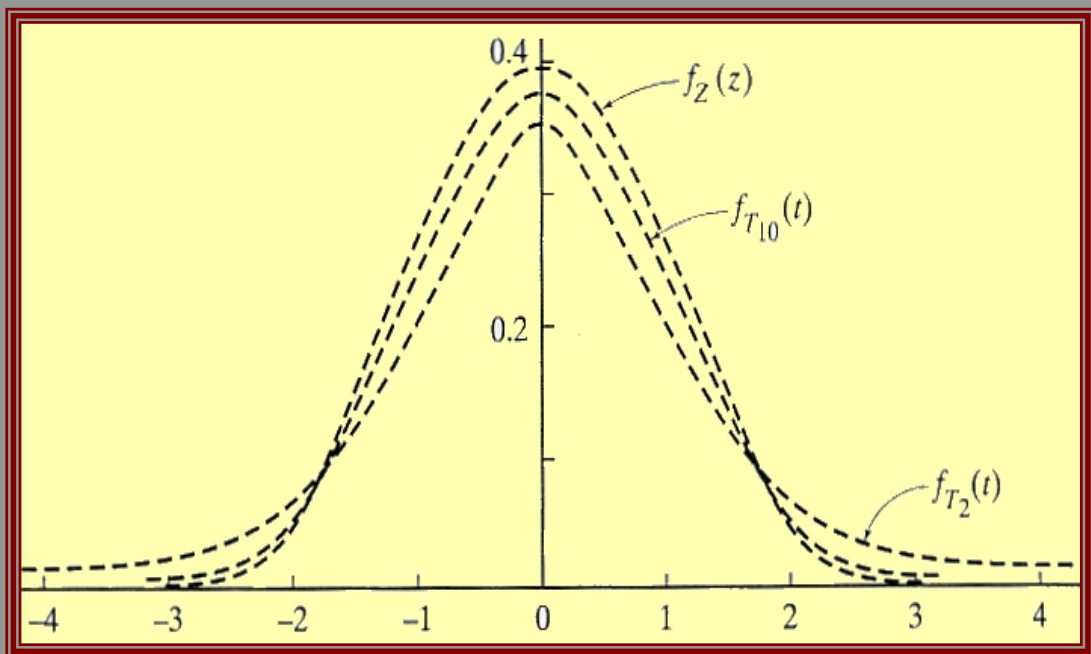


J P S S

A comprehensive journal of probability and statistics
for theorists, methodologists, practitioners, teachers, and others



JOURNAL OF PROBABILITY AND STATISTICAL SCIENCE

ISSN 1726-3328

JPSS

Journal of Probability and Statistical Science

A Comprehensive Journal of Probability and Statistics
for Theorists, Methodologists, Practitioners, Teachers, and Others

Volume 11 Number 1

February 2013

JPSS Editorial Board

Editor-in-Chief: Paul C. Chiou, Dept. of Math., Lamar Univ., Beaumont, TX 77710, USA; e-mail: chiou@math.lamar.edu.

Editors: (listed in alphabetical order according to last name)

Chien-Pai Han, Dept. of Math., Univ. of Texas at Arlington, Arlington, TX 76019, USA.

e-mail: cphan@uta.edu. (speciality: statistical inference, multivariate analysis, sampling theory)

Paul S. Levy, Statistics Research Division, RTI International, Research Triangle Park, NC 27709, USA.

e-mail: Levy@rti.org. (speciality: biomedical statistics and epidemiology, survey sampling)

W. L. Pearn, Dept. of I. E. & Management, National Chiao-Tung Univ., Hsinchu, Taiwan, ROC.

e-mail: roller@cc.nctu.edu.tw. (speciality: quality technology, applied statistics for industry)

Coordinating Editors:

Syed A. Hossain, Management Science Dept., Rider Univ., Lawrenceville, NJ 08648, USA.

e-mail: shossain@rider.edu. (speciality: Financial math., Mathematical statistics, Software reliability)

Borko D. Jovanovic, Dept. of Preventive Medicine, Northwestern Univ., Chicago, IL 60611, USA.

e-mail: borko@northwestern.edu. (speciality: biomedical statistics and epidemiology)

Chihwa Kao, Center for Policy Research, Syracuse Univ., Syracuse, NY 13244, USA.

e-mail: cdkao@maxwell.syr.edu. (speciality: statistics for economics and business)

B. M. Golam Kibria, Dept. of Statistics, Florida International Univ., Miami, FL 33199, USA.

e-mail: kibriag@fiu.edu. (speciality: statistical inference, regression analysis, applied statistics, etc.)

Andrzej Korzeniowski, Dept. of Math., Univ. of Texas at Arlington, Arlington, TX 76019, USA.

e-mail: korzeniowski@uta.edu. (speciality: probability theory and its applications)

Tze-San Lee, CDC/NCEH, 4770 Buford Highway, Mail Stop F-58, Atlanta, GA 30341-3717, USA.

e-mail: tjl3@cdc.gov. (speciality: general probability and statistics, change point analysis)

K. Muralidharan, Dept. of Statistics, M. S. Univ. of Baroda, Baroda-390002, India.

e-mail: lmv_murali@yahoo.com. (speciality: applied probability and statistics for industry)

Kamel Rebab, Dept. of Math. & Statistics, Univ. of Missouri, Kansas City, MO 64110-2499, USA.

e-mail: rekabk@umkc.edu. (speciality: statistical software testing and reliability, network security, biostatistics, statistics in advanced manufacturing & quality improvement, sequential analysis, etc.)

Mohammad Salehi M., Dept. of Math., Statistics, and Physics, Qatar Univ., P.O. Box 2713, Doha, Qatar.

e-mail: salehi@qa.edu.qa. (speciality: sampling theory and survey methodology)

Editorial Advisors:

Barry C. Arnold, Dept. of Statistics, U. of California, Riverside, CA 92521-0002, USA.

N. Balakrishnan, Dept. of Math. & Statistics, McMaster U., Hamilton, Ontario, Canada L8S 4K1.

Alexander Basilevsky, Dept. of Math. & Statistics, U. of Winnipeg, Winnipeg, Manitoba, Canada R3B 2E9.

Smiley W. Cheng, Dept. of Statistics, U. of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2.

James E. Gentle, Dept. of Comput. Science & Informatics, George Mason U., Fairfax, VA 22030, USA.

Arjun K. Gupta, Dept. of Math. & Statistics, Bowling Green State U., Bowling Green, Ohio 43403, USA.

Wolfgang Härdle, Institut für Statistik und Ökonometrie, Humboldt-Universität, Berlin, Germany.

André I. Khuri, Dept. of Statistics, U. of Florida, Gainesville, FL 32611-8545, USA.

Kiang Liu, Dept. of Preventive Medicine, Northwestern U., Chicago, IL 60611, USA.

Shaw-Hwa Lo, Dept. of Statistics, Columbia U., New York, NY 10027, USA.

Kung-Jong Lui, Dept. of Math. & Statistics, San Diego State U., San Diego, CA 92182-7720, USA.

Douglas C. Montgomery, Dept. of Industrial Engineering, Arizona State U., Tempe, AZ 85287, USA.

Serge B. Provost, Dept. of Statist. & Actuarial Sci., U. of W. Ontario, London, Ontario, Canada N6A 5B7.

Sheldon M. Ross, Dept. of Ind. Sys. Eng., U. of Southern California, Los Angeles, CA 90089, USA.

A. K. Md. Ehsanes Saleh, School of Math. & Statistics, Carleton U., Ottawa, Ontario, Canada K1S 5B6.

Robert J. Serfling, Dept. of Mathematical Sciences, U. of Texas at Dallas, Richardson, Texas 75083, USA.

Ahmad Reza Soltani, Dept. of Statistics and Operational Research, Kuwait U., Safat 13060, Kuwait.

Chih-Ling Tsai, Graduate School of Management, U. of California, Davis, CA 95616-8609, USA.

Lee-Jen Wei, Dept. of Biostatistics, Harvard U., Boston, MA 02115, USA.

Managing Advisor: Paul J. Smith, Dept. of Math., U. of Maryland, College Park, MD 20742, USA.

Production Editors:

Chih-Chiang Cheng, Dept. of Electrical Engineering, National Sun Yat-Sen U., Kaohsiung, Taiwan, ROC.

Sam Shyue-Ping Chi, Dept. of Information Management, Fu Jen Catholic U., Taipei, Taiwan, ROC.

Marketing Manager: Yu-Hong Chen, Center of Sampling Survey, Oriental Institute of Technology, Ban-Chiao City, Taipei County, Taiwan, ROC; e-mail: techcom5054@hotmail.com.

Managing (and Founding) Editor: Kuang-Chao Chang, Dept. of Statistics and Information Science, Fu Jen Catholic Univ., Taipei, Taiwan, ROC; e-mail: stat1016@mail.fju.edu.tw.

***JPS* Editorial Board**

(continued)

Associate Editors:

Md. Saleh Ahmed, Dept. of Math. and Statistics, Sultan Qaboos U., Muscat, Sultanate of Oman.
Essam K. AL-Hussaini, Dept. of Statistics & O. R., Kuwait U., Safat 13060, Kuwait.
K. K. Achary, Dept. of Statistics, Mangalore U., Mangalagangothri-574199, India.
Gokarna Aryal, Dept. of Math., CS & Statistics, Purdue U., Hammond, IN 46323, USA.
Olivier Basdevant, The World Bank, Washington DC 20433, USA.
John J. Borkowski, Dept. of Mathematical Sciences, Montana State U., Bozeman, Montana 59717, USA.
Connie M. Borrer, Division of Management Information, U. of Illinois, Champaign, IL 61820, USA
Elvan Ceyhan, Dept. of Math., Koc U., Sariyer, Istanbul, Turkey.
Chang-Tai Chao, Dept. of Statistics, National Cheng-Kung U., Tainan, Taiwan, ROC.
Ajit Chaturvedi, Dept. of Statistics, U. of Delhi, Delhi 110 007, India.
Jie Chen, Dept. of Math. & Statistics, U. of Missouri- Kansas City, Kansas City, MO 64110-2499, USA.
Mu-Chen Chen, Institute of Traffic and Transportation, National Chiao-Tung U., Hsinchu, Taiwan, ROC.
Chih-Hua Chiao, Dept. of Business Math., Soochow U., Taipei, Taiwan, ROC.
Tzu-chin R. Chou, Dept. of Applied Statistics and Information Sci., Ming Chuan U., Taoyuan, Taiwan, ROC.
Po-Huang Chyow, Marshfield Medical Research Foundation, Marshfield, WI 54449, USA.
David Drain, Dept. of Math. & Statistics, U. of Missouri-Rolla, Rolla, MO 65409-0020, USA.
Jamie Emerson, Perdue School of Business, Salisbury U., Salisbury, MD 21801, USA.
Shu-Kai Fan, Dept. of I. E., Yuan-Ze U., Taoyuan County, Taiwan, ROC.
Jan Hannig, Dept. of Statistics and O. R., U. of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA.
Chia-Ding Hou, Dept. of Statistics and Information Sci., Fu Jen Catholic U., Taipei, Taiwan, ROC.
Hsiao-Yun Huang, Dept. of Statistics and Information Sci., Fu Jen Catholic U., Taipei, Taiwan, ROC.
Yu-Sheng Hsu, Dept. of Math., National Central U., Chung-Li, Taiwan, ROC.
Steve Yih-huei Huang, Dept. of Math., Tamkang U., Tamsui, Taipei County, Taiwan, ROC.
Shahjahan Khan, Dept. of Math. & Computing, U. of S. Queensland, Toowoomba, Qld. 4350, Australia.
Tai-Ming Lee, Dept. of Statistics and Information Sci., Fu Jen Catholic U., Taipei, Taiwan, ROC.
Chung-Yi Li, Dept. of Health Care Management, National Taipei College of Nursing, Taipei, Taiwan, ROC.
Pen-Hwang Liao, Dept. of Mathematics, National Kaohsiung Normal U., Kaohsiung, Taiwan, ROC.
Chien-Tai Lin, Dept. of Mathematics, Tamkang U., Tamshui, Taipei, Taiwan, ROC.
Shang P. Lin, Dept. of Health Studies (Biostatistics Lab), U. of Chicago, Chicago, IL 60637, USA
Hung-Yi Lu, Dept. of Statistics & Information Science, Fu Jen Catholic U., Taipei, Taiwan, ROC.
Suzanne McCoskey, Dept. of Economics, United States Naval Academy, Annapolis, MD 21402, USA.
Vincent F. Melfi, Dept. of Statistics and Probability, Michigan State U., East Lansing, MI 48824, USA.
Weiwen Miao, Dept. of Math. & Computer Sci., Macalester College, Saint Paul, MN 55105, USA.
Magdi S. Moustafa, Dept. of Math., The American U. in Cairo, Cairo 11511, Egypt.
Hassen A. Muttlak, Dept. of Math. Sci, King Fahd U. of Petroleum and Minerals, Dhahran, Saudi Arabia.
Jeh-Nan Pan, Dept. of Statistics, National Cheng-Kung U., Tainan, Taiwan, ROC.
B. N. Pandey, Dept. of Statistics, Banaras Hindu U., Varanasi 221005, India.
M. N. Patel, Dept. of Statistics, School of Sciences, Gujarat U., Ahmedabad-380009, India.
Mohammad Z. Raqab, Dept. of Mathematics, U. of Jordan, Amman 11942, Jordan.
Kevin Robinson, Dept. of Math., Millersville U., PA 17551-0302, USA.
Amitava Saha, Directorate General of Mines Safety, Dhanbad, Jharkhand-826001, India.
Henri Schurz, Dept. of Mathematics, Southern Illinois U., Carbondale IL 62901-4408, USA.
John F. Shortle, Dept. of Systems Engineering and O. R., George Mason U., Fairfax, VA 22030, USA.
Lotfi Tadj, Dept. of Statistics and O. R., King Saud U., Riyadh 11451, Saudi Arabia.
Fred Torcaso, Dept. of Mathematical Sciences, The Johns Hopkins U., Baltimore, MD 21218, USA.
Chih-Li Wang, Dept. of Applied Statistics & Information Sci., Ming Chuan U., Taoyuan, Taiwan, ROC.
Calvin K. Yu, Dept. of I. E. & Management, Mingchi Institute of Technology, Taipei, Taiwan, ROC.
Liang Zeng, Dept. of Physics and Geology, U. of Texas Pan American, Edinburg, TX 78539, USA.

Associate Managing Editor:

Sy-Mien Chen, Dept. of Mathematics, Fu Jen Catholic U., Taipei, Taiwan, ROC.

Journal of Probability and Statistical Science

Published by: Susan Rivers' Cultural Institute, Hsinchu, Taiwan, ROC

(Cosponsored by: The International Chinese Association of Quantitative Management, Taiwan, ROC)

Aims and Scope The *Journal of Probability and Statistical Science (JPSS)*, ISSN 1726-3328) is a modified version of the *Journal of Propagations in Probability and Statistics (JPPS)*, ISSN 1607-7083). *JPSS*, like its predecessor *JPPS*, is a multipurpose and comprehensive journal of probability and statistics that publishes papers of interest to a broad audience of theorists, methodologists, practitioners, teachers, and any other users of probability and/or statistics. The scope of *JPSS* is intended to be quite broad, including all the major areas of probability and statistics. Research papers involving probability and/or statistics, either theoretical or applied in nature, will be seriously considered for publication. Additionally, papers involving innovative techniques or methods in teaching probability and/or statistics will also be considered. Papers submitted for publication consideration will be peer reviewed. Initially, we will publish semiannually, one issue each in February and August. Hopefully, as time accrues, we will be able to publish quarterly. It is the goal of *JPSS* to publish a wide range of works involving probability and/or statistics (theoretical and/or applied in nature) and provide widespread availability of such to a broad audience of people interested in probability and/or statistics.

Submission and Review Policies

1. Three hard copies of the manuscript written in English should be mailed to the **Editor-in-Chief, an Editor, a Coordinating Editor**, or to the **Managing Editor** at the address provided in the *JPSS* Editorial Board. Alternatively, submission of manuscript by email attachment is also acceptable.
2. A manuscript is accepted only with the understanding that the text has not appeared in publication, and that it is not being simultaneously reviewed by any other journal.
3. Submitted manuscripts are refereed by a double-blind process, meaning that the reviewers will not know the names of the authors and vice versa.
4. If an article is accepted for publication, the author(s) will be required to provide an electronic copy of the paper, in **Micro-soft Word** or **PCTEX** format, on a floppy disk or through an email attachment. The authors will also be requested to transfer their copyright on certain conditions to the publisher.

Publisher Harold C. H. Chen, Head, Susan Rivers' Cultural Institute. Address: 26, Lane 2, Chien Mei Road, Hsinchu, Taiwan, ROC. Phone: (03)5716594, Fax: (03)5712524.

魏蘇珊文教事業機構發行

總公司: 中華民國臺灣新竹市建美路 2 巷 26 號。

版權所有，不得翻印!

JPSS

Journal of Probability and Statistical Science

Volume 11 Number 1 February 2013

Table of Contents

Quadratic Forms in Unified Skew Normal Random Vectors -----	Mohammad A. Aziz and Arjun K. Gupta	1
Gumbel Distribution: Generalizations and Applications -----	K. K. Jose, Rani Sebastian, and Ancy Joseph	17
The Generalized Shannon-McMillan Theorems for Nonhomogeneous Markov Chains Indexed by a Homogeneous Tree -----	Kangkang Wang, Decai Zong, and Weicai Peng	31
On Correlated Random Graphs -----	Andrzej Korzeniowski	43
Estimating the Reliability Function for a Family of Inverse Distributions -----	Ajit Chaturvedi and Sudepta Ghosh	59
Generalized Inference for the Common Location Parameter of Several Location- Scale Families -----	Fuqi Chen and Séverien Nkurunziza	79
Bayes Prediction Intervals for the Pareto Model -----	Gyan Prakash and D. C. Singh	97

Appendix

Quadratic Forms in Unified Skew Normal Random Vectors

Mohammad A. Aziz

Arjun K. Gupta

University of Wisconsin-Eau Claire *Bowling Green State University*

ABSTRACT In this paper, we derive some moments of the quadratic forms and their functions under unified skew normal settings. First, we obtain the moment generating function of certain quadratic forms and discuss their distributions. Second, the joint moment generating functions of a linear compound and a quadratic form, and two quadratic forms have been obtained and conditions for their independence are given. Expected value of the ratios of quadratic forms in unified skew normal random vectors has also been studied. Finally, applications in context of time series and spatial statistics are discussed.

Keywords Unified skew normal distribution; Moment generating function; Linear compound; Independence; Ratio of quadratic forms; Time series.

1. Introduction

The multivariate unified skew normal (SUN) distribution has been introduced by Arellano-Valle and Azzalini [1]. In addition to being normal when the skewness parameter equal to zero, the family has properties similar to the normal distribution and yet is skew. We will study the quadratic forms and their applications in the context of SUN density. For other aspects of SUN density such as additive properties, inferential issues and applications, we refer to Gupta, Aziz and Ning [10], and Gupta and Aziz ([8], [9]).

There is a rich literature on the distribution of quadratic forms of the multivariate normal random vector. Earlier works were due to Cochran [5], Craig [6] etc. Recent references include

Received December 2011, revised August 2012, in final form October 2012.

Mohammad A. Aziz is affiliated to the Department of Mathematics at the University of Wisconsin-Eau Claire, Eau Claire, WI 54702-4004, USA; email: azizm@uwec.edu. Arjun K. Gupta is a Distinguished Professor in the Department of Mathematics and Statistics at Bowling Green State University, Bowling Green, OH 43403-0001, USA; email: gupta@bgsu.edu.

AMS 2000 Subject Classification: Primary 62 H10; Secondary 62P20.

Gumbel Distribution: Generalizations and Applications

K. K. Jose
St. Thomas College Pala

Rani Sebastian
K. E. College Kottayam

Ancy Joseph
B. K. College Kottayam

ABSTRACT As generalizations of Gumbel distribution, the Marshall-Olkin Gumbel maximum and minimum distribution as well as the Marshall-Olkin q -Gumbel distribution are introduced and their properties are studied. Minification processes with Marshall-Olkin q -Gumbel marginal distribution is also developed and studied.

Keywords Q -Gumbel distribution; Marshall-Olkin family; Extreme value distribution; Minification processes.

1. Introduction

Extreme Value Theory is widely used by many researchers in applied sciences when faced with modeling extreme values of certain phenomena, e.g., ocean wave modeling, wind engineering, thermodynamics of earthquakes, risk assessment on financial markets etc. The first results were developed considering independent observations but, more recently, models for extreme values have been constructed under the more realistic assumption of temporal dependence. The importance of the Gumbel distribution in practice is due to its extreme value behavior. It has been applied either as the parent distribution or as an asymptotic approximation, to describe extreme wind speeds, sea wave heights, floods, rainfall, age at death, minimum temperature, rainfall during droughts, electrical strength of materials, air pollution problems, geological problems, naval engineering etc.

Recently various authors have introduced several q -type distributions such as q -exponential, q -Weibull, q -logistic and various pathway models in the context of information theory, statistical mechanics, reliability modeling etc. The q -exponential distribution can be viewed as a stretched model (see Beck [2], Beck and Cohen [3]) for exponential distribution

Received October 2011, revised October 2012, in final form January 2013.

K. K. Jose is affiliated to the Department of Statistics at St. Thomas College, Arunapuram P. O., Palai, Kerala 686574, India; email: kkjstc@gmail.com. Rani Sebastian is affiliated to the Department of Statistics at K. E. College, Mannanam, Kottayam, Kerala 686561, India. Ancy Joseph is affiliated to the Department of Statistics at B. K. College, Amalagiri, Kottayam, Kerala 686561, India.

The Generalized Shannon-McMillan Theorems for Nonhomogeneous Markov Chains Indexed by a Homogeneous Tree

Kangkang Wang: *Jiangsu University of Science and Technology*

Decai Zong: *Changshu Institute of Technology*

Weicai Peng: *Chaohu University*

ABSTRACT In this paper, a Shannon-McMillan theorem for the nonhomogeneous Markov chains field on a homogeneous tree is discussed by constructing a nonnegative martingale and analytical methods. As corollaries, some Shannon-McMillan theorems for the nonhomogeneous Markov chains field on a homogeneous tree and the nonhomogeneous Markov chain are obtained. Two results which have been obtained are extended.

Keywords Shannon-McMillan theorem; Homogeneous tree; Markov chain field; Relative entropy density.

1. Introduction

Let T be a homogeneous tree on which each vertex has $M + 1$ neighboring vertices. We first fix any vertex as the "root" and label it by 0. Let σ, τ be vertices of a tree. Write $\tau \leq \sigma$ if τ is on the unique path connecting 0 to σ , $|\sigma|$ for the number of edges on this path. For any two vertices σ, τ , denote $\sigma \wedge \tau$ the vertex farthest from 0 satisfying

$$\sigma \wedge \tau \leq \sigma \quad \text{and} \quad \sigma \wedge \tau \leq \tau.$$

If $\sigma \neq 0$, then we let $\bar{\sigma}$ stand for the vertex satisfying $\bar{\sigma} \leq \sigma$ and $|\bar{\sigma}| = |\sigma| - 1$ (we refer

Received August 2010, revised June 2012, in final form August 2012.

Kangkang Wang (corresponding author) is affiliated to the School of Mathematics and Physics at Jiangsu University of Science and Technology, Zhenjiang 212003, China; email: wkk.cn@126.com. Decai Zong is affiliated to the Department of Computer Science and Engineering at Changshu Institute of Technology, Changshu 215500, China. Weicai Peng is affiliated to the Department of Mathematics at Chaohu University, Chaohu 238000, China.

Classification (MSC 2000): 60F15.

The work is supported by Foundation of Anhui Educational Committee (NO. KJ2012B117).

On Correlated Random Graphs

Andrzej Korzeniowski
University of Texas at Arlington

ABSTRACT Given $0 \leq \rho \leq 1$ and an integer n we construct a sequence of dependent *Bernoulli* random variables $\{\varepsilon_1, \dots, \varepsilon_n\}$ on the probability space $([0, 1], dx)$ with $P(\varepsilon_i = 1) = p = 1 - P(\varepsilon_i = 0)$ and pairwise correlation ρ between ε_i and ε_j . As an application we introduce a class of random graphs with n nodes for which connectivity by an edge between any two nodes has probability p while interdependency between any two edges is characterized by correlation ρ . A construction of graphs with such properties along with a *Monte Carlo* algorithm for their simulation are given.

Keywords Dependent Bernoulli variables; Generalized binomial distribution, ρ -correlated binomial random graphs, Monte Carlo algorithm.

1. Introduction

Bernoulli trials play a central role in statistical analysis of modeling phenomena arising in science, engineering and graph-based random networks [7]. In the monographs [1], [2], [3] among others, $\{0, 1\}$ valued independent random variables serve as building blocks in *binomial Random Graph* models, also studied in [4], [5], [6].

Our main objective is to relax independence by introducing a class of *dependent Bernoulli variables* leading to *Generalized Binomial Distribution*. The second objective is concerned with construction of ρ -*correlated binomial Random Graphs*. Finally, we devise an algorithm for generating graphs with n nodes and randomly placed edges. Simulations are carried for several illustrating examples. It is worth noting that correlation ρ in our model increases connectivity (i.e., higher probability for a larger total # of edges for $\rho > 0$). Also, $\rho = 0$ reverts back to the independent *Bernoulli* model, whereas the fully correlated case $\rho = 1$ gives *complete graph* with $C(n, 2)$ edges with probability p , and an *empty graph* with no edges with probability $1 - p$ respectively.

□ Received February 2012, revised October 2012, in final form January 2013.

□ Andrzej Korzeniowski is a Professor in the Department of Mathematics at the University of Texas at Arlington, Arlington, TX 76019, USA; email: Korzeniowski@uta.edu.

Estimating the Reliability Function for a Family of Inverse Distributions

Ajit Chaturvedi and Sudeepta Ghosh
University of Delhi

ABSTRACT A family of inverse distributions is proposed. The problems of estimating the reliability functions are considered. Uniformly minimum variance unbiased estimators and maximum likelihood estimators are derived. A comparative study of the two methods of estimation is done. Simulation study is performed.

Keywords Inverse distributions; Reliability function; Uniformly minimum variance unbiased estimators; Maximum likelihood estimators; Simulation study.

1. Introduction

A lot of work has been done in the literature to deal with inferential problems related to various inverse distributions. Keller and Kamath [20] derived inverse Weibull distribution on the basis of physical considerations on some failures of mechanical components subject to degradation phenomena, such as wear, fatigue and corrosion. Keller, Giblin and Farnworth [21] exhibited that this distribution gave best fit to the failure data of dynamic engine components (pistons, crankshaft, main bearings, etc.). Mudholkar and Kollia [28] referred to it as the reciprocal Weibull distribution. Erto [16] showed that the inverse Weibull distribution gave a good fit to the life testing data sets such as the times to breakdown of an insulating fluid subject to the action of a constant tension, reported in Nelson [29] and to the survival data in cancer chemotherapy, reported in Carter, Wampler and Stablein [8]. Such analysis led to further study of some estimation procedures and statistical properties of estimators. Erto [16] considered plotting positions technique and least-squares method to obtain the estimators for parameters and reliability function of the inverse Weibull distribution. Calabria and Pulcini [4] investigated the statistical properties of the maximum likelihood

Received January 2012, revised July 2012, in final form October 2012.

Authors of this article are affiliated to the Department of Statistics at University of Delhi, Delhi-110007, India; email address of Ajit Chaturvedi: ajitc2001@yahoo.co.in.

Generalized Inference for the Common Location Parameter of Several Location-Scale Families

Fuqi Chen and Sévérien Nkurunziza
University of Windsor

ABSTRACT In this paper, we are interested in inference problem concerning the common location parameter of k location-scale families with $k \geq 2$. More specifically, we study the case where the scale parameters of the families are unknown and possibly heterogeneous. The proposed solution is derived by using generalized inference method. To this end, we present a method of constructing the required generalized pivotal quantity (GPQ) and generalized p-value (GPV) for the common location parameter. The proposed approach is based on the minimum risk equivariant estimators (MRE) which is more general and more efficient than the maximum likelihood estimators (MLEs). Thus, we extend the approaches based on MLEs and conditional inference which have been so far applied to some specific distributions. Also, with intensive simulation studies, we illustrate the performance of the proposed approach in small and moderate sample sizes. Finally, the approach is applied to analyse the normal body temperature.

Keywords GCIs; Generalized p-value; Location-scale family; MRE; Pitman estimator.

1. Introduction

Testing the common location parameter of several location-scale families with unknown scale parameters is one of the most interesting statistical inference problems. There are many applications in which this problem is involved. For instance, this situation arises in statistical analysis that combines the information from several independent studies or meta-analysis. Indeed, the meta-analysis is more frequent in clinical trials as well as in social and behavioral sciences. Also, this is commonly seen in many statistical areas or designs such as balanced incomplete block designs, panel models, and some regression models, and in each of these scenarios, practitioners are often interested in inference concerning the common location parameter of several distributions with unknown scale parameters. For other applications and scenarios, we refer to Krishnamoorthy and Lu [6].

Received March 2010, revised June 2012, in final form September 2012.

Authors of this article are affiliated to the Department of Mathematics and Statistics at University of Windsor, Windsor, Ontario, N9B 3P4, Canada; emails: chen111n@uwindsor.ca and severien@uwindsor.ca.

Bayes Prediction Intervals for the Pareto Model

Gyan Prakash

D. C. Singh

S. N. Medical College

Harish Chandra P. G. College

ABSTRACT The Pareto model is proposed to be underlying model from which observables are to be predicted under the Bayesian approach. The prediction has been done under one-Sample and two-Sample Bayes prediction techniques. Both one-sided interval and the interval of central coverage prediction limits have been obtained. The item failure censored data from the proposed model is considered and the performances of the procedures are illustrated by a simulation technique.

Keywords Bayesian prediction technique; Item failure censoring; One and two samples prediction techniques.

1. Introduction

The Pareto distribution and their close relatives provide a very flexible family of fat-tailed distributions, which may be used as a model for the income distribution of higher income group. The Pareto model plays an important role in socio-economic studies. It is often used as a model for analyzing areas including city population distribution, stock price fluctuation, oil field locations and military areas. It has been found to be suitable for approximating the right tails of distribution with positive skewness. The Pareto distribution has a decreasing failure rate, so it has often been used for model survival after some medical procedures (the ability to survive for a longer time appears to increase, the longer one survives after certain medical procedures).

Davice & Feldstien [6] have viewed the Pareto distribution as a potential model for the life testing problems. This distribution has established its important role in variety of other problems such as size of cities and firms (Steindle [19]), business mortality (Lomax [11]), service time in queuing system (Harries [9]). Freiling [8] applied the Pareto law to study the distributions of nuclear particles. Harries [10] used this distribution in determining times of

Received September 2011, revised July 2012, in final form October 2012.

Gyan Prakash is affiliated to the Department of Community Medicine at S. N. Medical College, Agra, U. P., India; email: ggyanji@yahoo.com. D. C. Singh is affiliated to the Department of Statistics at Harish Chandra P. G. College, Varanasi, U. P., India.