ten groups of subjects with four subjects in each group that have been matched on some relevant variables (or even using the same subjects). The matched subjects in each group are exposed to four different treatments such as teaching methods, dosages of medicine, proportion of positive responses to statements or questions, etc. Assume that some criterion measure on at least a nominal scale is available to measure the effect of each treatment. Now rank the subjects in each group on the basis of their scores on the criterion. We may now ask whether the ranks in each treatment come from the same population. Had we been able to assume an interval or ratio measure and normally distributed errors, we might have used a repeated measures analysis of variance. Failing to meet the parametric test assumptions, we instead examine the sum of ranks obtained under each of the treatment conditions and ask whether they differ significantly. The test statistic is distributed as Chi-squared with degrees of freedom equal to the number of treatments minus one. It is obtained as where N is the number of groups, K the number of treatments (or number of subjects in each group), and Rj is the sum of ranks in each treatment.

Friedman4.LAZ will be used to demonstrate this procedure. Shown below is the dialog form to specify the analysis and the results of the analysis.

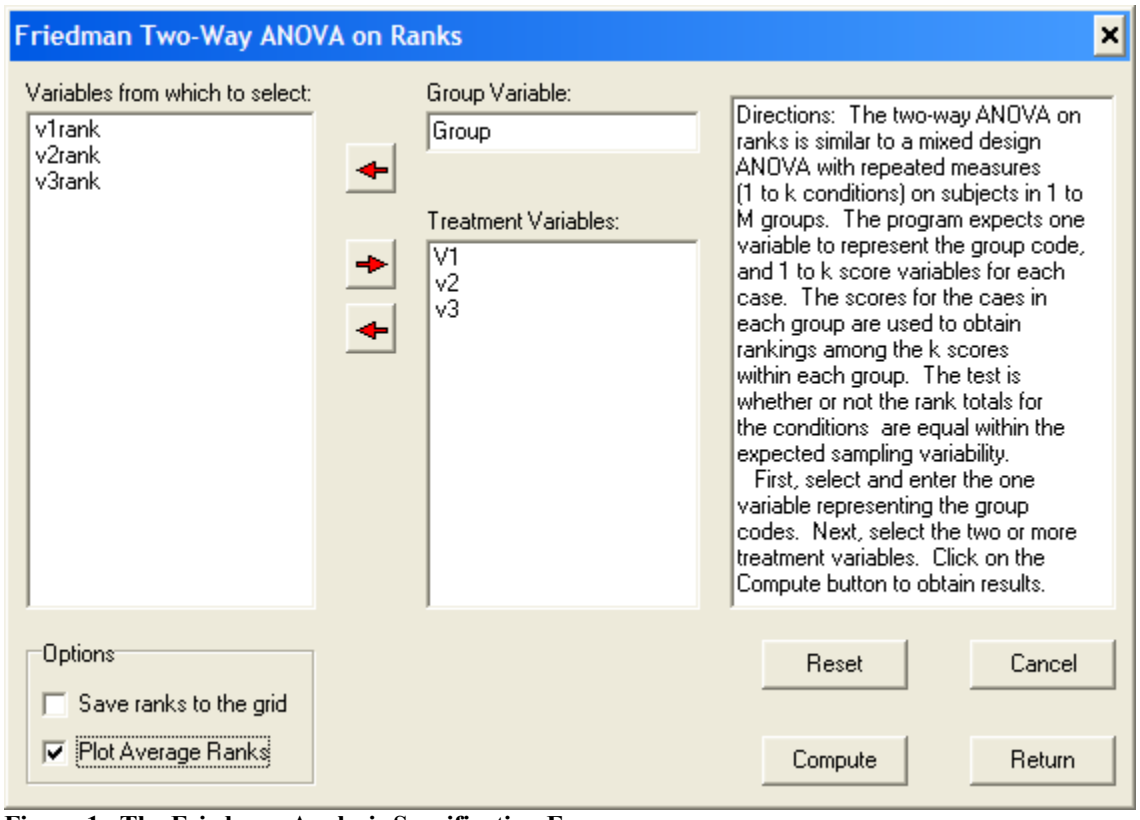

Figure 1. The Friedman Analysis Specification Form

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FRIEDMAN TWO-WAY ANOVA ON RANKS
See pages 166-173 in S. Siegels Nonparametric Statistics
for the Behavioral Sciences, McGraw-Hill Book Co., New York, 1956


Treatment means - values to be ranked.

                    V1          v2          v3
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Group 1	3.000	3.000	3.000
Group 2	3.000	3.000	0.000
Group 3	3.000	1.000	1.000
Group 4	2.000	2.000	1.000
Group 5	0.000	0.000	0.000
Group 6	2.000	2.000	1.000
Group 7	1.000	0.000	1.000
Group 8	2.000	1.000	1.000
Group 9	0.000	1.000	0.000
Group 10	0.000	1.000	1.000
Group 11	3.000	3.000	1.000
Group 12	3.000	3.000	3.000
Group 13	3.000	3.000	1.000
Group 14	3.000	2.000	1.000
Group 15	2.000	2.000	1.000
Group 16	2.000	3.000	0.000
Group 17	2.000	1.000	1.000
Group 18	1.000	2.000	2.000
Group 19	1.000	1.000	0.000
Group 20	3.000	2.000	2.000
Group 21	2.000	1.000	2.000
Group 22	3.000	3.000	2.000
Group 23	2.000	2.000	1.000
Group 24	3.000	2.000	1.000
Group 25	3.000	0.000	1.000
Group 26	3.000	2.000	2.000
Group 27	3.000	3.000	2.000
Group 28	2.000	2.000	2.000
Group 29	2.000	1.000	2.000
Group 30	3.000	3.000	1.000
Group 31	2.000	2.000	1.000
Group 32	2.000	2.000	0.000
Group 33	2.000	3.000	3.000
Group 34	3.000	3.000	3.000
Group 35	3.000	3.000	3.000
Group 36	2.000	2.000	2.000
Group 37	2.000	3.000	2.000
Group 38	2.000	3.000	1.000
Group 39	3.000	3.000	2.000
Group 40	3.000	2.000	1.000
Group 41	3.000	2.000	2.000
Group 42	2.000	2.000	1.000
Group 43	1.000	2.000	2.000
Group 44	2.000	1.000	1.000
Group 45	1.000	3.000	2.000
Group 46	1.000	2.000	2.000
Group 47	3.000	3.000	3.000
Group 48	3.000	3.000	2.000
Group 49	2.000	3.000	0.000

Number in each group's treatment.

	GROUP		
	V1	v2	v3
Group 1	1	1	1
Group 2	1	1	1

Group 3	1	1	1
Group 4	1	1	1
Group 5	1	1	1
Group 6	1	1	1
Group 7	1	1	1
Group 8	1	1	1
Group 9	1	1	1
Group 10	1	1	1
Group 11	1	1	1
Group 12	1	1	1
Group 13	1	1	1
Group 14	1	1	1
Group 15	1	1	1
Group 16	1	1	1
Group 17	1	1	1
Group 18	1	1	1
Group 19	1	1	1
Group 20	1	1	1
Group 21	1	1	1
Group 22	1	1	1
Group 23	1	1	1
Group 24	1	1	1
Group 25	1	1	1
Group 26	1	1	1
Group 27	1	1	1
Group 28	1	1	1
Group 29	1	1	1
Group 30	1	1	1
Group 31	1	1	1
Group 32	1	1	1
Group 33	1	1	1
Group 34	1	1	1
Group 35	1	1	1
Group 36	1	1	1
Group 37	1	1	1
Group 38	1	1	1
Group 39	1	1	1
Group 40	1	1	1
Group 41	1	1	1
Group 42	1	1	1
Group 43	1	1	1
Group 44	1	1	1
Group 45	1	1	1
Group 46	1	1	1
Group 47	1	1	1
Group 48	1	1	1
Group 49	1	1	1

Score Rankings Within Groups

	Treatment		
	V1	v2	v3
Group 1	2.000	2.000	2.000
Group 2	2.500	2.500	1.000
Group 3	3.000	1.500	1.500
Group 4	2.500	2.500	1.000

Group 5	2.000	2.000	2.000
Group 6	2.500	2.500	1.000
Group 7	2.500	1.000	2.500
Group 8	3.000	1.500	1.500
Group 9	1.500	3.000	1.500
Group 10	1.000	2.500	2.500
Group 11	2.500	2.500	1.000
Group 12	2.000	2.000	2.000
Group 13	2.500	2.500	1.000
Group 14	3.000	2.000	1.000
Group 15	2.500	2.500	1.000
Group 16	2.000	3.000	1.000
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Group 43	1.000	2.500	2.500
Group 44	3.000	1.500	1.500
Group 45	1.000	3.000	2.000
Group 46	1.000	2.500	2.500
Group 47	2.000	2.000	2.000
Group 48	2.500	2.500	1.000
Group 49	2.000	3.000	1.000

TOTAL RANKS

Variables	V1	v2	v3
	111.500	107.000	75.500

MEAN RANKS

Variables	V1	v2	v3
	2.276	2.184	1.541

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Chi-square with 2 D.F. =   15.704 with probability = 0.0004
Corrected for ties Chi-square with 2 D.F. =   23.496 with probability =
0.0000
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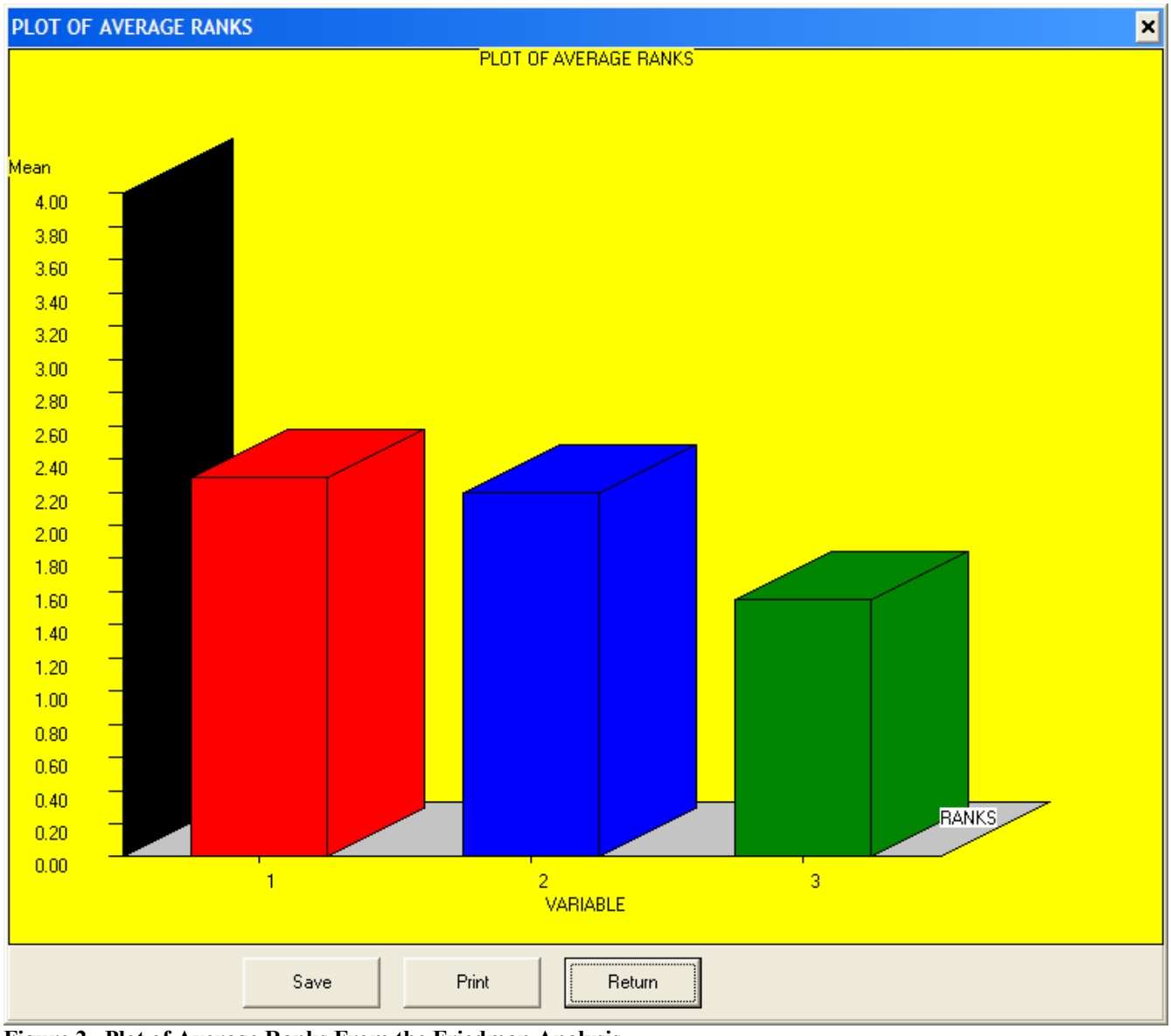

Figure 2. Plot of Average Ranks From the Friedman Analysis