Stanford Math Directed Reading Program Colloquium
Autumn 2017, Session I

Wednesday, January 10, 2018, 6:30pm–8:30pm
Sloan Mathematics Center, room 384-I (fourth floor)
Dinner available at 6:15pm

Mixing and Ergodicity of Measure Invariant Transformations — 6:30pm

Xingyu Yang
Mentor: Evangelie Zachos

Ergodic theory is a branch of dynamics that studies the asymptotic behavior of systems over time when acted upon by measure-invariant transformations. In this talk, we will define strong mixing, weak mixing, and ergodic transformations, and talk more about the similarities and differences of these, along with the interesting results that result from these definitions.

A short introduction to ergodic theory and the normality of most numbers — 6:50pm

Raul Girbal
Mentor: Cole Graham

In this talk I will provide a brief introduction to the subject area of ergodic theory. We shall be going through key definitions and concepts such as invariant measures, recurrence, ergodicity, and rotation transformation on the circle and under which conditions is it ergodic. I will also briefly describe several important results in the theory such as the Recurrence Theorem and the Pointwise Ergodic Theorem (Birkhoff's Theorem). Finally we will prove the normality of most numbers (a set with full measure) and briefly describe some current open problems.

Adversarial bandits and the Exp3 algorithm — 7:10pm

Anna Thomas
Mentor: Alex Dunlap

In this talk I'll give an overview of the multi-armed bandit problem, in which a gambler must choose a sequence of slot machines to play in order to maximize total reward. The core tradeoff that arises is balancing exploration of unseen arms and exploitation of arms which have performed well previously. I'll review the Exp3 algorithm (introduced by Auer, Cesa-Bianchi, Freund, and Schapire) for making decisions in the adversarial model, where the only assumption about the rewards is that they are bounded in $[0, 1]$.

Dolbeault cohomology and Hodge decomposition

7:30pm

Jack Lindsey
Mentor: Abigail Ward

Complex manifolds admit two natural notions of cohomology. One is the usual de Rham cohomology, which is well-defined absent a complex stucture and contains topological information. Another is Dolbeault cohomology, which depends on the complex structure of the manifold. We will introduce and compare these two cohomologies, state a powerful theorem (Hodge decomposition) linking them in the case of compact Kahler manifolds, and explore some consequences of this connection in the case of the 2-torus.

Historical errors in mathematical proofs

7:50pm

Vince Ranganathan
Mentor: Yuval Wigderson

Over the course of history, mathematicians have occasionally posited theorems that appear to be valid but are undermined by fallacies in the accompanying proofs. These mistakes are often caused by lack of clear and concise logical reasoning and subtle misordering of the logical steps. I will be presenting two interesting such errors, as well as their context, in mathematical history: Kempe's "proof" of the Four Color Theorem (1879), and Cauchy's "proof" that a convergent series of continuous functions is a continuous function (1826).

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