



Universiteit
Leiden
The Netherlands

Comments on "A generalization of Fisher's exact test in PxQ contingency tables using more concordant relations"

Kroonenberg, P.M.; Verbeek, A.

Citation

Kroonenberg, P. M., & Verbeek, A. (1987). Comments on "A generalization of Fisher's exact test in PxQ contingency tables using more concordant relations". *Communications In Statistics - Simulation And Computation*, 16, 301-306. Retrieved from <https://hdl.handle.net/1887/11642>

Version: Not Applicable (or Unknown)
License: [Leiden University Non-exclusive license](#)
Downloaded from: <https://hdl.handle.net/1887/11642>

Note: To cite this publication please use the final published version (if applicable).

COMMENTS ON "A GENERALIZATION OF FISHER'S EXACT TEST IN
PXQ CONTINGENCY TABLES USING MORE CONCORDANT RELATIONS"
Communications In Statistics, Volume B 14, 633-645.

The purpose of this note is to criticize Nguyen (1985) for his account of the literature on the generalization of Fisher's exact test and to point out parallels with existing algorithms of the algorithm proposed by Nguyen. Subsequently we will briefly raise some questions on the methodology proposed by Nguyen.

Nguyen (1985) suggests that all literature on exact testing prior to Nguyen & Sampson (1985) is based on the "more probable" relation or Exact Probability Test (EPT) as a test statistic. This is not correct. Yates (1934 - Pearson's X^2), Lewontin & Felsenstein (1965 - X^2), Agresti & Wackerly (1977 - X^2 , Kendall's tau, Kruskal & Goodman's gamma), Klotz (1966 - Wilcoxon), Klotz & Teng (1977 - Kruskal & Wallis' H), Larntz (1978 - X^2 , loglikelihood-ratio statistic G^2 , Freeman & Tukey statistic), and several others have investigated exact tests with other statistics than the EPT. In fact, Bennett & Nakamura (1963) are incorrectly cited as they investigated both X^2 and G^2 , rather than EPT. Also, Freeman & Halton (1951) are incorrectly cited for they generalized Fisher's exact test to pxq tables and not $2xq$ tables as stated. And they are even predated by Yates (1934) who extended the test to $2x3$ tables.

As is evident from Verbeek & Kroonenberg's (1985) survey of algorithms for just this problem, Nguyen's algorithm is basically similar to that of Agresti & Wackerly (1977) and Verbeek, Kroonenberg, & Kroonenberg (1983). A survey of the methodological literature on exact testing in contingency tables with fixed margins can be found in Verbeek & Kroonenberg (1979).

As an aside we should mention that the usefulness of the newly proposed statistic by Nguyen is not readily apparent. It is difficult to compute, and difficult to interpret. Moreover, no comparisons are made with the many existing statistics and models for ordinal associations (cf. Agresti, 1983, 1984), and no examples or circumstances are given where the new statistic would be applicable or superior. Furthermore, the generalizability of the simulation results with respect to the power are unclear, and, again comparisons with the power of existing methods are lacking.

Pieter M. Kroonenberg
University of Leiden
Leiden, the Netherlands

Albert Verbeek
University of Utrecht
Utrecht, the Netherlands

BIBLIOGRAPHY

- Agresti, A. (1983). A survey of strategies for modeling cross-classifications having ordinal variables. *J. Amer. Statist. Ass.*, 78, 184-194.
- Agresti, A. (1984). *Analysis of ordinal categorical data*. New York: Wiley.
- Agresti, A. and Wackerly, D. (1977). Some exact conditional tests of independence for $R \times C$ cross-classifications. *Psychometrika*, 42, 111-125.

- Bennett, B.M. and Nakamura, E. (1963). Tables for testing significance in a 2x3 contingency table. *Technometrics*, 5, 501-511.
- Freeman, G.H. and Halton, J.H. (1951). Note on an exact treatment of contingency, goodness of fit, and other problems of significance. *Biometrika*, 38, 141-149.
- Klotz, J.H. (1966). The Wilcoxon, ties, and the computer. *J. Amer. Statist. Ass.*, 61, 772-787; *Corr.* (1967), 62, 1520-1521.
- Klotz, J.H. and Teng, J. (1977). One-way lay-out for counts and the exact enumeration of the Kruskal-Wallis H distribution with ties. *J. Amer. Statist. Ass.*, 72, 165-169.
- Larntz, K. (1978). Small-sample comparisons of exact levels for chi-squared goodness-of-fit statistics. *J. Amer. Statist. Ass.*, 72, 253-263.
- Lewontin, R.C. and Felsenstein, J. (1965). The robustness of homogeneity tests in 2 x N tables. *Biometrics*, 21, 19-23.
- Nguyen, T.T. (1985). A generalization of Fisher's exact test in pxq contingency tables using more concordant relations. *Commun. Statist. Simul. Comp.*, 14, 633-645.
- Nguyen, T.T. and Sampson, A.R. (1985). Counting the number of pxq integer matrices more concordant than a given matrix. *Discrete Appl. Math.*, 11, 187-205.
- Verbeek, A. and Kroonenberg, P.M. (1979). Exact χ^2 -tests of independence in contingency tables with small numbers. Paper presented at the 12th European Meeting of Statisticalians, Varna, Bulgaria (Preprint Nr. 112, Department of Mathematics, University of Utrecht, The Netherlands.)
- Verbeek, A. and Kroonenberg, P.M. (1985). A survey of algorithms for exact distributions of test statistics in $R \times C$ contingency tables with fixed margins. *Comp. Statist. Data Anal.*, 3, 159-185.
- Verbeek, A., Kroonenberg, P.M., and Kroonenberg, S. (1983). User's manual to FISHER. A program to compute exact distributions and significance levels of statistics used for testing independence in $r \times c$ contingency tables with fixed marginal totals. Technical report, Sociological Institute, University of Utrecht, The Netherlands.
- Yates, F. (1934). Contingency tables involving small numbers and the χ^2 test. *J. R. Statist. Soc., Suppl.*, 1, 217-235.

RESPONSE from Author

First of all, I would like to thank Kroonenberg and Verbeek for showing some mistakes in referring I made in my paper "A Generalization of Fisher's Exact Test in $p \times q$ Contingency Tables using More Concordant Relations". Else, I do not think that I can agree with their opinion about this paper. Based on their Comment, it seems that their generating method is well enough for any kind of statistics we use for generalizing Fisher's exact test. In general, every generating method gives out the set of all non-negative integer matrices having the same row sum and column sum vectors as the observed matrix. The only difference among these methods is in the procedure to find the significance level of the observed matrix. A method of generation is appropriate for a test statistic if in this procedure we need to generate a least number of matrices. In this point, I do not think that it exists one method appropriate for all statistics. And this is the point Kroonenberg and Verbeek do not want to mention in their Comment. This is also a way to improve the effectiveness for the exact test. For good examples see Mehta and Patel (1980, 1983).

The main purpose of my paper is to generalize the Fisher's exact test under restricted alternative, the positive quadrant dependent set of distributions. This is an application of exact test to order restrictions (See Barlow, Bartholomew, Bremner and Brunk (1972). To see how complicated the likelihood ratio statistic in $2 \times c$ is, I refer to the paper of Grove (1980). In this paper, we also know how is this statistic in $r \times c$ case and a comparison of some test statistics using the Monte Carlo method. The simulation results of Grove give the similar conclusions as in my paper, i.e. no test statistic is superior in all cases of alternative. But the main point here is Kroonenberg and Verbeek do not want to mention about the purpose of their paper

(1983) about generalization the Fisher's exact test with no restriction in the alternative and mine in the restriction to to the PQD set.

Truc T. Nguyen
Bowling Green State University
Department of Mathematics and
Statistics
Bowling Green, Ohio 43403

BIBLIOGRAPHY

- Barlow, R. E., Bartholomew, D.J., Bremner, J.M and Brunk, H.D. (1972) Statistical Inference Under Order Restrictions. John Wiley and Sons Inc.
- Grove, D.M., (1980). A test of Independence against a Class of Ordered Alternative in 2xc Contingency Tables. Journal of the Amer. Statist. Assoc., Vol. 75, 454-459.
- Mehta, C.R. and Patel, N.B.. A network Algorithm for the Exact Treatment of the 2xk Contingency Tables. Communicat. in Statist. Ser. B9(6), 649-664.
- Mehta, C.R. and Patel, N.B. (1983). A Network Algorithm for Performing Fisher Esact Test in rxc Contingency Tables. Journal of the Amer.Statist. Assoc., Vol.78, 427-434.
- Verbeek, A., Kroonenberg, P.M., and Kroonenberg, S. (1983) User's manual to Fisher. A program to compute exaxt distributions and significance levels of Statistics used for testing independence in rxc Contingency tables with fixed marginal totals. Technical Report, Sociological Institute, University of Utrecht, The Netherlands.

RESPONSE from Kroonenberg and Verbeek

In Nguyen's reaction to our Comments he emphasizes that we do not acknowledge that different alternative hypotheses lead to different enumerations to achieve optimal efficiency. We concede that in theory his point of view is correct, but like to point out that in practice one would generally prefer a fast

algorithm and implementation that work efficiently for many alternative hypotheses, and can be easily adapted to accommodate other test statistics.

Pieter M. Kroonenberg
University of Leiden
Leiden, the Netherlands

Albert Verbeek
University of Utrecht
Utrecht, the Netherlands

*Received by Editor January, 1986; Final response and
retyping October, 1986.*

ALGORITHMS

Communications In Statistics, — Simulation and Computation, published algorithms as soon as a number have been received and reviewed. The Coeditors for the Algorithms Section are:

William J. Kennedy
Statistical Laboratory
Iowa State University
Ames, IA 50011

and

James E. Gentle
IMSL, Inc.
2500 CityWest Blvd.
Houston, TX 77042-3020

The Editorial Board for the Algorithms Section consists of the following people:

D. M. Allen, University of Kentucky, Lexington, KY 40506
Kenneth N. Berk, Illinois State University, Normal, IL 61761
Sally E. Howe, National Bureau of Standards, Washington, DC 20234
William M. Sallas, IMSL, Inc., Houston, TX 77042-3020
G. W. Stewart, University of Maryland, College Park, MD 20742

Each Contribution should be in the form of an algorithm certification, remark or survey. Preparation for publication will generally follow the specifications for preparation of manuscripts for Communications in Statistics as given at the end of the first issue of each year. Specific exceptions to the general form and format are given below. Each accepted submission will appear as a photographed reproduction of the manuscript as submitted by the author(s). Papers should be submitted to the coeditors of the algorithms section as given above.

Guidelines for Algorithms:

1. It is intended that each published algorithm will represent a new and significant contribution to Statistical Computing. Algorithms may, however, deal with nonstatistical problems, possibly nonnumerical, which arise in statistical computing work using a digital computer.
2. Submitted algorithms should be in ANSI FORTRAN (particularly the 1977 standard) unless the author gives sufficient justification for using another language or non-standard FORTRAN.
3. The author should submit to either one of the two Algorithms section editors the following:
 - (a) Three copies of the manuscript which includes a listing of the algorithm, provided it is not too long. Only the initial comments section of large algorithms will be published. The complete algorithm will be made available by the author.
 - (b) A single copy of the source subprograms, driver program, and test data on magnetic tape.
 - (c) Three copies of the printer listing or a test run which utilized the submitted program.