Abstracts – Invited/Contributed (Alphabetically Ordered)

The first author in the following list is the presenter, unless an asterisk (*) is used to indicate the presenter.

Title	Parameter estimation and investigation of the t-ratio in determining the presence of multicollinearity in a regression model
Authors	Adebayo Agunbiade Olabisi Onabanjo University, Nigeria Peter Ogunyinka Olabisi Onabanjo University, Nigeria
E-mail	bayoagunbiade@gmail.com

Session ID: Name	Date	Time	Location
S8: Modeling II	October 11	S8-1: 4:00 pm – 4:20 pm	Three Fires Room

Multicollinearity is one of the most misunderstood problems in multiple regression analysis. The main thrust of this paper is in the parameter estimation and investigation of the sufficiency and adequacy of the t-ratios only to confirm the presence of multicollinearity in a regression equation. To achieve this, a three-equation simultaneous model with three multicollinear exogenous variables is presented. Monte Carlo simulation indicates that the asymptotic results provide a better estimate with the Variance Inflation Factor. It was established that the criteria considered will suffice and not just the t-ratio only in determining the presence of multicollinearity.

Title	Regression analysis with errors from epsilon skew double inverted Weibull distribution
Authors	Flaih Ahmad Al Qadisiyah University, Iraq Hassan Elsalloukh University of Arkansas at Little Rock, AR, USA
E-mail	anflaih@ualr.edu , hxelsalloukh@ualr.edu

Session ID: Name	Date	Time	Location
S1: Modeling I	October 11	S1-2: 10:00 am – 10:20 am	Ojibway Room

In this paper we develop regression analysis when the random errors term are from the Epsilon Skew Double Inverted Weibull (ESDIW) distribution which generalized the Double Inverted Weibull (DIW) distribution. ESDIW distribution is a skewed density belonging to the Epsilon Skew Exponential Power (ESEP) family of distributions. We derive the parameter estimation of the ESDIW regression model utilizing the methods of least squares and the maximum likelihood. Also, we provide real data analysis.

Title	Likelihood estimation with partially observed array variate observations
Authors	Deniz Akdemir Cornell University, NY, USA
E-mail	da346@cornell.edu

Session ID: Name	Date	Time	Location
S15: Distribution and Inference II	October 12	S15-3: 4:40 pm – 5:00 pm	Ojibway Room

Missing data is an important challenge with high-dimensional data arranged in the form of an array. In this paper, we propose a probability model for partially observed multiway array data. Fisher scoring and expectation maximization are used for estimation of the parameters of this distribution and for imputation of missing cells.

Title	The Kumaraswamy-geometric distribution
Authors	Alfred Akinsete Marshall University, WV, USA
E-mail	akinsete@marshall.edu

Session ID: Name	Date	Time	Location
S3: Distribution I	October 11	S3-3: 11:50 am – 12:10 pm	Ojibway Room

This work defines and studies the Kumaraswamy-geometric distribution, a member of the T-geometric family of discrete distributions. Some properties of the Kumaraswamy-geometric distribution such as moments, probability generating function, hazard and quantile functions are studied. The method of maximum likelihood estimation is proposed for estimating the model parameters. Tests are proposed to compare the distribution with another existing member of the T-geometric family of discrete distributions. A real data set is used to illustrate the applications of the Kumaraswamy-geometric distribution.

Title	Statistical coding theory and digital communications
Authors	Abdinur Ali Norfolk State University, VA, USA Mushtaq Khan Norfolk State University, VA, USA
E-mail	amali@nsu.edu

Session ID: Name	Date	Time	Location
S13: Application III	October 12	S13-2: 3:05 pm – 3:25 pm	Ojibway Room

Codes are used to detect or correct errors in digital communications. There is always a chance that the data can be corrupted and the data have to be repaired. The goal of coding theory is to make the probability of error as small as possible. However, if the data is infected or deleted, the coding will help us to recover the original data. In this talk we will explain Cyclic and Convolutional codes. For Convolutional codes, we will examine probability based codes. In particular, we will describe sequential decoding and how to estimate error probabilities for optimum decoding algorithms.

Title	T-normal family of distribution: A new approach for generalizing the normal distribution.
Authors	Ayman Alzaatreh Austin Peay State University, TN, USA Carl Lee and Felix Famoye Central Michigan University, MI, USA
E-mail	alzaatreha@apsu.edu

Session ID: Name	Date	Time	Location
S11: Distribution III	October 12	S11-3:11:50 am – 12:10 pm	Ojibway Room

The idea of generating skewed distributions from normal has been of great interest among researchers for decades. The initial work by Azaalini (1985) on skew normal distributions has motivated researchers in developing general or different approaches to generate skew normal distributions. In this paper, a technique proposed in Alzaatreh, Lee & Famoye (2013) is used for generating the T-normal family of generalized normal distributions. Comparisons of this method and existing methods suggest that many existing methods can be derived using this framework. Some general properties including moments, mean deviations and Shannon entropy of the T-normal family are studied. Some new generalizations of the normal distribution, which are members of the T-normal family, are presented. Some members of the T-normal family of distributions, namely, exponential-normal, exponentiated-exponential-normal and Weibull-normal distributions are studied in detail. Some applications of these generalized normal distributions are provided to illustrate their flexibility.

Title	Generating high-tailed distributions through convolution of characteristic functions
Authors	Mohamed Amezziane Central Michigan University, MI, USA Wesley Wieczorek Zurich-North America, IL, USA
E-mail	amezz1m@cmich.edu

Session ID: Name	Date	Time	Location
S15: Distribution and Inference II	October 12	S15-2: 4:20 pm - 4:40 pm	Ojibway Room

The condition of moments existence requires that the skewness and kurtosis of any distribution cannot exist outside a parabola. Since the 19th century, statisticians have been trying to come up with flexible families of distributions that would cover as much as possible of the area inside the skewness-kurtosis parabola using as few shape parameters as possible. In this work, we propose a simple method of generating flexible distributions through convolution of smooth and rough characteristic functions or equivalently, multiplication of high-tailed and low-tailed density. We conduct a performance comparison with existing high-tailed skewed distributions and illustrate the flexibility of the new distributions by analyzing financial data.

Title	Application of binomial distribution with a shift parameter in one sample parametric test statistics
Authors	Kayode Ayinde Ladoke Akintola University of Technology, Nigeria
E-mail	kayinde@lautech.edu.ng

Session ID: Name	Date	Time	Location
S15: Distribution and Inference II	October12	S15-1: 4:00 pm – 4:20 pm	Ojibway Room

Semi-parametric and parametric statistical test statistics are often used to test hypothesis in one-sample problems. The paper provides the equivalent rank version of the parametric tests. It further develops and proposes an alternative semi-parametric test statistic in its distributional and asymptotic form to test hypothesis about one sample problem. The proposed test statistic involves averaging the ranks of the first P observations closest to the test value. It is a Binomial Distribution with a shift parameter. It is not influenced by population and sample sizes and the parametric statistical test of variability reduces to a test of location. A Monte Carlo experiment of 50,000 trials was conducted on the parametric and the proposed semi–parametric test statistics. Their type 1 error rates, sensitivity and specificity study as well as the agreement measures (the Kappa and Tau Statistics) between the parametric and the proposed statistics were examined. The paper identifies the value of P at which the error rate is considerably acceptable and further reveals that the proposed statistics performs well with the parametric test statistics in term of sensitivity. The performances of the test statistics based on specificity and agreement measures are generally moderate. The methodologies involved in using the proposed statistics are easier and simpler. Numerical examples illustrate the usage of the proposed statistics.

Title	Comonotonic lower convex order bound approximations for the sum of log unified skew normal random variables with applications in finance and insurance
Authors	Mohammad Aziz University of Wisconsin-Eau Claire, WI, USA Arjun Gupta Bowling Green State University, OH, USA
E-mail	azizm@uwec.edu

Session ID: Name	Date	Time	Location
S3: Distribution I	October 11	S3-1: 11:10 am – 11:30 am	Ojibway Room

The classical works in finance and insurance for modeling asset returns is the Gaussian model. However, when modeling complex random phenomena, more flexible distributions are needed which are beyond the normal distribution. This is because most of the financial and economic data are skewed and have "fat tails''. In this study, we consider a very flexible financial model to construct comonotonic lower convex order bounds in approximating the distribution of the sum of dependent log skew normal random variables. The dependence structure of these random variables is based on the unified skew-normal distribution. Accurateness of the approximation is also investigated numerically. Results obtained from our methods are competitive with those obtained from Monte Carlo method.

Title	Statistical Forecasting: Analytical Tools
Authors	Dila Ram Bhandari,

	Tribhuvan University, Nepal
E-mail	drbhandari2012@gmail.com

Session ID: Name	Date	Time	Location
S4: Applications I	October 11	S4-1: 11:10 am – 11:30 am	Three Fires Room

Statistics plays a vital role in every fields of human activity. The statistical tools like index number, correlation, time series analysis, regression analysis, hypothesis testing, and multivariate analysis help to analyze data and predict about future. Forecasting is the process of making statements about events whose actual outcomes have not yet been observed. Statistical forecasting concentrates on using the past to predict the future by identifying trends, patterns and business and economic drive within the data to develop a forecast with tools as regression analysis, time-series analysis and many more. Estimating the likelihood of an event takes place in the future, based on available data. Statistics is a set of techniques that are used in collecting, analyzing, presenting, and interpreting data. Statistical methods are used in a wide variety of occupations and help people identify, study, and solve many complex problems. Statistics is also widely used in the business and economic world. In many forecasting processes, statistical forecasting forms the baseline that is adjusted throughout the process. Risk and uncertainty are central to forecasting and prediction; it is generally considered good practice to indicate the degree of uncertainty of forecasts.

Title	Distributions for three-dimensional rotation data
Authors	Melissa Bingham University of Wisconsin-La Crosse, WI, USA Daniel Nordman and Stephen Vardeman Iowa State University, IA, USA
E-mail	mbingham@uwlax.edu

Session ID: Name	Date	Time	Location
S3: Distribution I	October 11	S3-2: 11:30 am – 11:50 am	Ojibway Room

Three-dimensional rotation data are common in areas such as materials science and human kinematics, yet distributions for these data that are easily accessible to practitioners are limited. Based on an intuitive, geometric construction, development of distributions for modeling three-dimensional rotation data will be discussed. These distributions provide advantages such as easily interpretable parameters and flexibility in modeling. Inference for these distributions will be considered, along with applications in which these distributions are useful.

Title	Doubly censored regression models
Authors	Heleno Bolfarine University of Sao Paulo, Brazil
E-mail	hbolfar@ime.usp.br

Session ID: Name	Date	Time	Location
S1: Modeling I	October 11	S1-4: 10:40 am – 11:00 am	Ojibway Room

In this talk we consider power distributions for modeling proportions or rates with zero and/or one in ation as an alternative to beta regression. The model considered is a mixture between a Bernoulli type process for explaining the zero and/or one excess and a limited power-normal model (Pewsey, Gomez and Bolfarine, Test, 2012) for explaining the continuous response. The maximum likelihood approach is considered for parameter estimation.

Title	Extreme ranked set sampling and its applications in parametric estimation
Authors	Manoj Chacko University of Kerala, India
E-mail	manojchacko02@gmail.com

Session ID: Name	Date	Time	Location
S12: Inference and Simulation	October 12	S12-1: 11:10 am – 11:30 am	Three Fires Room

Ranked set sampling (RSS) is applicable whenever ranking of a set of sampling units can be done easily by a judgment method or based on the measurement of an auxiliary variable on the units selected. In this work, different modifications of RSS such as extreme ranked set sampling, moving extreme ranked set sampling and ordered extreme ranked set sampling are considered. These modifications of RSS are applied to obtain estimators of parameters associated with the distribution of the study variate Y, based on the ranked set sample in which an auxiliary variable X correlated with Y is used to rank the sample units, when (X,Y) follows certain well known bivariate distributions such as bivariate Pareto distribution and Morgenstern type bivariate exponential distribution are obtained.

Title	Fitting a piecewise exponential model for the reliability of repairable systems using hierarchical Bayesian approaches.
Authors	Arpita Chatterjee Georgia Southern University, GA, USA Alan Polansky Northern Illinois University, IL, USA
E-mail	achatterjee@georgiasouthern.edu

Session ID: Name	Date	Time	Location
S6: Bayesian I	October 11	S6-2: 3:05 pm – 3:25 pm	Three Fires Room

This research develops methods for Bayesian analysis of a general piecewise exponential model for the reliability of multiple repairable systems. Common approaches to this problem model the expected time between failures using a geometric type sequence. In this research we consider generalizing this model, so that the expected time between failures is a monotone sequence. The model is then fit using hierarchical Bayesian approaches. The ordering of the mean time between failures is implemented into the model by considering prior distributions on the ordered subset of the parameter space. We also consider model selection problems concerning the validity of the monotonicity of the expected time between failures as well as the validity of a common parametric model for the monotone sequence. The methods are demonstrated on a well-known example concerning the reliability of mining equipment.

Title	Bayesian estimators of the lognormal-Pareto composite distribution
Authors	Chin-I Cheng and Kaladawala Cooray Central Michigan University, MI, USA
E-mail	cheng3c@cmich.edu

Session ID: Name	Date	Time	Location
S16: Bayesian II	October 12	S16-3: 4:40 pm – 5:00 pm	Three Fires Room

In this paper, Bayesian methods with both Jeffreys and conjugate priors for estimating parameters of the lognormal-Pareto composite distribution are considered. With Jeffreys prior, the posterior distributions for parameters of interest are derived and their properties are described. The conjugate priors are proposed and the conditional posterior distributions are provided. In addition, simulation studies are performed to obtain the upper percentage points of Kolmogorov-Smirnov and Anderson-Darling test statistics. Furthermore, these statistics are used to compare Bayesian and likelihood estimators. In order to clarify and advance the validity of Bayesian and likelihood estimators of the lognormal-Pareto composite distribution, well-known Danish fire insurance data set is reanalyzed.

Title	Nonparametric bootstrap estimation for ruin probabilities in the Cramer-Lundberg model
Authors	Sunghoon Chung Central Michigan University, MI, USA Ronald Butler Southern Methodist University, TX, USA
E-mail	chung2s@cmich.edu

Session ID: Name	Date	Time	Location
S2: Distribution and Inference	October 11	S2-3: 10:20 am – 10:40 am	Three Fires Room

We consider bootstrap inference implemented in the transform domain with the use of saddlepoint approximations. In this context, inference concerns ruin probabilities in Cramer-Lundberg models using data comprised of claim amounts and interarrival times for claims. Indirect inference is made possible through the Laplace transform for ruin probabilities which is an explicit function of the moment generating function for the distribution of claims and the interarrival rate. Simulations show that the proposed bootstrap estimators are more accurate than existing estimation methods for small and moderate amounts of initial capital. Bootstrap pointwise confidence bands exhibit very accurate coverage for all initial capitalization amounts.

Title	Optimal supersaturated designs and applications
Authors	Ashish Das Indian Institute of Technology, India
E-mail	ashish@math.iitb.ac.in

Session ID: Name	Date	Time	Location
S5: Application II	October 11	S13-1: 2:45 pm – 3:05 pm	Ojibway Room

A popular measure to assess 2-level supersaturated designs is the $E(s^2)$ criterion. With an objective to construct 2-level supersaturated designs with even or odd number of runs which have minimum $E(s^2)$, improved or more explicit lower bounds on $E(s^2)$ are used to show optimality properties of supersaturated designs. Conditions for supersaturated designs which attain the lower bounds are given. Hadamard matrices and finite fields are used for constructing $E(s^2)$ –optimal supersaturated designs. The lower bound is improved when the number of factors is large, and designs attaining the improved bounds are constructed by using the complements of designs with small number of factors. A method is provided to construct $E(s^2)$ –optimal supersaturated designs with odd number of runs from $E(s^2)$ –optimal supersaturated designs with even number of runs by deleting a run.

Title	Analysis of lifetime data for distributed systems subject to shared (hidden) risks by means of generalized multivariate model
Authors	Papadimitriou Dimitrios INTEC - Ghent University, Belgium
E-mail	dimitrios.papadimitriou@ugent.be

Session ID: Name	Date	Time	Location
S14: Distribution IV	October 12	S14-1: 2:45 pm – 3:05 pm	Three Fires Room

We examine the lifetime data of distributed systems that are subject to simultaneous failures involving multiple system components by means of a generalized statistical model. Analyzing their behavior is of critical importance to model the robustness and reliability properties of such systems. The main difficulty arises from the absence of information on the underlying common cause(s) of failures risking to affect simultaneously multiple components. Moreover, the spatial distribution of components sharing common risks is not directly derivable from the individual rate of failure occurrence observed for each component taken separately; hence, the interdependence between simultaneously failing components (joint failure events) requires the introduction of generalized multivariate distribution.

Title	The ALM distributions and their use in applied probability modeling
Authors	Boyan Dimitrov Kettering University, MI, USA
E-mail	bdimitro@kettering.edu

Session ID: Name	Date	Time	Location
S13: Application III	October 12	S13-3: 3:25 pm – 3:45 pm	Ojibway Room

A new class of probability distributions, called Almost-Lack-of-Memory (ALM) distributions was recently developed. These distributions suit environmental modeling, the modeling of risk processes in finances, insurance, techniques, services, politics, and social sciences. The author's works and works of followers and collaborators during latest 20 years formed an impressive collection of various results. The successful reflection of these topics in research literature and the interest of the young auditorium encourage me to present the most important achievements and perspectives of these distributions in today's scientific society.

Title	Bayesian analysis for exponential power regression models
Authors	Marco Ferreira University of Missouri, MO, USA Esther Salazar Duke University, NC, USA
E-mail	ferreiram@missouri.edu

Session ID: Name	Date	Time	Location
S16: Bayesian II	October 12	S16-1: 4:00 pm – 4:20 pm	Three Fires Room

We develop Bayesian analysis for the linear regression model with exponential power errors. Specifically, we derive explicit expressions for several objective Bayes priors for the model parameters. Further, for each of these objective Bayes priors we discuss the propriety of the implied posterior distributions. Finally, we illustrate the use of these objective Bayes priors with applications of the exponential power regression model to two real datasets.

Title	A new class of bivariate and multivariate weighted exponentiated- exponential distribution
Authors	Indranil Ghosh Austin Peay State University, TN, USA Ayman Alzaatreh Austin Peay State University, TN, USA
E-mail	ghoshi@apsu.edu

Session ID: Name	Date	Time	Location
S9: Distribution - Multivariate	October 12	S9-2: 10:00 am – 10:20 am	Ojibway Room

Weighted distributions (univariate and bivariate) have received a widespread attention over the last two decades because of its flexibility to analyze skewed data. In this paper, we focus our attention on a new class of bivariate and multivariate family of exponentiated-exponential distributions using the technique by Arnold, Ghosh and Alzaatreh (2013). Several structural properties of the bivariate weighted exponentiated -exponential distribution including moments, total positivity of order two and estimation of the model parameters are studied. Some properties of the multivariate extension of the proposed model are also discussed. For illustrative purposes, one data set is analyzed.

Title	Waiting time distribution for the emergence of superpatterns
Authors	Anant Godbole and Martha Liendo East Tennessee State University, TN, USA
E-mail	godbolea@etsu.edu

Session ID: Name	Date	Time	Location
S2: Distribution and Inference	October 11	S2-1: 9:40 am – 10:00 am	Three Fires Room

Consider a sequence $X_n, n = 1,2, \ldots$, of i.i.d. uniform random variables taking values in the alphabet set $\{1,2, \ldots d\}$. A *k-superpattern* is a realization of $X_n, n = 1,2, \ldots, t$ that contains, as an embedded subsequence, each of the (ordered Bell number of) non-order-isomorphic subpatterns of length *k*. We focus on the (non-trivial!) case of *d=k=3* and study the waiting time distribution of $\tau = \inf\{t \geq 7: X_n, n = 1,2, \ldots, t$ is a superpattern$\}$. In particular, the moments, generating function, and probability mass function are derived, and comparisons are drawn to runs distributions and waiting time distributions for omnisequences.

Title	Simulating continuous univariate and multivariate non-normal distributions based on the method of L-moments and L-comoments
Authors	Todd Headrick Southern Illinois University, IL, USA
E-mail	headrick@siu.edu

Session ID: Name	Date	Time	Location
S12: Inference and Simulation	October 12	S12-3: 11:50 am – 12:10 pm	Three Fires Room

Conventional product-moment-based algorithms are often used for generating continuous univariate or multivariate non-normal distributions associated with simulation studies. However, conventional product-moment estimates can be substantially biased or have high variance. As such, characterizations of several conventional moment-based algorithms by L-moments (comoments) are introduced. Specifically, algorithms associated with the (i) power method, (ii) double generalized lambda, (iii) Tukey g-and-h, and (iv) Schmeiser-Deutsch families of distributions are presented for the purpose of simulating non-normal distributions with specified values of L-skew, L-kurtosis, and L-correlation. It is demonstrated how L-moment estimators are superior to their corresponding conventional moment estimators in terms of bias and efficiency.

Title	On the quantum Zeno effect and time series
Authors	Kei Inoue Tokyo University of Science, Yamaguchi, Japan Karl-Heinz Fichtner Friedrich Schiller University Jena, Germany
E-mail	inoue@ed.yama.tus.ac.jp

Session ID: Name	Date	Time	Location
S13: Applications III	October 12	S13-1: 2:45 pm – 3:05 pm	Ojibway Room

Measuring a stochastic process at different times one gets a so called time series representing the random outputs of the measurements. We describe the distribution of such a time series if the underlying process is given by a unitary time evolution of a quantum system. Further, a certain quantum version of Zeno's arrow paradox is considered.

Title	On confidence interval estimators of multilevel attributable risk in cross-sectional studies
Authors	Khairul Islam Eastern Michigan University, MI, USA
E-mail	mislam4@emich.edu

Session ID: Name	Date	Time	Location
S10: Statistical Inference	October 12	S10-3: 10:20 am – 10:40 am	Three Fires Room

A simpler expression of the asymptotic variance for a multilevel attributable risk (AR) is derived and utilized for constructing confidence interval estimates of AR. We compare confidence interval estimators of AR using Wald statistic, log-transformation, logit-transformation and quadratic equation. As an alternative to the asymptotic approach, the boot-strap versions of such estimators are also considered which relieve practitioners of AR from using complicated asymptotic expressions from the delta method. A Monte Carlo simulation from specified multinomial distribution is considered to assess the finite sample performance of these intervals in terms of the coverage probability and the length of intervals.

Title	Robust estimation and fitting of reduced rank spatial model to large data sets
Authors	Casey Jelsema NIH/NIEHS, NC, USA Rajib Paul and Joseph McKean Western Michigan University, MI, USA
E-mail	jelsema.casey@gmail.com

Session ID: Name	Date	Time	Location
S1: Modeling I	October 11	S1-3: 10:20 am – 10:40 am	Ojibway Room

Reduced rank spatial models (RRSM) are popular in modeling spatial covariances for large spatial datasets. Methods of estimation such as EM algorithm and the current Method of Moments are susceptible to departures from the Normal distribution. We propose a modified MOM method; an empirical binned covariance matrix is constructed using the median absolute deviation and the L1 norm. The consistency of the proposed estimates is demonstrated theoretically and through simulation. The method is applied on remote sensing data obtained from NASA. Results show that the proposed method reduces the variability associated with kriging estimates in the presence of contaminated data.

Title	Inference for multivariate time-varying coefficient regression models		
Authors	Jiancheng Jiang and Yi Liu University of North Carolina - Charlotte, NC, USA		
E-mail	jjiang1@uncc.edu		
Session ID: Name	Date	Time	Location
S8: Modeling II	October 11	S8-2: 4:20 pm – 4:40 pm	Three Fires Room

In this talk we propose a multivariate time-varying coefficient regression model to fit vector time series data. The local linear smoother is employed to estimate the unknown coefficient matrices. Asymptotic normality of the proposed estimators is established. Several practical problems such as bandwidth selection are also considered. To test if commonly used vector AR models are appropriate for fitting a specific dataset, we develop the generalized likelihood ratio (GLR) test. Under the null models, the newly proposed GLR statistics is asymptotically represented as a weighted sum of rescaled chi-squared random variables, with the scaling constants and the degrees of freedom independent of the nuisance parameters. Simulations are conducted to demonstrate the performance of the proposed estimation and the Wilks phenomenon and the power of the test. A real data example is used to illustrate the value of the proposed methodology.

Title	Detection of multivariate outliers using a cluster-based approach		
Authors	Marcus Jobe Miami University, OH, USA Michael Pokojovy University of Konstanz, Germany		
E-mail	jobe1jm@cmich.edu		
Session ID: Name	Date	Time	Location
S4: Applications I	October 11	S4-2: 11:30 am – 11:50 am	Three Fires Room

Several outliers within a multivariate data set of interest significantly reduce the detection power of Hotelling's T^2 statistic. This reduction in detection power is typically referred to as masking. We propose a computer-intensive cluster-based approach that incorporates a reweighted version of Rousseeuw's minimum covariance determinant method with a multi-step cluster-based algorithm that initially filters out potential masking points. Compared to the most robust procedures, simulation studies show that our new method is better for outlier detection. Real data comparisons are presented.

Title	Maximizing leave-one-out likelihood for the location parameter of unbounded densities		
Authors	Wallin Jonas Lund University, Sweden Podgórski Krzysztof Lund University, Sweden		
E-mail	wallin@maths.lth.se		
Session ID: Name	Date	Time	Location
S10: Statistical Inference	October 12	S10-1: 9:40 am – 10:00 am	Three Fires Room

In this work, we propose an approach to estimation of the location parameter for a density that is unbounded at the mode. The estimator maximizes a modified likelihood in which the singular term in the full likelihood is left out, whenever the parameter value approaches a neighborhood of the singularity location. We show that the estimator is consistent and super-efficient for the class of distributions that we consider, which includes the generalized asymmetric Laplace distribution (Variance Gamma).

Title	Recent developments on the construction of bivariate distributions with fixed marginals		
Authors	Gwo Dong Lin Institute of Statistical Science, Academia Sinica, Taiwan, R.O.C.		
E-mail	gdlin@stat.sinica.edu.tw		
Session ID: Name	Date	Time	Location

S9: Distribution – Multivariate	October 12	S9-4: 10:40 am – 11:00 am	Ojibway Room
Since the 1930s it has been a challenging problem to construct a bivariate distribution with given marginals and correlation. Despite the fact that much effort has been devoted to this problem, for example, many relevant conference proceedings or monographs have been published in the past three decades, it still continues to be an active topic nowadays. In this survey paper we will simply focus on the recent developments on the FGM-related distributions and their generalizations including Sarmanov's distributions, Baker's distributions and Bayramoglu's distributions. This complements the most recent works: the review paper by Sarabia and Gomez-Deniz (2008, SORT) and the book by Balakrishnan and Lai (2009, Springer). It turns out that the most convenient unified approach to the problem is probably by way of a linear combination of the joint distributions of bivariate order statistics.			

Title	Nonlinear mixed-effects HIV dynamic models with considering left-censored measurements
Authors	Tao Lu State University of New York at Albany, NY, USA
E-mail	stat.lu11@gmail.com

Session ID: Name	Date	Time	Location
S1: Modeling I	October 11	S1-1: 9:40 am – 10:00 am	Ojibway Room
HIV dynamic model offers another perspective of studying pathogenesis of HIV infection and developing treatment strategy, other than laboratory experiments and clinical research. In this article, we propose a method that combines local polynomial mixed effect smoothing and Stochastic Approximation EM (SAEM) method for parameter estimates. We use the adapted method to investigate the effect of below detection data on parameter estimate for the time varying HIV dynamic model. The results show a distinct picture by taking into account censoring mechanism. The severity of HIV infection seems to be underestimated by model without considering censoring.			

Title	On the bivariate Polya-Aeppli distributions
Authors	Leda Minkova Sofia University, Bulgaria Narayanaswamy Balakrishnan McMaster University, Canada
E-mail	leda@fmi.uni-sofia.bg

Session ID: Name	Date	Time	Location
S9: Distribution - Multivariate	October 12	S9-1: 9:40 am – 10:00 am	Ojibway Room
In this paper we derive two types of bivariate Polya-Aeppli distributions. For the Type I, we use the bivariate Poisson distribution obtained by the trivariate reduction method and compound it with a geometric distribution. Type II bivariate Polya-Aeppli distribution is a compound Poisson distribution with bivariate geometric compounding distribution. We then discuss a number of properties of these distributions including the probability generating function, correlation structure, probability mass function, recursive relations, and conditional distributions. The generating functions of the tail probabilities are also obtained.			

Title	Bayesian multistate chronic disease, dynamic modelling: An application to a South African rheumatoid arthritis diseased cohort
Authors	Eustasius Musenge University of the Witwatersrand, South Africa
E-mail	Eustasius.Musenge@wits.ac.za

Session ID: Name	Date	Time	Location
S6: Bayesian I	October 11	S6-1: 2:45 pm – 3:05 pm	Three Fires Room

The primary goal of this article is to model the forces (rates) of recovery, relapse and mortality for patients started on rheumatoid arthritis (RA) standard treatment and the effect of adjusting for covariates. Bayesian based four state markov models were fit to the data adjusting for several explanatory variables to assess their effect to the forces of recovery and/or relapse. We employed generalised additive mixed models (GAMMs) which utilise nonparametric functions capable of handling complex data structures. Bayesian based GAMMs easily handle data which are; over-dispersed, auto-correlated, clustered, nested, hierarchical, spatially or temporary correlated and those numerically intractable (non-integrable).

Title	The distribution of the inverse square root transformed error component of the multiplicative time series model
Authors	Chinwe Nwosu Nnamdi Azikiwe University, Nigeria Bright Ajibade Petroleum Training Institute, Warri, Nigeria Julian Mbegbu University of Benin, Nigeria
E-mail	nwosucr@yahoo.com

Session ID: Name	Date	Time	Location
S5: Applications II	October 11	S5-2: 3:05 pm -3:25 pm	Ojibway Room

To increase efficiency in the use of data transformation in time series analysis, this paper investigated the distribution and properties of the left truncated $N\left(1,\sigma^2\right)$ error term, e_t , of the multiplicative time series model under inverse square root transformation with a view to establishing the condition when the transformed error term, e_t^*, is normally distributed with mean 1 as is expected of all error terms of the multiplicative time series model. The curve shapes of the probability density function (pdf) of e_t^*, g(y) sketched for different values of σ, $\sigma \in \left[0.05,\ 0.5\right]$ and the application of Rolle's theorem showed that g(y) is bell-shaped with mode ≈ 1 when σ ≤ 0.145. The normality of e_t^* for $\sigma < 0.15$ was further confirmed by simulated error terms. Finally the functional expressions for E(e_t^*) and Var(e_t^*) confirmed the mean of e_t^* to be 1 with Var(e_t^*) $\approx \frac{1}{4}$ Var(e_t) whenever $\sigma \le 0.14$. Hence, $\sigma \le 0.14$ is the recommended condition for successful inverse square root transformation.

Title	Weighted Dagum-Weibull and related distributions with applications to lifetime data
Authors	Broderick Oluyede and Benson Kimitei Georgia Southern University, GA, USA
E-mail	boluyede@georgiasouthern.edu

Session ID: Name	Date	Time	Location
S11: Distribution III	October 12	S11-2: 11:30 am – 11:50 am	Ojibway Room

A new class of weighted distributions, which we refer to as weighted Dagum-Weibull (WDW) and related distributions are proposed. Probability weighted moments (PWMs) of Dagum distribution are used in constructing this class of weighted distributions. This new class of distributions contains several weighted Dagum distributions such as length-biased Dagum-Weibull (LBDW), proportional hazard moment Dagum-Weibull (PHWDW), proportional reverse hazard moment Dagum-Weibull (PRHDW), length-biased Dagum-Rayleigh (LBDR), proportional hazard moment Dagum-Rayleigh (PHWDR), proportional reverse hazard moment Dagum-Rayleigh (PRHDR), length-biased Dagum-Exponential (LBDE), proportional hazard moment Dagum-Exponential (PHWDEXP), proportional reverse hazard moment Dagum-Exponential (PRHDE), Dagum-Weibull (DW), Dagum-Exponential (DE), and the parent Dagum distributions as special cases. Entropy and Fisher information of this class of weighted Dagum-Weibull distributions are derived. We estimate the model parameters via the maximum likelihood estimation procedure. Examples and comparison of the WDW distribution and its sub-models with the weighted generalized gamma, generalized gamma and generalized Lindley distributions are presented.

Title	Properties of the weighted generalized Lindley and related distributions

Authors	Mavis Pararai Indiana University of Pennsylvania, PA, USA
E-mail	pararaim@iup.edu

Session ID: Name	Date	Time	Location
S11: Distribution III	October 12	S11-1: 11:10 am – 11:30 am	Ojibway Room

A new class of weighted generalized Lindley distribution and related distributions are presented. Theoretical properties of the generalized Lindley model, weighted generalized Lindley distribution including the hazard function, reverse hazard function, moments, coefficient of variation, coefficient of skewness, coefficient of kurtosis, and entropy measures are derived. The results presented here generalize the generalized Lindley distribution and includes several distributions as well as special cases. The special cases include generalized Lindley distribution (GLD), weighted Lindley (WL), weighted Gamma (WG), Gamma (G) distributions and their underlying or parent distributions.

Title	Modified saddle point approximations and empirical extensions
Authors	Serge Provost University of Western Ontario, Canada
E-mail	provost@stats.uwo.ca

Session ID: Name	Date	Time	Location
S2: Distribution and Inference	October 11	S2-4: 10:40 am – 11:00 am	Three Fires Room

A polynomial adjustment is applied to the saddlepoint density approximation to improve its accuracy within the support of the target distribution. The polynomial coefficients are determined by making use of a moment-matching technique. A hybrid density approximation is also proposed. Density estimates that are based on empirical cumulant generating functions are introduced as well. The bivariate case, which is tackled via a standardizing transformation, involves the inversion of a high-dimensional matrix. The resulting representation of the joint density functions gives rise to a flexible copula family. Several illustrative examples will be presented.

Title	Geometric disintegration method
Authors	Wolf-Dieter Richter University of Rostock, Germany
E-mail	wolf-dieter.richter@uni-rostock.de

Session ID: Name	Date	Time	Location
S7: Distribution II	October 11	S7-3: 4:40 pm – 5:00 pm	Ojibway Room

The method presented here allows to derive exact statistical distributions if the density of the sample distribution is a function of an arbitrary norm, f(x)=g(||x||). This norm may adapt the model to a given cloud of sample points in a best geometric way and the density generator models both heavy and light tails. The log-concave and the l_{n,p}-symmetric sample distributions are particular cases of this model. We derive a geometric measure representation of the sample distribution which makes use of a norm-sensitively chosen non-Euclidean metric geometry for measuring subsets of density level sets and indicate several of the numerous possible applications.

Title	Determining individual baseball contributions from team run distributions
Authors	Steve Robinson Belmont University, TN, USA
E-mail	steve.robinson@belmont.edu

Session ID: Name	Date	Time	Location
S4: Applications I	October 11	S4-3: 11:50 am – 12:10 pm	Three Fires Room

It is often difficult to isolate an individual athlete's performance when his/her contributions depend on teammates (e.g., assists in basketball, receptions in football). Due to its many one-on-one interactions, however, baseball lends itself well to such a task. By simulating games with a given batting order, an expected run distribution can be generated. Then, considering lineups with or without a given player, these run distributions can be compared to find that player's expected contribution to a team's wins in a season.

Title	A multivariate two-sample test using regular minimum-weight spanning subgraphs
Authors	David Ruth United States Naval Academy, MD, USA
E-mail	druth@usna.edu

Session ID: Name	Date	Time	Location
S10: Statistical Inference	October 12	S10-2: 10:00 am – 10:20 am	Three Fires Room

A new nonparametric test is proposed for the multivariate two-sample problem as an extension of Rosenbaum's Cross-Match Test. Each observation is considered to be a vertex of a complete (undirected) weighted graph; interpoint distances are edge weights. A minimum-weight, r-regular spanning subgraph is constructed, and the proposed test statistic is the number of edges in the subgraph containing one observation from the first group and one from the second. Unequal distributions will tend to result in fewer edges that connect vertices between different groups. This test is sensitive to a wide range of distribution differences and has noteworthy power characteristics.

Title	Bivariate beta-generated distributions with applications to well-being data
Authors	Jose Maria Sarabia, Faustino Prieto and Vanesa Jorda University of Cantabria, Spain
E-mail	sarabiaj@unican.es

Session ID: Name	Date	Time	Location
S9: Distribution – Multivariate	October 12	S9-3: 10:20 am – 10:40 am	Ojibway Room

The class of beta-generated (BG) distributions (Eugene et al, 2002; Jones, 2004) has received a lot of attention in the last years. In this paper, several classes of bivariate distributions with marginal and/or conditional BG distributions are presented. These classes are constructed from different definitions of bivariate distributions with classical beta marginal and/or conditionals with different covariance structures. A new class of bivariate BG distributions based on the Sarmanov-Lee distribution is proposed and studied. Some specific bivariate distributions are studied and some extensions are considered. Finally, an empirical application with income and well-being data is presented.

Title	Geometric means of positive definite matrices and the matrix-variate log-normal distribution
Authors	Armin Schwartzman North Carolina State University, NC, USA
E-mail	armins@gmail.com

Session ID: Name	Date	Time	Location
S8: Modeling II	October 11	S8-3: 4:40 pm – 5:00 pm	Three Fires Room

This work introduces a new lognormal family of distributions on the set of symmetric positive definite (PD) matrices, seen as a matrix-variate extension of the univariate lognormal family of distributions. This family arises as the large sample limiting distribution via the central limit theorem of two types of geometric averages of i.i.d. PD matrices: the log-Euclidean average and the canonical geometric average. These averages correspond to two different geometries imposed on the set of PD matrices. The limiting distributions of these averages are used to provide large-sample confidence regions for the corresponding population means. The methods are illustrated on a voxelwise analysis of diffusion tensor imaging data, helping resolve the choice of voxelwise average type for this form of PD matrix data.

Title	Introducing the Conway-Maxwell-Skellam distribution for differences in count data containing common dispersion levels

Authors	Kimberly Sellers Georgetown University, DC, USA
E-mail	kfs7@georgetown.edu

Session ID: Name	Date	Time	Location
S7: Distribution II	October 11	S7-1: 4:00 pm - 4: 20 pm	Three Fires

The Skellam distribution is a discrete probability distribution whose associated random variable is defined as the difference of two independent Poisson random variables with different corresponding expected values, lambda1 and lambda2. Here, I introduce a generalized construct, namely where we instead consider the difference of two independent Conway-Maxwell-Poisson (COM-Poisson) random variables with differing parameters, lambda1 and lambda2, and a common associated dispersion parameter, nu. This distribution, which I have named the Conway-Maxwell-Skellam (COM-Skellam) distribution, is what results. I will present its form and associated properties, and propose its use as an alternative means to study differences in count data.

Title	Bayesian modeling of integer data using the generalized Poisson difference distribution
Authors	Golnaz Shahtahmassebi Nottingham Trent University, UK Rana Moyeed Plymouth University, UK
E-mail	golnaz.shahtahmassebi@ntu.ac.uk

Session ID: Name	Date	Time	Location
S16: Bayesian II	October 12	S16-2: 4:20 pm – 4:40 pm	Three Fires Room

Integer-valued random variables arising from the difference of two discrete variables are frequently seen in various applications. In this work we present a new methodology for analyzing such variables. For this purpose, we obtain the distribution and derive the properties of the difference of two generalized Poisson variables with unequal parameters. This distribution is adopted to model two sets of data: the data from the 2008-2009 Italian Serie A football season and a set of ultra-high frequency data relating to FTSE100 index futures using covariates. The analysis is carried out in a Bayesian framework using Markov Chain Monte Carlo methods. Various model diagnostics and model comparisons were undertaken which showed that the response variable in each case was explained well by the fitted model.

Title	On tests of hypotheses following transformations: An application to two-sample t-test
Authors	Tanweer Shapla and Khairul Islam Eastern Michigan University, MI, USA
E-mail	tshapla@emich.edu

Session ID: Name	Date	Time	Location
S10: Statistical Inference	October 12	S10-4: 10:40 am – 11:00 am	Three Fires Room

The t-test for testing equality of two population means requires the normality of populations the samples are being obtained. However, many real-life data violates the normality assumption. As such, the t-test cannot be applied or may result in invalid conclusion. Under this reality, non-parametric test or transformed tests could be used. In this presentation, a new transformed test will be investigated and compared with non-parametric test and untransformed t-test. Examples and simulation results reveal that the proposed test is more powerful than untransformed or non-parametric test in terms of the power and level of significance against violation of normality.

Title	Transforming the von Mises-Fisher distribution via generalized Möbius transformation
Authors	Kunio Shimizu Keio University, Japan
E-mail	k-shimizu@a2.keio.jp

Session ID: Name	Date	Time	Location
S2: Distribution and Inference	October 11	S2-2: 10:00 am – 10:20 am	Three Fires Room

Transforming the von Mises distribution via the Möbius transformation from the unit circle onto itself has been studied by Kato and Jones (2010, JASA). Some properties of the resulting distribution, such as unimodality/bimodality and symmetry/asymmetry, are discussed in their paper. In this talk we first mention the way of making a Möbius transformation from the unit sphere/hyper-sphere onto itself. Then we transform the von Mises-Fisher distribution via the multivariate Möbius transformation and study properties of the resulting distribution with its fit to data sets.

Title	A general model of random variation
Authors	Haim Shore Ben-Gurion University of the Negev, Israel
E-mail	shor@bgu.ac.il

Session ID: Name	Date	Time	Location
S5: Applications II	October 11	S5-3: 3:25 pm – 3:45 pm	Ojibway Room

Response Modeling Methodology (RMM) is a new platform for modeling monotone convex relationships. A unique feature of RMM is its "Continuous Monotone Convexity (CMC)" property, which renders separate monotone convex functions into points on the continuous spectrum of monotone convexity. The CMC property opens up new possibilities for developing generalized statistical distributions via modeling of the normal-based quantile function (the quantile expressed in terms of the respective standard normal quantile). In this presentation, the CMC property is exploited to develop a general model for random variation. Distribution fitting procedures and estimation methods are explored, using a set of 27 distributions.

Title	Adjusted method of moments estimators for power distribution parameters and their limiting distributions
Authors	A. R. Soltani Kuwait University, Kuwait
E-mail	asoltanir@yahoo.com

Session ID: Name	Date	Time	Location
S7: Distribution II	October 11	S7-2: 4:20 pm – 4:40 pm	Ojibway Room

The adjusted method of moments (AMM) is a method to estimate unknown parameters in the parametric statistical inference. Soltani and Homei (2009) introduced this method. As in the method of moments (MM), AMM estimators are solutions to certain system of equations obtained by equating moments (or sample moments) with their corresponding random Stieltjes partial sums (RSPS). The AMM equations are expressed in terms of the sample, sample order statistics, the population distribution function and its unknown parameters. They are in general more difficult than MM equations to solve. The advantage of AMM to the MM is that, there is no need to closed forms for population moments, and neither to the population distribution or density function. In this article we assume that our sample is taken from a population supported by a finite interval, and provide certain interesting statistical features of the RSPS and AMM estimators. We look into the limiting distribution of the AMM estimators. We demonstrate the normal distribution is not the right limiting distribution. At the end we provide applications for AMM estimators and their distributions with real data.

Title	The slash and skew-slash Student-t distributions
Authors	Fei Tan and Hanxiang Peng Indiana University-Purdue University Indianapolis, IN, USA
E-mail	ftan@math.iupui.edu

Session ID: Name	Date	Time	Location
S14: Distribution IV	October 12	S14-2: 3:05 pm – 3:25 pm	Three Fires Room

We first introduce the multivariate slash t distribution and investigate its properties. Then the multivariate skew-slash t distribution is defined. These distributions provide alternative choices in simulation and fitting of skewed and heavy-tailed data for which the normal fitting is not appropriate. Density curves of univariate slash and skew-slash distributions are graphically compared to the usual density curves. Bivariate density contours of skew-slash distributions are visually demonstrated. At the end, the skew-slash t distribution is used to fit real datasets and the fitting improves the skew-normal fitting of Azzalini and Capitanio and the skew-slash normal fitting of Wang and Genton.

Title	A new three-parameter lifetime distribution and associated inference		
Authors	Min Wang Michigan Technological University, MI, USA		
E-mail	minwang@mtu.edu		
Session ID: Name	Date	Time	Location
S14: Distribution IV	October 12	S14-3: 3:25 pm – 3:45 pm	Three Fires Room

In this paper, a new three-parameter lifetime distribution is introduced and various properties of the new distribution are discussed. These include shape of the probability density function, hazard rate function and its shape, quantile function, the limiting distributions of order statistics, and the moments. The unknown parameters are estimated by the maximum likelihood method. We develop an EM algorithm to find the maximum likelihood estimates of the unknown parameters, because they are not available in closed form. The Fisher information matrix is also obtained and it can be used for constructing the asymptotic confidence intervals. Finally, numerical examples based on two real-data sets are analyzed for illustrative purposes.

Title	Bayesian variable selection for mixed effects model with shrinkage prior		
Authors	Mingan Yang Central Michigan University, MI, USA		
E-mail	yang8m@cmich.edu		
Session ID: Name	Date	Time	Location
S6: Bayesian I	October 11	S6-3: 3:25 pm – 3:45 pm	Three Fires Room

Recently, many shrinkage priors have been proposed and studied in linear models to address massive regression problems. However, shrinkage priors are rarely used in mixed effects models. In this article, we address the problem of joint selection of both fixed effects and random effects with the use of several shrinkage priors in linear mixed models. The idea is to shrink small coefficients to zero while minimally shrink large coefficients due to the heavy tails. The shrinkage priors can be obtained via a scale mixture of normal distributions to facilitate computation. We use a stochastic search Gibbs sampler to implement a fully Bayesian approach for variable selection. The approach is illustrated using simulated data and a real example.

Title	Sampling for a distribution with complicated data structure		
Authors	Peng Zeng, Shumin Wang Auburn University, AL, USA		
E-mail	zengpen@auburn.edu		
Session ID: Name	Date	Time	Location
S12: Inference and Simulation	October 12	S12-2: 11:30 am – 11:50 am	Three Fires Room

In some computer experiments, the input is not numerical values but data with complicated structure. Sampling in such a scenario relies on an effective method for quantifying the data in order to generate a random sample. In this talk, we focus on a simulation study of the safety of high-field human MRI scanning. The major difficulty is how to generate a random sample of human heads that resemble those in a genuine human population. We propose an efficient way to quantify a human head and describe its distribution. A random sample can be generated easily.