Title: Large Cayley graphs of given degree and diameter

Speaker: Prof. Tomas Vetrik  
School of Mathematical Sciences  
University of KwaZulu-Natal  
Durban, South Africa

Date: 13 January 2012 (Friday)

Time: 3–4pm

Venue: MM3, Institute of Mathematical Sciences

Abstract
The degree-diameter problem is to determine the largest number of vertices in a graph of maximum degree \( d \) and diameter \( k \). The problem is motivated by network design. The topology of a network (such as telecommunications, multiprocessor, or local area network) is usually modeled by a graph in which vertices represent nodes (stations or processors) while edges stand for links or other types of connections. The network interpretation of the two parameters (diameter of a graph and vertex degrees) is obvious. The degree of a vertex is the number of connections attached to a node, while the diameter indicates the largest number of links that must be traversed in order to transmit a message between any two nodes.

It is well known that the number of vertices in a graph of maximum degree \( d \) and diameter \( k \) cannot exceed the Moore bound \( M_{d,k} = 1 + d + d(d - 1) + \ldots + d(d - 1)^{k-1} \). Research activities related to the degree-diameter problem fall into two main streams. On one hand there are proofs of non-existence of graphs of order close to the Moore bound, on the other hand there is a great deal of activity in constructions of large graphs of given maximum degree and diameter.
The study of large graphs of given degree and diameter has often been restricted to Cayley graphs, suitable because of their quick computer generation as well as from the point of view of diameter checking. A Cayley graph $C(G, X)$ is specified by a group $G$ and a set of generators $X$ for this group; the vertices of $C(G,X)$ are the elements of $G$ and there is an edge between two vertices $u$ and $v$ in $C(G,X)$ if and only if there is a generator $a \in X$ such that $v = ua$.

Let $C_{d,k}$ be the largest order of a Cayley graph of degree $d$ and diameter $k$. We present large Cayley graphs which yield the bound $C_{d,k} \geq k \left(\frac{d-3}{3}\right)^k$ for any diameter $k \geq 3$ and degree $d \geq 5$; see [1]. Moreover, we improve this bound for diameters 3, 4 and 5, hence we get $C_{d,3} \geq \frac{3}{16} (d-3)^3$ and $C_{d,3} \geq 25 \left(\frac{d-7}{4}\right)^5$ for any $d \geq 8$, and $C_{d,3} \geq 32 \left(\frac{d-8}{5}\right)^4$ for any $d \geq 10$; see [2]. By comparison with other available results in this area we show that, for $k \geq 3$ and sufficiently large $d$, our constructions give the current largest known Cayley graphs of degree $d$ and diameter $k$. We also present large Cayley graphs of Abelian and cyclic groups ([3]).

Let us mention that we use semidirect and wreath products of groups to construct Cayley graphs of general groups, and we construct Cayley graphs of Abelian (cyclic) groups with the help of direct products of Abelian (cyclic) groups.

References

SEMUA DIJEMPUT HADIR
Title: Efficient Estimation of Autoregressive Conditional Duration (ACD) Models using Estimating Functions (EF)

Speaker: Dr. Ng Kok Haur
ISM, UM

Date: 6 January 2012 (Friday)
Time: 10.00–11.00am
Venue: MM3, Institute of Mathematical Sciences

Abstract
This paper considers the theory of Estimating Functions (EF) to estimate the parameters of Autoregressive Conditional Duration (ACD) models. We investigate the effect of different error distributions on parameter estimation and study the properties of corresponding EF estimates. A Monte Carlo simulation study is conducted to assess the performance of suggested EF estimates. Results show that the mean values of the EF estimates are fairly close to the true values.

SEMUA DIJEMPUT HADIR
Title: A Bivariate Generalization of the Non-Central Negative Binomial Distribution

Speaker: Dr. Ng Choung Min
ISM, UM

Date: 6 January 2012 (Friday)

Time: 11.00–12.00pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

This paper proposes a bivariate generalization of the non-central negative binomial distribution which may arise as a model in two-dimensional photon and neural counting. The univariate NNB distribution has been applied as a mixed Poisson photon counting model. Various properties and parameter estimation, especially by a minimum distance method, based on the probability generating function, are considered. This bivariate distribution is also an extension of the Type II bivariate NNB distribution. To show the practical usefulness of the bivariate distribution proposed, an application to model low flux astronomical images is discussed. In this case, it is natural to consider also a multivariate version of the distribution as a mixed Poisson model. A real data set has been analyzed to illustrate the relevance of this distribution.
Title: In Search of An Appropriate Test for the Location Parameter

Speaker: Dr. Rossita M. Yunus
ISM, UM

Date: 9 January 2012 (Monday)

Time: 10.00–11.00am

Venue: MM3, Institute of Mathematical Sciences

Abstract

Three different tests; namely the parametric Student’s t-test, nonparametric Wilcoxon’s signed rank test, and Huber’s robust M-test are considered for testing the location of a population. In the study, the asymptotic power of the three tests is compared computationally for several types of distributions of simulated data. It is found that the M-test is robust to slight departures from the normal model assumption.

SEMUA DIJEMPUT HADIR
Title: New Method for Mode Jumping in MCMC Algorithms

Speaker: Dr. Adriana Irawati Nur Ibrahim
ISM, UM

Date: 9 January 2012 (Monday)

Time: 11.00–12.00pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

Standard Markov chain Monte Carlo (MCMC) sampling methods can experience problem sampling from multi-modal distributions. A variety of sampling methods have been introduced to overcome this problem. One of the methods, the mode jumping method of Tjelmeland & Hegstad (2001), tries to find a mode and propose a value from that mode in each mode jumping attempt. This approach is inefficient in that the work needed to find each mode and model the distribution in a neighbourhood of the mode is carried out repeatedly during the sampling process. We shall propose a new mode jumping approach which retains features of the Tjelmeland & Hegstad’s method but differs in that it finds the modes in an initial search, then uses this information to jump between modes effectively in the sampling run. We apply our method to an example with continuous variables and show that our method works well in general, and is better than the Tjelmeland & Hegstad’s method in particular.

SEMUA DIJEMPUT HADIR
Title: The concept of \( p \)-deficiency and its applications

Speaker: Dr Anitha Thillaisundaram  
Lecturer Position Applicant  
Institute of Mathematical Sciences, University of Malaya

Date: 11 January 2012 (Wednesday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

We use Schlage-Puchta's concept of \( p \)-deficiency and Lackenby's property of \( p \)-largeness to show that a group having a finite presentation with \( p \)-deficiency greater than 1 is large. What about when \( p \)-deficiency is exactly one? We also generalise a result of Grigorchuk on Coxeter groups to odd primes.

SEMUA DIJEMPUT HADIR

Research Group: Algebraic & Analytic Methods in Mathematical Sciences
Title: Non-monotonic hazard rates and mean residual life functions

Speaker: Prof. Ramesh C. Gupta  
Department of Mathematics and Statistics  
University of Maine, Orono, USA

Date: 16 January 2012 (Monday)  
Time: 10:00 am – 11:00 am  
Venue: MM3, Institute of Mathematical Sciences

Abstract

In the case of non-monotonic hazard rates with one or more turning points, methods for identifying the shape of the HR function and the MRLF will be developed and several examples will be presented. Some theoretical results for identifying the shape of the HR, in the case of weighted distributions, will be developed. Several situations, where the model can be represented as a weighted distribution of a known and simple model, will be investigated.

SEMUA DIJEMPUT HADIR

Research Group: Statistical Modeling and Computing
Title: Hazard rate of the normal and log-normal distributions

Speaker: Prof. Pushpa L. Gupta  
Department of Mathematics and Statistics  
University of Maine, Orono, USA

Date: 16 January 2012 (Monday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

This project deals with the determination of the monotonicity of the hazard rate function in the case of (1) normal distribution and multivariate normal distribution and (2) log-normal distribution and the bivariate log-normal distribution. In the case of bivariate normal distribution, the conditional distribution of $X \mid Y > y$ turns out to be the distribution of the skew normal variable. Similarly, in the case of bivariate log-normal distribution, such a conditional distribution turns out to be the distribution of the log-skew normal random variable.

It is well known that log-normal and bivariate log-normal distributions find applications in various fields including Engineering and medicine. Zou et al. (2009) comment that the log-normal distribution may be used to approximate right skewed data arising in a range of scientific enquiries, see also Limpert et al. (2001).
The multiplicative HR model is the usual proportional hazard rate (PHR) model and the additive HR model is the competing risk model. Needless to say, that the PHR model has proved to be of tremendous value in survival analysis. It is clear that in the case of PHR model, the shape and the turning points of the HR remain the same. It will be shown that lifting the HR by a constant does not necessarily mean the reduction of the MRLF by a constant. Similarly, multiplying the HR by a constant (PHR) model does not necessarily mean that the MRLF is divided by a constant.
Title: Hazard rate function of the discrete distributions

Speaker: Prof. Pushpa L. Gupta
Department of Mathematics and Statistics
University of Maine, Orono, USA

Date: 18 January 2012 (Wednesday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

Discrete failure rates arise in various common situations. For example: (1) a device can be monitored only per time period and the observation is taken as the number of time periods successfully completed prior to the failure of the device (2) a piece of equipment may operate in cycles and the data consist of the number of cycles completed prior to failure. Discrete failure rates also arise in several common situations in reliability theory where clock time is not the best scale on which to describe the life time. For example, in weapons reliability, the number of rounds fixed until failure is more important than the age in failure.

In this presentation, we shall discuss techniques for the determination of the IFR and DFR property for a wide class of discrete distributions. This will include: (1) Extended Katz family (2) Inverse linear failure rate distributions which include the usual Poisson, negative binomial and binomial distributions (3) a class of Hurwitz-Lerch-Zeta distributions and (4) the distribution of the Poisson distribution in the case of series and parallel systems.
The talk, accessible to all, will introduce the audience to an active area of graph labeling problems. A. Liu, S.K. Tan and the speaker considered a new labeling problem of graph theory in 1992. For a given graph $G$, a vertex labeling of $G$ is a mapping $f$ from vertex set $V(G)$ into the set $\{0, 1\}$. For each vertex labeling $f$ of $G$, we can define a partial edge labeling $f^*$ of $G$ in the following way. For each edge $(u, v)$ in $E(G)$, where $u, v$ in $V(G)$, we have

$$f^*(u, v) = \begin{cases} 0; & f(u) = f(v) = 0 \\ 1; & f(u) = f(v) = 1 \end{cases}$$

Note that if $f(u) \neq f(v)$, then the edge $(u, v)$ is not labeled by $f^*$. Let $v_0f(G)$ and $v_1f(G)$ denote the number of elements in the set of vertices of $G$ that are labeled by 0 and 1 under the mapping $f$ respectively. Likewise, let $e_0f^*(G)$ and $e_1f^*(G)$ denote the number of elements in the set of edges of $G$ that are labeled by 0 and 1 under the induced partial function $f^*$ respectively, that is,

$$v_0f(G) = |\{u \in V(G): f(u) = 0\}|$$

$$v_1f(G) = |\{u \in V(G): f(u) = 1\}|$$

$$e_0f^*(G) = |\{(u, v) \in E(G): f^*(u, v) = 0\}|$$

$$e_1f^*(G) = |\{(u, v) \in E(G): f^*(u, v) = 1\}|$$
\[ e_1 f^*(G) = |\{(u, v) \in E(G): f^*(u, v) = 1\}|. \]

A graph \( G \) is said to be a \textbf{balanced} graph or \( G \) is balanced, if there is a vertex labeling \( f \) of \( G \) that satisfies the following conditions:

(i) \( |v_0 f(G) - v_1 f(G)| \leq 1 \) and

(ii) \( |e_0 f^*(G) - e_1 f^*(G)| \leq 1. \)

The study of the theoretical properties of balanced graphs is a very promising area and offers a rich field for original research. After reviewing concepts of balanced graphs and balance index set of graphs, we look into various properties of those concepts. Recent progress toward balanced index sets of trees will be reported. Finally several unsolved problems and some conjectures will be proposed.

\textbf{SEMUA DIJEMPUT HADIR}

\textbf{Research Group} : Algebraic & Analytic Methods in Mathematical Sciences
Title: Matrices with determinant equal to some arithmetical functions

Speaker: Dr. Oon Shea Ming
Institute of Mathematical Sciences, University of Malaya

Date: 15 February 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

Since the time of Landau, we know that the estimates of certain simple arithmetical functions are closely related to the Prime Number Theorem. In this article, we construct some matrices with determinant equal to certain arithmetical functions which are related to Liouville function. This allows a possible alternative way to explore the Prime Number Theorem by means of inequalities involving matrices.

SEMUA DIJEMPUT HADIR

Research Group: Algebraic & Analytic Methods in Mathematical Sciences
Let $G$ be a graph. The skewness of $G$ is the minimum number of edges in $G$ whose removal results in a planar graph. Hence the skewness of a graph is a measure on how non-planar a graph is. In particular, the skewness of a graph is a lower bound for its crossing number. In this talk, some new and old results concerning the skewness of a graph are presented.
Title: Linear Spaces and Preservers of Persymmetric Triangular Matrices of Bounded Rank-two

Speaker: Mr. Ng Zhen Chuan
M.Sc. Candidate, Institute of Mathematical Sciences
Faculty of Science, University of Malaya
50603 Kuala Lumpur, Malaysia.

Date: 27 February 2012 (Monday)
Time: 9:00 am – 10:00 am
Venue: MM3, Institute of Mathematical Sciences

Abstract

Let $ST_n(F)$ denote the linear space of $n \times n$ persymmetric triangular matrices over a field $F$ with at least three elements. In this talk, we will address a complete classification of subspaces of bounded rank-two matrices of $ST_n(F)$. As an immediate consequence of this result, a characterization of rank-two subspaces of $ST_n(F)$ is obtained. Using the structural results of spaces of persymmetric triangular matrices of bounded rank-two, we obtain a complete description of rank-two nonincreasing linear mappings between persymmetric triangular matrix spaces.

SEMUA DIJEMPUT HADIR

Research Group: Algebraic and Analytic Methods in Mathematical Sciences
Supervisors: Professor Dr. Lim Ming Huat and Associate Professor Dr Chooi Wai Leong
Title: On crossing numbers and skewness of graphs

Speaker: Mr. Lee Chan Lye
PhD Candidate
Institute of Mathematical Sciences, University of Malaya

Date: 16 March 2012 (Friday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

Let $G$ be a graph. The crossing number of $G$, is the minimum number of pairwise intersections of its edges when $G$ is drawn in the plane. The skewness of $G$ is defined to be the minimum number of edges in $G$ whose removal results in a planar graph.

In this talk, results concerning these two parameters of some graphs, in particular, some 5-regular graphs, the generalized Petersen graphs $P(4k, k)$ and its related graphs, the complete graphs with an edge deleted, are presented.
Title: A just-in-time three-level integrated manufacturing system for linearly time-varying demand process

Speaker: Assoc. Prof. Dr. Mohd Omar
Institute of Mathematical Sciences, University of Malaya

Date: 21 March 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

This paper considers a just-in-time (JIT) manufacturing system in which a single manufacturer procures raw materials from a single supplier, process them to produce finished products, and then deliver the products to a single-buyer. The customer demand rate is assumed to be linearly decreasing time-varying. In the JIT system, in order to minimize the suppliers as well as the buyers holding costs, the supply of raw materials and the delivery of finished products are made in small quantities. In this case, both the supply and the delivery may require multiple installments for a single production lot. We develop a mathematical model for this problem, propose a simple methodology for solving the model, and illustrate the effectiveness of the method with numerical examples.
Title: Real hypersurfaces in non-flat complex space forms with conditions on the structure Jacobi operator

Speaker: Ren Shiquan  
MSc Candidate, Institute of Mathematical Sciences  
University of Malaya

Date: 4 April 2012 (Wednesday)
Time: 10:00 am – 11:00 am
Venue: MM3, Institute of Mathematical Sciences

Abstract

In this talk we first review foundations in Riemannian geometry, submanifolds, Jacobi equation, Jacobi operator, some properties of hypersurfaces, shape operator, curvature tensor, and complex space forms. We classify the real hypersurfaces in a non-flat complex space form with its structure Jacobi operator $R_\xi$ satisfying $(\nabla_X R_\xi)\xi = 0$, for all vector fields $X$ in the holomorphic distribution $D$. With this result, we prove the non-existence of real hypersurfaces with $D$-parallel as well as $D$-recurrent structure Jacobi operator in complex projective and hyperbolic spaces. We also give some characterizations for $\eta$-umbilical real hypersurfaces and get some other classification results, which imply the non-existence of real hypersurfaces with Codazzi-type structure Jacobi operator.

SEMUA DIJEMPUT HADIR

Research Group: Algebraic & Analytic Methods in Mathematical Sciences
INSTITUT SAINS MATEMATIK
UNIVERSITI MALAYA
SIRI SEMINAR KUMPULAN PENYELIDIKAN

Title: Modeling time series of counts with a new class of Mixture INAR(1) process

Speaker: Khoo Wooi Chen
PhD Candidate, Institute of Mathematical Sciences
University of Malaya

Date: 4 April 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

The popular thinning operator AR(1) process defined by McKenzie (1985) for time series of counts has good interpretability and is well studied with many real world applications. We proposed a times series count model based on the mixing operator AR(1) process of Pegram where the innovation term is another thinning process. Such a generalized stochastic operator is more flexible to deal with highly over dispersed data, which usually occurs in many areas, especially in ecological study. We estimate the stochastic parameters and discrete marginal parameters by the Yule Walker method and maximum likelihood estimation, respectively. Then, discrete marginal distributions like the Poisson and Negative Binomial are compared with respect to their suitability in the real examples. Finally, we evaluate and illustrate our proposed model with the real life data to show that it out performance the current existing binomial thinning processes.

SEMUA DIJEMPUT HADIR

Research Group: Statistical Modeling and Computing
Title: The Development of MatHeuristics for Integrated Product-Inventory-Distribution Model

Speaker: Titi Yuliana
MSc Candidate, Institute of Mathematical Sciences
University of Malaya

Date: 18 April 2012 (Wednesday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

The coordination of various processes within the supply chain network is becoming one way to increase the level of productivity and competitiveness of companies in the era of globalization. Supply Chain Management is linking each element of the manufacturing and coordinating the production, inventory, and distribution operations to eliminate the redundancies and inefficiencies during the whole process. As the most critical components of a supply chain network, coordinating the production, inventory, and distribution becomes the immediate goal at the planning level to meet the customer demand and also to minimize the cost. In particular production, inventory, and distribution routing problem (PIDRP) considered in this paper involves a single production facility, a set of customers with time varying demand, a finite planning horizon, and a fleet of homogenous vehicles that transports the product from the production warehouse to the customers. The main objective minimizes the routing, the set-up costs and the inventory holding costs both at the production facility and at the customers.
In this paper, we propose a three-phase methodology to solve the PIDRP. The PIDRP is formulated as mixed integer programming model, consisting of the production, inventory and the routing of vehicles to customers. Phase I solves the allocation model which is the simplified version (relaxed) of the original model to determine the amount to be delivered to each customer in each period. This serves as initial solution to the problem. In phase II, the results from Phase I are partitioned into clusters using a Capacitated Vehicle Routing Problem subroutine based on the Savings Algorithm. In Phase III we design a Scatter Search method by creating composite decision rules and surrogate constraints to improve the initial solutions. The concept of Path Relinking approach is then applied to integrate the intensification and diversification strategies through the process of generating linear combinations of a set of reference solutions creating combinations of solutions. The diversification is reinforced by the fact that a path between solutions in a neighborhood space will generally yield new solutions that share a significant subset of attributes contained in the parent solutions, in varying "mixes" according to the path selected and the location on the path that determines the solution currently considered. The intensification is achieved by selecting moves that perform the following role: upon starting from an initiating solution, the moves must progressively introduce attributes contributed by a guiding solution. Computational testing will be applied to several sets of instances to analyse the effectiveness of the method, and it will be compared it to the previous research work from the literature.

SEMUA DIJEMPUT HADIR

**Research Group**: Central of Statistical and Mathematical Modeling
A tolerance interval is an interval, based on a random sample, which is expected to contain a specified proportion or more of the sampled proportion. Tolerance intervals address the statistical problem of inference about the quantiles of a probability distribution that is assumed to adequately describe a process. Recently, Ong and Mukerjee (2011) derived two-sided Bayesian tolerance intervals with approximate frequentist validity, for a future observation in balanced one-way and two-way nested random effects models. We examine by a Monte Carlo study the effect of non-normal experimental errors and outliers on the tolerance interval. This is done by simulating 1000 data sets and computing the expected lengths, expected contents and confidence of the tolerance intervals.
Title: Coherent forecasting for discrete-valued stationary time series

Speaker: Prof. Atanu Biswas
Applied Statistics Unit, Indian Statistical Institute
Kolkata, India

Date: 23 May 2012 (Wednesday)
Time: 10:00 am – 11:00 am
Venue: MM3, Institute of Mathematical Sciences

Abstract

Coherent forecasting for discrete-valued stationary time series is considered. Coherent forecasting for count data has been studied in recent past. Here we consider the case of finite number of categories with different possible modeling. Specifically we consider $h$-step coherent forecasting with the Pegram's operator based model, the MTD model and the logistic regression based model. We obtain theoretical results along with numerical illustrations. The procedures are illustrated by using some real life data on infant sleep status.

SEMUA DIJEMPUT HADIR

Research Group: Statistical Modeling and Computing
Title : Gain in efficiency and sample size reduction using surrogate end-points

Speaker : Prof. Atanu Biswas
Applied Statistics Unit, Indian Statistical Institute, India

Date : 6 June 2012 (Wednesday)

Time : 3:00 pm – 4:00 pm

Venue : MM3, Institute of Mathematical Sciences

Abstract

Surrogate end-points are used when the true end-points are costly or time-consuming. In a typical set up we observe a fixed proportion of true-and-surrogate responses, and the remaining proportion are only-surrogate responses. It is obvious that the inclusion of such only-surrogate end-points increase the efficiency of associated estimation. In this present paper we want to quantify the gain in efficiency as a function of the proportion of available true responses. Also we obtain the expression of the gain in true sample size at the expense of surrogates to achieve a fixed power, as a function of the proportion of true responses. We present our discussion in the two-treatment set up in the context of odds ratio. We illustrate the procedure using some real data set.
Title: Conditional Heteroscedasticity, External Events and Application of Wavelet Filtering in Financial Time Series

Speaker: Mr. Md. Sabiruzzaman
PhD Candidate, Institute of Mathematical Sciences
University of Malaya

Date: 27 June 2012 (Wednesday)
Time: 10:00 am – 11:00 am
Venue: MM3, Institute of Mathematical Sciences

Abstract

External events like effective policies and financial crises are responsible for uneven changes (both permanent and temporary) in fundamentals of an economic process. Because of its relation with policies and crises, structural change in volatility has been studied with importance; however, the literatures on modeling and forecasting volatility of a financial time series relating the consequences of external events are limited. Though structural change is an unavoidable feature of an economic process, most of the econometric methods of modeling are developed with an assumption of no fundamental change. In order to avoid misleading conclusion, integrated study of external events and modeling volatility is in demand. Our contributions on these issues include detection of structural breaks in volatility with attention given to influence of outliers. The wavelet transformation is used successfully to improve the traditional method. We then concentrate on the issues of modeling and forecasting volatility in the presence of structural breaks. The summary of these findings are then integrated to produce a complete algorithm for analyzing financial time series addressing all relevant features.
We propose a proxy measure of volatility, call it multiscale wavelet periodogram (MSWP), based on maximum overlap discrete wavelet transform, and show that it can be used as an alternative input for the test to identify the break points. Our simulation results demonstrate that the use of MSWP instead of the squared variable can solve the size distortion problem associated with the CUSUM-type test for the detection of shifts in the unconditional variance while the powers of the test in these two cases are comparable. We then show that presence of large outliers may have significant effect on the CUSUM type test and subsequently on break detections. Our findings suggest that the Winsorization technique is useful to mitigate the influence of outliers on the procedure. Based on simulation experiment we propose a cutoff value for Winsorization which provides a trade-offs between efficiency and robustness of the test. We also investigate the working capability of existing models for modeling volatility with permanent shifts in the process. Here, we argue that the widely used Markov-switching approach is unable to report the permanent change, and a volatility model with dummy variable is a better choice in such a case. This study is further extended to selecting proper sample period for modeling when forecasting is the main purpose. Our empirical evidences show that observations prior to a break do not contain much information for predicting future. As a summary of our findings finally, we present a flow chart for analyzing financial time series and demonstrate the steps for modeling and forecasting volatility when structural breaks are anticipated. Although financial time series is the main focus of this thesis, our approach can be applied to any volatile time series.

**SEMUA DIJEMPUT HADIR**

Research Group: Statistical Modeling and Computing
Title: Equivalence among matching extendibility, factor-criticality and strong connectivity

Speaker: Prof. Zan-Bo Zhang
Department of Computer Engineering, Guangdong Industry Technical College, Guangzhou, China
(Department of Computer Science, Sun Yat-sen University, Guangzhou, China)

Date: 12 July 2012 (Thursday)

Time: 10:00 am – 11:00 am

Venue: MM3, Institute of Mathematical Sciences

Abstract

In this talk, we discuss the equivalence among matching extendibility, factor-criticality and strong connectivity.

A graph $G$ is said to be $k$-extendable for $0 \leq k \leq (\nu - 2)/2$ if it is connected, contains a matching of size $k$ and any matching in $G$ of size $k$ is contained in a perfect matching of $G$. A graph $G$ is said to be $k\frac{1}{2}$-extendable if (1) for any vertex $v$ of $G$ there exists a matching of size $k$ in $G - v$, and (2) for every vertex $v$ of $G$, every matching of size $k$ in $G - v$ is contained in a perfect matching of $G - v$. A graph $G$ is said to be $n$-factor-critical for $0 \leq n \leq \nu - 2$, if $G - S$ has a perfect matching for any $S \subseteq V(G)$ with $|S| = n$.

Given a bipartite graph $G$ with a perfect matching $M$, if we oriented the edges of $G$ towards one part of it, then contract the edges of $M$, we obtain a digraph $D$. It has been
known for a long time that $G$ is 1-extendable if and only if $D$ is strongly connected. In 1999, Robertson, Seymour and Thomas pointed out further that $G$ is $k$-extendable if and only if $D$ is strongly $k$-connected.

Such an equivalence relation helps to explain many similar results on $k$-extendibility of bipartite graphs and strongly $k$-connectivity of digraph. We use it to give a simple proof for a Menger-type characterization of $k$-extendable bipartite graphs.

It is easily seen that a $2k$-factor-critical ($(2k + 1)$-factor-critical) graph is $k$-extendable ($k$-extendable), but the converse is not true.

Favaron and Shi has noticed that, when $k$ is large, a $k$-extendable graph is $2k$-factor-critical, and hence these two classes of graphs coincide. Later, Yu proved that such an equivalence relation holds when $k \geq 2(|G| + 1)/3$.

We thoroughly settle this problem by proving that when $k \geq (|G| + 2)/4$, the equivalence relation holds, and that the bound is best possible. Furthermore, we give a characterization of $k$-extendable graphs that are not $2k$-factor-critical when $k = |G| = 4$. A similar equivalence between $k$-extendable graphs and $(2k + 1)$-factor-critical graphs is also obtained. The main results are as follow.

1. If $k \geq (|G| + 2)/4$, then a non-bipartite graph $G$ is $k$-extendable if and only it is $2k$-factor-critical.
2. If $k \geq (|G| - 3)/4$, a graph $G$ is $k$-extendable if and only if it is $(2k + 1)$-factor-critical.
3. A characterization of $k$-extendable graphs that are not $2k$-factor-critical when $k = \nu/4$.

**SEMUA DIJEMPUT HADIR**

Research Group: Discrete Mathematics
A two parameter discrete gamma distribution is derived corresponding to the continuous two parameters gamma distribution using the general approach for discretization of continuous probability distributions. One parameter discrete gamma distribution is obtained as a particular case. A few important distributional and reliability properties of the proposed distribution are examined. Parameter estimation by different methods is discussed. Performance of different estimation methods are compared through simulation. Data fitting is carried out to investigate the suitability of the proposed distribution in modeling discrete failure time data and other count data.
Title: On Higher Approximation in Generalized Urn Models

Speaker: Prof. Sh. M. Mirakhmedov
Institute of Mathematics and Information Technologies, Uzbekistan

Date: 10 September 2012 (Monday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

Many combinatorial problems in probability and statistics can be formulated and better understood by using appropriate urn models. The properties of several types of urn models have been extensively studied in literature. We consider a Generalized Urn Model (GUM) defined as follows. Let \( \xi = (\xi_1, \ldots, \xi_N) \) be a random vector with independent and non-negative integer components such that \( P\{\xi_1 + \ldots + \xi_N = n\} > 0 \), for a given integer \( n > 1 \). Also let \( \eta = (\eta_1, \ldots, \eta_N) \) be a r.vec. whose distribution is defined by
\[
L(\eta_1, \ldots, \eta_N) = L(\xi_1, \ldots, \xi_N | \xi_1 + \ldots + \xi_N = n)
\]
here and in what follows, \( L(X) \) stands for the distribution of a r.vec. \( X \). This model is what we call a GUM: a sample of size \( n \) is drawn from an urn containing \( N \) types of objects and \( \eta_m \) represents the number of \( m \)-th type of object appearing in the sample; the distribution of the r.vec. \( \xi \) defines the sample scheme. We are interested in a general class of so namely “decomposable statistic” (DS): \( f_{1,N}(\eta_m) + \ldots + f_{N,N}(\eta_m) \), where \( f_{m,N} \) are Borel functions defined for non-negative axis. The following three special cases of the GUMs and related DS are common in applications: (i) Sample scheme with replacement (alternatively know as multinomial random allocation scheme), in this case r.v.s \( \xi_m \) have Poisson distribution; the classical chi-square, likelihood-ratio statistic, and the empty-cells statistic are examples of the DS. (ii) Sample scheme without replacement, in case r.v.s \( \xi_m \) have Binomial distribution; the sample sum for instance, is a statistic of the DS. (iii) Multicolor Pólya- Egenberger urn model, when the r.v.s \( \xi_m \) have Negative-binomial distribution; for instance, a sum of functions of “spacings-frequencies” under the hypothesis of homogeneity of two samples can be formulated as a DS in this GUM. We are presenting a general approach to derive Edgeworth expansions for DS. The result is applied for DS in aforementioned examples of GUM. New results for the sample sum, for the chi-square statistic, and the so-called Dixon statistic are obtained.
Title : Near Matches and Applications

Speaker : Prof. S. Rao Jammalamadaka
University of California, Santa Barbara, CA. USA.

Date : 12 September 2012 (Wednesday)
Time : 3:00 pm – 4:00 pm
Venue : MM3, Institute of Mathematical Sciences

Abstract
When two judges rank the same n objects, we say a “near match of order k” occurs on the i-th object if their ranks for this, are close to within k. Of interest is the number of near matches in such a context, and its large-sample distribution. Applications to a nonparametric test in randomized block designs and to a new measure of association will be presented, along with some efficiency comparisons.

SEMUA DIJEMPUT HADIR

Research Group : Applied Statistical Forecasting
Title: Approximation by normal distribution of a sample sum in sample scheme without replacement

Speaker: Prof. Sh. M. Mirakhmedov  
Institute of Mathematics and Information Technologies, Uzbekistan

Date: 18 September 2012 (Tuesday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

A sample sum in the scheme without replacement from a finite population of independent random variables is studied. The Lindeberg condition of asymptotic normality, Berry-Esseen bound, two and three term Edgeworth asymptotic expansions and Cramer’s type large deviation results are derived.
Title : A Generalized von Mises Distribution

Speaker : Prof. S. Rao Jammalamadaka  
University of California, Santa Barbara, CA. USA.

Date : 20 September 2012 (Thursday)

Time : 10:00 am – 11:00 am

Venue : MM3, Institute of Mathematical Sciences

Abstract

In this talk we present a generalization of the very popular model for circular data, the von Mises (or the Circular Normal) distribution. This generalization is broad enough to cover unimodal as well as multimodal data, and also symmetric as well as asymmetric circular data. We give some important characterizations and properties for this class of distributions and briefly discuss some related optimal testing procedures.

SEMUA DIJEMPUT HADIR

Research Group : Applied Statistical Forecasting
Title: Unified Approach to Modeling and Inference for Bivariate Directional Data with Applications to Environmental and Financial Statistics

Speaker: Prof. Ashis SenGupta
Applied Statistics Unit, Indian Statistical Institute, Kolkata, India

Date: 11 September 2012 (Tuesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract
The coastal areas of Malaysia pose challenges for modelling directional data. For example, asymmetric and bimodal distributions for wind directions are often encountered, as will be shown in this lecture. The effect of wind direction on environmental pollution is well-known. Several probability distributions are constructed to model such data. Unified approaches to optimal statistical inference for parameters of such distributions are presented using, e.g. the concept of LMMPU tests (SenGupta and Vermeire, JASA, 1987). It is shown that such distributions are also capable of modelling high volatility bivariate financial data. Several real-life examples are presented. Challenging problems for future research are also enhanced.

SEMUA DIJEMPUT HADIR

Research Group: Statistical Modeling and Computing
Title: Models of Production-Repair Inventory Systems with Time-varying Demand

Speaker: Mr. Yeo Heng Giap Ivan (Ph.D student)
Institute of Mathematical Sciences, University of Malaya

Date: 10 October 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract
In this research, we proposed three integrated inventory models in which a time-varying demand for a finished product is satisfied by both newly fabricated items and by repaired returned items. Our models assumed that the new items are produced using raw materials that are procured from externally sources, and a fixed proportion of the returned items are collected and later repaired to a condition that is indistinguishable from new items. Three types of items are held in stock: returned items, serviceable items, and raw materials. The first model operates over an infinite planning horizon with time-varying production and repair rates. We proposed a total cost per unit time function, and derived the conditions under which the solution to the underlying minimization problem is global optimal. Then we proposed a solution procedure and illustrated it with some numerical examples. The second model operates over a finite planning horizon with constant production and repair rates. We also proposed a total cost function and a solution procedure that makes use of Microsoft Excel’s Solver plugin, which is capable of solving constrained nonlinear optimization problems. Then we illustrated this procedure with some numerical examples as well. In addition, we performed sensitivity analysis to investigate the reaction of this model to parameter changes. The final model is an extension of the second model to the case of multiple production and repair setups per time interval. As before, we proposed a numerical solution procedure, verified it with some numerical examples, and investigated the model’s sensitivity to parameter changes.

SEMUA DIJEMPUT HADIR

Research Group: Applied Mathematics
Boxplot is a simple and flexible graphical tool that has been widely used in exploratory data analysis. One of its main applications is to identify extreme values and outliers in univariate data set. While boxplot is useful for the real line data set, circular boxplot has been introduced for the circular data set due to the bounded property of the circular variable. The problem of finding the appropriate boxplot criterion has been widely discussed for the linear case to suit various conditions and shapes of distribution including normal and skewed distributions. In this paper, we look at similar problem in identifying appropriate circular boxplot criterion for different circular distributions. For illustration, we apply the circular boxplot on several real data sets.
Title: An inequality for CR submanifolds of hypersurface type in a complex projective space

Speaker: Loo Tee How
Institute of Mathematical Sciences, University of Malaya

Date: 7 November 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

It is well-known that the shape operator of a submanifold, which is neither holomorphic nor totally real in a complex projective space cannot be parallel. In 1976, Maeda obtained a sharp inequality for the norm of the covariant derivative of the shape operator for real hypersurfaces in a complex projective space and completely classified the equality case in this inequality. In this talk, we study a similar inequality for CR-submanifolds of hypersurface type in a complex projective space.

SEMUA DIJEMPUT HADIR

Research Group: Algebraic & Analytic Methods in Mathematical Sciences
Title: Statistical analysis of discrete-valued time series using categorical ARMA models

Speaker: Prof. Atanu Biswas
Applied Statistics Unit, Indian Statistical Institute, 203 B.T. Road, Kolkata 700 108, India, atanu@isical.ac.in

Date: 31 October 2012 (Wednesday)
Time: 3:00 pm – 4:00 pm
Venue: MM3, Institute of Mathematical Sciences

Abstract

This talk is about the analysis of discrete-valued time series using a class of categorical ARMA models recently proposed by Biswas and Song (2009). Such ARMA processes are flexible to model discrete-valued time series, allowing a wide range of marginal distributions such as binomial, multinomial, Poisson and nominal/ordinal categorical probability mass functions. To apply these models in the data analysis this paper focuses on the development of a needed statistical toolbox, which includes maximum likelihood estimation and inference, model selection, and goodness-of-fit test. Particularly in AR models a bias-corrected AIC statistic is derived for the order selection, while a randomized conditional moment (RCM) test is furnished to examine the goodness-of-fit. Finite-sample performances of the proposed methods are examined through simulation studies, in which the bias-corrected AIC is shown to outperform the traditional AIC and BIC statistics and the RCM test achieves desirable power. As part of the numeric illustration, a data analysis of categorical time series on infant sleep quality is provided by the application of this new toolbox.
Title: On The Number of Spanning Trees, Orientations and Cycles

Speaker: Prof. Carsten Thomassen  
Department of Mathematics Technical University of Denmark.

Date: 19 December 2012 (Wednesday)

Time: 3:00 pm – 4:00 pm

Venue: MM3, Institute of Mathematical Sciences

Abstract

One of the most fundamental properties of a connected graph is the existence of a spanning tree. Also the number $\tau(G)$ of spanning trees is an important graph invariant. It plays a crucial role in Kirchhoff’s classical theory of electrical networks, for example in computing driving point resistances. More recently, $\tau(G)$ is one of the values of the Tutte polynomial which now plays a central role in statistical mechanics. So are $a(G)$, the number of a cyclic orientations, and $c(G)$, the number of orientations in which every edge is in a directed cycle. As a first step towards convexity properties of the Tutte polynomial, Merino and Welsh conjectured that $\tau(G) \leq \max\{a(G),c(G)\}$ for every loopless and bridgeless multigraph $G$. In this talk we discuss these concepts and problems.
INSTITUT SAINS MATEMATIK
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SIRI SEMINAR KUMPULAN PENYELIDIKAN

Title : On the Skewness of Graphs
Speaker : Sim Kai An (SGP110005)  
Institute of Mathematical Sciences
Date : 14 December 2012 (Friday)
Time : 3:00 pm – 4:00 pm
Venue : MM3, Institute of Mathematical Sciences

Abstract

Let $G$ be a graph. The skewness of $G$, $sk(G)$, is the minimum, number of edges in $G$ whose deletion results in a planar graph. Planar graph is a graph that can be drawn in a plane in such a way that no edges cross each other. In this talk, background of skewness of graphs and results concerning the skewness of some graphs are presented. We determine completely the skewness of a complete $k$ – partite graph for each $k \leq 4$.

SEMUA DIJEMPUT HADIR

Research Group: Discrete Mathematics