Subject

In this tutorial, we show how to use the FRIEDMAN'S ANOVA BY RANKS component. We use this test when we want to check the null hypothesis that K related (matched) samples come from the same population. That matching can be achieved by studying the same group of individuals under each of the K conditions (repeated measure with various conditions).

Dataset

We use the Howell's book dataset HOWELL_P_742_K_RELATED_SAMPLES.XLS [1]. It contains 17 lecturers to which a jury gives a grade in 3 circumstances: an oral presentation without slides; an oral presentation with some slides; an oral presentation with many slides.

None	Some	Many
50	58	54
32	37	25
60	70	63
58	60	55
41	66	59
36	40	28
26	25	20
49	60	50
72	73	75
49	54	42
52	57	47
36	42	29
37	34	31
58	50	56
39	48	44
25	29	18
51	63	68

Table 1 -- Note of lecturers according to the number of slides used

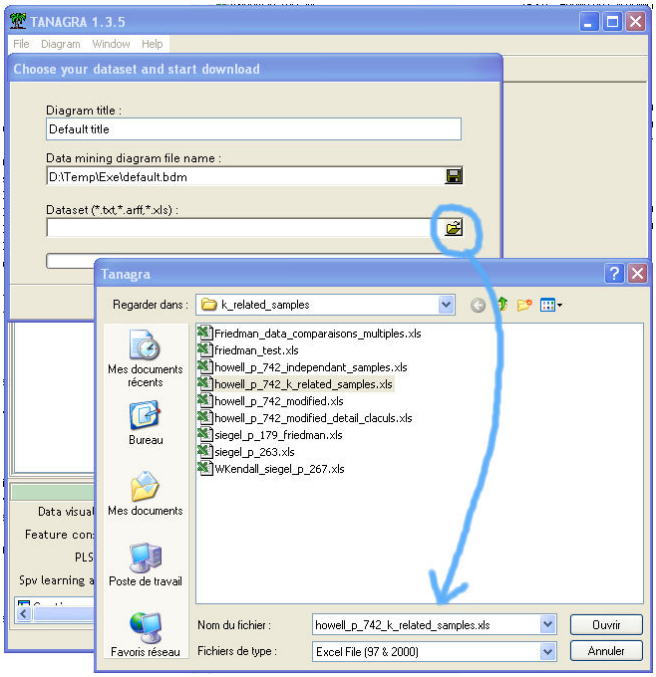
We want to check, at the significance level of 1%, the influence of the number of slides on the quality of the presentation. We have 3 related samples; we must to take into account this information in order to eliminate the disparities due to the lecturer particularities.

[1] D. Howell, « Statistical Methods for Psychology », Duxbury, 1997, p. 742; French edition.

Friedman ANOVA

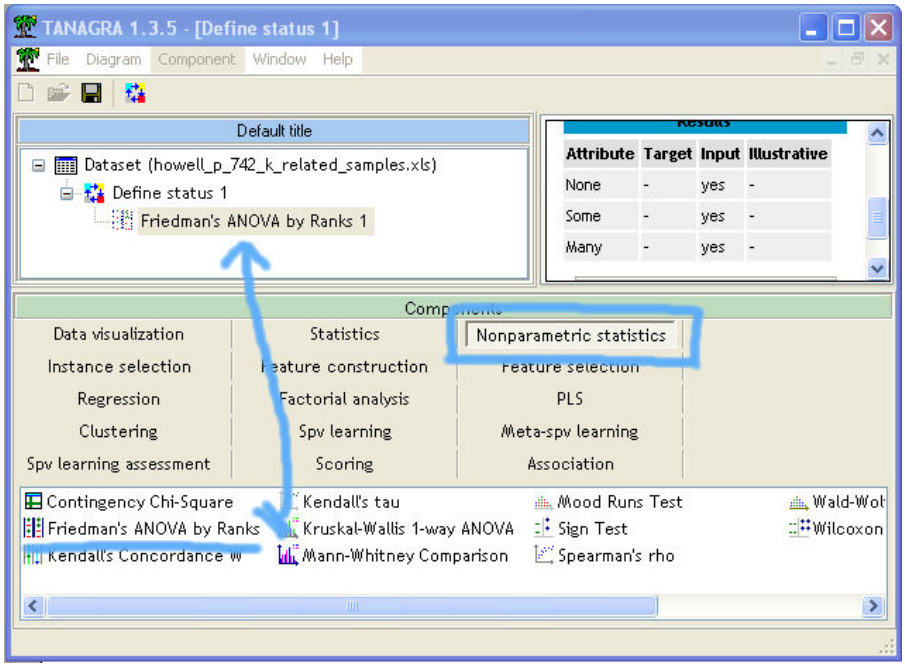
Import the dataset

First of all, we build a new diagram and import the dataset (FILE / NEW). We select our dataset HOWELL_P_742_K_RELATED_SAMPLES.XLS.



Friedman's Test

We insert a DEFINE STATUS in the diagram; we set the 3 variables as INPUT. Next, we add the FRIEDMAN'S ANOVA BY RANKS component.



The results show that the number of slides used influences the performances of lecturers.

Friedman's ANOVA by Ranks 1

Parameters

Results

Results

RANKS			Friedman Statistic	
Att.	Sum(Ranks)	Mean(Ranks)	Stat.	Value
None	30.0	1.7647	Frideman Fr	10.94118
Some	45.0	2.6471	d.f.	2
Many	27.0	1.5882	p-value	0.00421

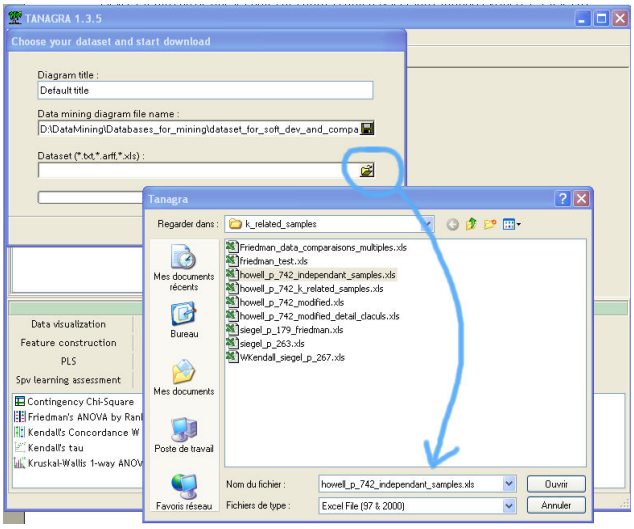
A rapid glance on the results shows that using moderately slides (SOME) enables obtaining a good performance. The Friedman's ANOVA take into account our "related samples" context. It is very important because, if we omit this information, some particular lecturers' can alter the statistical test. For instance, the lecturer n°16 improves significantly his performance when he uses some slides, but its best performance is worse than the majority of the others, whatever the context.

In the following, we repeat our test without taking into account the "matched samples" information: we consider that we have 3 independent samples.

One way ANOVA on independent samples

Dataset

We close the previous diagram with the FILE / CLOSE menu. We build a new diagram with the FILE / NEW option, and handle the HOWELL_P_742_INDEPENDANT_SAMPLES.XLS dataset.



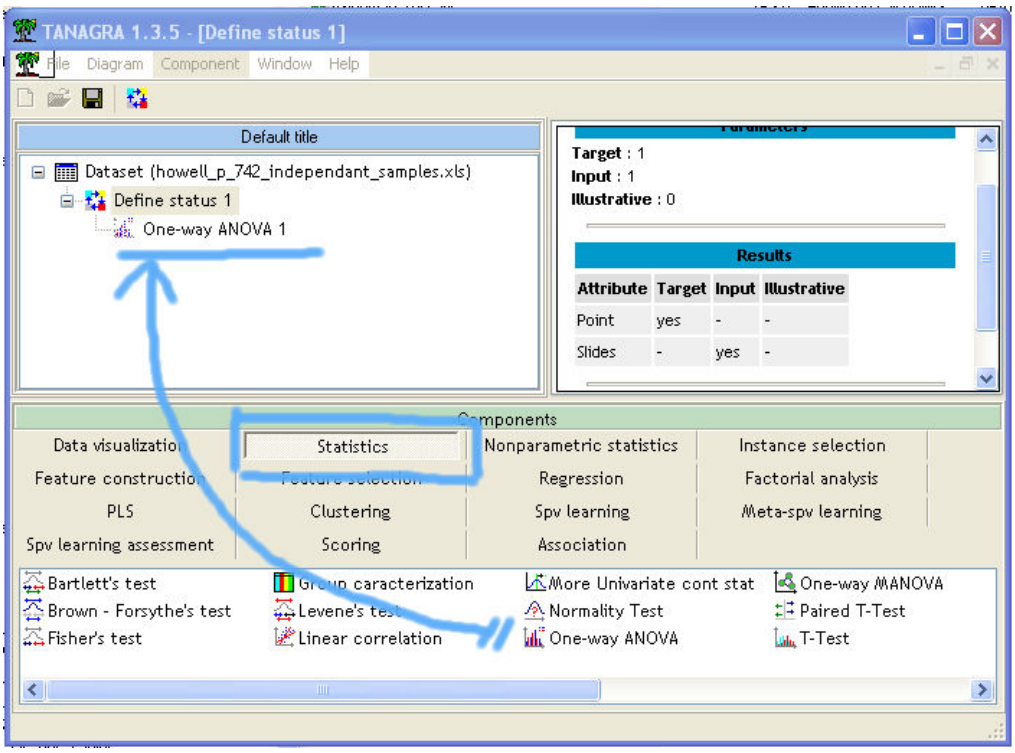
In the context of independent samples, the organization of the dataset must be different. We have 51 examples; we add a new attribute that point out the number of slides used by the lecturer.

Point	Slides
50	None
32	None
60	None
58	None
37	None
58	None
39	None
25	None
51	None
58	Some
37	Some
...	...
...	...

Table 2 – Dataset file format for independent samples

One-way ANOVA

We insert a DEFINE STATUS component in the diagram; we set POINTS as TARGET and SLIDES as INPUT. Then, we insert the ONE WAY ANOVA component.



We see that we obtain a different conclusion: it seems that the null hypothesis, the number of slides does not influence the performance of the lecturers, is compatible with our dataset.

We obtain this erroneous conclusion because we did not use information indicating that the performances were measured 3 times on the same subjects.

One-way ANOVA 1

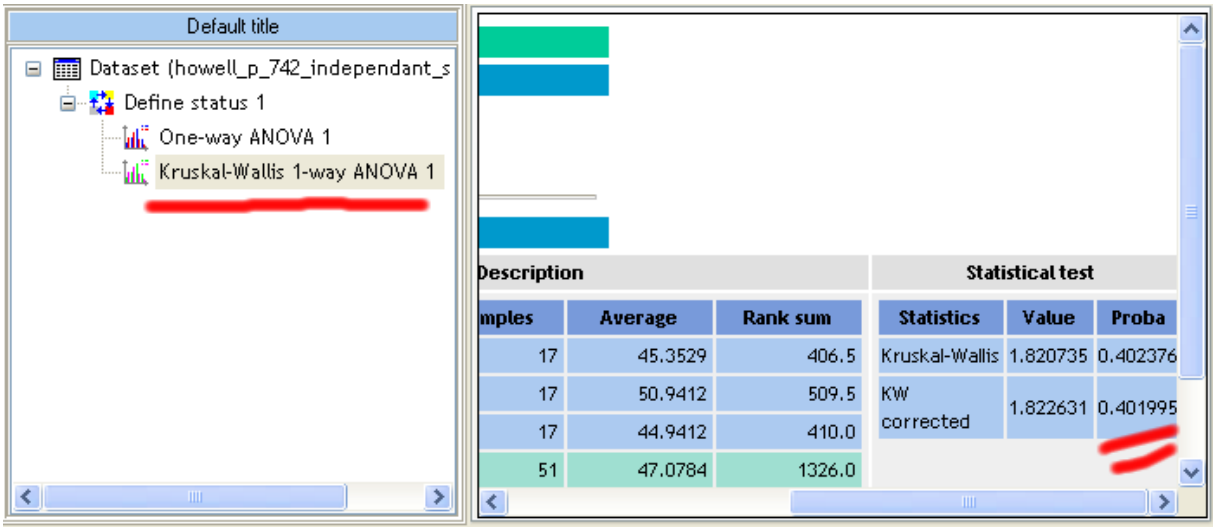
Parameters

Parameters	
Sort results	no

Results

Attribute_Y	Attribute_X	Description				Statistical test		
		Value	Examples	Average	Std-dev	Variance decomposition		
						Source	Sum of square	d.f.
		None	17	45.3529	12.8449	BSS	381.9216	2
		Some	17	50.9412	14.4199	WSS	10751.7647	48
Point	Slides	Many	17	44.9412	17.2933	TSS	11133.6863	50
		All	51	47.0784	14.9223	Significance level		
						Statistics	Value	Proba
						Fisher's F	0.852522	0.432692

The Kruskal-Wallis nonparametric test gives the same erroneous conclusion.



Description			Statistical test		
mples	Average	Rank sum	Statistics	Value	Proba
17	45.3529	406.5	Kruskal-Wallis	1.820735	0.402376
17	50.9412	509.5	KW corrected	1.822631	0.401995
17	44.9412	410.0			
51	47.0784	1326.0			