### Monday, December 12, 2022

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>4:00pm-5:00pm</td>
<td>Group, Lie and Number Theory -- Subhajit Jana (Queen Mary University, London) <em>Optimal lifting, optimal Diophantine exponent, and automorphic forms</em> (Special room and time) -- 3096 East Hall</td>
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### Tuesday, December 13, 2022

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>9:00am-5:30pm</td>
<td>Special Events -- Cognitive Fatigue MURI Research Forum -- 4448 East Hall</td>
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### Wednesday, December 14, 2022

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>3:00pm-4:00pm</td>
<td>Financial/Actuarial Mathematics -- Yonatan Shadmi (Technion) <em>Robust scheduling in the high uncertainty heavy traffic regime</em> -- Zoom link Virtual</td>
</tr>
<tr>
<td>4:00pm-5:00pm</td>
<td>Financial/Actuarial Mathematics -- Melih Iseri (USC) <em>Set Valued HJB Equations</em> -- 1360 East Hall</td>
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Group, Lie and Number Theory  
Monday, December 12, 2022, 4:00pm-5:00pm  
3096 East Hall  
Subhajit Jana (Queen Mary University, London)  

**Optimal lifting, optimal Diophantine exponent, and automorphic forms (Special room and time)**

We start by talking about two arithmetic problems with similar flavors. The first one is about quantifying the density of $\text{SL}(n, \mathbb{Z}[1/p])$ in $\text{SL}(n, \mathbb{R})$. A conjecture of Ghosh--Gorodnik--Nevo predicts that the elements of $\text{SL}(n, \mathbb{R})$ can be "optimally approximated" by the elements in $\text{SL}(n, \mathbb{Z}[1/p])$. The second problem is about quantifying the surjectivity of the mod $q$ map from $\text{SL}(n, \mathbb{Z})$ to $\text{SL}(n, \mathbb{Z}/q\mathbb{Z})$. A conjecture of Sarnak predicts that almost all elements in $\text{SL}(n, \mathbb{Z}/q\mathbb{Z})$ can be "optimally lifted" to $\text{SL}(n, \mathbb{Z})$.

In a recent joint work with Amitay Kamber, we prove the optimal lifting conjecture for square-free $q$. In another work with Amitay Kamber, we also prove the optimal approximation conjecture but conditionally on the "Density hypothesis". We will describe how the spectral theory of automorphic forms crucially plays a central role in our proofs. These are based on the following two recent preprints.

Special Events
Tuesday, December 13, 2022, 9:00am-5:30pm
4448 East Hall

Cognitive Fatigue MURI Research Forum

The Cognitive Fatigue MURI Research Forum will take place on Tuesday, December 13, from 9:00 am - 5:30 pm, in-person (4448 East Hall) and on Zoom. Please see the outline of topics and speakers below. A detailed schedule and the Zoom webinar link are available on the event's web page: https://sites.lsa.umich.edu/cfmuri/cf-research-forum/.

Welcome - 9:00 AM - 9:20 AM
Daniel Forger (Michigan)

Biomarkers of Fatigue - 9:20 AM-11:20 AM
Brieann Satterfield (Washington State); Sherman Fan (Michigan); Hans Van Dongen (Washington State); Sara Aton (Michigan); Brendon Watson (Michigan)

New Mathematical Approaches to Computational Psychiatry and Fatigue - 12:00 PM - 2:20 PM
Dae Wook Kim (Michigan); Benjamin Shapiro (Dartmouth Hitchcock); Zachary Kilpatrick (Colorado Boulder); Amy Cochran (Wisconsin); Jonathan Rubin (Pitt); Michael Browning (Oxford); Zhenke Wu (Michigan)

Cortical and Brain Modeling to Understand EEG and fMRI - 2:40 PM - 5:00 PM
Axel Hutt (INRIA); James Hazelden (Washington); Ruby Kim (Michigan); Michael Frank (Brown); Lilianne Mujica-Parodi (Stony Brook); Scott Killgore (Arizona); Gustavo Deco (Pompeu Fabra)
Financial/Actuarial Mathematics  
Wednesday, December 14, 2022, 3:00pm-4:00pm  
Zoom link  Virtual  
Yonatan Shadmi (Technion)  
Robust scheduling in the high uncertainty heavy traffic regime

We propose a model uncertainty approach to heavy traffic asymptotics that allows for a high level of uncertainty. That is, the uncertainty classes of underlying distributions accommodate disturbances that are of order 1 at the usual diffusion scale, as opposed to asymptotically vanishing disturbances studied previously in relation to heavy traffic. A main advantage of the approach is that the invariance principle underlying diffusion limits makes it possible to define uncertainty classes in terms of the first two moments only. The model we consider is a single server queue with multiple job types. The problem is formulated as a zero-sum stochastic game played between the system controller, who determines scheduling and attempts to minimize an expected linear holding cost, and an adversary, who dynamically controls the service time distributions of arriving jobs and attempts to maximize the cost. The heavy traffic asymptotics of the game are fully solved. It is shown that an asymptotically optimal policy for the system controller is to prioritize according to an index rule and for the adversary it is to select distributions based on the system's current workload. The workload-to-distribution feedback mapping is determined by an HJB equation, which also characterizes the game's limit value.
In this talk we introduce a notion of set valued PDEs. The set values have been introduced for many applications, such as time inconsistent stochastic optimization problems, multivariate dynamic risk measures, and nonzero sum games with multiple equilibria. One crucial property they enjoy is the dynamic programming principle (DPP). Together with the set valued Itô formula, which is a key component, DPP induces the PDE. In the context of multivariate optimization problems, we introduce the set valued Hamilton-Jacobi-Bellman equations and established its wellposedness. In the standard scalar case, our set valued PDE reduces back to the standard HJB equation.

Our approach is intrinsically connected to the existing theory of surface evolution equations, where a well-known example is mean curvature flows. Roughly speaking, those equations can be viewed as first order set valued ODEs, and we extend them to second order PDEs. Another difference is that, due to different applications, those equations are forward in time (with initial conditions), while we consider backward equations (with terminal conditions). The talk is based on a joint work with Prof. Jianfeng Zhang.