**Semester Spring 2009**
**Location:** Royall Hall, Room 213 (Unless otherwise noted)
**Day & Time:** Wednesdays or Fridays, 2:00-2:50 pm (Unless otherwise noted)
Campus Map for Talks (PDF Format)

**Organizer:** Dr. Hristo Voulov, 235-5851
**Email:** voulovh@umkc.edu

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**Dates, Titles, Speakers (with Abstracts as available)**

**Wednesday Feb. 18**
**Transformations of $Z_2^{\infty}$ in the Study of the Axiom of Choice**
**Eric Hall**, Department of Mathematics and Statistics, UMKC

This talk is about the recent solution to the problem of finding a model of set theory in which the axiom of choice for pairs fails but in which every set of pairs has an infinite partial choice function. Independence results in set theory such as this often reduces to combinatorial problems involving permutation. In this case, it turns out that what is needed is to study permutations which are linear transformations of the vector space $Z_2^{\infty}$—the countable infinite dimensional vector space over the 2-element field $Z_2$.

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**Wednesday Feb. 25**
**Some Properties of Solutions of Nonlinear Second Order Differential Equations**
**Lianwen Wang**, Department of Mathematics and Computer Science, University of Central Missouri

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**Wednesday March 11**
**Miron Bekker**, Department of Mathematics and Statistics, UMKC

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**Friday March 20**
**Gauss-Seidel Estimation of Generalized Linear Mixed Models with Application to Poisson Modeling of Spatially Varying Disease Rates**
**Subharup Guha**, University of Missouri-Columbia

Generalized linear mixed models (GLMMs) are often fit by computational procedures such as penalized quasi-likelihood. Special cases of GLMMs are generalized linear models, which are often fit using algorithms like iterative weighted least squares (IWLS). High computational costs and memory space

constraints make it difficult to apply these iterative procedures to data sets having a very large number of records.

We propose a computationally efficient strategy based on the Gauss-Seidel algorithm that iteratively fits sub-models of the GLMM to collapsed versions of the data. The strategy is applied to investigate the relationship between ischemic heart disease, socioeconomic status and age/gender category in New South Wales, Australia, based on outcome data consisting of approximately 33 million records. For Poisson and binomial regression models, the Gauss-Seidel approach is found to substantially outperform existing methods in terms of maximum analyzable sample size. Remarkably, for both models, the average time per iteration and the total time until convergence of the Gauss-Seidel procedure are less than 0.3% of the corresponding times for the IWLS algorithm. This is joint work with Drs. Louise Ryan and Michele Morara.

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**Friday April 3**

**Compound Poisson disorder problems with nonlinear detection delay penalty cost functions**

**Savas Danayic**, Operation Research and Financial Engineering, Princeton University

The quickest detection of the unknown and unobservable disorder time, when the arrival rate and mark distribution of a compound Poisson process suddenly changes, has been formulated in a Bayesian setting, where the detection delay penalty is a general smooth function of the detection delay time. Under suitable conditions, the problem is shown to be equivalent to the optimal stopping of a finite-dimensional piecewise-deterministic strongly Markov sufficient statistic. The solution of the optimal stopping problem is described in detail for the compound Poisson disorder problem with polynomial detection delay penalty function of arbitrary but fixed degree. The results are illustrated for the case of the quadratic detection delay penalty function.

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**Friday April 10**

**Automorphic-invariant non-densely defined hermitian contractive operators**

**Miron Bekker**, Dept of Mathematics and Statistics, UMKC

We consider operators with norm not greater than 1, defined on a proper subspace of a Hilbert space that have Hermitian property (non-densely defined Hermitian contractions). In addition we assume that such operators are unitarily equivalent to their linear-fractional transformations (automorphic-invariant operators). We show that any such operator always admits a self-adjoint extension with the same norm that is also automorphic-invariant. A functional characterization of such operators is given in terms of a resolvent of the self-adjoint automorphic-invariant extension. A special attention is given to the case when the codimension of the domain of the non-densely defined Hermitian contraction is one. Examples of automorphic-invariant operators are considered.

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**Friday April 17, 5:00-5:50 (unusual time)**

**Kneser's Theorem in Quantum Calculus**

**Martin Bohner**, Dept of Mathematics and Statistics, Missouri University of Science and Technology

While difference equations deal with discrete calculus and differential equations with continuous calculus, so-called q-difference equations are considered when studying q-calculus. In this talk, we present certain oscillation criteria for second-order q-difference equations, among them a q-calculus version of the famous Kneser theorem.

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**Friday April 24**

**Robustness of Volatility Estimation**

**Yingying Li**, Operation Research and Financial Engineering, Princeton University

This talk contains three major parts. All are about the market microstructure error and volatility estimation using high frequency data.

In the *first part*, we consider the case when the market microstructure error is solely due to rounding. Rounding errors affect the estimation of volatility and understanding them is important especially when we use high frequency data. We study the asymptotic behavior of the Realized Volatility (RV) which is commonly used as an estimator of the integrated volatility. We prove the convergence of the RV and scaled RV under different conditions on the rounding level and the number of observations. A bias-corrected volatility estimator is proposed and the associated central limit theorem is shown. Simulation results show that improvement in statistical properties can be substantial.

In the *second part*, we consider microstructure as an arbitrary contamination of the underlying latent securities price, through a Markov kernel. Special cases include additive error, rounding, and combinations thereof. Our main result is that, subject to smoothness conditions, the Two Scales Realized Volatility is robust to the form of contamination. To push the limits of our result, we show what happens for some models involving rounding and see in this situation how the robustness deteriorates with decreasing smoothness. Our conclusion is that under reasonable smoothness, one does not need to consider too closely how the microstructure is formed, while if severe non-smoothness is suspected, one needs to pay attention to the precise structure and also the use to which the estimator of volatility will be put.

In the *third part*, we present a generalized pre-averaging approach for estimating the integrated volatility. This approach also provides consistent estimators of other powers of volatility. It gives feasible ways to consistently estimate the asymptotic variance of the estimator of the integrated volatility. This approach, which possesses an intuitive transparency, can generate rate optimal estimators (with convergence rate $n^{-1/4}$).

Graduate Seminar Series — **Fall 2009**

**Location:** Haag Hall, rm 306 (Unless otherwise noted)
**Day & Time:** Wednesdays or Fridays, 2:00-2:50 pm (Unless otherwise noted)
Campus Map for Talks (PDF Format)

**Organizer:** Dr. Liana Sega, 235-2849
**Email:** segal@umkc.edu

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**Dates, Titles, Speakers (with Abstracts as available)**

- **Friday, Sept. 11**
  **Basic Notions of Control Theory for Linear Time-Invariant Systems**
  **Miron Bekker**, Department of Mathematics and Statistics, UMKC

  We discuss notions of controllability, observability, transfer functions, and related statements for linear finite dimensional time invariant systems.

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- **Friday, Sept. 18**
  **Response-adaptive Designs: some reflections and some results**
  **Nancy Flournoy**, Department of Statistics, University of Missouri

  In response-adaptive designs, decisions about the experimental process are made based on accruing observations as trials accumulate. Response-adaptive procedures have a rich history both hypothesis testing and estimation situations. In some, accruing information is primarily used in deciding stop the experiment. In others, treatment allocation probabilities are altered, for example, to favor the better treatment or to stay away from toxic doses. Such procedures are becoming increasingly popular. This talk will provide a brief survey of the field, with a focus that is admittedly biased by the author's own interests.

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- **Wednesday, Sept. 30**
  **Robust Estimation for Randomized Play the Winner Design**
  **An-Lin Cheng**, School of Nursing, UMKC

  Randomized play the winner design, an adaptive design for clinical trials that is aimed at allocating more patients to a better performing treatment, has received much attention lately. Minimum Hellinger distance methodology has been studied in several settings such as i.i.d. data, Markov chain data, and branching processes data. It has been shown that in these settings the methodology yields "robust" and "efficient" estimates at the model. In this talk, we will describe Minimum Hellinger Distance method of estimation for data accrued using the randomized play the winner design. We will also describe a novel one-step Monte-Carlo approximation for

calculating these estimators. We will examine the asymptotic and coverage properties of our method using a "semi-parametric" bootstrap methodology. We will illustrate our results using data from a clinical trial conducted by Eli-Lilly and company.

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- **Friday, Oct. 9**
  **Online Monitoring a Large Number of Data Streams**
  **Yajun Mei**, School of Industrial and Systems Engineering, Georgia Institute of Technology

  In the modern information age one often monitors a large number of data stream with the aim of offering the potential for early detection a "trigger" event, e.g., biosurveillance and signal detection. In this talk, we are interested in the scenario in which we do not know when the event will occur or which subset of data streams will be affected by the event. Two families of scalable monitoring schemes are proposed based on the sum of the local CUSUM statistics that are "large" under either hard thresholding or top-r thresholding rules. Both are shown to possess certain asymptotic optimality properties.

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- **Friday, Oct. 16**
  **A mathematical model for multi-name credit based on community flocking**
  **Kiseop Lee**, Department of Mathematics, University of Louisville

  We present a new mathematical model for multi-name credit which employs stochastic flocking. Flocking mechanisms have been used in a variety of models of biological, sociological and physical aggregation phenomena. As a direct application of a flocking mechanism, we introduce a credit risk model based on community flocking for a credit worthiness index (CWI). Correlations between different credit worthiness indices are explained in terms of an interaction rate from the flocking system. Based on the flocking model for CWI, we provide a credit curve for individual names and a default time distribution. We study how to price credit derivatives such as a credit default swap (CDS) and a collateralized debt obligation (CDO) with the proposed model.

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- **Friday, Oct. 23**
  **Bayesian Data Analysis for Ordinal Data**
  **Fanglong Dong**, Department of Mathematics and Statistics, UMKC

  Bayesian statistics is an important part of statistics and it provides another angle of statistics. Ordinal data are every common in daily life such as the student's grade. We can easily fit a logistic regression model on this type of data, however, we are not sure how to define residual from a frequentist's perspective thus we are unable to detect outlier. Recent research try to solve this problem but not perfectly solved because the dimension of the estimated probabilities falling in every category form a vector. We try to look at this question from a Bayesian perspective by using the idea of latent variable. With the help of latent variable, we

can successfully detect outlier. I will talk briefly about the idea of Bayesian thinking and how can we apply Bayesian statistics to ordinal data analysis.

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- **Wednesday, Nov. 4**
  **A matroidal phenomenon of transforming graphs and matrices into balanced structures**
  **Lavanya Kannan**, Stowers Institute for Medical Research

  A graph $G$ is said to be 1-balanced if for any non-trivial subgraph $H$ of $G$, we have $|E(H)|/(|V(H)|-1) \leq |E(G)|/(|V(G)|-1)$. A 1-balanced graph is regarded as a minimally vulnerable network since a knowledgeable enemy (ignoring edge-connectivity) would find no edge set attractive to attack. In this talk, I will present a method to systematically transform any given graph into a 1-balanced graph. Recently, this result has been extended to any general matroid, graphs being a specific type of matroid. Another well-known example of matroids is the representable matroid defined on the columns of the matrices. We will see how a definition of balanceness can be given to matrices and how we may transform any given matrix into a balanced matrix via elementary column operations. We will also see (if time permits) that all these results can be given in the terminology of matroids.

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- **Friday, Nov. 13**
  **Training or Search? Evidence and an Equilibrium Model.**
  **Jun Nie**, Federal Reserve Bank of Kansas City

  Training programs are a major tool of labor market policies in OECD countries. I use a unique panel data set on the labor market experience of individual German workers between 2000 and 2002 to estimate a dynamic model of search and training, which allows me to quantify the impact of training programs and unemployment benefits on employment, unemployment, output, and the government expenditures.

  The model extends Ljungqvist and Sargent (JPE, 1998) by incorporating a training decision and a broader menu of unemployment benefits. I use the Simulated Method of Moment to estimate the structural model. To circumvent the non-smooth and local optima problem in the computation of classical extremum estimators, I implement the Laplace type estimator (LTE) approach recently proposed by Chernozhukov and Hong (2005). The model can match the observed distribution and transitions among different labor market status as well as important wage earning moments conditional on different unemployment experience.

  I use the model to quantitatively study the recent reforms implemented in Germany and run more counterfactual experiments. I simulate the transition path under back-to-back unexpected reforms in 2003-2006 and find the dynamics of the models unemployment rates are close to the data. In a counterfactual experiment in which I model an economy with a German-like training system and a US-like unemployment benefit structure (roughly, benefits are lower), I find that employment and output rise substantially.