ICCPP-STATISTICS

- Friedman test

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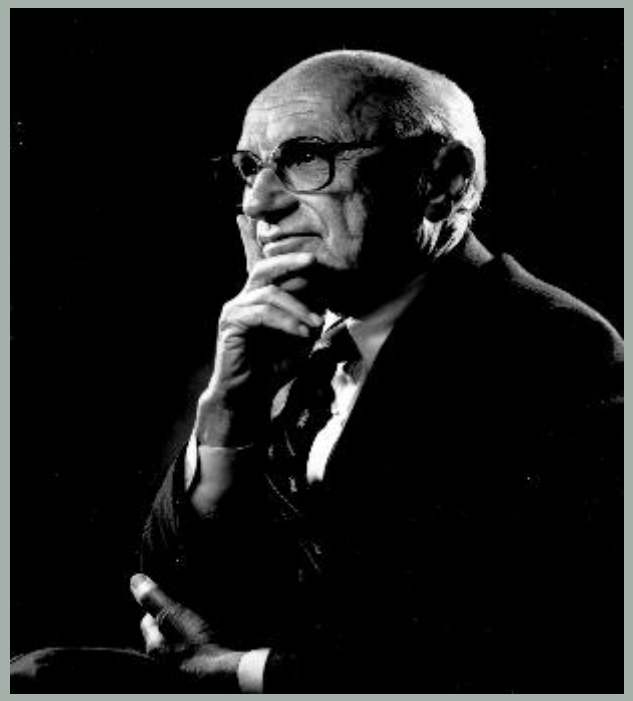

Milton Friedman (1912-2006)

Friedman test

Definition

- Friedman's test is a non-parametric test for finding differences in treatments across multiple attempts.

Formula

$$FM = \left[\frac{12}{(N * k * (k + 1)} \right] * \Sigma R^{2} - [3 * N * (k + 1)]$$

k = numbers of columns

n = number of rows

R = sum of the ranks.

Uses

- The Friedman test is the non-parametric alternative to the one-way ANOVA with repeated measures.

  It is used to test for differences between groups when the dependent variable being measured is ordinal.

Uses

- Nonparametric means the test doesn't assume your data comes from a particular distribution (like the normal distribution). Basically, it's used in place of the ANOVA test when you don't know the distribution of your data.

Running the test

Your data should meet the following requirements:

- Data should be ordinal or continuous,
- Data comes from a single group, measured on at least three different occasions,

Running the test

- The sample was created with a random sampling method,
- Blocks are mutually independent (i.e. all of the pairs are independent — one doesn't affect the other),

Running the test

- Observations are ranked within blocks with no ties.
- The null hypothesis for the test is that the treatments all have identical effects, or that the samples differ in some way.

  For example, they have different centers, spreads, or shapes. The alternate hypothesis is that the treatments do have different effects.

1. Prepare your data for the test

Step 1 Sort your data into blocks (columns in a spreadsheet).for this example, we have 12 patients getting three different treatments.

Patient	Treatment 1	Treatment 2	Treatment 3
1	209	88	109
2	412	388	142
3	315	451	155
4	389	325	121
5	210	126	75
6	136	118	49
7	178	227	101
8	228	98	49
9	240	205	142
12	113	88	45
11	178	194	55
12	321	349	121

1. Prepare your data for the test

Step 2 Rank each column separately. The smallest score should get a rank of 1. I am ranking across rows here so each patient is being ranked a 1, 2, or 3 for each treatment.

	Rank		
Patient	Treatment 1	Treatment 2	Treatment 3
1	3	1	2
2	3	2	1
3	2	3	1
4	3	2	1
5	3	2	1
6	3	2	1
7	2	3	1
8	3	2	1
9	3	2	1
10	3	2	1
11	2	3	1
12	2	3	1

1. Prepare your data for the test

Step 3 Sum the ranks (find a total for each column)

	Rank		
Patient	Treatment 1	Treatment 2	Treatment 3
1	3	1	2
2	3	2	1
3	2	3	1
4	3	2	1
5	3	2	1
6	3	2	1
7	2	3	1
8	3	2	1
9	3	2	1
10	3	2	1
11	2	3	1
12	2	3	1
Totals	32	27	13

2. Run the Test

This test isn't usually run by hand, as the calculations are time consuming and labor-intensive.

Nearly all popular statistical software packages can run this test. However, I'm including the manual steps here for reference.

2. Run the Test

Step 4 Calculate the test statistic. You'll need:

n: number of subjects (12)

k: number of treatments (3)

R: The total ranks for each of the three columns (32, 27, 13).

2. Run the Test

Insert these into the following formula and solve:

$$FM = \left[\frac{12}{(N * k * (k + 1)} \right] * \Sigma R^{2} - [3 * N * (k + 1)]$$

$$FM = \left[\frac{12}{[12 * 3 * (3 + 1)]} \right] * 32^{2} + 27^{2} + 13^{2} - [3 * 12 * (3 + 1)]$$

2. Run the Test

Insert these into the following formula and solve:

$$FM = [\ 12/144\ ] * [\ 1024 + 729 + 169\ ] - 144$$

$$FM = [\ .083 * 1922\ ] - 144$$

$$FM = 15.526$$

2. Run the Test

Step 5 Find the FM critical value from the table of critical values for Friedman (see table below).

Use the k=3 table (as that is how many treatments we have) and an alpha level of 5%.

You could choose a higher or lower alpha level, but 5% if fairly common — so use the 5% table if you don't know your alpha level.

Friedman's ANOVA by Ranks Critical Value Table

Three tables according by "k".

If your k is over 5, or your n is over 13, use the chi square critical value table in Step 5 to get the critical value.

Friedman's ANOVA by Ranks Critical Value Table

K = 3

N	α <.10	α ≤.05	α <.01
3	6.00	6.00	—
4	6.00	6.50	8.00
5	5.20	6.40	8.40
6	5.33	7.00	9.00
7	5.43	7.14	8.86
8	5.25	6.25	9.00
9	5.56	6.22	8.67
10	5.00	6.20	9.60
11	4.91	6.54	8.91
12	5.17	6.17	8.67
13	4.77	6.00	9.39
∞	4.61	5.99	9.21

Friedman's ANOVA by Ranks Critical Value Table

K = 4

N	α <.10	α ≤.05	α <.01
2	6.00	6.00	–
3	6.60	7.40	8.60
4	6.30	7.80	9.60
5	6.36	7.80	9.96
6	6.40	7.60	10.00
7	6.26	7.80	10.37
8	6.30	7.50	10.35
∞	6.25	7.82	11.34

Friedman's ANOVA by Ranks Critical Value Table

K = 4

N	α <.10	α ≤.05	α <.01
3	7.47	8.53	10.13
4	7.60	8.80	11.00
5	7.68	8.96	11.52
∞	7.78	9.49	13.28

References

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