International Conference on Advances in Probability and Statistics - Theory and Applications: A Celebration of N. Balakrishnan's 30 years of Contributions to Statistics

Wednesday, December 28– Saturday, December 31, 2011

Conference Program and Abstracts

VENUE

The Chinese University of Hong Kong
Hong Kong SAR
China

Conference website:
http://faculty.smu.edu/ngh/icaps2011.html

PROGRAM

ROOM ARRANGEMENT

Session	Location
Plenary Sessions	Lecture Theatre 1 (LT1), Lady Shaw Building
Sessions 1 – 13 A	Lecture Theatre 2 (LT2), Lady Shaw Building
Sessions 1 – 13 B	Lecture Theatre 3 (LT3), Lady Shaw Building
Sessions 1 – 13 C	Lecture Theatre 4 (LT4), Lady Shaw Building
Sessions 1 – 13 D	Lecture Theatre 5 (LT5), Lady Shaw Building
Sessions 4, 6 & 10 E	Classroom 1 (C1), Lady Shaw Building

LUNCH LOCATION

The Poolside Canteen of Benjamin Franklin Center

PROGRAM SUMMARY

Time	***Activity***
	Wednesday, December 28, 2011
8:00-9:00	*Registration and Refreshments*
9:00-9:30	Opening Ceremony
9:30-10:30	Plenary Talk 1 (Way Kuo)
10:30-11:00	*Coffee Break*
11:00-12:30	Parallel Invited Sessions
	Session 1A: Univariate and Multivariate Distributions Session 1B: Concomitants of Order Statistics Session 1C: Ranking and Selection Methods and Applications Session 1D: Statistical Inference Under Monotone Constraints
12:30-13:50	*Lunch*
13:50-15:20	Parallel Invited Sessions
	Session 2A: Statistical Models and Quality Control Session 2B: Pitman Closeness for Ordered Data and Applications Session 2C: Scan Statistics and Applications Session 2D: Multivariate Models with Copulas
15:20-15:45	*Coffee Break*
15:45-17:15	Parallel Invited Sessions
	Session 3A: Seimparametric Inference in Reliability and Survival Data Session 3B: Applied Probability and Queuing Theory Session 3C: Optimal Factorial Designs and its Applications Session 3D: New Development in Categorical Data and Based on Divergence Measures
17:25-18:25	Parallel Contributed & Students Sessions
	Session 4A: Reliability and Statistical Quality Control Session 4B: Statistical Methods for Survival and Panel Data Session 4C: Geometry, Algebra and Machine Learning: Applications in Statistics Session 4D: Statistical Models and Analysis for Imperfect Data Session 4E: Special Students Session I

Time	***Activity***
	Thursday, December 29, 2011
9:00-10:00	Plenary Talk 2 (Barry Arnold)
10:10-11:40	Parallel Invited Sessions
	Session 5A: Optimal Designs in Step-Stress Models Session 5B: Bounds and Inequalities for Ordered Data Session 5C: Statistical Methods in Assessment of Agreement Session 5D: Multivariate Distribution Theory I
11:40-12:00	*Coffee Break*
12:00-13:00	Parallel Contributed and Students Sessions
	Session 6A: Analysis of Censored Data Session 6B: Distribution Theory and Circular Models Session 6C: Bayesian Methods and Probability Models with Applications Session 6D: Stochastic Processes: Theory and Applications Session 6E: Special Students Session II
13:00-14:20	*Lunch*
14:20-15:50	Parallel Invited Sessions
	Session 7A: Predictive Analysis based on Censored Data Session 7B: Discrete Ordered Data and Properties Session 7C: Multivariate Statistical Analysis Session 7D: Distribution and Stochastic Modelling
15:50-16:15	*Coffee Break*
16:15-18:15	Parallel Invited and Students Sessions
	Session 8A: Directional Data Analysis Session 8B: Statistical Models and Methods for Financial and Economic Data Session 8C: Divergence Measures and Their Statistical Applications Session 8D: Special Students Session III
18:30-20:00	Transportation to Banquet Location
20:00-22:30	*Banquet*

Time	***Activity***
	Friday, December 30, 2011
9:00-10:00	Plenary Talk 3 (M. C. Jones)
10:10-11:40	Parallel Invited Sessions
	Session 9A: Progressive Censoring Methodology and Applications Session 9B: Theory and Applications of Order Statistics Session 9C: Robust Inference with Divergence Measures Session 9D: Multivariate Distribution Theory II
11:40-12:00	*Coffee Break*
12:00-13:00	Parallel Contributed Sessions
	Session 10A: Regression and Linear Models Session 10B: Resampling Methods with Applications Session 10C: Statistical Methods in Genetics and Medical Sciences Session 10D: Asymptotic Theory in Statistics Session 10E: Special Students Session IV
13:00-14:20	*Lunch*
14:20-15:50	Parallel Invited Sessions
	Session 11A: Step-Stress Models and Inference Session 11B: Ranked-set Sampling and Inference Session 11C: Longitudinal Data Analysis Session 11D: Reliability Sampling Plans and Analysis with Applications
15:50-16:15	*Coffee Break*
16:15-17:45	Parallel Invited Sessions
	Session 12A: Nonparametric statistics Session 12B: Statistical Models and Methods for Some Real Life Applications Session 12C: Exceedances, Distributions and Applications Session 12D: Univariate and Multivariate Skewed Distributions

Time	***Activity***
Saturday, December 31, 2011	
9:00-10:00	Plenary Talk 4 (Enrique Castillo)
10:00-10:20	*Coffee Break*
10:20-11:50	Parallel Invited & Contributed Sessions
	Session 13A: Statistical Methods in Lifetime Models and Biomedical Sciences Session 13B: Applied Statistical Methods: Segmentation and Classification Session 13C: Algebraic Methods in Experimental Design Session 13D: Statistical Inference
11:50-12:20	*Closing Ceremony*

PLENARY TALKS

Wednesday, December 28, 2011, 9:30 – 10:30

IMPORTANCE MEASURES IN RELIABILITY AND RISK

Way Kuo, City University of Hong Kong, Kowloon Tong, Hong Kong

Chair: *Enrique Castillo,* University of Cantabria, Santander, Spain

Thursday, December 29, 2011, 9:00 – 10:00

BALA'S CONTRIBUTIONS TO THE SKEW LITERATURE

Barry C. Arnold, University of California, Riverside, CA, U.S.A.

Chair: *H. N. Nagaraja,* Ohio State University, Columbus, OH, U.S.A.

Friday, December 30, 2011, 9:00 – 10:00

SOME PARAMETRIC FAMILIES OF DISTRIBUTIONS AND THEIR INTERCONNECTIONS

Chris Jones, The Open University, Milton Keynes, England

Chair: *Barry C. Arnold,* University of California, Riverside, CA, U.S.A.

Saturday, December 31, 2011, 9:00 – 10:00

SOME APPLICATIONS OF STATISTICS TO TRAFFIC MODELS

Enrique Castillo, University of Cantabria, Santander, Spain

Chair: *Jose Maria Sarabia,* University of Cantabria, Santander, Spain

Wednesday, December 28, 2011: Parallel Sessions

1A: Univariate and Multivariate Distributions with Applications (11:00-12:30)

Organizer: *Chin Diew Lai,* Massey University, New Zealand

Chair: *Chin Diew Lai,* Massey University, New Zealand

11:00-11:30	Parameter and Quantile Estimation for Lifetime Distributions with Unknown Location Parameter *Hideki Nagatsuka,* Tokyo Metropolitan University, Japan
11:30-12:00	Weibull Models for Bathtub-shaped Failure Rate Distribution *Mie Xie,* The City University of Hong Kong, Kowloon, Hong Kong
12:00-12:30	A Generalized Logistic Frailty Model *Chin Diew Lai,* Massey University, New Zealand

1B: Concomitants of Order Statistics (11:00-12:30)

Organizer: *H. N. Nagaraja,* Ohio State University, Columbus, OH, U.S.A.

Chair: *H. N. Nagaraja,* Ohio State University, Columbus, OH, U.S.A.

11:00-11:30	Selection with Concomitants of Order Statistics *Ke Wang,* Fudan University, Shanghai, China
11:30-12:00	Fisher Information in Censored Samples from Marshall-Olkin Bivariate Exponential Distribution *Qinying He,* Southwestern University of Finance and Economics, Sichuan, China
12:00-12:30	Simulation of Complete and Censored Samples from Common Bivariate Exponential Distributions *H. N. Nagaraja,* Ohio State University, Columbus, OH, USA

1C: Ranking and Selection Methods and Applications (11:00-12:30)

Organizer: *S. Panchapakesan,* Southern Illinois Univ., Carbondale, U.S.A.

Chair: *Lifang Hsu,* Le Moyne College, Syracuse, NY, U.S.A.

11:00-11:30	A Bayesian Approach for Selecting the Best Exponential Population with Interval Censored Samples *Lee-Shen Chen,* Ming Chuan University, Taiwan
11:30-12:00	Multiple Targets Characterization of Electromagnetic Vulnerability *Pinyuen Chen,* Syracuse University, New York, U.S.A.
12:00-12:30	Ranking Independent Variables in Linear Models *Deng-Yuan Huang,* Fu-Jen Catholic University, Taiwan

1D: Statistical Inference Under Monotone Constraints (11:00-12:30)

Organizer: *S. Park,* Yonsei University, Seoul, South Korea

Chair: *Chien-Tai Lin,* Tamkang University, Taiwan

11:00-11:30	Additive Isotone Regression *Kyusang Yu,* Konkuk University, Seoul, South Korea
11:30-12:00	Isotonic Mean Estimator for the Judgement-Post Stratified Samples *Johan Lim,* Seoul National University, Seoul, South Korea
12:00-12:30	Estimation of the Shape Constrained Partially Linear Model and the Liquidity Cost *Donghyeon Yu,* Seoul National University, Seoul, South Korea

2A: Statistical Models and Quality Control (13:50-15:20)

Chair: *Chin Diew Lai,* Massey University, New Zealand

13:50-14:20	Reliability Properties in Some Classes of Conditionally Specified Models *Jose Maria Sarabia,* University of Cantabria, Spain
14:20-14:50	Nonparametric Inference on Lifetime Models *Hannelore Liero,* University of Potsdam, German
14:50-15:20	Consumer's Risk and Costs in Zero Acceptance Number Sampling *Govindaraju Kondaswamy,* Massey University, New Zealand

2B: Pitman Closeness for Ordered Data and Applications (13:50-15:20)

Organizer: *Katherine Davies,* University of Manitoba, Winnipeg, MB, Canada

Chair: *Anna Dembińska,* Warsaw University of Technology, Poland

13:50-14:20	Pitman Closeness for Progressively Type-II Right Censored samples *William Volterman,* McMaster University, Hamilton, ON, Canada
14:20-14:50	Pitman Closeness as a Criterion for the Determination of the Optimal Progressive Censoring Scheme *Katherine Davies,* University of Manitoba, Winnipeg, MB, Canada
14:50-15:20	Closeness of Order Statistics to Record Statistics *Jafar Ahmadi,* Ferdowsi University of Mashhad, Iran

2C: Scan Statistics and Applications (13:50-15:20)

Organizer: *Joseph Glaz,* Univ. of Connecticut, Storrs, Connecticut, U.S.A.

Chair: *Joseph Glaz,* Univ. of Connecticut, Storrs, Connecticut, U.S.A.

13:50-14:20	Adjustments to Scan Statistics on Irregular Designs *Hock Peng Chan,* National University of Singapore, Singapore
14:20-14:50	Approximation for the Three Dimensional Scan Statistics Distribution *Alexandru Amarioarei,* University Lille1, INRIA Modal, France
14:50-15:20	Approximations for Distributions of Scan Statistics for Normal Data *Joseph Glaz,* Univ. of Connecticut, Storrs, Connecticut, U.S.A.

2D: Multivariate Models with Copulas (13:50-15:20)

Organizer: *Nikolai Kolev,* University of Sao Paulo, Brazil

Chair: *Nikolai Kolev,* University of Sao Paulo, Brazil

13:50-14:20	Multivariate Geometric Distributions with Lack-of-Memory Property, d-monotone Sequences, and Infinitely Divisible Laws *Natalia Shenkman,* TU Munich, Germany
14:20-14:50	A New Index to Measure Dependence *Verónica González-López,* University of Campinas, Brazil
14:50-15:20	A Non-parametric Test of Independence *Jesus Garcia,* UNICAMP, Brazil

3A: Semiparametric Inference in Reliability and Survival Data (15:45-17:15)

Organizer: *Laurent Bordes,* University of Pau, Pau, France

Chair: *Laurent Bordes,* University of Pau, Pau, France

15:45-16:15	Quasi-Hadamard Differentiability: A New Differentiability Concept with Applications to Almost Everything *Eric Beutner,* Maastricht University, Netherlands
16:15-16:45	EM-like Algorithms for Semiparametric Lifetime Mixture Models Under Random Censoring *Laurent Bordes,* University of Pau, Pau, France

3B: Applied Probability and Queuing Theory (15:45-17:15)

Organizer: *Narayan Bhat,* Southern Methodist University, Dallas, TX, U.S.A.

Chair: *Joseph Glaz,* Univ. of Connecticut, Storrs, Connecticut, U.S.A.

15:45-16:15	Exact-order Asymptotic Analysis for Closed Queueing Networks *Cathy Xia,* Ohio State University, Columbus, OH, U.S.A.
16:15-16:45	A Stochastic Optimal Control Problem in Workforce Management *Yingdong Lu,* IBM T.J. Watson Research Center, New York, U.S.A.
16:45-17:15	Load Balancing with Distributed Balancers *Yi Lu,* University of Illinois at Urbana-Champaign, U.S.A.

3C: Optimal Factorial Designs and its Applications (15:45-17:15)

Organizer: *Runchu Zhang,* Nankai University, Tianjin, China

Chair: *Runchu Zhang,* Nankai University, Tianjin, China

15:45-16:15	Optimal Fractions of Two-Level Factorials under a Baseline Parametrization *Boxin Tang,* Simon Fraser University, Vancouver, BC, Canada
16:15-16:45	The Stepwise Response Refinement Screener (SRRS) *Frederick Kin Hing Phoa,* Institute of Statistical Science, Academia Sinica, Taiwan
16:45-17:15	Construction of Blocked Two-Level Designs with General Minimum Lower Order Confounding *Shengli Zhao,* Qufu Normal University, Qufu, China

3D: New Developments in Categorical Data Based on Divergence Measures (15:45-17:15)

Organizer: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

Chair: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

15:45-16:15	Adjusted Power-Divergence Test Statistics for Simple Goodness-of-Fit under Clustered Sampling *Aylin Alin,* Dokuz Eylul University, Izmir, Turkey
16:15-16:45	On a Transformed φ-divergence Goodness-of-Fit Statistic for Testing a Logistic Regression Model *Nobuhiro Taneichi,* Kagoshima University, Kagoshima, Japan
16:45-17:15	A New Influence Measure in Polytomous Logistic Regression Models based on φ-divergence Measures *Nirian Martin,* Carlos III University of Madrid, Madrid, Spain

4A: Reliability and Statistical Quality Control (17:25-18:25)

Chair: *Katherine Davies,* University of Manitoba, Canada

17:25-17:45	On Reliability of Generalized k-out-of-n system and reliability importance for (n, f, k) system *Kirtee Kamalja,* North Maharashtra University, Jalgaon, India
17:45-18:05	Enhanced Rules to Increase the Sensitivity of a Shewhart Chart *Michael Boon Chong Khoo,* Universiti Sains Malaysia, Malaysia
18:05-18:25	Bayesian Estimation of the Change Point Using X Control Chart *Fazlollah Lak,* Persian Gulf University, Iran

4B: Statistical Methods for Survival and Panel Data (17:25-18:25)

Chair: *Hannelore Liero,* University of Potsdam, German

17:25-17:45	Generalized Concept of Relative Risk and Wider Applications of the Cox Proportional Hazards Model *Bojuan Zhao,* Tianjin University of Finance and Economics, China
17:45-18:05	Testing for the Presence of a Cure Fraction in Clustered Interval-Censored Survival Data *Xiangmei Ma,* Nanyang Technological University, Singapore
18:05-18:25	General Trend Analysis of Bivariate Continuous Panel Data *Wei-Hsiung Chao,* National Dong Hwa University, Taiwan

4C: Geometry, Algebra and Machine Learning: Applications in Statistics (17:25-18:25)

Chair: *Runchu Zhang,* Nankai University, Tianjin, China

17:25-17:45	Mix Orthogonal Arrays: Constructions and Applications *Man Van Minh Nguyen,* University of Technology, Ho-Chi-Minh City, Viet Nam
17:45-18:05	Kernel Alignment Feature Selection for Computational Drug Design *William W. L. Wong,* University of Toronto, Ontario, Canada
18:05-18:25	Estimation in Models with a Kronecker Product Covariance Structure *Tatjana Von Rosen,* Stockholm University, Sweden

4D: Statistical Models and Analysis for Imperfect Data (17:25-18:25)

Chair: *Nikolai Kolev,* University of Sao Paulo, Brazil

17:25-17:45	Kendall's Tau for Bivariate Interval Censored Data *Yuneung Kim,* Seoul National University, South Korea
17:45-18:05	Multiple Outliers Detection in Samples from One-parameter Exponential Family *Nirpeksh Kumar,* M. G. Kashi Vidyapith University, India
18:05-18:25	A Novel Method for Simultaneously Correction to the Bias of Population Stratification and Unmeasured Confounders *Hui-Wen Lin,* Soochow University, Taipei, Taiwan

4E: Special Students Session I (17:25-18:25)

Chair: *Tao Li,* Peking University, Beijing, China

17:25-17:45	Estimation in Multilevel Models with Circularly Block Symmetric Covariance Structure *Yuli Liang,* Stockholm University, Sweden
17:45-18:05	Conditional Bivariate Order Statistics *Gülder Kemalbay,* Yildiz Technical University, Istanbul, Turkey
18:05-18:25	Family of Matrix Elliptical t-Distributions *Anis Iranmanesh,* Islamic Azad University, Mashhad, Iran

Thursday, December 29, 2011: Parallel Sessions

5A: Optimal Designs in Step-Stress Models (10:10-11:40)

Organizer: *David Han,* Univ. of Texas, San Antonio, Texas, U.S.A.

Chair: *David Han,* Univ. of Texas, San Antonio, Texas, U.S.A.

10:10-10:40	Comparison Between Constant-stress Testing and Step-stress Testing under Type-I Censoring *David Han,* Univ. of Texas, San Antonio, Texas, U.S.A.
10:40-11:20	Step-Stress Modeling Based on Sequential Order Statistics *Maria Kateri,* University of Ioannina, Greece
11:10-11:40	Reliability Modeling for Engineering Design Under Step-stress and Variable-stress Situations *Efrén M. Benavides,* Universidad Politécnica de Madrid, Spain

5B: Bounds and Inequalities for Ordered Data (10:10-11:40)

Organizer: *Tomasz Rychlik,* Polish Academy of Sciences, Torun, Poland

Chair: *Tomasz Rychlik,* Polish Academy of Sciences, Torun, Poland

10:10-10:40	A Simple Method for Obtaining the Maximal Correlation Coefficient with Applications to Ordered Data *Nickos Papadatos,* University of Athens, Greece
10:40-11:20	Bounds on Dispersion of Order Statistics *Tomasz Rychlik,* Polish Academy of Sciences, Torun, Poland
11:10-11:40	Bounds for Moments of Concomitants *Andrzej Okolewski,* Technical University of Lodz, Poland

5C: Statistical Methods in Assessment of Agreement (10:10-11:40)

Organizer: *Pankaj K. Choudhary,* Univ. of Texas, Dallas, Texas, U.S.A.

Chair: *H. N. Nagaraja,* Ohio State University, Columbus, OH, U.S.A.

10:10-10:40	Matrix-based Concordance Correlation Coefficient *Sasiprapa Hiriote,* Silpakorn University, Thailand
10:40-11:20	An AUC-like Index for Agreement Assessment *Zheng Zhang,* Brown University, Providence, Rhode Island, U.S.A.

5D: Multivariate Distribution Theory I (10:10-11:40)

Organizer: *Enkelejd Hashorva,* University of Lausanne, Switzerland

Chair: *Enkelejd Hashorva,* University of Lausanne, Switzerland

10:10-10:40	Extremes and Products of Multivariate AC-Product Random Vectors - With Insurance Applications *Yang Yang,* Nanjing Audit University, China
10:40-11:20	Consistent Estimation of the Shape of the Means with Applications in 3-D Shape Analysis *Alfred Kume,* University of Kent, United Kingdom
11:10-11:40	Logistic Vector Random Fields with Logistic Direct and Cross Covariance Functions *Chunsheng Ma,* Wichita State University, Kansas, U.S.A.

6A: Analysis of Censored Data (12:00-13:00)

Chair: *Jafar Ahmadi,* Ferdowsi University of Mashhad, Iran

12:00-12:20	Results on Residual Renyi Entropy under Progressive Censoring *Sarah Jomhoori,* University of Birjand, Iran
12:20-12:40	An EM Algorithm for Estimating the Parameters of the Generalized Exponential Distribution under Unified Hybrid Censored Data *Arezou Habibi,* Ferdowsi University of Mashhad, Iran

6B: Distribution Theory and Circular Models (12:00-13:00)

Chair: *A. SenGupta,* Indian Statistical Institute, Kolkata, India

12:00-12:20	An Extended Family of Circular Distributions Related to Wrapped Cauchy Distributions via Brownian Motion *Shogo Kato,* Institute of Statistical Mathematics, Japan
12:20-12:40	Symmetric Circular Models Through Duplication and Cosine Perturbation *Toshihiro Abe,* The Institute of Statistical Mathematics, Japan
12:40-13:00	A Bivariate Cardioid Distribution Generated From a Circular-Circular Structural Model *Minzhen Wang,* Keio University, Japan

6C: Bayesian Methods and Probability Models with Applications (12:00-13:00)

Chair: *Paramjit Gill,* University of British Columbia Okanagan, Canada

12:00-12:20	A Bayesian rating system using W-Stein's identity *Chiu-Hsing Weng,* National Chengchi University, Taiwan
12:20-12:40	Applying Sensitivity Analysis on Probabilistic Graphical Models *Hei Chan,* The Institute of Statistical Mathematics, Japan
12:40-13:00	Coin Tossing, Fibonacci Numbers, and Indian Music *M. B. Rao,* University of Cincinnati, Cincinnati OH, U.S.A.

6D: Stochastic Processes: Theory and Applications (12:00-13:00)

Chair: *Peng Zhao,* Lanzhou University, China

12:00-12:20	Almost Sure Convergence of the Stationary Bootstrap in a Class of General Weak Dependence *Eunju Hwang,* Ewha Womans University, South Korea
12:20-12:40	Pricing and Hedging Volatility Derivatives under the Modified Constant Elasticity of Variance Model *Leung Lung Chan,* University of New South Wales, Australia
12:40-13:00	Uniform Convergence of Wavelet Expansions of Random Processes *Andriy Olenko,* La Trobe University, Australia

6E: Special Students Session II (12:00-13:00)

Chair: *Laurent Bordes,* University of Pau, Pau, France

12:00-12:20	Multi-stress Aging Model for One-Shot Device Testing Data under Exponential Distribution *Man Ho Ling,* McMaster University, Hamilton, Ontario, Canada
12:20-12:40	Finite Mixture Normal Model and its Application to Truncated Grid Data *Boyu Wei,* Tsinghua University, China
12:40-13:00	A Two Step Model for PLS with Group Effect *Ying Li,* Swedish University of Agricultural Sciences, Sweden

7A: Predictive Analysis Based on Censored Data (14:20-15:50)

Organizer: *Indrani Basak,* Penn State Altoona, Altoona, PA, U.S.A.

Chair: *Indrani Basak,* Penn State Altoona, Altoona, PA, U.S.A.

14:20-14:50	Bayesian Accelerated Life Testing of Series Systems *Chiranjit Mukhopadhyay,* Indian Institute of Science, India
14:50-15:20	Prediction of Times to Failure of Censored Items for a Simple Step-Stress Model with Progressive Censoring *Indrani Basak,* Penn State Altoona, Altoona, PA, U.S.A.
15:20-15:50	Prediction of Failure Times of Censored Items in Progressively Censored Samples *Prasanta Basak,* Penn State Altoona, Altoona, PA, U.S.A.

7B: Discrete Ordered Data and Properties (14:20-15:50)

Organizer: *Anna Dembińska,* Warsaw University of Technology, Poland

Chair: *Tomasz Rychlik,* Polish Academy of Sciences, Torun, Poland

14:20-14:50	Bounds on L-statistics from Discrete Models *Agnieszka Goroncy,* Nicolaus Copernicus University, Poland
14:50-15:20	On the Asymptotics of Numbers of observations in Random Regions Determined by Order Statistics *Anna Dembińska,* Warsaw University of Technology, Poland

7C: Multivariate Statistical Analysis (14:20-15:50)

Organizer: *Bimal Sinha,* University of Maryland, Baltimore County, MD, U.S.A.

Chair: *Nikolai Kolev,* University of Sao Paulo, Brazil

14:20-14:50	Empirically Effective Bond Pricing Model and Analysis on Term Structures of Implied Interest Rates in Financial Crisis *Takeaki Kariya,* GSB, Meiji University, Japan
14:50-15:20	Combining Multivariate Bioassays: Accurate Inference Using Small Sample Asymptotics *Thomas Mathew,* University of Maryland, Baltimore County, MD, U.S.A.
15:20-15:50	Semiparametric Principal Components Poisson Regression on Clustered Data *Erniel Barrios,* University of the Philippines, Philippines

7D: Distribution and Stochastic Modelling (14:20-15:50)

Organizer: *Leda Minkova,* Sofia University, Bulgaria

Chair: *Leda Minkova,* Sofia University, Bulgaria

14:20-14:50	Measures and Tests of Skewness for the Multivariate Skew-normal Distribution *Bruno Scarpa,* Università di Padova, Italy
14:50-15:20	Recent Contributions to the Distributions of Order k *Leda Minkova,* Sofia University, Bulgaria
15:20-15:50	Multivariate Semi-Markov Processes and Some Applications *Raimondo Manca,* "Sapienza" University of Rome, Italy

8A: Directional Data Analysis (16:15-18:15)

Organizer: *A. SenGupta,* Indian Statistical Institute, Kolkata, India

Chair: *A. SenGupta,* Indian Statistical Institute, Kolkata, India

16:15-16:45	Modified Möbius Distributions on the Unit Disc *Kunio Shimizu,* Keio University, Japan
16:15-17:15	Bivariate Cardioid Distributions *Seng Huat Ong,* University of Malaya, Malaysia
17:15-17:45	Maxent Directional Distributions, Entropies and their Estimation *A. SenGupta,* Indian Statistical Institute, Kolkata, India
17:45-18:15	Inverse Batschelet Distributions for Circular Data *Arthur Pewsey*, University of Extremadura, Spain

8B: Statistical Models and Methods for Financial and Economic Data (16:15-18:15)

Organizer: *Boris Choy,* The University of Sydney Business School, Australia

Chair: *Boris Choy,* The University of Sydney Business School, Australia

16:15-16:45	Inference of Seasonal Long-memory Time Series with Measurement Errors *Henghsiu Tsai,* Institute of Statistical Science, Academia Sinica, Taiwan
16:15-17:15	Bayesian Stochastic Volatility Model for Australian National Electricity Market Spot Price *Eric Wing Wah Fung,* University of Sydney, Australia
17:15-17:45	On Asymmetric Generalised t Stochastic Volatility Models *Joanna Wang,* University of Sydney, Australia
17:45-18:15	Stochastic volatility models and quantile regression using asymmetric Laplace error distribution via uniform scale mixtures *Boris Choy,* University of Sydney, Australia

8C: Divergence Measures and Their Statistical Applications (16:15-18:15)

Organizer: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

Chair: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

16:15-16:45	Statistical inference via divergences for semiparametric two-sample density ratio models *Amor Keziou,* Laboratoire de Mathématiques, Université de Reims, France
16:15-17:15	Minimum density power divergence method in time series models *Sangyeol Lee,* Seoul National University, South Korea
17:15-17:45	On Testing Composite Hypotheses with Divergence Statistics *Domingo Morales,* University Miguel Hernàndez de Elche, Spain
17:45-18:15	Weighted Sampling, Maximum Likelihood and Minimum Divergence Estimators *Michel Broniatowski* , LSTA Université Pierre et Marie Curie, Paris, France

8D: Special Students Session III (16:15-18:15)

Chair: *Indrani Basak,* Penn State Altoona, Altoona, PA, U.S.A.

16:15-16:35	On the Likelihood Estimation of Parameters of Birnbaum-Saunders Distribution Based on Censored Samples *Xiaojun Zhu,* McMaster University, Hamilton, Ontario, Canada
16:35-16:55	A New Property of Lagrangian Distributions *Tomoaki Imoto,* Keio University, Japan
16:55-17:15	One Extremely Large Deviation Result *Zhansheng Cao,* University Paris 6, France
17:15-17:35	Local Influence Analysis in Cross-over Designs *Chengcheng Hao,* Stockholm University, Sweden
17:35-17:55	The Power of Stein's Method in an Isometric Study of the Lindeberg-Feller Central Limit Theorem *Ben Berckmoes,* University of Antwerp, Belgium
17:55-18:15	Likelihood Inference for Lognormal and Weibull Data with Left Truncation and Right Censoring with Illustrations *Debanjan Mitra,* McMaster University, Hamilton, Ontario, Canada

Friday, December 30, 2011: Parallel Sessions

9A: Progressive Censoring Methodology and Applications (10:10-11:40)

Organizer: *Erhard Cramer,* RWTH Aachen University, Germany

Chair: *Erhard Cramer,* RWTH Aachen University, Germany

10:10-10:40	Adaptive Progressive Type-I Censoring *George Iliopoulos,* University of Piraeus, Greece
10:40-11:10	The Art of Progressive Censoring *Erhard Cramer,* RWTH Aachen University, Germany
11:10-11:40	Bayesian Analysis of Progressively Censored Competing Risks Data *Debasis Kundu,* Indian Institute of Technology Kanpur, India

9B: Theory and Applications of Order Statistics (10:10-11:40)

Chair: *Prasanta Basak,* Penn State Altoona, Altoona, PA, U.S.A.

10:10-10:40	Baker-Lin-Huang type Bivariate distributions based on order statistics *Konul Bayramoglu,* Middle East Technical University, Ankara, Turkey
10:40-11:10	Moments of Order Statistics from Weibull distribution in the Presence of Multiple Outliers *Khalaf Sultan,* King Saud University, Saudi Arabia
11:10-11:40	A Review on Convolutions and Order Statistics from Heterogeneous Samples *Peng Zhao,* Lanzhou University, China

9C: Robust Inference with Divergence Measures (10:10-11:40)

Organizer: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

Chair: *Leandro Pardo,* Complutense University of Madrid, Madrid, Spain

10:10-10:40	Robust Estimation in Non-parametric Normed Space *Claudio Agostinelli,* Ca' Foscari University, Italy
10:40-11:10	Minimum Distance Estimation Based on Tangent Disparities *Ayanendranath Basu,* Indian Statistical Institute, India
11:10-11:40	Robust and Bayesian Analysis of Non-Stationary Data via Disparities *Giles Hooker,* Cornell University, Ithaca, NY, U.S.A.

9D: Multivariate Distribution Theory II (10:10-11:40)

Organizer: *Enkelejd Hashorva,* University of Lausanne, Switzerland

Chair: *Enkelejd Hashorva,* University of Lausanne, Switzerland

10:10-10:40	On Pearson-Kotz Dirichlet Random Vectors *Enkelejd Hashorva,* University of Lausanne, Switzerland
10:40-11:10	Seeking Hidden Risks using Multivariate Regular Variation *Bikramjit Das,* ETH Zurich, Switzerland
11:10-11:40	A Fast Generating Algorithm for Dirichlet Random Vectors with Some Extensions *Ying-Chao Hung,* National Chengchi University, Taiwan

10A: Regression and Linear Models (12:00-13:00)

Chair: *Ismihan Bairamov,* Izmir University of Economics, Balcova, Turkey

12:00-12:20	Bayesian Adaptive Calibration and Variable Selection in Linear Measurement Error Models *Hongmei Zhang,* University of South Carolina, Columbia, SC, U.S.A.
12:20-12:40	Unbalanced Mixed Linear Models and Explicit Estimators *Dietrich Von Rosen,* Swedish University of Agricultural Sciences, Sweden
12:40-13:00	An Empirical Investigation to Study the Trenss in Cereals Crop Production Based on Parametric and Nonparametric Regression Models *Arunachalam Rajarathinam*, Manonmaniam Sundaranar University, India

10B: Resampling Methods with Applications (12:00-13:00)

Chair: *Antonella Capitanio,* University of Bologna, Italy

12:00-12:20	Permutation Multiple Tests on Ordering with application to the study of listening conditions in classrooms *Stefano Bonnini,* University of Ferrara, Italy
12:20-12:40	Improving Power of Multivariate Combination-based Permutation Inferences *Livio Corain,* University of Padova, Italy

10C: Statistical Methods in Genetics and Medical Sciences (12:00-13:00)

Chair: *Eugenia Stoimenova,* Bulgarian Academy of Sciences, Sofia, Bulgaria

12:00-12:20	A Generalized Genetic Association Study with Samples of Related Subjects *Zeny Feng,* University of Guelph, ON, Canada
12:20-12:40	Optimal Significance Analysis of Microarray Data in a Class of Tests whose Null Statistic can be Constructed *Hironori Fujisawa,* Institute of Statistical Mathematics, Japan
12:40-13:00	A Stochastic Model for HIV Infection *Pandiyan Pichamuthu,* Annamalai University, India

10D: Asymptotic Theory in Statistics (12:00-12:40)

Chair: *Ahad Jamalizadeh,* Shahid Bahonar University of Kerman, Iran

12:00-12:20	Asymptotic Normality of Quantile Regression Estimators for Samples from a Finite Population *Hitoshi Motoyama,* Institute of Statistical Mathematics, Japan
12:20-12:40	A Fast Wavelet Algorithm for Analyzing One-Dimensional Signal Processing and Asymptotic Distribution of Wavelet Coefficients *Mahmoud Afshari,* Persian Gulf University, Iran
12:40-13:00	Information Geometry in Large Dimension Contingency Table *Philip Cheng,* Academia Sinica, Taiwan

10E: Special Students Session IV (12:00-13:00)

Chair: *Erhard Cramer,* RWTH Aachen University, Germany

12:00-12:20	Empirical likelihood inference in mixture of semiparametric varying coefficient models for longitudinal data with nonignorable dropout *Xingcai Zhou,* Southeast University, China
12:20-12:40	Fisher Information in Censored Samples from the Block-Basu Bivariate Exponential Distribution and Its Applications *Lira Pi,* Ohio State University, Columbus, OH, U.S.A.
12:40-13:00	On Some Likelihood Inferential Aspects for Different Cure Rate Models *Suvra Pal,* McMaster University, Hamilton, Ontario, Canada

11A: Step-Stress Models and Inference (14:20-15:50)

Organizer: *Qihao Xie,* Bombardier Inc., Mississauga, Ontario, Canada

Chair: *David Han,* Univ. of Texas, San Antonio, Texas, U.S.A.

14:20-14:50	Inference for a Simple Gamma Step-stress Model with Type-II Censoring *Laila Alkhalfan,* McMaster University, Hamilton, ON, Canada
14:50-15:20	Accelerated Life Tests for Weibull Series Systems with Masked Data *Wan-Lun Wang,* Feng Chia University, Taiwan

11B: Ranked-set Sampling and Inference (14:20-15:50)

Organizer: *Tao Li,* Peking University, Beijing, China

Chair: *Tao Li,* Peking University, Beijing, China

14:20-14:50	Improving Power to Detect Intervention Effects in Hierarchical Linear Models via Ranked Set Sampling *Xinlei Wang,* Southern Methodist University, Dallas, TX, U.S.A.
14:50-15:20	Multi-ranker Designs for Partially Rank Ordered Judgment Post Stratified and Ranked Set Sampling Designs *Omer Ozturk,* Ohio State University, Columbus, OH, U.S.A.
15:20-15:50	Sign Test Using k-tuple Ranked Set Samples *Tao Li,* Peking University, Beijing, China

11C: Longitudinal Data Analysis (14:20-15:50)

Organizer: *Xingqiu Zhao,* The Hong Kong Polytechnic University, Hong Kong

Chair: *Xingqiu Zhao,* The Hong Kong Polytechnic University, Hong Kong

14:20-14:50	Empirical Likelihood and Quantile Regression in Longitudinal Data Analysis *Cheng Yong Tang,* National University of Singapore, Singapore
14:50-15:20	Statistical Analysis of Bivariate Recurrent Event Data with Incomplete Observation Gaps *Yang-Jin Kim,* Sookmyung Women's University, South Korea
15:20-15:50	Semiparametric Estimation Methods for Longitudinal Data with Informative Observation Times *Xingqiu Zhao,* The Hong Kong Polytechnic University, Hong Kong

11D: Reliability Sampling Plans and Analysis (14:20-15:50)

Organizer: *Chien-Tai Lin,* Tamkang University, Tamshui, Taiwan

Chair: *Chien-Tai Lin,* Tamkang University, Tamshui, Taiwan

14:20-14:50	Optimal Design for Degradation Tests Based on Gamma Degradation Process with Random Effects *Chih Chun Tsai,* Tamkang University, Tamshui, Taiwan
14:50-15:20	Statistical Inference of a Series System with Masked Data with Correlated Log-normal Lifetime Distributions under Type-I Censoring *Tsai-Hung Fan,* National Central University, Taoyuan, Taiwan
15:20-15:50	Bayesian Variable Sampling Plans for the Exponential Distribution *Chien-Tai Lin,* Tamkang University, Tamshui, Taiwan

12A: Nonparametric Statistics (16:15-17:45)

Organizer: *Eugenia Stoimenova,* Bulgarian Academy of Sciences, Sofia, Bulgaria

Chair: *Eugenia Stoimenova,* Bulgarian Academy of Sciences, Sofia, Bulgaria

16:15-16:45	A Distribution-Free Test for Mean Residual Life Function *Maryam Sharafi,* Razi University, Iran
16:45-17:15	Distance Based Approach for Construction of Rank Tests *Eugenia Stoimenova,* Bulgarian Academy of Sciences, Sofia, Bulgaria
17:15-17:45	On Some One-sided Non-parametric Control Charts *Jean-Christophe Turlot,* Universitè de Pau et des Pays de l'Adour, France

12B: Statistical Models and Methods for Some Real Life Applications (16:15-17:45)

Organizer: *Boris Choy,* The University of Sydney Business School, Australia

Chair: *Boris Choy,* The University of Sydney Business School, Australia

16:15-16:45	Does Information and Communication Technology Increase Production Efficiency? A Comparison Between OECD Service Industries *Sophia Dimelis,* Athens University of Economics and Business, Athens, Greece
16:45-17:15	Estimation of Copula Models with Discrete Margins via Bayesian Data Augmentation *Mohamad Khaled,* University of Technology Sydney, Sydney, Australia
17:15-17:45	Bayesian Modelling of Twenty20 Cricket *Paramjit Gill,* University of British Columbia Okanagan, Kelowna, BC, Canada

12C: Exceedances, Distributions and Applications (16:15-17:45)

Organizer: *Ismihan Bairamov,* Izmir University of Economics, Turkey

Chair: *Ismihan Bairamov,* Izmir University of Economics, Turkey

16:15-16:45	Estimation and Goodness-of-Fit Procedures for Farlie-Gumbel-Morgenstern Bivariate Copula of Order Statistics *Tugba Yildiz,* Dokuz Eylül University, Izmir, Turkey
16:45-17:15	On Conditional Independent Random Variables *Ismihan Bairamov,* Izmir University of Economics, Balcova, Turkey
17:15-17:45	On the Reliability Properties of Coherent Systems *Majid Asadi,* University of Isfahan, Iran

12D: Univariate and Multivariate Skewed Distributions (16:15-17:45)

Organizer: *Antonella Capitanio,* University of Bologna, Italy

Chair: *Antonella Capitanio,* University of Bologna, Italy

16:15-16:45	The Work of Fernando de Helguero on Non-normality Arising from Selection *Adelchi Azzalini,* University of Padua, Italy
16:45-17:15	Skew-elliptical Distributions and Their Relationship with Order Statistics *Ahad Jamalizadeh,* Shahid Bahonar University of Kerman, Iran
17:15-17:45	On a Method for Obtaining Relevant Directions for Scale Mixtures of Multivariate Skew-normal Distributions *Antonella Capitanio,* University of Bologna, Italy

Saturday, December 31, 2011: Parallel Sessions

13A: Statistics Methods in Quality of Life and Biomedical Sciences (10:20-11:50)

Chair: *M. L. Tang,* The Hong Kong Baptist University, Hong Kong

10:20-10:50	Algebraic Statistics and Applications to Statistical Genetics *M. B. Rao,* University of Cincinnati, Cincinnati OH, U.S.A.
10:50-11:20	A Random-Sum Wilcoxon Statistic and Its Application to Analysis of ROC and LROC Data *Larry Tang,* George Mason University, Fairfax, Virginia, U.S.A.
11:20-11:50	Statistical Validation of Quality of Life Measurements obtained via Self-Rated Questionnaire, and their analysis in a longitudinal setting *Mesbah Mounir,* Université Pierre et Marie Curie (Paris 6), Paris, France

13B: Applied Statistical Methods: Segmentation and Classification (10:20-11:50)

Organizer: *Graciela González Farìas,* CIMAT, Monterrey, Mexico

Chair: *Graciela González Farìas,* CIMAT, Monterrey, Mexico

10:20-10:50	Quadratic Spatial Logistic Regression for Image Segmentation *Oscar Dalmau,* Centre for Mathematical Research, Mexico
10:50-11:20	Cost Sensitive Binary AdaBoost *Victor Muñiz,* Research Center in Mathematics, Mexico

13C: Algebraic Methods in Experimental Design (10:20-11:50)

Organizer: *Po Yang,* DePaul University, Chicago, Illinois, U.S.A.

Chair: *Xingqiu Zhao,* The Hong Kong Polytechnic University, Hong Kong

10:20-10:50	Foldover Plan on Asymmetric Factorials and its Uniformity *Zujun Ou,* Central China Normal University/Jishou University, China
10:50-11:20	Minimal Markov Basis for Tests of Main Effects Models for 2^{p-1} Fractional Factorial Designs *Satoshi Aoki,* Kagoshima University, Japan
11:20-11:50	A Construction Method of Incomplete Split-Block Designs Supplemented by Control Treatments *Shinji Kuriki,* Osaka Prefecture University, Japan

13D: Statistical Inference (10:20-11:50)

Chair: *Katherine Davies,* University of Manitoba, Canada

10:20-10:40	Using Murthy's Estimator in Inverse Sampling Designs *Mohammad Salehi,* Qatar University, Qatar
10:40-11:00	On Inference of Overlapping Coefficients in Two Lomax Populations Using Different Sampling Methods *Amal Helu,* University of Jordan, Jordan

ABSTRACTS

[December 28, 2011 Plenary Talk]

Importance Measures in Reliability and Risk

Way Kuo
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The concept of importance measures in a coherent reliability system was proposed in the 1960s. Given the increasing trend of using complex and complicated systems, it is quickly noticed that optimal design for such systems is nearly impossible without further investigating other types of importance measures. For example, design for safety of Fukushima-Daiichi nuclear power plants affected by the Sendai's earthquakes in Japan has been a typical challenge that we face today. Other applications include the software design and design for nano systems.

This talk is based on the book, to be published by Wiley in 2012, "Importance Measures in Reliability, Risk, and Optimization: Principles and Applications," 385 pp, by Way Kuo and X. Zhu. This book provides a unified and comprehensive view on modeling the importance measures through which we generalize the problems in reliability and others.

[December 29, 2011 Plenary Talk]

Balas Contributions to the Skew Literature

Barry C. Arnold
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TRather than try to survey all of Balas contributions to the Statistics literature (which, anyway, would be impossible in any reasonable amount of time), I will focus on his creative contributions to the specific area of skewed distributions. A brief outline of univariate and multivariate skewed models will be provided to help put Balas work in context.

[December 30, 2011 Plenary Talk]

Some Parametric Families of Distributions and Their Interconnections

Chris Jones
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Families of univariate continuous distributions with just a very few shape parameters controlling skewness and tail weight have an as yet underacknowledged role in modern statistical modelling: by building flexible yet parsimonious distributions into complex statistical models as marginal and conditional distributions, robustness of inference for parameters of interest can be achieved. In this talk, I will consider some interconnected ways in which such families of distributions can be generated.

Let g be the density of a symmetric univariate continuous distribution. Let W be a transformation function satisfying a particular important constraint, and let w be its derivative. Families of distributions can be generated from these ingredients in various different ways. Three such recipes will be considered in this talk. Two should be familiar: distributions of transformations of random variables and Azzalini-type skew-symmetric distributions. A third recipe is novel and will be the main course on the menu: what I call "transformation of scale" distributions, with densities of the form $2g(W^{-1}(x))$, for those special Ws. Some general properties of this approach will be explored and contrasted with properties of its competitors. An important pre-existing special case of this approach is the class of two-piece distributions. The sinh-arcsinh transformation and the closely related t_2 distribution function will add their distinctive flavours to the talk. A parallel development in circular distributions might be served for dessert.

[December 31, 2011 Plenary Talk]

Some Applications of Statistics to Traffic Models

Enrique Castillo
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Three statistical applications to estimation and prediction in traffic networks are presented. In the first, the number of route users are assumed to be independent α-shifted $\Gamma(\theta, \lambda)$ random variables $H(\alpha, \theta, \lambda)$, with common λ, the link, OD (origin-destination) and node flows are also $H(\alpha, \theta, \lambda)$ variables. We assume that the main source of information is plate scanning, which permits us to identify, totally or partially, the vehicle route, OD and link flows by scanning their corresponding plate numbers at an adequately selected subset of links. A Bayesian approach using conjugate families is proposed that allows us to estimate different traffic flows, such as route, OD-pair, scanned link or counted link flows. A detailed description is given of how the prior assessment, the sampling, the posterior updating and the Bayesian distribution are obtained.

In the second application, a FIFO rule consistent model for the continuous dynamic network loading problem is presented. The model consists of five units: a path origin flow wave definition unit, a path wave propagation unit, a congestion analysis unit, a network flow propagation unit and an inference engine unit. The path flow intensity wave, which is the basic information, is modeled as a linear combination of basic waves. Next, the individual path waves are propagated throughout the paths by using a conservation equation that stretches or enlarges the wave lengths and increases or reduces the wave heights depending on the degree of congestion at the different links. Then, the individual path waves are combined together to generate the link and node waves. Finally, the inference engine unit combines all information items to make them compatible in times and locations using the above mentioned iterative method until convergence.

In the third application, a stochastic demand dynamic traffic model to predict some traffic variables such as link travel times, link flows or link densities and their time evolution in real networks is presented. The Bayesian network model considers that the variables are generalized Beta variables such that when marginally transformed to standard normal become multivariate normal. Two options to learn the parameters of the model are provided: (a) one based on previous observations of the same variables, and (b) based on simulated data using existing dynamic models. The model is able to provide a point estimate, a confidence interval or the density of the variable being predicted. To this end, a closed formula for the conditional future variable values (link travel times or flows) given the available past variable information, is provided. Since only local information is relevant to short-term link flow predictions, the model is applicable to very large networks.

Finally, the models are illustrated by their application to the Nguyen Dupuis, the Ciudad Real and Cuenca networks and the Vermont-State example. The resulting traffic predictions seem to be promising for real traffic networks and can be done in real time.

Note: Joint work with María Nogal and Aida Calviño.

[1A:1] Parameter and Quantile Estimation for Lifetime Distributions with Unknown Location Parameter

Hideki Nagatsuka
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In this talk, we discuss parameter and quantile estimation for some lifetime distributions with unknown location parameter, including the Weibull, gamma, lognormal and inverse Gaussian distributions, which are widely used in life-testing and reliability analysis. The regularity conditions for maximum likelihood (ML) estimation of parameters are not satisfied in this case due to the presence of the location parameter. This non-regular problem can result in the likelihood function being unbounded and so the ML estimators do not have desirable asymptotic properties.

For this reason, various alternative methods of estimation have been considered in the literature. First, we introduce some well-known methods. Next, we propose efficient methods for the parameters and quantiles of these lifetime distributions with unknown location parameter, and we show that these methods, based on the use of some statistics invariant to unknown location, do overcome the problem of unbounded likelihood. In addition, by means of a Monte Carlo simulation study, we show that the proposed method performs well compared to other prominent methods in terms of bias and MSE. Finally, we present some illustrative examples.

Note: Joint work with Narayanaswamy Balakrishnan (McMaster University).

[1A:2] Weibull Models for Bathtub-shaped Failure Rate Distribution

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Bathtub-shaped failure rate function is common in reliability context. However, the traditional Weibull distribution can only be able to model increasing or decreasing failure rate. In this talk we review some existing models that extends the 2-parameter Weibull distributions to 3 or 4 parameter distribution so that it is able to model bathtub-shaped failure rate. We will also discuss some related research issues for future research and applications.

[1A:3] A Generalized Logistic Frailty Model

Chin Diew Lai
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Massey University
New Zealand
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We propose a new aging model which is a generalization of the logistic frailty model first considered by Vaupel (1990) for fitting human mortality data. Essentially, we introduce a shape parameter to the existing model to allow more flexibility in modeling life time data beyond human mortality study. Model properties such as the survival function, density and the hazard rate function are derived. Parameter estimation is also investigated. In particular, we show that the model is very versatile; able to take a variety of non-monotonic hazard rate shapes. We also examine the effect of each parameter on the shape of the hazard rate. A well known survival data set is satisfactorily fitted by the proposed distribution.

[1B:1] Selection with Concomitants of Order Statistics

Ke Wang
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In this paper we consider the applications of concomitants of order statistics to selection problems. The first problem we want to address is to select the best candidates based on associated characteristics. Using the distributional results of order statistics of concomitants, we derive the probability that subjects with the best concomitant values turn out to be the best candidates in terms of the variable of our primary interest. A large sample approximation to this probability is also derived. Then we consider the problem of identifying candidate polymorphisms (markers) conferring disease risk from a large number of markers. The probability that the true markers are selected at the end of the two-stage design as discussed in Satagopan et al. (2004) is derived and approximated.

Note: Joint work with Haikady Nagaraja (The Ohio University, U.S.A.)

[1B:2] Fisher Information in Censored Samples from Marshall-Olkin Bivariate Exponential Distribution

Qinying He
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We use a simple approach to determine explicit expressions for the FIM for the three parameters of the Marshall-Olkin bivariate exponential distributions for a single pair of order statistic and its concomitant, and Type II censored samples. We evaluate the FIM for various parameter values and sample sizes, and determine its limiting form as the sample size increases. We discuss implications of our findings to inference based on small and large samples and for ranked-set samples from this distributions.

Note: Joint work with H. N. Nagaraja (Ohio State University).

[1B:3] Simulation of Complete and Censored Samples from Common Bivariate Exponential Distributions

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Let $(X_{i:n}, Y_{[i:n]})$ be the vector of the ith X-order statistic and its concomitant observed in a random sample of size n where the marginal distribution of X is absolutely continuous. First, we suggest some general recipes for simulation of complete and censored samples from such bivariate distributions. Next, for the Downton, Marshall-Olkin, Gumbel (Type I) and Farlie-Gumbel-Morgenstern bivariate exponential distributions, we describe in detail the algorithms for simulating complete and censored samples. We compare different approaches and suggest efficient algorithms suited for specific purposes.

Note: Joint work with Dr. Qinying He (Southwestern University of Finance and Economics, Chengdu, China), and Dr. Chunjie Wu (Shanghai University of Finance and Economics, Shanghai, China).

[1C:1] A Bayesian Approach for Selecting the Best Exponential Population with Interval Censored Samples

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In recent years, interval censoring has received a lot of attention. In this talk, we study the problem of selecting the largest mean lifetime among several exponential populations having interval censored samples using a Bayesian approach. A Bayes selection procedure and a curtailed Bayes selection procedure are proposed and derived. A numerical example is provided to illustrate the implement of the selection procedures and show the efficacy of the curtailed Bayes selection procedure compared with the general Bayes selection procedure.

Note: Joint work with Ming-Chung Yang (Kainan University, Taiwan).

[1C:2] Multiple Targets Characterization of Electromagnetic Vulnerability

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We use statistical selection methodology to characterize multiple targets in electromagnetic fields, which result from ground, weather, and sea clutter or internal electromagnetic interference due to the antenna subsystems. This electromagnetic interference occurs at the same frequencies as the target returns yet a specific statistical distribution in amplitude emerges over time. Holland and St. John (Statistical Electromagnetics, 1999, CRC Press) concluded that the observed EM field power fluxes and cable powers follow either a chi-square distribution or a log-normal distribution, which implies either distribution in all measurements due to internal electromagnetic interference (EMI) problems. That is, such an EM field can be characterized by either an exponential distribution or a log-normal distribution. These cases exist also in a far field as a result of what the aircraft returns, while the distribution exists due to multiple reflecting surfaces instead of internal EM fields from radar subsystems previously mentioned. Clutter also produces these same distributions in the fat field. For the exponential distribution case, we propose subset selection procedure to identify EM fields whose reference parameters are those of candidate targets rather than the interfering EM sources. We discuss the properties of our proposed procedure by numerical examples and give simulation examples to illustrate the procedure.

Note: Joint work with Lifang Hsu (Le Moyne College) and S. Panchapakesan (Southern Illinois University).

[1C:3] Ranking Independent Variables in Linear Models

Deng-Yuan Huang
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Consider the linear model as the true model of size p. From this model, we obtain the size p-1 so called reduced models. Each of it by dropping the independent variable at a time. Let the X matrix of the reduced model obtained by dropping the independent variable. Correspondingly, we have the residual sums of squares for the reduced models . Under the true model assumption, it is shown that their distributs are the non-central chi-square distributions. The noncentrality is used to measure the strength of influence for the true model. The larger influence is defined to be more important in the true model. We will use the confidence interval approach to rank the importance of the independent variables in linear models. Some examples are also studied.

Note: Joint work with Ren-Fen Lee (Kaohsiung University of Applied Sciences).

[1D:1] Additive Isotone Regression

Kyusang Yu
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This presentation is about optimal estimation of the additive components of a nonparametric, additive isotone regression model. It is shown that asymptotically up to first order, each additive component can be estimated as well as it could be by a least squares estimator if the other components were known. The algorithm for the calculation of the estimator uses backfitting. Convergence of the algorithm is shown. Finite sample properties are also compared through simulation experiments.

Note: Joint work with Enno Mammen (Universitat Mannheim).

[1D:2] Isotonic Mean Estimator for the Judgement-Post Stratified Samples

Johan Lim
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MacEachern, Stasny, and Wolfe (2004, Biometrics60, 207-215) introduced a data collection method, called judgment poststratification (JPS), based on ideas similar to those in ranked set sampling, and proposed methods for mean estimation from JPS samples. We propose an improvement to their methods, which exploits the fact that the distributions of the judgment post strata are often stochastically ordered, so as to form a mean estimator using isotonized sample means of the post strata. This new estimator is strongly consistent with similar asymptotic properties to those in MacEachern et al. (2004). It is shown to be more efficient for small sample sizes, which appears to be attractive in applications requiring cost efficiency. In this work, we further extend our method to JPS samples with multiple rankers. The new estimator for the JPS with multiple rankers solve the generalized isotonic regression with matrix partial order. The performance of the new estimator is compared to other existing estimators through simulation.

Note: Joint work with Soohyun Ahn (Seoul National University), Xinlei Wang (Southern Methodist University), and Min Chen (University of Texas Southwest Medical Center).

[1D:3] Estimation of the Shape Constrained Partially Linear Model and the Liquidity Cost

Donghyeon Yu
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This paper is concerned with a class of partially linear models (PLMs) with shape constraints. We are motivated by a recent work on liquidity cost by Cetin et al. (2003). The liquidity risk is defined as an additional risk in the market due to the timing and size of a trade. Cetin et al. (2003) propose a rigorous mathematical model incorporating this liquidity risk into the arbitrage pricing theory. In this work, we reformulate the Cetin's model using the partially linear model with a monotone function (liquidity cost) and estimate it from empirical data. To estimate the model, we consider two procedures, the constrained least square method (LS) and the newly proposed two-stage procedure and compare them. The two-stage procedure consists of: (i) nonparametric function estimation without taking into account the shape constraint and (ii) shape modification of the nonparametric estimate by solving an associated constraint optimization problem. The proposed two-stage procedure is in spirit similar to the extension of the arguments for the two-stage nonparametric function estimation method in Mammen, Marron, Turlach, and Wand (2001) to the class of PLMs under consideration. The associated infinite-dimensional optimization problem for the extension is very hard to solve, but the infinite-dimensional problem at the second stage

of the proposed two-stage procedure admits a computationally efficient solution. We apply the procedures to estimating the costs of companies in real market with Dow Jones data.

Note: Joint work with Johan Lim (Seoul National University), Kiseop Lee (University of Louisville), and Bohyun Jung (LIG Insurance Co., Ltd.).

[2A:1] Reliability Properties in Some Classes of Conditionally Specified Models

Jose Maria Sarabia
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In this work, reliability properties in some classes of bivariate continuous distributions based on conditional specification are studied and reviewed. These classes include bivariate distributions based on specification of conditional hazard functions, constructed by conditioning on different kinds of events. Other classes are also considered. Several reliability properties are studied including survival and hazard bivariate functions, conditional densities and hazard rate functions of the marginal and conditional distributions and the Clayton-Oakes measure. Some characterizations are given. Properties for the series and parallel systems with components lifetimes having these dependence structures are studied.

[2A:2] Nonparametric Inference on Lifetime Models

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Lifetime data are distinguished from other types of data by the occurrence of censoring. The most common type of censoring is right censoring. So due to censoring one is just able to observe a sample

$$(Y_1, \Delta_1), \ldots, (Y_n, \Delta_n) \quad \text{with} \quad Y_i = \min(T_i, C_i), \quad \Delta_i = 1(T_i \leq C_i), \quad i = 1, \ldots, n.$$

(It will be assumed that the T_i's and C_i's are i.i.d. and that the T_i and the censoring variables are independent.)

Nonparametric methods taking into account this censoring are based on the well-known Nelson–Aalen estimator and the Kaplan–Meier estimator for the cumulative hazard function and the survival function, respectively.

Applying smoothing methods to these estimators one obtains nonparametric estimators for the hazard rate and the density function under censoring. In the talk asymptotic properties of these estimators are summarized; the main aspect is to show how these estimators can be used for testing goodness of fit. Several proposals for test procedures are considered. Roughly speaking, the test

statistics are weighted L_2-type distances. For the comparison of these procedures the influence of the censoring on the power of the test is investigated.

Moreover, the question, whether Monte Carlo methods or resampling methods can be used to determine critical values, is discussed.

In more complex situations the survival time T depends on some covariate X. That is, one observes

$$(Y_1, \Delta_1, X_1), \ldots, (Y_n, \Delta_n, X_n)$$

and is interested in the conditional survival function defined by $S(t|x) = P(T > t|X = x)$. Depending on the pre-knowledge one can distinguish between different types of modeling: Without knowledge about the type of the relationship between X and T one chooses a model without structure. In this case, putting together the idea of the derivation of the Kaplan–Meier estimator and methods for the construction of estimators in nonparametric regression models leads to appropriate estimators for S.

Examples for models with structure are the "Accelerated Life Time's model, where $S(t|x) = S_0(t\psi(x))$, and the "Proportional Hazard's; model with $S(t|x) = S_0(t)^{\psi(x)}$. Here S_0 is a so-called baseline survival function and the function ψ describes the influence of the covariates. The talk gives a survey of existing nonparametric methods for estimating S_0 and ψ; moreover an example for testing the function ψ is presented.

[2A:3] Consumer's Risk and Costs in Zero Acceptance Number Sampling

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The primary purpose of sampling inspection is the protection of consumer's interests. Although under simple cost models, sampling inspection never serves the producer's interest, some form of sampling inspection can be beneficial to the consumer under the same assumptions. We consider the case of isolated lot inspection, and examine the implications for consumer risk of economic sample design and errors in the inspection process. Acceptance sampling is shown to be cost effective to the consumer whenever the lot quality is less than perfect, and even for perfect lot quality in the presence of inspection errors. For large heterogeneous lots, we show that consumer protection can only be achieved by sampling each homogeneous sublot as if it were an isolated lot.

it Note: Joint work with Mark Bebbington (Massey University.

[2B:1] Pitman Closeness for Progressively Type-II Right Censored samples

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We extend previous results concerning Pitman closeness of progressively censored order statistics to population quantiles within a single sample, and across two samples. We further consider prediction of a future order statistic based on the Pitman closeness criteria. Some explicit expressions are given, including some distribution free results for the median for symmetric distributions.

Note: Joint work with Katherine Davies (University of Manitoba) and Narayanaswamy Balakrishnan (McMaster University).

[2B:2] Pitman Closeness as a Criterion for the Determination of the Optimal Progressive Censoring Scheme

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We consider here the problem of finding the optimal progressive censoring scheme for the exponential distribution according to Pitman closeness criterion. We calculate explicitly the Pitman closeness probabilities and show that for some small sample sizes, the optimal progressive censoring scheme is the usual Type-II right censoring case. We conjecture this to be the case for all sample sizes. We also present a general algorithm for the numerical computation of the Pitman closeness probabilities.

Note: Joint work with William Volterman (McMaster University) and Narayanaswamy Balakrishnan (McMaster University).

[2B:3] Closeness of Order Statistics to Record Statistics

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Suppose order statistics were observed from a finite sample of size n of continuous random variables. It is well-known that these statistics have been used in a wide range of problems, including robust statistical estimation, detection of outliers, characterization of probability distributions and goodness-of-fit tests, analysis of censored samples, reliability analysis and strength of materials. Independently, consider record values from another sequence of iid variables from the same distribution. Record data also arise in a wide variety of practical situations. Recently, some works have been done on prediction of record values based on observed order statistics. Here, we consider the point prediction of a future record values and study the closeness of order statistics to record values from a location-scale family of distributions in the sense of Pitman closeness. Then, we discuss the determination of the closest order statistic from the current sample according to the simultaneous closeness probabilities. Explicit expressions are derived for the pertinent Pitman closeness probabilities, and then special cases are given as examples.

Note: Joint work with Narayanaswamy Balakrishnan (McMaster Universeity).

[2C:1] Adjustments to Scan Statistics on Irregular Designs

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There is a well-developed literature on multi-scale detection problems that works around the idea that test statistics on the smallest scale asymptotically dominates the Type I error. To counter this effect, individual adjustments on the test statistics are required when defining the scan statistic, in order to achieve optimal performance across all scales. However the adjustments are rigidly defined on a univariate setting with a regular design. It is unclear what these adjustments are in a practical setting, on a multivariate space, on designs that tends to be rather irregular. We adopt here a more flexible approach, but retaining the key ideas behind such adjustments.

[2C:2] Approximation for the Three Dimensional Scan Statistics Distribution

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We consider the discrete and continuous three dimensional scan statistics. Viewed as the maximum of an 1-dependent stationary r.v.'s sequence, we provide approximations and error bounds for the probability distribution of the scan statistics. Simulation results and comparisons with other approximations are presented for the binomial and Poisson models.

Note: Joint work with Cristian Preda (Ecole Polytechnique Universitaire de Lille).

[2C:3] Approximation for Distributions of Scan Statistics for Normal Data

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In this lecture approximations and inequalities for scan statistics for normal data in one and two dimensions will be presented. Both cases of known and unknown mean and variance will be discussed. Numerical results, based on new R algorithms for multivariate normal and t distributions, will be presented to evaluate the accuracy of these approximations.

Note: Joint work with Xiao Wang.

[2D:1] Multivariate Geometric Distributions with Lack-of-Memory Property, d-monotone Sequences, and Infinitely Divisible Laws

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This paper studies and characterizes multivariate geometric distributions with lack-of-memory (LM) property. First, a multivariate extension of the univariate geometric law is derived using a discrete analogue of the Marshall-Olkin exponential "shock model". It is shown that only the subclass of multivariate LM distributions with positively correlated components can be obtained in this way. A more general probabilistic model, containing precisely all multivariate geometric LM distributions, is proposed. Opposed to the Marshall-Olkin construction based on exponential as

well as geometric shocks, the latter construction of multivariate geometric LM distributions allows for negative correlations. For both stochastic models, the exchangeable subclass is characterized by d-monotone sequences. Moreover, the extendible subclass with conditionally independent and identically distributed components is determined and constructed using a random walk. A one-to-one relationship between the extendible subclass of the Marshall-Olkin type geometric distributions and infinitely divisible distributions is highlighted, the copula is obtained, and the dependence structure is discussed.

Note Joint work with Matthias Scherer (TU Munich) and Jan-Frederik Mai (Assenagon).

[2D:2] A New Index to Measure Dependence

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We introduce a new index to detect dependence in trivariate distributions. The index is based on the maximization of the coefficients of directional dependence over the set of directions. We show how to calculate the index using the three pairwise Spearman's rho coefficients and the three common 3-dimensional versions of Spearman's rho. We display examples where the index identifies dependence undetected by the aforementioned 3-dimensional versions of Spearman's rho. The value of the new index and the direction in which the maximal dependence occurs are easily computed and we illustrate it with a simulation study.

Note: Joint work with Jesús García (University of Campinas) and Roger Nelsen (Lewis and Clark College)

[2D:3] A Nonparametric Test of Independence

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We propose a new class of nonparametric tests for the supposition of independence between two continuous random variables X and Y. Given a sample of (X, Y), the tests are based on the size of the longest increasing subsequence (from now on L.I.S.) of the permutation which maps the ranks of the X observations to the ranks of the Y observations. We identify the independence assumption between the two continuous variables with the space of permutation equipped with the uniform distribution and we show the exact distribution of the L.I.S. We calculate the distribution for several sample sizes. Through a simulation study we estimate the power of our tests for diverse alternative hypothesis under the null hypothesis of independence. We show that our tests have a

remarkable behavior when the sample has very low correlation and visible (or hidden) dependence. We illustrate the use of our test on two real data examples with small sample sizes.

Note: Joint work with Verónica González-López (State University of Campinas).

[3A:1] Quasi-Hadamard Differentiability: A New Differentiability Concept with Applications to Almost Everything

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Quasi-Hadamard differentiability has recently been introduced by Beutner and Zaehle. It is weaker than Hadamard differentiability. Yet, it is strong enough to establish a delta method. In this talk, several applications are presented ranging from well-known statistics like L-statistics to various types of data as, for instance, progressively Type-II censored order statistics.

[3A:2] EM-like Algorithms for Semiparametric Lifetime Mixture Models Under Random Censoring

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We present several iterative methods based on EM and Stochastic EM methodology, that allow to estimate parametric or semiparametric mixture models for randomly right censored lifetime data, provided they are identifiable. We consider different levels of completion for the (incomplete) observed data, and provide genuine or EM-like algorithms for several situations. In particular, we show that in censored semiparametric situations, a stochastic step is the only practical solution allowing computation of nonparametric estimates of the unknown survival function. The effectiveness of the new proposed algorithms is demonstrated in simulation study and actual datasets.

Note: Joint work with Didier Chauveau (Universit d'Orlans).

[3B:1] Exact-order Asymptotic Analysis for Closed Queueing Networks

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We the asymptotic behavior of a general class of product-form BCMP closed queueing networks as the population size grows large. We first derive the asymptotic behavior of the normalization constant for the stationary distribution in exact order, and use this result to further establish the exact-order asymptotic behavior of a number of system performance metrics. Our result improves the well-known limiting distribution of non-bottleneck stations in closed BCMP networks by providing the exact order behavior. Our asymptotic formulas also allow us to derive new, computationally simple approximations for performance metrics that signicantly improve upon existing approximations for large-scale networks. In addition to their direct use for the analysis of large networks, these new approximations are particularly useful for reformulating large-scale queueing network optimization problems into more easily solvable forms, which we demonstrate with an optimal capacity planning example.

Note: Joint work with David George (Ohio State University) and Mark Squillante (IBM T.J. Watson Research Center).

[3B:2] A Stochastic Optimal Control Problem in Workforce Management

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An important problem in workforce management involves determining a company's staffing portfolio from a mix of different sources. We consider the special case of determining a company's positions in its internal and external workforce given the uncertainty and volatility of growing/emerging demand, and the risks associated with these positions. To solve this problem, we take a risk hedging approach and formulate a stochastic optimal control problem for maximizing the expected discounted profit over an infinite horizon. Our main results include deriving the optimal workforce management policy and establishing that it is of base stock type (2-sided). Numerical experiments have been conducted to provide insights and understand the optimal policy. A multidimensional extension of the problem will also be discussed.

Note: Joint work with Xuefeng Gao (Georgia Institute of Technology), Mayank Sharma (IBM), and Mark Squillante (IBM).

[3B:3] Load Balancing with Distributed Balancers

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The prevalence of service-oriented computing, exemplified by search and social networking, has motivated an increasingly wide web-facing front end in Cloud data centers. Horizontal scaling is favored for its elasticity and distributed design of load balancers is highly desirable. We propose a novel algorithm called Join-Idle-Queue (JIQ), which outperforms the state-of-the-art "Power-of-Two" algorithm . The performance characterization of the JIQ algorithm involves an interesting analysis of load balancing "in the reverse direction".

[3C:1] Optimal Fractions of Two-Level Factorials under a Baselines Parameterization

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Two-level fractional factorial designs are considered under a baseline parametrization. The criterion of minimum aberration is formulated in this context and optimal designs under this criterion are investigated. The underlying theory and the concept of isomorphism turn out to be significantly different from their counterparts under orthogonal parametrization, and this is reflected in the optimal designs obtained.

[3C:2] The Stepwise Response Refinement Screener (SRRS)

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Supersaturated designs are useful in investigating in a large number of factors in a few experimental runs, particularly in the screening experiments. In this talk, a new analysis procedure called the Stepwise Response Renement Screener (SRRS) method is proposed to screen important eects. It includes two main procedures: Factor Screening and Model Reconstruction. Analysis of several real-life experiments suggests that the SRRS method can retrieve simialr results as the existing methods do. The SRRS method performs well in the simulation studies when compared to some existing methods in the literature including the Dantzig Selector.

[3C:3] Construction of Blocked Two-Level Designs with General Minimum Lower Order Confounding

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Zhang, Li, Zhao and Ai (2008) proposed a general minimum lower order confounding (GMC for short) criterion, which aims at selecting optimal factorial designs in a more elaborate and explicit manner. By extending the GMC criterion to the case of blocked designs, Zhang, Wei and Li (2011) proposed a B^1-GMC criterion. The present paper gives a construction theory and obtains the B^1-GMC $2^{n-m}:2^r$ designs with $n \geq 5N/16+1$, where $2^{n-m}:2^r$ denotes a two-level regular blocked design with $N=2^{n-m}$ runs, n treatment factors and 2^r blocks. The construction result is simple and complete. Up to isomorphism, the B^1-GMC $2^{n-m}:2^r$ designs are constructed as follows: the n treatment factors and the 2^r-1 block effects are respectively assigned to the last n columns and other specific 2^r-1 columns of the saturated $2^{(N-1)-(N-1-n+m)}$ design with Yates order. With such a simple structure, the B^1-GMC designs can be conveniently used in practice. Examples are included to illustrate the theory.

it Note: Joint work with Pengfei Li (University of Alberta), Runchu Zhang (Nankai University), and Rohana Karunamuni (University of Alberta)

[3D:1] Adjusted Power-Divergence Test Statistics for Simple Goodness-of-Fit Under Clustered Sampling

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Categorical data have mostly been analyzed by methods under the assumption of multinomial or product multinomial sampling which are based on simple random selection for data collection. These methods assume independence of observations which is far from realistic. Any large scale survey will involve clustering or stratification. This study focuses on clustered sampling which involve correlated observations in the same cluster. Most popular test statistics to analyze classical data are Pearson chi-square and likelihood ratio statistics which are already available in all statistical soft wares involving standard procedures to analyze categorical data. These test statistics are based on the assumption of independent observations. In most of the studies involving sampling method rather than simple random sampling, correlations amongst the observations are, unfortunately, ignored and proceeded as if ordinary chi-squared tests will behave much the same under multinomial sampling. Ignoring the effect of survey design and using Pearson chi-square and likelihood ratio test statistics could lead inflated values for test statistics which cause unacceptably liberal type-I errors. Some adjustments on Pearson chi-square and likelihood ratio test statistics have been proposed by some authors such as, Rao and Scott (1979, 1981, 1984) and Bedrick (1983) to handle this problem.

[3D:2] On a Transformed ϕ-divergence test Statistic for Testing a Logistic Regression Model

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We consider logistic regression models in which the response variables are measured on a binary scale. We also consider a class of statistics which is based on f-divergence as a goodness-of-fit test statistics for the model. The class of statistics include the statistics based on power divergence family as a special case. Well known Pearson's chi-square statistic and deviance (log likelihood ratio statistic) are included in power divergence family. All members of f-divergence statistics have the limiting chi-square distribution assuming a certain condition under null hypothesis that logistic regression model is correct.

Note: Joint work with Yuri Sekiya (Hokkaido University of Education) and Jun Toyama (Hokkaido University).

[3D:3] A New Influence Measure in Polytomous Logistic Regression Models based on ϕ-divergence Measures

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Consider a response random variable Y belonging to one of the J distinct categories $C_1, \ldots, C_J$, which is observed together with $p+1$ explanatory variables $\boldsymbol{x}^T = (1, x_1, \ldots, x_p) \in \mathbb{R}^{p+1}$. For convenience $x_0 = 1$. Let $\pi_j(\boldsymbol{x}) = P(Y \in C_j|\boldsymbol{x}), j = 1, \ldots, J$, denote the probability that the random variable Y belongs to the category $C_j, j = 1, \ldots, J$, when the explanatory variable is $\boldsymbol{x}$. More specifically suppose that the dependence between Y and $\boldsymbol{x}$ can be modeled by the logistic model

$$\pi_j(\boldsymbol{x}) = \exp(\boldsymbol{\beta}_j^T \boldsymbol{x}) / \sum_{l=1}^{j} \exp(\boldsymbol{\beta}_l^T \boldsymbol{x}), j = 1, \ldots, J, \tag{1}$$

where $\boldsymbol{\beta}_j^T = (\beta_{0j}, \ldots, \beta_{pj})$, $j = 1, \ldots, J-1$, is a vector of unknown parameters and $\boldsymbol{\beta}_J$ is a $(p+1)$-dimensional vector of zeros, for convenience. The vector

$$\boldsymbol{\beta}^T = (\boldsymbol{\beta}_1^T, \ldots, \boldsymbol{\beta}_{J-1}^T) \tag{2}$$

is a ν-dimensional with $\nu = (J-1)(p+1)$. The intercept parameters are β_{0j}, $j = 1, \ldots, J-1$, and $(\beta_{1j}, \ldots, \beta_{pj})$ are regression parameter vectors, $j = 1, \ldots, J-1$. The model described in (1) is the classical *Polytomous Logistic Regression Model* (PLRM) or *Multinomial Logistic Regression Model*. For more details see Amemiya (1981), Anderson (1972, 1982, 1984), Lesaffre (1986), Lesaffre and

Albert (1989), Mantel (1966), Theil (1969), McCullagh (1980) Liu and Agresti (2005), Engel (1988) and references there in. In the following we denote by

$$\Theta = \left\{ \boldsymbol{\beta}_j^T = (\beta_{0j}, \ldots, \beta_{pj}), j = 1, \ldots, J-1 : \beta_{sj} \in \mathbb{R}, s = 0, \ldots, p \right\},$$

the parameter space associated with the PLRM.

In these tipy of models sometimes occurs that one or more components of the data exerts a disproportionate influence on the model estimation. We need a reliable tool for identifying such troublesome cases in order to decide either eliminate from the sample, when the data collect was badly realized, or otherwise take care on the use of the model because the results could be affected by such components. We denote by $\hat{\boldsymbol{\beta}}^{\phi}$ the minimum ϕ-divergence estimator of $\boldsymbol{\beta}$ when all de observations are considered and by $\hat{\boldsymbol{\beta}}^{\phi}_{(i)}$ the minimum ϕ-divergence estimator of $\boldsymbol{\beta}$ when we are not considering the ith observation. In this paper we shall consider a measure of the influence of ith observation based on

$$D_{\psi}\left(\boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}), \boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}_{(i)})\right)$$

where by $D_{\psi}\left(\boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}), \boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}_{(i)})\right)$ we are denoting the ψ-divergence between the probability vectors $\boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi})$ and $\boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}_{(i)})$. We provide the asymptotic distribution of $D_{\psi}\left(\boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}), \boldsymbol{p}(\hat{\boldsymbol{\beta}}^{\phi}_{(i)})\right)$ in order to look for a meaningful cutoff point for detecting influential and leverage observations.

Note: Joint work with Leandro Pardo (Complutense University of Madrid). The research in this paper was supported in part by Spanish agency grant DGI MTM2006-06872.

[4A:1] On Reliability of Generalized k-out-of-n system and reliability importance *(n,f,k)* system

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A generalized k-out-of-n system, denoted by $((n_1, n_2, , n_N), f, k)$ system, consists of N modules with the i^th module composed of n_i components in parallel and fails if and only if there exist at least f failed components or at least k consecutive failed modules. To evaluate the reliability of $((n_1, n_2, , n_N), f, k)$ system, a generalized sequence of multivariate Bernoulli trials $Y_i, 1 = i = N$ where each $Y_i = (Y_i1, Y_i2, , Y_(in_i))$ is independent n_i-variate Bernoulli random vector, with $P(Y_ij = 1) = p_ij, i = 1, 2, , N, j = 1, 2, , n_i$ is considered. We obtain the pgf of joint distribution of $X_(n, k)$, the number of failure runs of length k in derived sequence $X_1, X_2, , X_n$ from $Y_i, 1 = i = N$ and S, the number of failures in $Y_1, Y_2, , Y_n$. To obtain the exact pmf from the pgf of joint distribution of $(S, X_(n, k))$ in terms of matrix polynomials, an algorithm is developed. Finally we discuss the use of derived distribution in evaluation of reliability of generalized k-out-of-n system. The method of implementation of developed results is also discussed with reference to mathematical software. A generalized k-out-of-n system is a structural generalization of (n, f, k) system with specific

number of components added in parallel to each of its components. To optimize the structure of generalized k-out-of-n system, the reliability importance formula for the components of (n, f, k) system is developed. Numerical work demonstrates the flexibility of developed results.

[4A:2] Enhanced Rules to Increase the Sensitivity of a Shewhart Chart

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Two enhanced rules are suggested in this paper. The enhanced rules are designed, based on the Markov chain method. The performances of these rules are evaluated by means of the average run length (ARL) values and compared to that of the conventional approach and those based on the standard rules. A Shewhart Xbar chart incorporating one of the enhanced rules signals an out-of-control condition if either a point is beyond the outer limits denoted by UCLO/LCLO or when two of four successive points plot between UCLI and UCLO or between LCLO and LCLI. The Shewhart Xbar chart that uses the other rule gives an out-of-control signal if either a point is beyond the outer UCLO/LCLO limits or when three successive points plot between UCLI and UCLO or between LCLO and LCLI, where the values of these limits are different from those of the first rule. The simulation results show that the two enhanced rules have the best overall performances.

Note: Joint work with Teh Sin Yin (Universiti Sains Malaysia).

[4A:3] Bayesian Estimation of the Change Point Using $\bar{X}$ Control Chart

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The process personnel always seek the opportunity to improve the processes. One of the essential steps for process improvement is to quickly recognize the starting time or the change point of a process disturbance. The proposed approach combines the $\bar{X}$ control chart with the Bayesian estimation technique. We show that the control chart has some information about the change point and this information can be used to make an informative prior. Then two Bayes estimators corresponding to the informative and a non informative prior along with MLE are considered. Their efficiency are compared through a series of simulations. The results show that the Bayes estimator with the informative prior is more accurate and more precise when the means of the process before and after the change point time are not too closed. In addition the efficiency of the Bayes estimator with the informative prior increases as the change point goes away from the origin.

[4B:1] Generalized Concept of Relative Risk and Wider Applications of the Cox Proportional Hazards Model

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In this paper, the concept of relative risk, which is usually defined as the ratio of two incidence rates, is generalized in two directions. One is for ordinal response variables, and the other is as a summarization or weighted average of different relative risks. The generalized relative risk using the Cox proportional hazards model can be viewed as a generalization of the Mantel-Haenszel estimator, and can be used as basic statistics to reflect the relationships between a response variable which can be ordinal, countable or continuous and the covariates in a study. Examples are given to illustrate the generalized concept of relative risk and the use of the proportional hazards model and the Kaplan-Meier estimator in social and economic studies.

[4B:2] Testing for the Presence of a Cure Fraction in Clustered Interval-Censored Survival Data

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Clustered interval-censored survival data are often encountered in clinical and epidemiological studies due to geographic exposures and periodic visits of patients. When a nonnegligible cured proportion exists in the population, several authors in recent years have proposed to use mixture cure models incorporating random effects or frailties to analyze such complex data. However, the implementation of the mixture cure modeling approaches may be cumbersome. Interest then lies in determining whether or not it is necessary for adjusting the cured proportion prior to the mixture cure analysis. We mainly focuses on the development of a score test for testing the presence of cured subjects in clustered and interval-censored survival data. Through simulation, we evaluate the sampling distribution and power behavior of the score test. A bootstrap approach is further developed, leading to more accurate signicance levels and greater power in small sample situations. We illustrate applications of the test using data sets from a smoking cessation study and a retrospective study of early breast cancer patients, respectively.

Note: Joint work with Liming Xiang (LMXiang@ntu.edu.sg).

[4B:3] General Trend Analysis of Bivariate Continuous Panel Data

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In many follow-up studies, the underlying continuous response processes of interest may undergo natural fluctuation over time, as is the case with blood pressure. In these situations, transitions between specific states are often not as interesting as the general direction and rate of movement, since uncountably many transitions between states are involved and they do not provide a summary information about the evolution of the process. To provide such general trend information in the panel data setting of a single continuous response, Chao and Chen (2009) developed a Markov-based regression model that can be viewed as a continuous time first order autoregressive regression model with time varying lag effects of the covariate. In this talk, we further extend their model to settings of panel data of two continuous response variables. In addition to assessing the general trend of each underlying response process, the proposed model can assess if there is feedback effect of one response process on the other process. For robust inference on parameters in the conditional mean structure, the generalized estimating equation approach is adopted.

Note: Joint work with Yi-Ran Lin (National Dong Hwa University).

[4C:1] Mixed Orthogonal Arrays: Constructions and Applications

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In this paper, we introduce new mathematical methods for constructing mixed orthogonal arrays (OAs) of strength t, with a given parameter set of run-size and factor levels. Specifically, a necessary condition for the existence of balanced fractional factorial designs with any strength provided the design defining parameters. Few new arrays with run size up to 100 have been found with the proposed methods.

Note: Joint work with Scott Murray (Faculty of Information Science and Engineering, University of Canberra) and Thien An Ngoc Vo (Lac Hong University).

[4C:2] Kernal Alignment Feature Selection for Computational Drug Design

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Quantitative structure-activity relationships (QSARs) correlate biological activities of chemical compounds with their physicochemical descriptors. By modeling the observed relationship seen between molecular descriptors and their corresponding biological activities, we may predict the behavior of other molecules with similar descriptors. In QSAR studies, it has been shown that the quality of the prediction model strongly depends on the selected features within molecular descriptors. Thus, methods capable of automatic selection of relevant features are very desirable. In this talk, we present a new feature selection algorithm for a QSAR study based on kernel alignment which has been used as a measure of similarity between two kernel functions. In our algorithm, we deploy kernel alignment as an evaluation tool, using recursive feature elimination to compute a molecular descriptor containing the most important features needed for a classification application. Empirical results show that the algorithm works well for the computation of descriptors for various applications involving different QSAR data sets. The prediction accuracies are substantially increased and are comparable to those from earlier studies.

Note: Joint work with Forbes J. Burkowski (University of Waterloo).

[4C:3] Estimation in Models with a Kronecker Product Covariance Structure

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In this article we consider a $p \times q$-dimensional random matrix $\boldsymbol{X}$ distributed normally with mean $\boldsymbol{\mu}$ and covariance matrix $\Sigma = \Psi \otimes \Phi$, where $\Psi : q \times q$, $\Phi : p \times p$ are assumed to be positive definite but unknown. Based on a sample of matrices under different structures on the parameter matrices, maximum likelihood estimators are obtained via flip-flop algorithms. In particular the convergence of the algorithm to a unique solution will be discussed.

Note: Joint work with Dietrich Von Rosen (Swedish University of Agricultural Sciences).

[4D:1] Kendall's Tau for Bivariate Interval Censored Data

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This paper proposes a modification of the Kendall's tau coefficient for bivariate interval censored data. Bivariate failure time data occur in many medical studies. In those studies, the estimation of the dependence is often an important step in the analysis of the data. Many procedures are proposed for bivariate failure time data only when right censoring is presented. However, less attention is given to bivariate interval censored data. In this paper, we propose modifications of Kendall's tau statistic for current status data (case 1 interval censored data) and case 2 interval censored data. We numerically compare our proposal to the two stage estimator by Sun et al.(2006). They estimate the model parameter by maximizing the pseudo log likelihood function under a given copula model and further estimate Kendall's tau, a function of the model parameter, by plugging in the model parameter. We finally apply the methods to analyzing the AIDS clinical data presented in Sun et al.(2006).

Note: Joint work with Johan Lim (Seoul National University) and Dohwan Park(Seoul National University).

[4D:2] Multiple Outliers Detection in Samples from One-parameter Exponential Family

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The problem of multiple outliers detection in one-parameter exponential family is considered. The outlier detection procedure involves two estimates of the parameter which are obtained by maximizing two log-likelihoods; the complete data log-likelihood and its conditional expectation given suspected observations. The results are obtained explicitly for a subfamily of one-parameter exponential family of continuous distributions.

[4D:3] A Novel Method for Simultaneously Correction to the Bias of Population Stratification and Unmeasured Confounders

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Population stratification (PS) is an important topic in studies of gene-disease association. To our knowledge, population-based case-control studies of gene-disease association are susceptible to the population stratification (PS). In order to avoid PS, studies usually use data from a homogeneous population. However, adjustment of PS using traditional matching methods may have misgivings since it is hard to identify the hidden population strata, such as the migration of ethnic or miscegenation. Some association statistical methods for using genome-wise association (GWA) have been proposed to correct PS on population-based association studies. Also, these approaches main idea are to use genome-wise markers to correct PS, for public methods include genomic control (GC), structured association (SA), principal components analysis (PCA) and partial least squares (PLS). However, due to cost effective considerations, in actual studies, the issue of funding is often limited. Hence, only a subset of observers have extracted GWA study, but not all observers. On the other hand, missing confounds is also important impact bias for case-control study, such as BMI and smoking in epidemiologic studies using claims data or population dataset. To our knowledge, most studies of gene-disease association do not simultaneously take PS and distribution of unobserved confounders into account. Targeting these challenges, we proposed a novel two-stage method to simultaneously adjust the bias of PS and unobserved confounders. The two-stage procedure we proposed always yields valid results even when there exists PS or unmeasured confounders in the study population, and it also provides an effective and convenient study design methods under constraints in research funding.

[4E:1] Estimation in Multilevel Models with Circularly Block Symmetric Covariance Structure

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The multilevel model with the circularly block symmetric covariance structure is considered. We established the spectral properties of this patterned covariance matrix. The maximum likelihood estimators for model parameters are obtained, and the estimability of the variance-covariance parameters is discussed

Note: Joint work with Tatjana Von Rosen (Stockholm University) and Dietrich Von Rosen (Swedish University of Agricultural Sciences).

[4E:2] Conditional Bivariate Order Statistics

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Let (X,Y) be a bivariate random vector with joint distribution function F(x,y) and (X1,Y1),...,(Xn,Yn) be independent copies of (X,Y). We consider the bivariate order statistics of the this sample under condition that m of n of these random vectors fall below the threshold (t,s). The distribution function of conditional bivariate order statistics are derived.

Note: Joint work with Ismihan Bairamov (Izmir University of Economics).

[4E:3] Family of Matrix Elliptical t-Distributions

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In this paper, we constract a new matrix elliptical t- distribution. This distribution is a new generalization of matrix t distribution which has potential application in Bayesian analysis. Some examples are proposed for specific structures of this newly derived matrix distribution. Further estimation of parameters are derived and an application in Bayesian multivariate regression is exhibited.

Note: Joint work with Mohammad Arashi (Islamic Azad University) and Sayyed Mohammad Mahdi Tabatabaey (Ferdowsi University of Mashhad).

[5A:1] Comparison Between Constant-stress Testing and Step-stress Testing under Type-I Censoring

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By running the life tests at higher stress levels than normal operating conditions, accelerated life testing quickly yields information on the lifetime distribution of a test unit. The lifetime at the design stress is then estimated through extrapolation using a regression model. In constant-stress testing, a unit is tested at a fixed stress level until failure or the termination time point of the test, while step-stress testing allows the experimenter to gradually increase the stress levels at some

prefixed time points during the test. In this work, the optimal k-level constant-stress and step-stress accelerated life-tests are compared for the exponential distribution under complete sampling and Type-I censoring. The objective is to quantify the advantage of using the step-stress testing relative to constant-stress one. A log-linear relationship between the mean lifetime parameter and stress level is assumed and the cumulative exposure model holds for the effect of changing stress in step-stress testing. The optimal design point is then determined under C-optimality, D-optimality, and A-optimality criteria. The efficiency of step-stress testing compared to constant-stress testing is discussed in terms of the ratio of optimal objective functions based on the information matrix.

Note: Joint work with Tony Ng (Southern Methodist University).

[5A:2] Step-Stress Modeling Based on Sequential Order Statistics

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Standard step-stress models under the usual cumulative exposure model assumption need to restrict to exponential underlying lifetime distributions in order to conclude to explicit expressions for the maximum likelihood estimators (MLEs) of the expected lifetimes under each stress level and their conditional density functions, given their existence. Furthermore, under the classical censoring schemes, the existence of the MLE at each stress level is not always guaranteed. Here, a sequential order statistics (SOS) model is proposed for step-stress models under repeated type-II censoring. This censoring scheme ensures the existence of estimates of the expected lifetimes at all stress levels by fixing the number of observed failures for each stress level. The time points of stress level change are consequently random. In the SOS set-up, the underlying lifetime distribution can be any absolutely continuous distribution function, leading to gamma distributed MLEs. Associated inferential issues are discussed and illustrated via simulated examples. The model is developed for the one sample and multiple samples cases.

[5A:3] Reliability Modeling for Engineering Design Under Step-stress and Variabler-stress Situations

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The concept of reliability links statistics and engineering. On one hand, Statistics, as a pure mathematical branch, is able to create complex models with a huge number of degrees of freedom. The larger the number of degrees of freedom, the best the fitting of the reliability model to the experimental lifetime data. This feature provides statistician with a huge capacity for dealing with quite a diverse engineering results. On the other hand, Engineering, as a pure applied branch,

needs to isolate the most relevant parameters that affect the performance and the reliability of a device in order to create a simple model that guides the decision making process during design. The lower the number of main parameters retained in the engineering model, the larger the number of studied configurations during the preliminary stage of a design process. This feature provides engineer with a huge capacity for finding the best values of several configurations. Therefore, one important task of the statistics is to increase the complexity of the model in order to increase its flexibility, and one important task of the engineering is to decrease the complexity of the model in order to isolate the minimum number of important decisions as soon as possible. This paper revises this apparent contradiction and proposes a set of requirements that a reliability model must accomplish in order to be optimum for the preliminary design stage of a given device. The paper also describes a reliability model that could accomplish with this set of requirements. Three applications of the model are discussed: thermal shock, thermal cycling, and mechanical superficial fatigue cycling. An important result of the application of the model to thermal shock and thermal cycling of ICs is the achievement of a new value of the Coffin-Manson exponent that solves some previous controversial results.

[5B:1] A Simple Method for Obtaining the Maximal Correlation Coefficient with Applications to Ordered Data

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We provide a method that enables the simple calculation of the maximal correlation coefficient of a bivariate distribution, under suitable conditions. In particular, the method applies to order statistics and records.

Note: Joint work with Tatiana Xifara (Lancaster University).

[5B:2] Bounds on Dispersion of oRder Statistics

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Papadatos (1995,1997) presented sharp bounds on variances of order statistics, expressed in terms of variances of single observations, in the cases of independent identically distributed samples from the general and symmetric populations, respectively. We present a more precise solution to the latter problem. We also solve analogous problems for arbitrarily dependent identically distributed random variables. Our bounds are valid for many general dispersion measures, based on the notion of M-functionals. Some of results were derived in cooperation with Krzysztof Jasinski.

[5B:3] Bounds for Moments of Concomitants

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We present sharp mean, variance and mean-variance bounds for concomitants of order statistics and the maximum of concomitants of selected order statistics. The dependence between pair components is modeled by completely or partially known possibly non-identical copulas or is generated by sampling without replacement from finite populations. We propose to use concomitants to evaluate individual premiums for a heterogeneous collective of insurance risks and apply our bounds to compare these premiums with expected value and standard derivation premium principles.

Note Joint work with Marek Kaluszka (Technical University of Lodz).

[5C:1] Matrix-based Concordance Correlation Coefficient

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In many clinical studies, Lin's concordance correlation coefficient (CCC) is a common tool to assess the agreement of a continuous response measured by two raters or methods. However, the need for measures of agreement may arise for more complex situations, such as when the responses are measured on more than one occasion by each rater or method. In this work, we propose a new CCC in the presence of repeated measurements, called the "matrix-based concordance correlation coefficient(MCCC)" based on a matrix norm that possesses the properties needed to characterize the level of agreement between two $p \times 1$ vectors of random variables. It can be shown that the MCCC reduces to the CCC when $p = 1$. For inference, we propose an estimator for the MCCC based on U-statistics. Furthermore, we derive the asymptotic distribution of the estimator of the MCCC which is proven to be normal. The simulation studies confirm that overall in terms of accuracy, precision, and coverage probability, the estimator of the MCCC works very well in general cases especially when the sample size is greater than 40. Finally, we use real data from an Asthma Clinical Research Network (ACRN) study and the Penn State Young Women's Health Study for demonstration.

Note: Joint work with Vernon M. Chinchilli (Penn State Hershey College of Medicine, U.S.A.).

[5C:2] An AUC-like Index for Agreement Assessment

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The commonly used statistical measures for assessing agreement among multiple raters, such as intraclass correlation coefficient(ICC) or concordance correaltion coefficient(CCC), have well-known dependency on the data normality assumption, hereby are heavily influenced by data outliers. In addition, AVOVA-based ICC only utilizes complete cases when missing data is present. Here we are proposing a novel agreement measure, rank-based agreement index(rAI), by estimating agreement with data's overall ranks. Such non-parametric approach provides a global measure of agreement across distribution of data values. We how rAI can be calculated from the overall ranks of each subject's extreme values. Furthermore, we propose an agreement curve, a graphic tool that aids in visualizing degree of the agreement, a cuve strongly resembles the receiver operating characteristic(ROC) curve. We further show rAI is related with area under the agreemetn curve by a common scale. Consequently, rAI shares important features with the area under the ROC curve(AUC). Simulation results and data analysis examples are presented.

[5D:1] Extremes and Products of Multivariate AC-Produce Random Vectors-With Insurance Applications

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Motivated by recent findings of Asimit et al. (2011) and Tang et al. (2011) in this paper we consider a tractable multivariate risk structure which includes as special case Sarmanov dependence structure. We derive several asymptotic results for both the sum and the product of such risk and then present 4 applications related to actuarial mathematics.

Note: Joint work with Enkelejd Hashorva (University of Lausanne).

[5D:2] Consistent Estimation of the Shape of the Means with Applications in 3-D Shape Analysis

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The inference of 3-dimensional objects when the invariances of rotations and locations (and possibly scaling) is preserved is the object of shape analysis whose main applications are in biology, object recognition and medical imaging. The basic assumptions of most of the models used in practical applications are based on the multivariate distributions of the coordinates of a finite (but sometimes large) entity of landmark points.

Due to the geometrical complexity of the shape spaces, the inferential issues of random shapes induced even from Gaussian distributions of landmarks are not fully answered especially in 3-dimensional objects. This talk addresses these issues by providing a maximum likelihood estimation approach which is the first to provide consistent estimates for the shape of the means in 3 dimensional objects.

The likelihood function is not straightforward to evaluate as it is given in terms of the hypergeometric functions of the matrix argument where the zonal polynomials play a key role. The method that we propose is based on evaulating the derivatives of such zonal polynomials and exploits the properties the shape preserving transformations like rotation, scale and location.

[5D:3] Logistic Vector Random Fields with Logistic Direct and Cross Covariance Functions

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The logistic vector random field is introduced in this paper as the scale mixture of Gaussian vector random fields. Just like a Gaussian one, a logistic vector random field is characterized by its mean function and covariance matrix function, so that it is flexible to allow for any possible mean structure or covariance matrix structure. For such vector random fields we particularly derive covariance matrix functions whose direct and cross covariances are of the logistic type. (This is a joint work with N. Balakrishnan)

[6A:1] Results on Residual Rényi Entropy under Progressive Censoring

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This paper explores properties of the residual R;enyi entropy (RRE) of progressively type II censored samples. The RRE of sth order statistic from a continuous distribution function is represented in terms of the RRE of the sth order statistic from uniform distribution. In general, we do not have a closed form for RRE of order statistics in most of distributions. This gives us a motivation for obtaining some bounds for RRE in progressively censored samples. In addition, Several kernel type estimators are proposed. Some properties of these estimators are also studied.

Note: Joint work with Fatemeh Yousefzadeh (University of Birjand).

[6A:2] An EM Algorithm for Estimating the Parameters of the Generalized Exponential Distribution under Unified Hybrid Censored Data

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The unified hybrid censoring is a mixture of generalized Type-I and Type-II hybrid censoring schemes. This article presents the statistical inferences on Generalized Exponential Distribution parameters when the data are obtained from the unified hybrid censoring scheme. It is observed that the maximum likelihood estimators can not be derived in closed form. The EM algorithm for computing the maximum likelihood estimators is proposed. We calculated the observed Fisher information matrix using the missing information principle which is useful for constructing the asymptotic confidence intervals. Simulations studies are performed to compare the performances of the estimators obtained under different schemes. Finally, a real data set has been analyzed for illustrative purposes.

Note Joint work with Masoumeh Izanlo (Ferdowsi University of Mashhad).

[6B:1] An extended family of circular distributions related to wrapped Cauchy distributions via Brownian motion

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We introduce a four-parameter extended family of distributions related to the wrapped Cauchy distribution on the circle. The proposed family can be derived by altering the settings of a problem in Brownian motion which generates the wrapped Cauchy. The densities of this family have a closed form and can be symmetric or asymmetric depending on the choice of the parameters. Trigonometric moments are available, and they are shown to have a simple form. Other topics related to the model, including an alternative derivation and Mbius transformation, are considered.

Note: Joint work with M. C. Jones (The Open University).

[6B:2] Symmetric Circular Models Through Duplication and Cosine Perturbation

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In this talk, we consider models for circular data displaying two diametrically opposed modes. A general construction which can be used to generate such models, founded upon doubling the argument of a base symmetric unimodal distribution and cosine perturbation, is proposed. Fundamental properties of the resulting models are described, as are those of a particularly flexible family of distributions and three of its submodels. Parameter estimation via the method of moments and maximum likelihood is discussed, and a likelihood-ratio test for antipodal symmetry developed. The proposed models and inferential methods are applied in the analysis of a circular data set.

Note: Joint work with Arthur Pewsey (University of Extremadura).

[6B:3] A Bivariate Cardioid Distribution Generated from a Circular-circular Structural Model

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In this study we consider a bivariate cardioid distribution generated from a circular-circular structural model linked with Mbius transformation or a method of trivariate reduction. The joint probability density function and trigonometric moments are explicitly obtained. An illustration is given for wind direction data as an application of the bivariate cardioid distribution.

[6C:1] A Bayesian Rating System Using W-Stein's Identity

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For Internet games, large online ranking systems are much needed. We propose a Bayesian approximation method, based on a variant of Stein's identity (1981), to obtain online ranking algorithms with simple analytic update rules. Experiments on game data show that the accuracy of our approach is competitive with state of the art systems such as TrueSkill, but the running time as well as the code are much shorter. We also compare our method with Glicko rating system, designed for rating chess players.

[6C:2] Applying Sensitivity Analysis on Probabilistic Graphical Models

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Probabilistic graphical models such as Bayesian networks are widely used for large-scale data analysis as they model probabilistic knowledge naturally and allow the use of efficient inference algorithms to draw conclusions from the model. Sensitivity analysis of probabilistic graphical models is the analysis of the relationships between the inputs (local beliefs), such as network parameters, and the outputs (global beliefs), such as values of probabilistic queries, and addresses the central research problem of how beliefs will be changed when we incorporate new information to the current model. We provide many theoretical results, such as the assessment of global belief changes due to local belief changes, the identification of local belief changes that induce certain global belief changes, and the quantifying of belief changes in general.

[6C:3] Coin Tossing, Fibonacci Numbers, and Indian Music

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Fibonacci numbers occur in nature. In coin tossing Fibonacci numbers do occur. For example, toss a coin until two consecutive heads appear. In the probability distribution of the number of tosses required Fibonacci numbers do appear. We introduce generalized Fibonacci numbers and show that some natural problems in coin tossing lead to the generalized Fibonacci numbers. We show connection between Fibonacci numbers and their variations to Indian music and poetry.

[6D:1] Almost Sure Convergence of the Stationary Bootstrap in a Class of General Weak Dependence

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We consider the stationary bootstrap for weakly dependent sequences proposed by Doukhan and Louhichi (Stochastic Process. Appl. 84 (1999) 313), establishing strong consistency of the bootstrap variance and bootstrap sample mean under the dependent structure for observation process. Our results extend the weak consistency results of Politis and Romano (1994) and the circular block bootstrap results of Shao and Yu (1993) under mixing condition to a stronger result of almost sure convergence for a more general stationary bootstrap under a more general weak dependence condition including mixings, association, Gaussian sequences and Bernoulli shifts. The main tools in proving the almost sure convergences are the Marcinkiewicz-Zygmund inequality and the maximal inequality under the weak dependence.

Note: Joint work with Dong Wan Shin (Ewha Womans University).

[6D:2] Pricing and Hedging Volatility Derivatives under the Modified Constant Elasticity of Variance Model

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This paper studies volatility derivatives such as variance and volatility swaps, options on both volatility and variance for the modified constant elasticity of variance model under the benchmark approach. The analytical expressions of pricing and hedging formulae for variance swaps are

presented. The numerical solution for volatility swaps and options on both volatility and variance are also demonstrated.

Note: Joint work with Eckhard Platen (University of Technology).

[6D:3] Uniform Convergence of Wavelet Expansions of Random Processes

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In various statistical, data compression, signal processing applications and simulation, it could be used to convert the problem of analyzing a continuous-time random process to that of analyzing a random sequence, which is much simpler. Multiresolution analysis provides an efficient framework for the decomposition of random processes.

This approach is widely used in statistics to estimate a curve given observations of the curve plus some noise. Various extensions of the standard statistical methodology were proposed recently. These include curve estimation in the presence of correlated noise. For these purposes the wavelet based expansions have numerous advantages over Fourier series and often lead to stable computations. However, in many cases numerical simulation results need to be confirmed by theoretical analysis.

Note: Joint work with Yuriy Kozachenko (National Kyiv University) and Olga Polosmak (National Kyiv University).

[6E:1] Multi-stress Aging Model for One-Shot Device Testing Data under Exponential Distribution

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Left- and right-censored life time data arise naturally in one-shot device testing. An experimenter is often interested in identifying eects of several variables on the lifetime of a device, and moreover multiple-stress experiments controlling several variables simultaneously result in reducing the experimental time as well as the cost of the experiment. Here, we develop an EM algorithm for making inference on the reliability at a specic time as well as the mean lifetime based on one-shot device testing data under the exponential distribution in the case of multiple stress factors. We use the log-linear link function for this purpose. Unlike in the typical EM algorithm, it is not necessary to obtain maximum likelihood estimates (MLEs) of the parameters at each step of the iteration. By using the one-step Newton-Raphson method, we observe that the convergence occurs quickly.

In addition, we discuss the construction of condence intervals for some reliability characteristics by using the asymptotic properties of MLEs based on the Fisher information matrix. New results on uniform convergence in probability for general classes of wavelet expansions of Gaussian random processes are given. The results are obtained under simple conditions which can be easily verified. The conditions are less restrictive than those in the former literature. Some well-known examples (stationary processes, fractional Brownian motion) will be discussed.

Note: Joint work with Narayanaswamy Balakrishnan (McMaster University).

[6E:2] Finite Mixture Normal Model and its Application to Truncated Grid Data

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Evenly spaced grid data $(x, y, f(x, y))$'s are commonly observed in experiments. Some data points may be missing (truncated) due to the limitation on the range of the machine measurements. Traditional nonlinear fitting methods arise two problems: the curse of dimension and the divergence of nonlinear iteration. In this paper mixture normal model is employed to fit the grid-data surface. This approach treats the grid data surface as the bivariate mixture normal density of binned and truncated data and improves the standard EM algorithm so as to estimate the parameters. This paper concludes with a brief application to spectral analysis, in which fluorescent intensities are observed in response to different emission and excitation wave lengths.

[6E:3] A Two Step Model for PLS with Group Effect

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In this article, we consider the regression of a univariate response on some random predictors with the general goal of inferring a future observation. The data have a near-collinear structure and additionally group effects are assumed to exist. A two step estimation procedure is proposed. The first step is to summarize the information in the predictors via a bilinear model. The bilinear model has a Krylov structured within individual design matrix, which is the link to classical partial least squares (PLS) analysis and a between individual design matrix which handles the group effects.The second step is the prediction step using conditional expectation approach. The two step approach gives us new insight in understanding PLS. Explicit maximum likelihood estimator of the dispersion matrix and mean for the predictors are derived under the assumption that the covariance between the response and explanatory variable is known. It is shown that the mean square error of the two step approach is always smaller than PLS.

Note: Joint work with Dietrich Von Rosen (Swedish University of Agricultural Sciences).

[7A:1] Bayesian Accelerated Life Testing of Series Systems

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Consider J component series systems, in which the system fails as soon as one of its constituent components fails. Now consider life testing of such series systems that are subjected to stress levels that are much more severe than the stress levels that are envisaged under the normal usage conditions. This is primarily done to collect observations on failure times within limited time that is available for system life testing. But despite this effort of inducing early failures, almost always there will be a few systems that do not fail even under such accelerated stress conditions leading to censored observations. The objective of such "accelerated life testing"; is to draw inference on the reliability of such series systems at the normal usage stresses, which involves prediction or more precisely extrapolation.

Though the literature on Bayesian accelerated life testing, as well as that of the series systems is huge, there is a considerable research gap for problems which involve both. In this work, the existing literature is first extended by considering K stresses in general, as opposed to the usual consideration of a single stress variable. Next a general stress translation function of an appropriate parameter of the component lifetime distribution is proposed which can accommodate standard ones like Arrhenius, power-rule, log-linear model etc. as special cases. Bayesian analysis is developed for three distinct parametric models of component lifetimes (which are assumed to be mutually independent in all three cases) namely, exponentials, Weibulls with equal shape parameter, and Weibulls with distinct shape parameters. In all the three cases, only the scale parameters (and not the Weibull shape parameters) are assumed to be affected by applied stresses which are modelled using the general stress translation function mentioned above, which involve the so-called stress coefficients.

Priors on all the parameters, namely the stress coefficients and the Weibull shape parameter(s) are assumed to be log-concave and independent of each other. Under such priors, the conditional posteriors of each of the scalar parameters given the rest are also shown to be log-concave. This facilitates Gibbs sampling from the joint posterior of the parameters for all the three models. This sampling approach of posterior, as opposed to say an analytical approach, which anyway is impossible for the considered models, also greatly facilitates inference on the ultimate quantities of interest namely, the component and system density, survival and hazard functions at the normal usage stresses. Not only are the Bayes'; estimates (under squared error loss) of these quantities of interest, which are standard tools for Bayesian predictive inference (like for example the predictive density, survival and hazard functions), are easily computable, but one can also easily obtain highest posterior density credible bands for these quantities of interest. The developed methodology has been illustrated by analysing a real data set obtained from the literature using Normal priors (which are log-concave apart from being very convenient for expressing one's prior opinion) on the stress coefficients and Gamma priors on the Weibull shape parameters.

Note: Joint work with Soumya Roy (Indian Institute of Science).

[7A:2] Prediction of Times to Failure of Censored Items for a Simple Step-Stress Model with Progressive Censoring

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In this article, we consider the problem of predicting times to failure of units which are progressively censored under a simple step-stress model. Regular and hybrid schemes for Type II progressive censoring are considered. The maximum likelihood predictors (MLP) and the conditional median predictors (CMP) are discussed. The MLP or modified MLP (MMLP) are derived for exponential and extreme value populations. In addition, for these populations, the conditional distributions are used to derive the CMP. Some numerical examples are presented to illustrate the prediction methods discussed here. Comparison of different predictors are made with respect to mean squared prediction error (MSPE). Using simulation studies, prediction intervals are also generated for the examples.

Note: Joint work with N. Balakrishnan (McMaster University).

[7A:3] Preidction of Failure Times of Censored Items in Progressively Censored Samples

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In this article, we consider the problem of predicting times to failure of units censored in multiple stages in a progressively censored sample from an absolutely continuous population. The best linear unbiased predictors (BLUP), the maximum likelihood predictors (MLP), and the conditional median predictors(CMP) are considered. The properties of MLP such as unbiasedness, consistency and efficiency are examined. The MLP or modified MLP (MMLP) are derived for exponential and extreme value populations. In addition, for these populations, the conditional distributions are used to derive the CMP. Comparison of different predictors are made with respect to mean squared prediction error (MSPE). Finally, some numerical examples are presented to illustrate all the prediction methods discussed here.

Note: Joint work with Basak Indrani (Penn State Altoona) and N. Balakrishnan (McMaster University).

[7B:1] Bounds of L-statistics from Discrete Models

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We consider models of samples drawn from finite populations with and without replacement. We establish optimal lower non-negative and upper non-positive bounds on the expectations of linear combinations of order statistics centered about the population mean in units generated by the population central absolute moments of various orders. We also specify the general results for important examples of sample extremes, range, spacings and Gini mean differences.

Note: Joint work with Tomasz Rychlik (Polish Academy of Sciences).

[7B:2] On the Asymptotics of Numbers of Observations in Random Regions Determined by Order Statistics

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In this talk, I will study the limiting behavior of numbers of observations that fall into regions determined by order statistics and Borel sets.

First, I will show that proportions of such observations converge almost surely to some population quantities as the sample size increases to in?nity. I will derive my results for independent and identically distributed observa- tions from an arbitrary cumulative distribution function, in particular, I will allow samples drawn from discontinuous laws. I will also give extensions of these results to the case of randomly indexed samples with some dependence between observations.

Next, I will show that suitably centered and normed versions of these numbers are asymptotically multivariate normal under some conditions. I will consider two cases: one where the population distribution function is discontinuous, and second where it is continuous and the order statistics are extreme. Finally, I will compare results obtained for the two cases with their analogues for absolutely continuous distribution function and central order statistics.

[7C:1] Empirically Effective Bond Pricing Model and Analysis on Term Structures of Implied Interest Rates in Financial Crisis

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In his book(1993) Kariya proposed a government bond (GB) pricing model that simultaneously values individual fixed-coupon (non-defaultable) bonds of different coupon rates and maturities via a discount function approach, and Kariya and Tsuda (1994) verified its empirical effectiveness of the model as a pricing model for Japanese Government bonds (JGBs) though the empirical setting was limited to a simple case. In this paper we first clarify the theoretical relation between our stochastic discount function approach and the spot rate or forward rate approach in mathematical finance. Then we make a comprehensive empirical study on the capacity of the model in view of its pricing capability for individual GBs with different attributes and in view of its capacity of describing the movements of term structures of interest rates that JGBs imply as yield curves. Based on various tests of validity in a GLS (Generalized Least Squares) framework we propose a specific formulation with a polynomial of order 6 for the mean discount function that depends on maturity and coupon as attributes and a specific covariance structure. It is shown that even in the middle of the Financial Crisis, the cross-sectional model we propose is shown to be very effective for simultaneously pricing all the existing JGBs and deriving and describing zero yields.

Note: Joint work with Kyousui Ouh (GSB,Meiji University), Zhu Wang (ICI), Eiichi Doi (SST,Meiji University) and Yoshirou Yamamura (GSB, Meiji University).

[7C:2] Combining Multivariate Bioassays: Accurate Inference Using Small Sample Asymptotics

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For several independent multivariate bioassays performed at different laboratories or locations, the problem of testing the homogeneity of the relative potencies is addressed, assuming the usual slope-ratio or parallel line assay model. When the homogeneity hypothesis holds, interval estimation of the common relative potency is also addressed. These problems have been investigated in the literature using likelihood based methods, under the assumption of a common covariance matrix across the different studies. This assumption is relaxed in this investigation. Numerical results show that the usual likelihood based procedures are inaccurate for both of the above problems, in terms of providing inflated type I error probabilities for the homogeneity test, and providing coverage probabilities below the nominal level for the interval estimation of the common relative potency, unless the sample sizes are large, as expected. Correction based on small sample asymptotics is investigated in this article, and this provides significantly more accurate results in the small sample scenario. The results are also illustrated with examples.

Note: Joint work with Gaurav Sharma (University of Maryland Baltimore County, U.S.A.) and Ionut Bebu (Uniformed Services University of the Health Sciences, U.S.A.).

[7C:3] Semiparametric Principal Components Poisson Regression on Clustered Data

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Clustering of observations and interdependency of predictors are two common problems in modeling count data with multivariate predictors. We propose to use principal components of predictors to mitigate the multicollinearity problem. To abate information losses due to dimension reduction, a semiparametric link between the count dependent variable and the principal components is postulated. Clustering of observations is accounted into the model as a random component and the model is estimated via the backfitting algorithm. A simulation study illustrates the advantages of the proposed model over standard poisson regression in a wide range of simulation scenarios.

Note: Joint work with Kristina Celene Manalaysay (University of the Philippines).

[7D:1] Measures and Tests of Skewness for the Multivariate Skew-normal Distribution

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Our main objective is to calculate and compare different measures of multivariate skewness for the skew-normal family of distributions. For this purpose, we consider some of the most used multivariate measures of skewness. The exact expressions of most measures are derived for the family of skew-normal distributions, while Songs measure of shape is approximated by the use of delta method. The behavior of these measures, their similarities and differences, possible interpretations, and their practical use in testing for multivariate normal are studied by evaluating their power in the case of some specific members of the multivariate skew-normal family of distributions. We also introduce a test for multivariate skew-normality. This is a joint work with N. Balakrishnan and partially with Antonella Capitanio.

[7D:2] Recent Contributions to the Distributions of Order k

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In this talk I will give a brief review of the development of the theory and applications related to the distributions of order k. I will start with the discrete distributions of order k, related to independent Bernoulli trials. The distributions, related to two-state and multi-state homogeneous Markov chain will be discussed. A special attention will be paid to N. Balakrishnan's contribution to the distributions of order k. I will continue with the recent results related to the compound distributions, stochastic processes of order k and applications in risk theory. Some particular cases of risk models of order k will be given.

[7D3] Multivariate Semi-Markov Processes and Some Applications

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Semi-Markov process is a bivariate process in which the two random variables that run together are respectively the time and the state space. The multivariate semi-Markov processes were defined in Neuts and Purdue (1970). Other papers were written on this topic. We recall some of them, i.e. Janssen and Reinhard (1982), Janssen and Manca (1997) and Ball et al. (2002). All these papers defined a multivariate semi-Markov process with more than the two canonical variables but always determining a-priori the number of random variables that are given in the process. Fundamentally, starting from the problem to be solved some new random variable is added to the process. Starting from the idea given in the work of Ching et al. (2003) on the multivariate Markov chain we generalize it by allowing any kind of sojourn time distribution, or in other terms we introduce a multivariate semi-Markov process that can be of any dimension depending on the number of variables that the application needs.

Note: Joint work with Giovanni Salvi ("Sapienza" University of Rome) and Guglielmo D'Amico (University of Chieti and Pescara).

[8A:1] Modified Mobius Distributions on the Unit Disc

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Jones (2004) introduced the Mbius distribution, a skew distribution on the disc. The distribution is so called because it is generated by applying the Mbius transformation from the unit disc to itself to the bivariate spherically symmetric beta (Pearson type II) distribution. It is a skew distribution, but has symmetric property about a line through the origin.

In this talk we propose modified Mbius distributions which are skew even about a line through the origin. An illustrative example is given for latitude, longitude and magnitude data of earthquakes.

[8A:2] Bivariate Cardioid Distributions

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Bivariate generalizations of the cardioid distribution have been constructed by the mixture method. These mixture models allow ease of estimation and generation on a computer for Monte Carlo simulation studies. Two types of mixtures have been considered. These result in bivariate cardioid models which allow for test of uniformity and independence. In one of these bivariate cardioid models, a bivariate beta distribution, which generalizes the bivariate beta distribution of Olkin and Liu (2003), has been constructed and used as mixing distribution. A test of uniformity or isotropy of a given set of directions is developed. To illustrate the application of one of the models, a data set on orientation of nests of 50 scrub birds and creek directions has also been analyzed.

Note: Joint work with Ashis SenGupta (Indian Statistical Institute).

[8A:3] Maxent Directional Distributions, Entropies and their Estimation

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Several Circular and Directional distributions characterized by maximum entropy are derived. For some of these distributions, the entropy measures are obtained. Classical and decision-theoretic based estimators of such measures are explored. A new bimodal, possibly asymmetric, linear generalized t-distribution is derived through circular statistics. It is noted through this distribution that maxent characterization of corresponding circular distribution is simple, while that of the linear distribution could be formidable.

[8A:4] Inverse Batschelet Distributions for Circular Data

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A means of generating four-parameter unimodal families of distributions on the circle which display wide ranges of skewness and peakedness is proposed. Various non-trivial extensions of an approach first used by Papakonstantinou (1979) and Batschelet (1981) are used to transform the scale of a base unimodal distribution. The key is to employ inverses of transformations similar to the ones used by them. The skewness transformation is especially appealing as it has no effect on the normalising constant. The distributions generated display orthogonality between the elements of two pairings of the parameters into (location, skewness) and (concentration, peakedness). Examples are presented to illustrate the application of a particularly appealing extension of the von Mises distribution.

[8B:1] Inference of Seasonal Long-memory Time Series with Measurement Errors

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We consider the estimation of Seasonal Autoregressive Fractionally Integrated Moving Average (SARFIMA) models in the presence of additional measurement errors by maximizing the Whittle likelihood. We show that the maximum Whittle likelihood estimator (spectral maximum likelihood estimator) is asymptotically normal, and study its finite-sample properties through simulation. The efficacy of the proposed approach is illustrated be a real-life internet traffic example.

Note: Joint work with Heiko Rachinger.

[8B:2] Bayesian Stochastic Volatility Model for Australian National Electricity Market Spot Price

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Following the deregulation of generation and supply in the Australian electricity market in the late 90's, the National Electricity Market (NEM) is established in 1998 which is a wholesale market for electricity supply comprising several interconnected regional networks on the eastern seaboard

of Australia covering the states of New South Wales, Victoria, Queensland, South Australia and Tasmania. Each state has its half-hourly spot price for electricity (A$/MWh) based on a grow pool merit order dispatch system. Since electricity demand is highly dependent on weather, particularly temperature. Any unexpected temperature fluctuation would heavily influence the electricity demand and in consequence, introduce significant volatility on spot price. Other factors including non-scheduled forced outage of generation units and transmission network, and strategic bidding behavior of generators in the wholesale market also lead to withholding generation capacity which will then creates demand-supply unbalance which will result in spot price volatility. The Australian NEM spot price is now restricted to vary between minus A$1,000 to A$12,500 per MWh. This paper elaborates the application of Bayesian analysis on different stochastic volatility (SV) models to evaluate the Australian NEM half-hourly spot price. Models being discussed include univariate and bivariate SV models with jumps using normal and t-distributions for volatility, which are compared to some deterministic models including mean-reversion jump diffusion model. Bayesian SV models are proved to be superior in representing the Australian electricity market spot price in general.

Note: Joint work with Heiko Rachinger.

[8B:3] On Asymmetric Generalised t Stochastic Volatility Models

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In modelling the time-varying volatility process of financial returns, the Gaussian and the Student-t distributions are widely used in stochastic volatility (SV) models. This paper proposes the use of the generalised t (GT) distribution which nests the Gaussian, Student-t, Laplace and exponential power distributions. Since the GT distribution is a member of the scale mixture of uniform (SMU) family of distribution, we implement the GT distribution via its SMU representation. We show this SMU form can substantially simplify the Gibbs sampler for Bayesian simulation-based computation. We extend the basic SV model to account for volatility asymmetry using different asymmetry specifications. In an empirical study, we apply the asymmetric GT SV models to the daily returns of the S&P 500 index. Model implementation relies on Bayesian Markov chain Monte Carlo (MCMC) algorithms using the WinBUGS package. Results show that different asymmetry specifications as well as different error distributions have significant impacts on the estimated log-volatilities.

Note: Joint work with Heiko Rachinger.

[8B:4] Stochastic Volatility Models and Quantile Regression Using Asymmetric Laplace Error Distribution via Uniform Scale Mixtures

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This paper considers the Bayesian analysis of a stochastic volatility (SV) model with an asymmetric Laplace distribution (ALD) for the innovation term of the return. We propose a uniform scale mixture representation for the probability density function of the ALD which is given in Yu and Zhang (2005) and show that the use of scale mixture will simplify the Gibbs sampler. The primary aim of this paper is to develop efficient computational methods for statistical inference of SV models with ALD. The second aim is to consider the Bayesian quantile SV model. Both SV model with ALD and Bayesian quantile SV model will be applied to stock market return data and the value-at-risk will be forecasted.

Note: Joint work with Heiko Rachinger.

[8C:1] Statistical inference via divergences for Semiparametric Two-Sample Density Ratio Models

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We consider estimation and test problems for semiparametric two-sample density ratio models. The profile empirical likelihood (EL) function is not well defined under the null hypothesis that the laws of the samples are equal. We give a solution to this problem making use of divergences and Fenchel duality. We propose a class of estimates and test statistics, and we show, for a particular divergence, that the corresponding criterion can be interpreted as the dual form of the profile EL. The asymptotic properties of the estimates and test statistics are studied both under the null and alternative hypotheses. The proposed approach can also accommodate the corresponding k-sample problem.

[8C:2] Minimum Density Power Divergence Method in Time Series Models

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In this talk, we consider the application of minimum density power divergence estimator (MDPDE) to time series models such as GARCH models and stochastic differential equation models. Further, we will consider the MDPDE for the covariance matrix of stationary time series. It will be demonstrated that the MDPDE has a robust property compared to ordinary sample autocovariances.

[8C:3] On Testing Composite Hypotheses with Divergence Statistics

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The idea of using the functionals of information theory, such as the entropy or divergence, in statistical inference is not new. In fact the so-called statistical information theory has been a subject of extensive statistical research over the past years. Minimum divergence estimators have been used successfully in models for continuous and discrete data. The divergence statistics obtained by replacing either one or both parameters by suitable estimators have become very good alternatives to the classical likelihood ratio statistics. Traditional divergence-based test statistics are the log-likelihood ratio and the Pearson or Freeman-Tukey statistics. The power-divergence family of statistics may be used to link the traditional test statistics through a single-valued parameter. In addition, they are monotonously related to the family of Rnyi divergences. A more general family of divergences, which is also used for estimating and testing, is the family of phi-divergences. The scope of this work is to review a wide class of test statistics, based on divergence measures, that can be used to test composite hypotheses in one or several sample problems. They are an alternative to the classical likelihood ratio, Wald's or Rao's score test statistics.

[8C:4] Weighted Sampling, Maximum Likelihood and Minimum Divergence Estimators

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This talk explores Maximum Likelihood in parametric models in the context of Sanov type Large Deviation Probabilities. Connexion is stated with minimum divergence estimation under weighted

sampling. It is shown that to any Cressie Read divergence it can be associated a specific weighted sampling scheme for which the resulting estimators are optimal in various respects. A link is established with Natural Exponential Families with power variance functions, unifying therefore various aspects of parametric inference. Use is made of variational forms of divergence criterions.

Note: Joint work with Zhansheng Cao (LSTA Universit Pierre et Marie Curie, Paris).

[8D:1] On the Likelihood Estimation of Parameters of Birnbaum-Saunders Distribution Based on Censored Samples

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The Birnbaum-Saunders distribution is one of the commonly used models for analyzing lifetime data arising from reliability and survival studies. In this talk, we will discuss the existence and uniqueness of the maximum likelihood estimates of the scale and shape parameters of this distribution based on censored samples. We will also proposed some simple estimation methods for the unknown parameters and discuss the construction of the corresponding confidence intervals. Next, we will present the results of an extensive Monte Carlo simulation study carried out to evaluate the performance of the proposed estimators. Finally, some real data from the reliability literature will be used to illustrate all the methods of inference discussed before.

Note: Joint work with Narayanaswamy Balakrishnan (McMaster University).

[8D:2] A New Property of Lagrangian Distributions

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The Lagrange expansion is the power series expansion of the inverse function of an analytic function and it leads to two families of distributions; Lagrangian distributions of the first kind (Consul and Shenton, 1972) and of the second kind (Janardan and Rao, 1983), both of which are generated through two analytic functions with some conditions.For example, the generalized negative binomial distribution belonging to Lagrangian distributions is generated through the probability generating functions of two binomial distributions and those of two negative binomial distributions. We give a condition for the combinations of two analytic functions that a Lagrangian distribution is constructed.An interpretation of the statement is given by using a queueing process.An extension of the Gould identity is obtained as an application.

[8D:3] One Extremely Large Deviation Result

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We give firstly one extremely large deviation theorem for variables distributed by Weibull type density, then one result similar to Gipps Principle is obtained. These two results lead together to the application on solving one type of equation associated to slowly varying function.

Note: Joint work with Michel Broniatowski (University Paris 6).

[8D:4] Local Influence Analysis in Cross-over Designs

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The aim of this work is to develop a new methodology to detect influential observations in cross-over design models with random individual effects. Various case-weight perturbations are performed. We derived the exact solution of influence of the perturbations on each parameter estimate and its dispersion matrix. Closed-form maximum likelihood estimates (MLEs) of variance components as well as fixed effect parameters in the cross-over design models are utilized in the proofs. The work exhibits the possibility to produce closed-form expressions of the influence using of the residuals in mixed models. A discussion on restrictions of the case-weighted perturbation schemes because of structural covariance is also given.

Note: Joint work with Tatjana Von Rosen (Stockholm University) and Dietrich Von Rosen (Swedish University of Agricultural Sciences).

[8D:5] The Power of Stein's Method in an Isometric Study of the Lindeberg-Feller Central Limit Theorem

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The Lindeberg-Feller CLT characterizes when the sequence of normalized rowwise sums of a rowwise independent triangular array of random variables converges weakly to a standard normally distributed random variable. More precisely, the theorem states that if the triangular array satisfies the so-called Feller negligibility condition, then normal convergence of the normalized row wise sums is equivalent with the famous Lindeberg condition.

Since normal convergence is metrized by the Kolmogorov-Smirnov distance, the Lindeberg-Feller CLT actually provides a necessary and sufficient condition for the superior limit of the sequence of Kolmogorov distances between a standard normally distributed random variable and the rowwise sums of a Feller negligible triangular array to be zero.

We will perform a what we call isometric study of this result in which we try to capture in which cases the above mentioned superior limit is not zero, but nevertheless small. We will do this by providing upper and lower bounds for the superior limit. Stein's method will turn out to be a powerful and indispensable tool for the elaboration of this program.

[8D:6] Likelihood Inference for Lognormal and Weibull Data with Left Truncation and Right Censoring with Illustrations

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The lognormal distribution and the Weibull distribution are quite commonly used as lifetime data models. The EM algorithm is used to estimate the parameters of these two models based on left truncated and right censored data. For the lognormal distribution, the maximization step of the algorithm is carried out by two alternative methods, with one involving approximation using Taylor series expansion (leading to approximate maximum likelihood estimate) and the other based on the EM gradient algorithm (Lange, 1995). These two methods are compared based on Monte Carlo simulations. For the Weibull distribution, EM gradient algorithm is used in the maximization step. It is observed that for both of these models under left truncation and right censoring, the Fisher scoring method for obtaining the maximum likelihood estimates does not lead to satisfactory results. However, for lognormal distribution the Fisher scoring method works satisfactorily when the truncation percentage is small. For both the models, the asymptotic variance-covariance matrices of the MLEs are derived by using the missing information principle (Louis, 1982), and then the asymptotic confidence intervals for the model parameters are obtained. The proposed methods are compared to the standard methods, wherever applicable, in terms of bias, mean square error, average tolerance level, coverage probabilities for the confidence intervals etc., through extensive simulation studies. Finally, some numerical examples are given to illustrate all the methods of inference developed here.

Note: Joint work with N. Balakrishnan (McMaster University).

[9A:1] Adaptive Progressive Type-I Censoring

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Progressive Type-I censoring is a sampling scheme that has as main goal to control the duration of a life time experiment. In its standard version, the researcher determines in advance the time points at which test units will be withdrawn from the experiment as well as the corresponding number of units that will be withdrawn. However, the scheme has some potential drawbacks. Like in all Type-I censoring procedures, there is a positive probability of observing no failures at all. On the other hand, the units may start to fail in a higher rate than expected and so, the progressive censoring scheme can not implemented as planned. In order to avoid such situations, the researcher should be able to modify the rules as the experiment evolves. This means that he/she is allowed to change (i.e. adapt) the whole progressive censoring scheme (time points and/or number of removals) during the life test so that a meaningful dataset to be obtained. In this talk I will discuss general adaptive procedures for progressive Type-I censoring as well as related inference for the parameters of the underlying life distribution.

[9A:2] The Art of Progressive Censoring

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Progressive censoring has received great attention in the last two decades. The key objectives of this presentation are to provide both a review of major results and a perspective on current trends.

[9A:3] Bayesian Analysis of Progressively Censored Competing Risks Data

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In this paper we consider the Bayesian inference of the unknown parameters of the progressively censored competing risks data, when the lifetime distributions are Weibull. It is assumed that the latent cause of failures have independent Weibull distributions with the common shape parameter, but different scale parameters. In this article, it is assumed that the shape parameter has a log-concave prior density function, and for the given shape parameter, the scale parameters have Beta-Dirichlet priors. When the common shape parameter is known, the Bayes estimates of the scale parameters have closed form expressions, but when the common shape parameter is unknown, the

Bayes estimates do not have explicit expressions. In this case we propose to use MCMC samples to compute the Bayes estimates and highest posterior density (HPD) credible intervals. Monte Carlo simulations are performed to investigate the performances of the estimators. Two data sets are analyzed for illustration. Finally we provide a methodology to compare two different censoring schemes and thus find the optimum Bayesian censoring scheme.

[9B:1] Baker-Lin-Huang Type Bivariate Distributions Based on Order Statistics

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Baker (2008) introduced a new class of bivariate distributions based on distributions of order statistics from two independent samples of size n. Lin-Huang (2010) discovered an important property of Baker's distribution and showed that the Pearson's correlation coefficient for this distribution converges to maximum attainable value, i.e. the correlation coefficient of the Frecht upper bound, as n increases to infinity. Bairamov and Bayramoglu (2011) investigated a new class of bivariate distributions constructed by using Baker's model and distributions of order statistics from dependent random variables, allowing high correlation than that of Baker's distribution. In this paper a new class of Baker's type bivariate distributions with high correlation are constructed on the base of distributions of order statistics by using an arbitrary continuous copula instead of the product copula.

Note: Joint work with Ismihan Bairamov (Izmir University of Economics).

[9B:2] Moments of Order Statistics from Weibull Distribution in the Presence of Multiple Outliers

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In this paper, we derive exact expressions for the single and product ?moments of order statistics from Weibull distribution under the contamination model. We assume that the first part of the available sample if of size p with density function f(x) while the remaining, p observations (outliers) of size (n-p) with density function arises from some modified version of $f(x)$, which is called $g(x)$, in which the location and/or scale parameters have been shifted in value. Next, we investigate the effect of the outliers on the BLUE of the scale parameter. In addition, we show the usefulness of the findings by using Monte Carlo technique.

Note: Joint work with Mohamed Moshref (Al Azhar University).

[9B:3] A Review on Convolutions and Order Statistics from Heterogeneous Samples

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Convolutions and order statistics from heterogeneous samples often arise in a natural way in many applied areas. In this talk, we review recent developments on stochastic comparisons of convolutions and order statistics of heterogeneous random variables in terms of the majorization type order of parameter vectors. The case when one sample involves identically distributed variables is discussed, and we reveal the link between various stochastic orderings of convolutions and order statistics and various means of parameters. We also discuss the applications of the comparison results in the different fields.

Note: Joint with Narayanaswamy Balakrishnan (McMaster University) and Xiaohu Li (Xiamen University).

[9C:1] Robust Estimation in Non-parametric Normed Space

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Robust estimation deals with the problem of stability of estimators under a certain type of mis-specification of the model with respect to the true and unknown distribution of the data to be analyzed. The word stability is often associated to the behaviour of the variance and/or of the bias of the estima- tors. In this talk we consider the problem of optimal robust procedure in both parametric and non-parametric setting. We review some important results, already presented in the literature, in a unified framework. We discuss about a different way of defining the bias of an estimator under contamination and we show that, under this measure of bias, the minimum distance/disparity estimators are always optimal under certain conditions. Finally, we explore how to construct optimal robust estimator based on an appropriate disparity measure when the contamination neighborhood is generated using a norm between distributions, in both parametric and non parametric setup.

[9C:2] Minimum Distance Estimation Based on Tangent Disparities

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This paper introduces the new family of tangent disparities based on the tangent function and considers robust inference based on it. The properties of the resulting inference procedures are studied. The estimators are asymp- totically efficient with asymptotic breakdown points of 1/2 at the model. The corresponding tests are equivalent to the likelihood ratio test under the null.

This family of divergences form a special case of disparities or phi-divergences. We describe the particular features that distinguish this family within the class of disparities. Numerical studies substantiate the theory developed and compare the performance of the methods with those based on the Hellinger distance and maximum likelihood.

Note: Joint work with Chanseok Park (Clemson University).

[9C:3] Robust and Bayesian Analysis of Non-Stationary Data via Disparities

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Disparity based inference proceeds by minimizing a measure of disparity between a parametric family of density functions and a kernel density estimate based on observed i.i.d. data. For a class of disparity measures, of which Hellinger distance is one of the best known, minimum disparity estimates of parameters are both robust to outliers and also statistically efficient.

This talk introduces three novel methods based on disparities. We develop two disparity-based approaches for nonlinear regression settings, based either on a nonparametric estimate of a conditional density, or by considering the marginal distribution of residuals. Both approaches can be shown to be both robust and efficient.

We also demonstrate that disparities can be used to replace log likelihoods in Bayesian inference, allowing Monte Carlo Markov Chain methods to be applied to obtain robust posterior distributions while retaining asymptotic posterior efficiency. Combining these approaches allows any component of a Bayesian hierarchical model to be made robust to outliers by replacing part of the complete data log likelihood with a disparity.

Note: Joint work with Anand Vidyashankar (George Mason University).

[9D:1] On Pearson-Kotz Dirichlet Random Vectors

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This class of of Pearson-Kotz Dirichlet random vectors is very tractable from the distributional point of view, and surprisingly of particular interest for approximation of large classes of Dirichlet distributions. This talk discusses some basic distributional and asymptotic properties of Pearson-Kotz Dirichlet random vectors.

Note: Joint work with N. Balakrishnan (McMaster University).

[9D:2] Seeking Hidden Risks using Multivariate Regular Variation

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Multivariate regular variation plays a role in assessing tail risk in diverse applications such as finance, telecommunications, insurance and environmental science. The classical theory, being based on an asymptotic model, sometimes leads to inaccurate and useless estimates of probabilities of joint tail regions. This problem can be partly ameliorated by using hidden regular variation (Resnick (2002), Mitra & Resnick(2010)). We offer a more flexible definition of hidden regular variation using a modified notion of convergence of measures that provides improved risk estimates for a larger class of tail risk regions. The new definition unifies ideas of asymptotic independence and asymptotic full dependence and avoids some deficiencies observed while using vague convergence.

Note: (Joint with A. Mitra and S. Resnick).

[9D:3] A Fast Generating Algorithm for Dirichlet Random Vectors with Some Extensions

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In this talk we introduce a fast algorithm for generating Dirichlet random vectors. The algorithm is based on transformation of beta variates, in which we provide three useful guidelines to accelerate the generation of the desired random vector. Numerical results show that the proposed algorithm

significantly outperforms (in terms of computer generation time) all existing methods almost for the entire class of shape parameters. Finally, we highlight some useful extensions of this particular generating algorithm.

[10A:1] Bayesian Adaptive Calibration and Variable Selection in Linear Measurement Error Models

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We propose a Bayesian variable selection method built upon an extended Zellner's g-prior in linear measurement error models. Pseudo variables are introduced into the model to facilitate choosing a tuning parameter that indirectly controls the selection of variables. Simulation results indicate that models selected using the proposed method are generally more favorable with smaller prediction losses than the models selected using classical Zellner's g-priors. The proposed method is further demonstrated using two data sets: gene expression data from a lung disease study and food frequency questionnaire data from a nurse study.

Note: Joint work with Xianzheng Huang (Univ. of South Carolina), Jianjun Gan (Glaxosmithkline), Wilfried Karmaus (Univ. of South Carolina) and Tara Sabo-Attwood (Univ. of Florida).

[10A:2] Unbalanced Mixed Linear Models and Explicit Estimators

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The model may be unbalanced and then it becomes complicated to find explicit estimators with reasonable uncertainty.

Testing of both variance components and fixed effects in an unbalanced mixed model relies usually on approximationss, in particular, Satterthwaite's approximation of the test statistics. The derived tests have unknown distributions, both under the null and alternative hypotheses, due to the lack of independence and chi-squaredness of the mean squares involved. In this presentation we will adopt ideas from, among others, Gallo & Khuri (1990) and fversten (1993) where a resampling approach has been presented for obtaining tests and implement the ideas into an estimation approach.

Note: Joint work with Tatjana Von Rosen (Stockholm University) and Júlia Volaufová.

[10A:3] An Empirical Investigation to Study the Trenss in Cereals Crop Production Based on Parametric and Nonparametric Regression Models

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The present investigation was carried out to study the trends in production of cereals crops grown in Gujarat State based on non-linear and non-parametric regression models. The statistically most suited non-linear models were selected on the basis of adjusted R2, significant regression co-efficients and co-efficient of determination (R2). The selected model was further tested for randomness and normality of error terms. When more than one model was found suitable further screening based on lower values of Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) was done. The standard SPSS Ver 17.0 package was used to fit linear, non-linear and time-series models. The Curve expert Ver.1.3 software package was used to estimate the initial values for the non-linear models. When none of the non-linear models were found suitable to fit the trends nonparametric regression was employed to study the trends.

The results indicated that none of the Non-linear models were found suitable to fit the trend in area of bajra, paddy and maize crops due to either nonsignificant partial regression co-efficients or non-fulfilling the assumptions of the residuals. Nonparametric regression model was selected as the best fitted trend function for the area under the bajra, paddy and maize crops. For the production and productivity of bajra crop the Rational function and Hoerl model, respectively was found suitable to fit the trends. The Hoerl and Logistic models were found suitable to fit the trends in production and productivity of paddy crop. In case of wheat crop the non-linear models namely MMF was found suitable to fit the trends in area as well as productivity of wheat crop where as in case of production the exponential model was found suitable to fit the trends in production of wheat crop data. The Gaussian and Horel model, respectively were found suitable to fit the trends in production and productivity of maize crop.

Note: Joint work with Vinoth Balakrishnan (Manonmaniam Sundaranar University).

[10B:1] Permutation Multiple Tests on Ordering with Application to the Study of Listening Conditions in Classrooms

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When studying the listening conditions of young students in classrooms, one of the most interesting problem consists in testing the stochastic ordering of intelligibility scores respect to the school grade. Listening tests to compare the intelligibility of pupils from different grades should simulate different ambient noises and take also into account the quality of the speech transmission. Classic

parametric ANOVA and multiple pair wise comparison procedures have been proposed in the specific literature to test the significance of differences in intelligibility of groups of students but a procedure to test a ranking of the intelligibility of the considered groups has not yet been proposed. In this framework a permutation multiple test on ordering is proposed to test a specific ordering of the intelligibility of pupils from different school grades under different ambient noises. The procedure is based on multiple directional two-sample tests (partial tests) to compare couple of grades and on the application of a nonparametric combination to test the global ordering taking into account the dependence among the partial tests. Adjusting the partial p-values to control the multiplicity allows to attribute the global significance of the test on ordering to specific pair wise comparisons. The presence of different levels of quality of speech transmission requires also the application of a stratified analysis and a multistep combination procedure. The proposed method is applied to real data related to a survey accomplished in 2010 on pupils aged 8-10 years (grades III, IV and V of the italian primary school) in some institutes of Ferrara (Italy).

Note: Joint work with Nicola Prodi (University of Ferrara), Luigi Salmaso (University of Padova) and Chiara Visentin (University of Ferrara).

[10B:2] Improving Power of Multiariate Combination-based Permutation Inferences

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The purpose of this work is to present how power of multivariate combination-based inferences can be improved by means of a pairs of procedures able to effectively exploit some peculiar characteristics of this methodology. Permutation tests are essentially of an exact nonparametric nature in a conditional context, where conditioning is on the pooled observed data as a set of sufficient statistics in the null hypothesis (Pesarin and Salmaso, 2010a). From a general point of view, the main difficulties when developing a multivariate inferential procedure arise because of the underlying dependence structure among variables, which is generally unknown. Moreover, a global answer involving several dependent variables is often required, so the question is how to combine the information related to whole set of variables into one global answer. The combination-based permutation approach allow us to provide a flexible and effective analysis in terms of both the specification of the multivariate hypotheses and the nature of the variables involved without the need of modeling for dependence among variables. There are two different procedures which may help us to gain power within the multivariate combination-based permutation inferences: multi-variable and multi-aspect approach. Both methods take essentially advantage of a peculiar and unique property of multivariate combination-based permutation inferences, i.e. the so-called finite-sample consistency (Pesarin and Salmaso, 2010b). It can be proved that, for a given fixed number of units, when the number of variables increases and the noncentrality parameter of the underlying population distribution increases with respect to each added variable, then power of the multivariate combination-based permutation tests is monotonically increasing. Since in many real applications it may happen that the number of observed variables may be much larger than that of units the principle underlying the finite-sample consistency can be effectively exploited, simply trying to

adding new variables to the observed dataset when keeping fixed the same units. We call this idea as the multi-variable approach. Note that within the traditional parametric approach this proposal appears as counterintuitive and counterproductive due to the well know problem connected with the loss of degrees of freedom which arises when keeping the sample size fixed and in the same time the dimensionality (number of variables) of the inferential problem is increasing. Alternatively, or in addition to the method just mentioned, it is possible to consider the so-called multi-aspect approach originally proposed by Fisher: In hypotheses testing problems the experimenter might have to face not only one, but a class of hypotheses, and it may happen that he is interested in all the hypotheses of such class It follows that different significance tests may be thought as a set of tests for testing different aspects of the same hypothesis (Pesarin and Salmaso, 2010a). Hence, the metaphor of the problem is that different significance tests are suitable for testing different aspects of the same null hypothesis. Within the combination-based permutation framework it means that significance (aspect) tests may be effectively combined using a combining function sensitive to (a few, some or many) deviations from the null hypothesis.

Note: Joint work with Rosa Arboretti Giancristofaro (University of Padova).

[10C:1] A Generalized Genetic Association Study with Samples of Related Subject

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Genetic association study is an essential step to discover genetic factors that are associated with a complex trait of interest. In this paper, we present a novel generalized quasi-likelihood score (GQLS) test that is suitable for a study with either a quantitative trait or a binary trait. We use a logistic regression model to link the phenotypic value of the trait to the distribution of allelic frequencies. In our model, the allele frequencies are treated as a response and the trait is treated as a covariate that allows us to leave the distribution of the trait values unattended. Simulation studies indicate that our method is more powerful in comparison with family-based association test (FBAT) and controls the type I error at the desired levels. We apply our method to analyze data on Holstein cattle for an estimated breeding value phenotype.

[10C:2] Optimal Significance Analysis of Microarray Data in a Class of Tests whose Null Statistic can be Constructed

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Microarray data often consist of a large number of genes and a small number of replicates. We have examined testing the null hypothesis of equality of mean for detecting differentially expressed

genes. The p-value for each gene is often estimated using permutation samples not only for the target gene but also for other genes. This method has been widely used and discussed. However, direct use of the permutation method for the p-value estimation may not work well, because two types of genes are mixed in the sample; some genes are differentially expressed, whereas others are not. To overcome this difficulty, various methods for appropriately generating null permutation samples have been proposed.

We consider two classes of test statistics that are naturally modified to null statistics. We then obtain the uniformly most powerful (UMP) unbiased tests among these classes. If the underlying distribution is symmetric, the UMP unbiased test statistic is similar to that proposed by Pan (2003). Under another condition, the UMP unbiased test statistic has a different formula with one more degree of freedom and therefore is expected to give a more powerful test and a more accurate p-value estimation from a modified null statistic. In microarray data, because the number of replicates is often small, differences in the degree of freedom will produce large effects on the power of test and the variance of the p-value estimation.

[10C:3] A Stochastic Model for HIV Infection

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The spread of the HIV infection has created an pandemic situation all over the world. The antigenic diversity threshold in a particular level of the antigenic diversity of the invading antigen beyond which the immune system breaks down and a person becomes seropositive. In this paper the expected time and variance to seroconversion are derived under the assumption that the antigenic diversity threshold comprises of two components namely the natural antigenic diversity threshold level of human immune system and the threshold component due to use of ART. Numerical illustration is also provided.

[10D:1] Asymptotic Normality of Quantile Regression Estimators for Samples from a Finite Population

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We derive the asymptotic normality of the quantile regression estimators for a simple random sample from a finite population.

[10D:2] A Fast Weavelet Algorithm for Analyzing One-Dimensional Signal Processing and Asymptotic Distribution of Wavelet Coefficients

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In this paper, we obtain an algorithm to analyze and synthesize a signal or function f by using wavelet coefficients. We consider a sample point $(tj\ ,\ sj)$ including a value $sj = f(tj)$ at height sj and abscissa (time or location) tj . We apply wavelet decomposition by using shifts and dilations of the basic Haar transform. We use MATLAB software for computing wavelet coefficients in this algorithm. Some relationsships between wavelets coefficients and empirical distribution of wavelet coefficients are investigated.

[10D:3] Information Geometry in Large Dimension Contingency Table

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Recent studies by the authors (Statistica Sinica, 2008; JASA, 2010) showed that mutual information identities present geometric interpretations for the statistical inference of categorical data. It also offers a notable advantage that linear information models (LIM) can be used to select significantly related variables to a target variable of interest (JDS, 2007). The derived method of variable selection is easily applied to any large dimension contingency data table. In contrast, existing methods such as the generalized linear models would yield different results using auxiliary model selection criteria, say AIC or BIC. An empirical study of a large and sparse contingency table is presented with simple illustrations.

Note: Joint work with Keng Lin (Academia Sinica), Michelle Liou (Academia Sinica) and Ben-Chang Shia (Fu Jen Catholic University).

[10E:1] Empirical Likelihood Inference in Mixture of Semiparametric Varying Coefficient Models for Longitudinal Data with Nonignorable Dropout

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Longitudinal data are often collected from experimental studies or clinical trials. In the long-term longitudinal studies, dropout and other types of missing data are common; in many cases, dropout induces a missingness process that is nonignorable in the sense that missingness depends probabilistically on observable information. There are some model-based approaches to deal with informative dropout in longitudinal data, for example, likelihood-based approaches including selection models, mixture models, and moment-based methods. In this paper, mixture of semiparametric varying coefficient models for longitudinal data with nonignorable dropout is investigated by empirical likelihood inference. We estimate the nonparametric function based on the estimating equations and the local linear profile-kernel method. An empirical log-likelihood ratio statistic for parametric components is proposed to construct confidence regions, and is shown to be asymptotically chi-square distribution. The nonparametric version of the Wilk's theorem is also derived. A simulation study is undertaken to illustrate the finite sample performance of the proposed method. Further, we apply the empirical likelihood method in the mixture of semiparametric varying coefficient models to the CD4 data from the Multi-Center AIDS Cohort Study, and have some new findings.

Note: Joint work with Jin-Guan Lin (Southeast University).//[.1in]

[10E:2] Fisher Information in Censored Samples from the Block-Basu Bivariate Exponential Distribution and Its Applications

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Let $(X_{i:n}, Y_{[i:n]}), 1 \leq i \leq r < n$, be the first r order statistics and their concomitants of a random sample from the absolutely continuous Block-Basu bivariate exponential distribution with pdf having the form $\lambda_1\lambda(\lambda_2+\lambda_{12})(\lambda_1+\lambda_2)^{-1}e^{-\lambda_1 x-(\lambda_2+\lambda_{12})y}$ when $0 \leq x < y$ and $\lambda_2\lambda(\lambda_1+\lambda_{12})(\lambda_1+\lambda_2)^{-1}e^{-\lambda_2 y-(\lambda_1+\lambda_{12})x}$ when $0 \leq y < x$. We find the Fisher Information (FI) matrix in our type II right censored sample and examine the growth pattern of the FI relative to the total FI on λ_1, λ_2, and λ_{12} as r/n changes in (0,1) for finite and infinite sample sizes. We describe its implications on the design of censored trials. We also consider left and double censoring schemes.

Note: Joint work with Haikady N. Nagaraja (Ohio State University).

[10E:3] On Some Likelihood Inferential Aspects for Different Cure Rate Models

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Cure rate models are models for survival or lifetime data consisting of a surviving fraction. Traditional methods of survival analysis, including the Cox regression model, are concerned with survival only and do not address the possibility of disease cure. However, estimation of a treatment-specific cure rate provides valuable information that is not only of use to the investigator but is of primary interest to the patient at the time of diagnosis. In the recent work of Rodrigues et al. (2009), a flexible cure rate survival model was developed by assuming the number of competing causes of the event of interest to follow the Conway-Maxwell Poisson distribution. They also discussed the maximum likelihood estimation of the parameters of this cure rate survival model. As the data obtained from cancer clinical trials are often subject to right censoring, the EM algorithm can be used as a powerful tool to estimate the parameters of the model based on right censored data. In this work, the cure rate model developed by Rodrigues et al. is considered and exact likelihood inference is drawn based on the EM algorithm. Finally, the method of inference developed here is illustrated with a cutaneous melanoma data.

Note: Joint work with Narayanaswamy Balakrishnan (McMaster University).

[11A:1] Inference for a Simple Gamma Step-stress Model with Type-II Censoring

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In reliability and life testing experiments, one of the most technical strategies that allows manufacturers and designers to identify, improve and control critical components is called the Accelerated Life Tests (ALT). The main idea of those tests is to investigate the products reliability at higher than usual stress levels such as voltage, pressure, temperature, cycling rate or loads on each unit to ensure earlier failure than what could result under the usual normal environmental conditions. A model is then fitted to the accelerated failure times and then extrapolated to estimate the life distribution under normal conditions. Accelerated life test is usually done using constant stress, step stress, or linearly increasing stress levels.Unlike the constant stress experiments which could last for a long time, the step-stress experiment reduces test time and assures faster failures. It starts by applying low stress on each unit and after a pre-specified time, the stress is increased. So, the stress is repeatedly increased and held until the test unit fails. In this test scheme, there could be more than one change of stress level.Assuming Type-II censoring, which is formed by terminating the life-testing experiment when a specified number of failures are observed and the remaining units are censored.

[11A:2] Accelerated Life Tests for Weibull Series Systems with Masked Data

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In this talk, I will introduce a p-stage step-stress accelerated life test on n system products, where each system contains m statistically independent non-identical components connected in series, and it fails if any component has broken down. Due to cost considerations or environmental restrictions, masked causes of system failures and type-I censored observations might occur in the collected data. The time to failure under a pre-specified stress environment is described by a Weibull-distributed cumulative exposure model. A computationally feasible procedure based on the hybrid EM-NR algorithm is developed for maximum likelihood estimation of the model. Further, the reliability of the system and components are estimated at a specified time under usual operating conditions. The proposed method is illustrated through a numerical example and a simulation study under various masking levels.

Note: Joint work with Prof. Tsai-Hung Fan.

[11B:1] Improving Power to Detect Intervention Effects in Hierarchical Linear Models via Ranked Set Sampling

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The effectiveness of educational interventions is most convincingly established by randomized experiments. Such experiments require recruitment of participants at various levels, and whenever possible, use a random process to select units at each level. Unless the expected effect size is large or the level of noise is low, the number of units to be randomized often needs to be large to achieve adequate statistical power. However, implementation of intervention programs in a large number of sites and evaluation of a large number of students are often difficult and/or expensive tasks. Thus a data collection method that can increase statistical power without adding additional sites or students would be useful to reduce cost. Here, we will examine the application of ranked set sampling (RSS), a cost-efficient method of data collection, for educational experiments. Though well established in Statistics and many application fields, RSS has not yet been applied in educational studies. Outcome data in such studies typically have a multilevel structure, and so hierarchical linear models (HLMs) become a natural choice for data analysis. However, the theoretical developments in RSS to date are all within the structure of one-level models. Thus, implementation of RSS at one or more levels of a HLM will require development of new theory and methods.

Note: Joint work with Lynne Stokes (Southern Methodist University).

[11B:2] Multi-ranker Designs for Partially Rank Ordered Judgment Post Stratified and Ranked Set Samplling Designs

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Standard applications of Judgment post stratified (JPS) and ranked set sampling (RSS) designs rely on the ability of a ranker to assign ranks to potential observations on available experimental units and do not allow ties in judgment ranking. Ranker is forced to produce a single rank for each ranked unit. This usually leads to loss of efficiency in inference. In many settings, there are often more than one rankers available and each of these rankers provide judgment ranks.

This paper proposes two sampling schemes, one for JPS and the other for RSS, to combine the judgment ranks of these rankers to produce a strength of agreement measure for each fully measured unit.Judgment ranking process is flexible to allow rankers to declare ties whenever they do not have high confidence to rank the units. This strength measure is used to draw inference for the population mean and median. The paper shows that the estimators constructed based on this strength measure provide a substantial improvement over the same estimators based on judgment ranking information of a single best ranker.

[11B:3] Sign Test Using k-tuple Ranked Set Samples

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The sign test based on the k-tuple ranked set samples(RSS) is discussed in this article. We first derive the distribution of the k-tuple RSS sign test statistic. In addition, the asymptotic distribution is also obtained. Then we compare it to the counterparts based on simple random sample and classical ranked set sample, respectively. Both asymptotic relative efficiency and the power are presented. Finally, the imperfect ranking effect is discussed.

[11C:1] Empirical Likelihood and Quantile Regression in Longitudinal Data Analysis

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We propose a novel quantile regression approach for longitudinal data analysis. Through using empirical likelihood, the approach naturally incorporates auxiliary information from the conditional mean model and can account for the within subject correlations. The efficiency gain is quantified theoretically and demonstrated empirically via extensive simulation studies and the analysis of a real data.

[11C:2] Statistical Analysis of Bivariate Recurrent Event Data with Incomplete Observation Gaps

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In a longitudinal study, subjects can experience two types of recurrent events. Also, there may exist intermittent dropouts resulting in repeated observation gaps during which no recurrent events are observed. In this paper, we consider a special case where information on the observation gap is incomplete, that is, the terminating time of observation gap is not available while the starting time is known. Such an incomplete information is incorporated in terms of interval censored mechanism. Bivariate random effect is applied for the association between two events. EM algorithm is applied to recover unknown terminating time of observation gap. Simulation studies are carried out to evaluate the performance of the proposed estimators for two cases,(i) covariate-independent and (ii) covariate-dependent termination time of observation gap. We apply to young drivers'; suspension data where there exist several causes.

[11C:3] Semiparametric Estimation Methods for Longitudinal Data with Informative Observation Times

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In the analysis of longitudinal data, observation times may be correlated with response process and some component of covariates. In this article we extend Sun et al. (2005) and conditional model to a model that the response mean function is established conditional on the covariates and interaction

between the observation history and some component of the covariates, leaving patterns of the observation times to be arbitrary. A spline-based least-square estimation procedure is proposed for regression parameters and nonparametric function, and consistency, rate of convergence and asymptotic normality of the proposed estimators are established. Simulation studies demonstrate that the proposed inference procedure performs well. The analysis of a bladder tumor data is presented to illustrate the proposed method.

Note: Joint work with Shirong Deng (The Hong Kong Polytechnic University) and Li Liu (Wuhan University).

[11D:1] Optimal Design for Degradation Tests Based on Gamma Degradation Process with Random Effects

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Degradation models are usually used to provide information on the reliability of highly reliable products that are not likely to fail under the traditional life tests or accelerated life tests.Gamma process is a natural model for describing degradation paths which exhibit a monotone increasing pattern,while the commonly used Wiener process is not appropriate in such a case.In this paper,we discuss the problem of optimal design for degradation tests based on a gamma degradation process with random effects.In order to conduct a degradation experiment efficiently,several decision variables (such as the sample size, inspection frequency, and measurement numbers) need to be determined carefully.These decision variables affect not only the experimental cost, but also the precision of estimation of parameters of interest.Under the constraint that the total experimental cost does not exceed a pre-specified budget, the optimal decision variables are found by minimizing the asymptotic variance of the estimate of the $100p$-th percentile of the lifetime distribution of the product.A laser data is used to illustrate the proposed method.Moreover,the effects of model mis-specification that occurs when the random effects are not taken into consideration in the gamma degradation model are assessed analytically.The numerical results of these effects reveal that the impact of model mis-specification on the accuracy and precision of the prediction of percentiles of the lifetimes of products are somewhat serious for the tail probabilities. A simulation study shows that the simulated values are quite close to the asymptotic values.

Note: Joint work with Sheng Tsaing Tseng (National Tsing-Hua University) and Narayanaswamy Balakrishnan (McMaster University).

[11D:2] Statistical Inference of a Series System with Masked Data with Correlated Log-normal Lifetime Distributions under Type-I Censoring

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In a series system, the system fails if any of the component fails. It is often to include masked data in which the component that causes failure of the system is not observed. We will discuss the reliability analysis of a series system under Type-I censoring scheme when the components are assumed to have correlated log-normal lifetime distributions. Furthermore, the symmetric assumption that the probability of masking does not depend on the true failure cause is released. We will compare both the Bayesian approach and the maximum likelihood inference on the model parameters as well as the system mean life time and the reliability function. Simulation study reveals that the correlated phenomena may have less influence on the inference of the system lifetime distribution but could be more accurate using conditional inference for that of the components.

Note: Joint work with Tsung-Ming Hsu (National Central University).

[11D:3] Bayesian Variable Sampling Plans for the Exponential Distribution

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In this work, we investigate the variable sampling plans for the exponential distribution under four different progressive hybrid censoring schemes. The explicit expressions of the Bayes risk of a sampling plan under the selected progressive hybrid censoring schemes are established when a general quadratic loss function, which includes the sampling cost, the time-consuming cost, and the salvage, is used. Finally, numerical comparisons between the proposed optimal sampling plans are made, and the examination of the robustness is performed.

Note: Joint work with Yen-Lung Huang (Tamkang University).

[12A:1] A Distribution-Free Test for Mean Residual Life Function

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The mean residual life at time t_0 to be the mean of the lifetime that remains after time t_0, conditional on the unit still begin in operation at t_0. Some distribution-free tests have been discussed in the literature when null hypothesis of the underlying failure distribution is exponential, versus the alternative that it has a monotone mean residual life function. In this paper, a new test statistic is derived for testing constant versus decreasing mean residual life , and then derive its exact null distribution and examine its power properties, through a Monte Carlo simulation study.

[12A:2] Distance Based Approach for Construction of Rank Tests

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Nonparametric tests based on ranks are often defined trough a distance of observed ranking to a set of permutations. By defining the distance to be minimum interpoint distance between appropriate sets of permutations Critchlow (1992) reveals relationship of many familiar rank test statistics with popular distance measures on permutations.

To construct a rank for a typical testing situation we proceed in four steps.

Step 1. Collect all data relevant to the problem, and rank order all of these observations. This produces a single permutation denoted by A.

Step 2. Identify the set of permutations which are equivalent (for the testing problem) to the observed permutation A. This equivalence class of permutations is denoted by [A].

Step 3. Identify the set E of extremal permutations consisting of all permutations which are least in agreement with the null hypothesis and most in agreement with the alternative.

Step 4. To test the hypotheses take a metric d on permutations. The proposed test statistic is the minimum distance between the sets A and E.

Since d(A,E) measures the distance from A to the set of permutations which are most in agreement with the alternative, it follows that the test based on it rejects the null hypothesis for small values of d(A,E).

We will discuss several distances on permutations that are widely used in statistics and are appropriate for the above construction. We will show the advantage of the method: (1) works in variety of testing situations; (2) gives rise to many familiar nonparametric test statistics; (30 produces several other test statistics which are less familiar, yet, equally plausible; and (4) enable us to extend our tests to other hypothesis testing situations.

[12A:3] On Some One-sided Non-parametric Control Charts

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We propose some non-parametric one-sided control charts based on precedence statistic or related ones. These control charts are designed especially for lifetime distributions. Hence we want to test whether $G = F$ or $G > F$ where F is the distribution of an unit under control and G is the distribution of an unit of a test sample. Such kind of control charts have not be studied previously in the literature. In this talk we will present two control charts, the first one being based on the classical precedence statistic and the second one on a weighted version of the precedence statistic. For these two control charts we compute critical values and unconditional average run length (ARL) under the null assumption and also under the two different Lehmann alternatives. Numerical computations are also provided.

Note: Joint work with Christian Paroissin (Universit de Pau et des Pays de l') and Narayanaswamy Balakrishnan (McMaster University).

[12B:1] Does Information and Communication Technology Increase Production Efficiency? A Comparison Between OECD Service Industries

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In this paper we explore the hypothesis that information and communication technologies (ICT) are beneficial to industries in reducing production inefficiencies. A stochastic production frontier is simultaneously estimated with a technical inefficiency model using services industry data across a panel of 16 OECD countries during 1995-2004. The obtained evidence indicates a significantly negative relationship between ICT and technical inefficiency in the sectors of transports & storage and wholesale & retail trade. The most efficient countries are the Netherlands in the industry of wholesale & retail trade, Ireland in hotels & restaurants, as well as in post & telecommunications, UK in transports & storage, and the USA in financial intermediation and real estate, renting & business activities.

Note: Joint work with Sotiris Papaioannou.

[12B:2] Estimation of Copula Models with Discrete Margins via Bayesian Data Augmentation

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Estimation of copula models with discrete margins is known to be difficult beyond the bivariate case. We show how this can be achieved by augmenting the likelihood with uniform latent variables, and computing inference using the resulting augmented posterior. To evaluate this we propose two efficient Markov chain Monte Carlo sampling schemes. One generates the latent variables as a block using a Metropolis-Hasting step with a proposal that is close to its target distribution. Our method applies to all parametric copulas where the conditional copula functions can be evaluated, not just elliptical copulas as in previous Bayesian work. Moreover, the copula parameters can be estimated joint with any marginal parameters. We establish the effectiveness of the estimation method by modeling consumer behavior in online retail using Archimedean and Gaussian copulas and by estimating 16 dimensional D-vine copulas for a longitudinal model of usage of a bicycle path in the city of Melbourne, Australia. Finally, we extend our results and method to the case where some margins are discrete and others continuous.

Note: Joint work with Professor Michael S. Smith.

[12B:3] Bayesian Modeling of Twenty20 Cricket

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Twenty20 cricket is the newest form of sport of cricket where each team bats for 20 overs. With more aggressive batting style than one-day and test cricket, T20 has become very popular. Given that only a finite number of outcomes can occur on each ball that is bowled, a model is developed where the outcome probabilities are estimated from historical data. The probabilities depend on the batsman, the bowler, the number of wickets lost and the number of overs bowled. Using the data from 139 international matches, a Bayesian model is developed. The model includes parameters measuring the effects of batsman and bowler, stage of the game: number of wickets lost and number of overs bowled. In addition to modelling the scoring patterns, the Bayesian model also produces a ranking of about 700 batsmen and about 400 bowlers who have played Twenty20 cricket up to April 2011.

Note: Joint work with Sotiris Papaioannou.

[12C:1] Estimation and Goodness-of-Fit Procedures for Farlie-Gumbel-Morgenstern Bivariate Copula of Order Statistics

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In this study, we provide the Farlie-Gumbel-Morgenstern bivariate copula of rth and sth order statistics. The main emphasis in this study is on the inference peocedure which is based on the maximum pseudo-likelihood estimate for the copula parameter. As for the methodology, goodness-of-fit test statistic for copulas which is based on a Cramer-von Mises functional of the empirical copula process is applied for selecting an appropriate model by bootstrapping. An application of the methodology to simulated data set is also presented.

Note: Joint work with Burcu H. Ucer (Dokuz Eylul University).

[12C:2] On Conditional Independent Random Variables

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A different approach to conditionally independent random variables is considered, the necessary and sufficient conditions for conditional independence in terms of the partial derivatives of distribution functions and copulas are given. Also, the distributional properties of order statistics of conditionally independent random varaiables are studied. It is shown that these distributions can be expressed in terms of partial derivatives of copulas. The permanent expressions for distributions of order statistics are also presented. Possible applications are discussed.

[12C:3] On the Reliability Properties of Coherent Systems

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The concept of 'signature' is a useful tool to study the stochastic and aging properties of coherent systems. Let $X_{1:n}, X_{2:n}, ..., X_{n:n}$ denote the ordered lifetimes of the components of a coherent system. Assuming that T denotes the lifetime the system, the signature of the system is defined to be a vector $\mathbf{s} = (s_1, s_2, ..., s_n)$ in which $s_i = P(T = X_{i:n})$, $i = 1, 2, ..., n$. In this talk, we consider a coherent system and assume that there is some partial information about the failure status of the system e.g. the lifetime of the system is in a set A, where $A \subseteq [0, \infty)$. We study various properties

of the conditional signature with elements $P(T = X_{i:n}|T \in A)$, $i = 1, 2, ..., n$, where A is either of the form $A = \{t\}$, or $A = (t, \infty)$ or $A = (0, t)$, $t > 0$.

Some coherent systems have the property that in the time of failure of the system, some of components remain unfailed in the system. We address the stochastic and aging properties of the residual lifelengths of the live components of the system under different conditions.

[12D:1] The Work of Fernando de Helguero on Non-normality Arising from Selection

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The current literature on so-called skew-symmetric distributions is closely linked to the idea of a selection mechanism operated by some latent variable. We illustrate the pioneering work of Fernando de Helguero who in 1908 put forward a formulation for the genesis of non-normal distributions based on a selection mechanism which perturbs a normal distribution, via an argument which has close connections with the construction now widely used in this context. Arguably, de Helguero can then be considered the precursor of the current idea of skew-symmetric distributions. Unfortunately, a tragic quirk of fate did not allow him to pursue his project beyond the initial formulation and his work went unnoticed for the rest of the 20th century.

Note: Joint with Giuliana Regoli (University of Perugia).

[12D:2] Skew-elliptical Distributions and Their Relationship with Order Statistics

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In this talk, I will discuss some recent work of mine on skew-elliptical distributions and their relationship with order statistics from multivariate elliptical and multivariate unified skew-elliptical distributions. The first part of my talk will discuss distributions of order statistics from a bivariate normal distribution. We show that these distributions are mixtures of the univariate Azzalini skew-normal distributions (Azzalini, 1985). Followed by this, I will discuss our work on distributions of order statistics from a trivariate normal distribution and we will present explicit experssions for mean and variance of these order statistics. The next part of my talk will discuss an extension of this work where we will discuss order statistics from multivariate elliptical distributions and we look at the normal and t cases in details. The last part of my talk involves our recent submitted work where we show that the cumulative distribution functions (cdfs) of order statistics and linear combination of order statistics from multivariate skew-elliptical distributions can be expressed as

mixtures of cdfs of multivariate unified skew-elliptical distributions. These mixture representations can be used to obtain moments of order statistics, where they exist.

[12D:3] On a Method for Obtaining Relevant Directions for Scale Mixtures of Multivariate Skew-normal Distributions

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By means of the comparison of different scatter matrices, Tyler et al. (2009) introduced a general method for analyzing multivariate data. On the basis of their results, a method for finding and exploring the relevant directions for scale mixtures of skew-normal distributions is introduced and discussed. The particular cases of the skew-normal and skew-t distributions will be discussed in more details.

[13A:1] Algebraic Statistics and Applications to Statistical Genetics

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Testing Hardy-Weinberg Equilibrium of a multi-allelic genetic marker in the population of interest is the first step before proceeding with a comprehensive genetic analysis. The chi-squared test based on the data collected is the standard staple. The chi-squared test is an asymptotic test and certain conditions have to be met before it is applied. If the chi-squared test is not applicable, conducting an exact test a la Fisher is a way out. When pursuing Fisher's exact test some monumental computational problems crop up. In this talk we will outline how the usage of Algebraic Statistics softens computational quagmire. We will also talk about Markov Bases and MCMC simulations for the computation of p-values. If time permits, we will broach triad designs and gene-environment interactions.

[13A:2] A Random-Sum Wilcoxon Statistic and Its Application to Analysis of ROC and LROC Data

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We propose a random-sum Wilcoxon statistic. The Wilcoxon-Mann-Whitney statistic is commonly used for a distribution-free comparison of two groups. One requirement for its use is that the sample sizes of the two groups are fixed. This is violated in some of the applications such as medical imaging studies and diagnostic marker studies; in the former, the violation occurs since the number of correctly localized abnormal images is random, while in the latter the violation is due to some subjects not having observable measurements. For this reason, we propose here a random-sum Wilcoxon statistic for comparing two groups in the presence of ties, and derive its variance as well as its asymptotic distribution for large sample sizes. The proposed statistic includes the regular Wilcoxon statistic. Finally, we apply the proposed statistic for summarizing location response operating characteristic data from a liver computed tomography study, and also for summarizing diagnostic accuracy of biomarker data.

[13A:3] Statistical Validation of Quality of Life Measurements obtained via Self-Rated Questionnaire, and their anslysis in a Longitudinal Setting

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An important aspect in many clinical and health studies is the assessment of Health related Quality of Life (HrQoL). Researches on HrQoL have drawn much recent interest particularly for chronic diseases (such as HIV-infection or cancer) of which lack of a definitive cure is a common feature. The aim of clinical trials carried out in medicine is to estimate efficiency and safety of new therapies. HrQoL is a subjective complex concept reflecting the idea of well-being with respect to the context where the person lives. In clinical studies, HrQoL reflects two notions: well-being physically (not to feel pain, not to be ill) and well-being mentally (to have good relations with the others, not to be stressed). Despite the growing importance of HrQoL outcomes and more generally of Patient-Reported Outcomes (PRO) in medical research satisfactory methods of analysis of these data remain an issue.

In HrQoL Research, various statistical methodologies can be used to answer scientific questions. The first and the more difficult is the Measurement step, which is in Health Sciences often based on an assumption of existence of a multidimensional latent variable that we can indirectly observe through a built questionnaire (the measurement instrument) involving items (questions) producing dichotomous (bernouilli) or polytomous (multinomial) ordinal responses.

Statistical Validation of Quality of Life Measurements is mainly done through the validation of some specific measurement models relating the observed outcomes to the unobserved theoretical latent construct (the HrQoL variable that scientist aim to assess). Validation of such models,

based on goodness of fit (GOF) tests, is not straight forward, mainly because the set of variables involved in the models is partly unobserved. Goodness of fit tests in the latent context still remains an issue. A second, more controversial, issue in that context is the respective role of models and data. Traditionally in statistical applications, the choice of a model is left to the actual data. A model is validated if the real data support it! A model is validated if it is chosen among the other rival models by the real data! If we adopt this traditional approach without precautions, we could validate any HrQoL questionnaire, to the delight, of course, of the person who developed it. So, in our context, the right approach is to use a good model, previously selected for its underlying theoretical measurement properties, in order to evaluate the questionnaire with the help of the observations recorded. We have to keep in mind that the goal is to evaluate the instrument (the questionnaire), not to evaluate the measurement model. So for the statistician, the first consequence is that, when a goodness of fit test is significant, we have to think about improving the questionnaire or to try to explain an unexpected behaviour of some people. We dont have to think about changing the model. The second consequence is to focus on the underlying theoretical measurement properties of the model that we need to validate, i.e., we need to check if the data produced by the questionnaire when it is fulfilled by a fixed number of patients (real life data) is coherent with these properties.

In this talk, I will present some classical and/or modern measurement models used in HrQoL research focusing on explaining their underlying measurement properties and the consequence in the construction of some derived Gof tests or graphical validation procedures. My presentation will be mainly based on real HrQoL questionnaires and data. Another important issue is the Measurement and/or the Analysis of HrQoL in a longitudinal context. I will present some new measurement and analysis models that could be used in that context.

[13B:1] Quadratic Spatial Logistic Regression for Image Segmentation

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Image segmentation is an important task of digital image processing. In this work we propose a quadratic model for multi-class supervised image segmentation. The presented method is based on the Logistic Regression model. One drawback of Logistic Regressing is that it does not consider spatial coherence which is very important in the case of image processing. In the new model we introduce the spatial coherence through a Markov Random Field prior. As we model the segmentation problem using a quadratic cost function, the global optimum can be obtained by solving a linear system of equations for each class. This also provides good computational properties to our model.

Note: Joint work with Teresa Alarcon (Universidad de Guadalajara) and Graciela Gonzalez (Centre for Mathematical Research).

[13B:2] Cost Sensitive Binary AdaBoost

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In the standard binary classification algorithms, the misclassification cost is assumed equal for any class, however, in many application areas it is not valid. Based on AdaBoost, we propose a method to solve this problem, which consists in a modification of the AdaBoost exponential loss function in order to introduce different misclassification costs. We show that the proposed loss function is minimized by the optimal Bayes classifier, and we present an extensive set of experiments with synthetic and real datasets to show the performance and advantages of our proposal compared to existing approaches in the literature.

Note: Joint with Johan Van Horebeek (Research Center in Mathematics) and Rogelio Ramos (Research Center in Mathematics).

[13C:1] Foldover Plan on Asymmetric Factorials and its Uniformity

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The foldover is a useful technique in construction of two-level factorial designs. A foldover design is the follow-up experiment generated by reversing the sign(s) of one or more factors in the initial design. The full design obtained by joining the runs in the foldover design to those of the initial design is called the combined design. In this paper, the concept of foldover plan is generalized to asymmetric factorial designs and the uniformity measured by wrap around L_2-discrepancy of the combined design is discussed. Some lower bounds of wrap around L_2-discrepancy of combined designs for two kinds of asymmetric fractional factorials are obtained, which can be used as a benchmark for searching optimal foldover plans. Our results provide a theoretical justification for optimal foldover plans in terms of uniformity criterion.

Note: Joint with Hong Qin (Central China Normal University).

[13C:2] Minimum Markov Basis for Tests of Main Effects Models for 2^{p-1} Fractional Factorial Designs

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We consider conditional exact tests of factor effects in designed experiments for discrete response variables. Similarly to the analysis of contingency tables, a Markov chain Monte Carlo method can be used for performing exact tests, especially when large-sample approximations are poor and the enumeration of the conditional sample space is infeasible. To construct a connected Markov chain over an appropriate sample space, a common approach is to calculate a Markov basis. Theoretically, a Markov basis can be characterized as a generator of a well-specified toric ideal in a polynomial ring and is computed by computational algebraic softwares. However, the computation of a Markov basis sometimes becomes infeasible even for problems of moderate sizes. In this study, we obtain the closed form expression of minimal Markov bases for the main effect models of 2^{p-1} fractional factorial designs.

[13C:3] A Construction Method of Incomplete Split-Block Designs Supplemented by Control Treatments

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We give a construction method of incomplete split-block designs supplemented by control treatments, using a modified Kronecker product of two square lattice designs for test row and column treatments. We consider a mixed linear model for the observations with a three step randomization, i.e., the randomization of blocks, the randomization of the rows (or columns) within each block and the randomization of the columns (or rows) within each block. We characterize such incomplete split-block designs with respect to the general balance property and we give the stratum efficiency factors for the incomplete split-block designs.

[13D:1] Using Murthy's Estimator in Inverse Sampling Designs

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Inverse sampling is an adaptive sampling technique where the sample size is adaptive in that it depends on the incoming information. The technique is credited to Haldane (1945), when he used

inverse sampling to estimate the frequency of a rare event. The inclusion probability of a rare event may be so small that, under a fixed-sample size design, not enough cases of interest are selected to estimate either the attribute of interest or to use a statistical method like the contingency table to analysis the data On the basis of a proof using Rao-Blackwell theorem, Murthys estimator can now be applied to inverse sampling designs to provide unbiased estimators of the mean and variance of the mean estimator (Salehi and Seber, 2001). Using Murthys estimator, we derive estimators for different inverse sampling including a general inverse sampling design, multiple inverse sampling, a version of quota sampling.

Note: Joint work with George Af Seber (New Zealand University of Auckland).

[13D:2] On Inference of Overlapping Coefficient in Two Lomax Populations Using Different Sampling Methods

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This paper investigates point and interval estimation for some well known measures of Overlap. Two types of sampling procedure, namely, Simple Random Sample and Ranked Set Sample from two Lomax populations with different shape parameters are considered. Simulation studies are conducted to get insight on the performance of the proposed estimators. Taylor series approximations as well as bootstrap method are used to construct confidence intervals for those measures.

Note: Joint with Hani Samawi (Georgia Southern University).

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