NATIONAL MATHEMATICS INITIATIVE

(NMI)

9th Thematic Programme

(August 2012 – 2013)

PROBABILITY: THEORY AND APPLICATIONS

International Conference on Limit Theorems in Probability

(January 09 - 11, 2013)

DEPARTMENT OF MATHEMATICS

INDIAN INSTITUTE OF SCIENCE

BANGALORE

International Conference on
Limit Theorems in Probability
(January 09 - 11, 2013)

ORGANIZING COMMITTEE

- Mrinal K. Ghosh, Indian Institute of Science, Bangalore
- Srikanth K. Iyer, Indian Institute of Science, Bangalore
- Manjunath Krishnapur, Indian Institute of Science, Bangalore
- Kavita Ramanan, Brown University, USA
- Rahul Roy, ISI Delhi, Delhi

ACKNOWLEDGEMENTS

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INTERNATIONAL CONFERENCE ON LIMIT THEOREMS IN PROBABILTY
January 09 – 11, 2013

INDIAN INSTITUTE OF SCIENCE
BANGALORE

January 09, 2013
Wednesday

Venue: Lecture Hall – I, Department of Mathematics, IISc, Bangalore

09: 30AM – 10:15 AM	Shankar Bhamidi	Limited choice and randomness in evolution of networks. Two adventures.
10:25 AM – 11:10 AM	Subhroshekhar Ghosh	What does a Point Process outside a domain tell us about what's Inside?
11:10 AM – 11:45 AM	**Coffee /Tea Break**	
11:45 AM – 12:30 PM	Shirshendu Chatterjee	Asymptotic Behavior of Aldous' Gossip Process
12:30 PM – 02:00 PM	**Lunch**	
02:00 PM – 02:45 PM	S Ramasubramanian	An asymptotic result on Skorokhod problem in an orthant
02:55 PM –03:40 PM	Arijit Chakrabarty	Random matrices with entries from a moving average process
03:40 PM – 04:15 PM	**Coffee/ Tea Break**	
04:15 PM – 05:00 PM	Arvind Ayyer	Markov chains from partially ordered sets

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January 10, 2013
Thursday

Venue: Lecture Hall – I, Department of Mathematics, IISc, Bangalore

09:30 AM -- 10:15 AM	Gennady Samorodnitsky	On the existence of paths Between points in high level excursion sets of Gaussian random fields
10:25AM – 11:10 AM	Ghurumuruhan Ganesan	Size of giant component in a random geometric graph
11:10 AM – 11:45 AM	**Coffee /Tea Break**	
11:45 AM – 12:30 PM	Michel Ledoux	Chaos of a Markov operator and the fourth moment condition
12:30 PM –02:00 PM	**Lunch**	
02:00 PM – 2:45 PM	Amir Dembo	Persistence Probabilities
02:55PM – 03:40 PM	Antar Bandyopadhyay	Expected Total Number of infections for Virus Spread on a finite network
03:40 PM – 04:15 PM	**Coffee/ Tea Break**	
04:15 PM – 05:00 PM	Mokshay Madiman	An overview of entropy power inequalities, and their relationship to limit theorems

INTERNATIONAL CONFERENCE ON LIMIT THEOREMS IN PROBABILTY
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January 11, 2013
Friday

Venue: Lecture Hall – I, Department of Mathematics, IISc, Bangalore

09:30 AM -- 10:15 AM	Arnab Sen	Random Toeplitz matrices
10:25AM – 11:10 AM	Krishna Maddaly	Level repulsion in the Anderson model decaying randomness
11:10 AM – 11:45 AM	**Coffee /Tea Break**	
11:45 AM – 12:30 PM	Krishna Athreya	Coalescence in branching processes
12:30 PM –02:00 PM	**Lunch**	
02:00 PM – 2:45 PM	Ravi Kannan	Sampling from a Matrix
02:55PM – 03:40 PM	Yogeshwaran D	On the topology of some random complexes built over stationary point processes
03:40 PM – 04:15 PM	**Coffee/ Tea Break**	
04:15 PM – 05:00 PM	Tim Austin	Exchangeable random measures

“Limited choice and randomness in evolution of networks. Two adventures.”

Bhamidi Sreekalyani Shankar
University of North Carolina
Chapel Hill

Absract

The last few years have seen an explosion in network models describing the evolution of real world networks. In the context of math probability, one aspect which has seen an intense focus is the interplay between randomness and limited choice in the evolution of networks, ranging from the description of the emergence of the giant component, the new phenomenon of "explosive percolation" and power of two choices.?
The aim of this talk is to describe two pieces of recent work exploring this phenomenon.

1. Bounded size rules: We describe a general model for the evolution of a dynamic random graph? process evolving through the addition of random edges with limited choice called bounded size rules.
We show that all such rules belong to the same universality class in terms of critical behavior in the emergence of the giant component as the Erdos-Renyii random graph. We will describe the new techniques one has to develop to analyze fine-scale results for such processes.

2. Superstar model and Twitter event networks: To model the formation of "superstars" in twitter event networks, we describe a simple variant of preferential attachment which seems to perform better on empirical data than the standard model. We will describe the mathematical techniques required to rigorously analyze this model.?

“What does a Point Process Outside a Domain tell us about what’s inside?”

Subhroshekar Ghosh
University of California
Berkeley

Absract

In a Poisson point process we have independence between disjoint spatial domains, so the points outside a disk give us no information on the points inside. The story gets a lot more interesting for spatially correlated processes. We focus on the two main natural examples of repulsive point processes on the plane - the Ginibre ensemble (arising from eigenvalues of random matrices) and zero ensembles of certain Gaussian power series. We show that here the outside points actually tell us a lot - they determine almost surely the "mass" or the "centre of mass" of the inside points (as the case may be), and that they determine "nothing more".

This gives us a glimpse into a hierarchy of point processes based on their rigidity, of which we know only the simplest examples.

Time permitting, we will also look at several interesting consequences of our results, with applications to continuum percolation, reconstruction of Gaussian entire functions, completeness of random exponentials, and others.

“Asymptotic Behavior of Aldous' Gossip Process”

Shirshendu Chatterjee
New York
USA

Absract

Aldous (2007) defined a gossip process in which space is a discrete torus of size N, and the state of the process at time t is the set of individuals who know the information. Information spreads from a site to its nearest neighbors at rate 1/4 each and at rate N^{-\alpha} to a site chosen at random from the torus. We will be interested in the case in which \alpha < 3, where the long range transmission significantly accelerates the time at which everyone knows the information. We prove three results that precisely describe the spread of information and asymptotic behavior of the cover time in a slightly simplified model on the (real) torus.

“An asymptotic result on Skorokhod problem in an orthant”

S.Ramasubramanian
Indian Statistical Institute
Bangalore

Absract

We consider the problem of asymptotic irrelevance of initial condition for the Skorokhod problem in an orthant. A characterization of this property is given. Also a useful sufficient condition is presented. Some implications for stochastic processes are also pointed out.

This is a joint work with Offer Kella.

“Random matrices with entries from a moving average process”

Arijit Chakrabarty
Indian Statistical Institute
Delhi

Absract

We study the limiting spectral distribution (LSD) of symmetric random matrices whose entries come from a moving average process, the input sequence being the entries of a Wigner matrix. The description of the LSD is via its Cauchy transform which is characterized as the solution of a functional equation. In two special cases, we get a neat description of the LSD - one as a free product convolution of two distributions, and the other one as a dilation of the Wigner semicircular law.

This is a joint work with Rajat S. Hazra and Deepayan Sarkar.

“Markov chains from partially ordered sets”

Arvind Ayyer
UC, Davis
USA

Absract

Counting linear extensions of posets is an important problem with many applications. Motivated by groundbreaking work of Schützenberger in the 70s in combinatorics, we consider Markov chains on labelled posets whose moves resemble those of the 15-puzzle. We will first prove a product formula for the stationary distributions for arbitrary posets. This gives another natural generalization of the Tsetlin library. For certain special posets, we can also prove explicit formulas for the eigenvalues, with their multiplicities, of the generators. This is joint work with Steve Klee and Anne Schilling.

“On the existence of paths between points in high level excursion sets of Gaussian random fields”

Gennady Samorodnitsky
Cornell University
New York

Absract

The structure of Gaussian random fields over high levels is a well researched and well understood area, particularly if the field is smooth. However, the question as to whether or not two or more points which lie in an excursion set belong to the same connected component has eluded analysis. We study this problem from the point of view of large deviations, analyzing the asymptotic probabilities that two such points are connected by a path laying within the excursion set, and so belong to the same component. This problem turns out to be intimately related to the problem of finding minimal energy measures with respect to the covariance kernel of the field. We characterize such measures, and prove that the optimal (most likely) paths are, in fact, the minimal capacity paths. We will conclude with considering the case of two points far away from each other, and observing the difference between the short and long memory cases.

“Size of giant component in a random geometric graph”

Ghurumuruhan Ganesan
Indian Statistical Institute
Delhi

Absract

Consider n nodes independently and uniformly distributed in the unit square S centred at origin. Connect two nodes by an edge if the distance between them is less than r_n where nr_n^2 â†’ âˆž and nr_n^2 < Alog n for some constant A. The resulting graph G is called the random geometric graph. In the first part of the talk, we show that the giant component of G contains at least n-o(n) nodes with probability at least 1-o(1).

In the second part of the talk, we study infection spread in G. We prove that the infection spreads with speed at least D_1nr_n^2 and at most D_2nr_n^2 for some positive constants D_1 and D_2. This is unlike infection spread in regular graphs (like e.g. Z^2) where infection spreads at a constant speed.

Reference: G. Ganesan (2012). Size of giant component in a random geometric graph. Accepted for publication, Annals Inst. Henri Poincare.

“Chaos of a Markov operator and the fourth moment condition”

Michel Ledoux
Université de Toulouse
France

Absract

We analyze from the viewpoint of an abstract Markov operator recent results by D. Nualart and G. Peccati, and I. Nourdin and G. Peccati, on the fourth moment as a condition on a Wiener chaos to have a distribution close to Gaussian.

“Persistence Probabilities”

Amir Dembo
Stanford University
USA

Absract

Persistence probabilities concern how likely it is that a stochastic process has a long excursion above fixed level and of what are the relevant scenarios for this behavior. Power law decay is expected in many cases of physical significance and the issue is to determine its power exponent parameter. I will survey recent progress in this direction (jointly with Jian Ding, Fuchang Gao, and Sumit Mukherjee), dealing with random algebraic polynomials of independent coefficients, iterated partial sums and other auto-regressive sequences, and with the solution to heat equation initiated by white noise.

“Expected Total Number of Infections for Virus Spread on a Finite Network”

Antar Bandyopadhyay
Indian Statistical Institute
Delhi

Absract

In this talk we will consider a simple virus infection spread model on a finite population of n agents connected by some neighborhood structure. Given a graph G on n vertices, we begin with some fixed number of initial infected vertices. At each discrete time step, an infected vertex tries to infect its neighbors with probability $\beta \in (0,1)$ independently of others and then it dies out. The process continues till all infected vertices die out.

We focus on obtaining proper lower bounds on the expected number of ever infected vertices. We obtain a simple lower bound, using \textit{breadth-first search} algorithm and show that for a large class of graphs which can be classified as the ones which locally ``look like" a tree in sense of the \emph{local weak convergence} \cite{AlSt04}, this lower bound gives better approximation than some of the known approximations through matrix-method based upper bounds.

“An overview of entropy power inequalities, and their relationship to limit theorems”

Mokshay Madiman
Yale University
USA

Absract

We will provide an overview of a useful class of probabilistic inequalities known as "entropy power inequalities". The classical entropy power inequality of Shannon and Stam implies that entropy increases when doubling sampling size in the central limit theorem. Much later, Artstein, Ball, Barthe and Naor obtained a generalization of the Shannon-Stam inequality that implies that entropy increases along the central limit theorem (at every step). Our first goal is to review these inequalities and a number of motivations for considering them, and generalizations of them obtained with Andrew Barron. In the second part of the talk, we will consider an inverse question: when is the ratio between the two sides in the entropy power inequality not too different from 1? A particularly clean answer (obtained with Sergey Bobkov) can be given in the case where the probability measures under consideration are log-concave, but there are also things that can be said in greater generality (based on work with Ioannis Kontoyiannis).

“Random Toeplitz matrices”

Arnab Sen
Cambridge
England

Absract

Random Toeplitz matrices belong to the exciting area that lies at the intersection of the usual Wigner random matrices and random Schrodinger operators. In this talk I will describe two recent results on random Toeplitz matrices. First, the maximum eigenvalue, suitably normalized, converges to the 2-4 operator norm of the well-known Sine-kernel. Second, the limiting eigenvalue distribution is absolutely continuous, which partially settles a conjecture made by Bryc, Dembo and Jiang (2006). I will also present several open questions and conjectures.

“Level repulsion in the Anderson Model with decaying randomness”

Krishna Maddaly
Institute of Mathematical Sciences
Chennai

Absract

In this joint work with Dhriti Ranjan Dolai, we consdier the Anderson model with decaying randomness on the d-dimensional lattice and when the dimension is bigger than 2, show that for a class of random potentials , the local statistics at a countable set of energies in the spectrum is the 'clock statistics' for almost all configurations of the potential.

“Coalescence in branching processes”

Krishna B. Athreya
Iowa State University
Ames

Absract

Consider a branching tree. Go to the nth generation. If there are at least two vertices in that generation pick two of them at random by srswor(simple random sampling without replacement) and trace their lines of descent back in time till they meet. Call that generaion Xn. Do the same thing with all individuals in the nth generation. Call that Yn. In this talk we discuss the distributions of Xn and Yn and their asymptotics for Galton Watson trees as n goes to infinity for single and multitype cases for the four cases: subcritical, critical, supercritical, explosive. Applications to branching random walks will also be discussed.

“Sampling from a matrix”

Ravi Kannan
Microsoft Research Labs
Bangalore

Absract

Linear Algebra computations take too long on large modern matrices, so one computes with a sample of rows. The theoretical question is: when are invariants (singular values/vectors) of the sample sub-matrix close to those of the whole? Sampling probabilities proportional to squared length ensure this and have many other interesting properties such as an approximate reconstruction of the whole matrix based on a sample of rows and columns. More recently, the subject of Matrix and Graph Sparsifiction has been developed, drawing on results on sampling from Functional Analysis.

“On the topology of some random complexes built over stationary point processes”

Yogeshwaran D
Institute of Technology Haifa
Israel

Absract

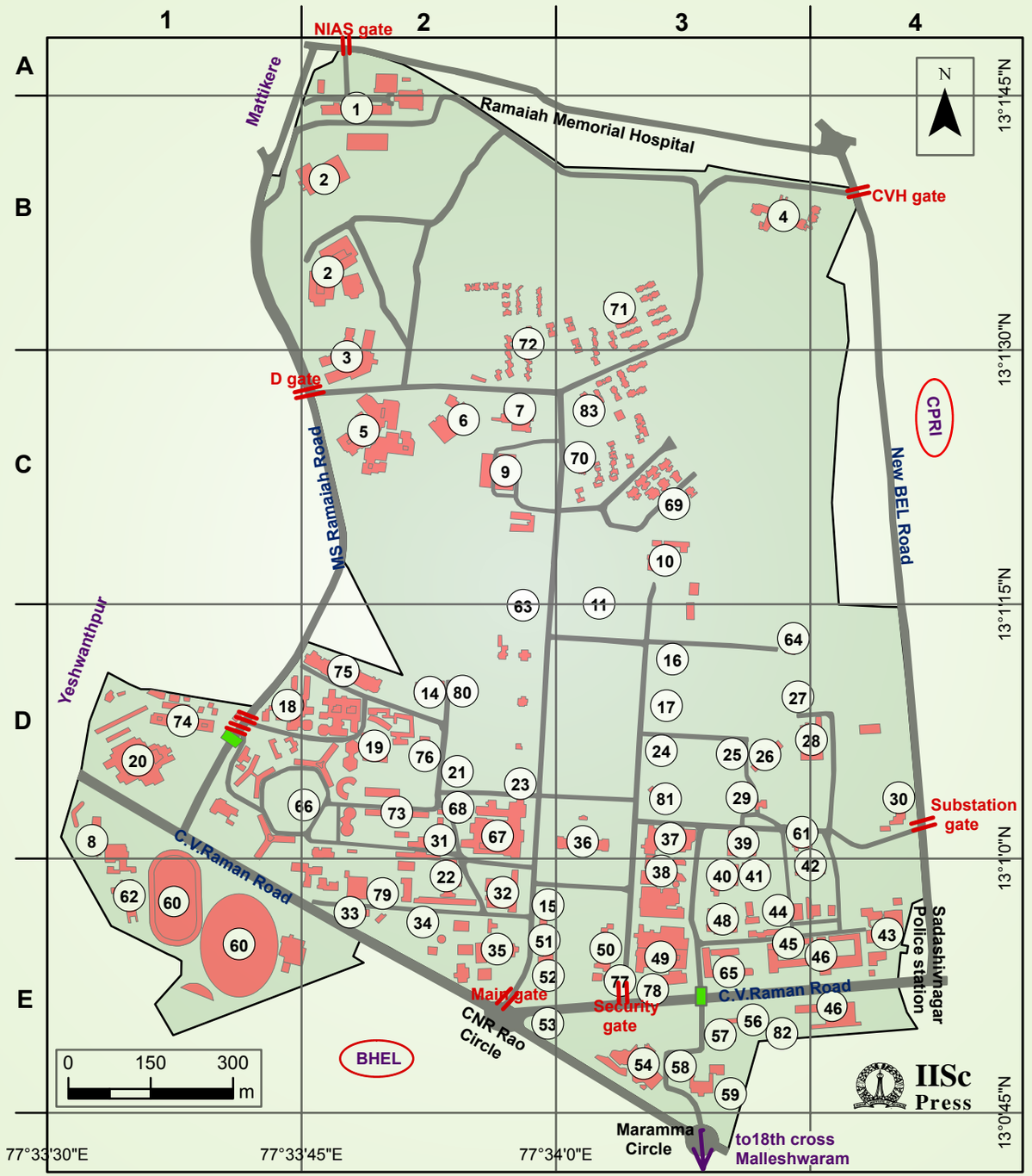
There has been recent interest in understanding the homology of random simplicial complexes built over point processes. I shall describe results about the growth of homology groups of Cech and Vietoris-Rips complexes built over general stationary point processes. Both these complexes have points of the point process as vertices and the faces are determined by some deterministic geometric rule. The aim of the talk shall be to explain the quantitative differences in the growth of homology groups measured via Betti numbers between the Poisson point process and other point processes which exhibit repulsion such as the Ginibre ensemble, zeros of Gaussian analytic functions, perturbed lattice etc. I shall also try to hint at the proof techniques which involve detailed analysis of subgraph and component counts of the associated random geometric graphs and are applicable to similar functionals of point processes such as Morse critical points. This is a joint work with Prof. Robert Adler.

“Exchangeable random measures”

Tim Austin
New York University
USA

Absract

Classical theorems of de Finetti, Aldous-Hoover and Kallenberg describe the structure of exchangeable probability measures on spaces of sequences or arrays. Similarly, one can add an extra layer of randomness, and ask after exchangeable random measures on these spaces. It turns out that those classical theorems, coupled with an abstract version of the `replica trick' from statistical physics, give a structure theorem for these random measures also. This leads to a new proof of the Dovbysh-Sudakov Theorem describing exchangeable positive semi-definite matrices, and also offers a formalism for extending the Parisi ultrametricity conjecture in the setting of dilute mean-field spin glass models.



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