Stanford Math Directed Reading Program Colloquium
Fall 2023

1-9-24, 6:30pm–8:00pm
Sloan Mathematics Center, room 384 H (fourth floor)
(Some) Dinner available at 6:00pm

The spectral theorem for compact symmetric operators on Hilbert spaces

Paul Di Folco

Mentor: Andy Yin

In this talk, I will provide a brief overview of Hilbert spaces as a generalization of finite-dimensional Euclidean vector spaces and cover some examples and important facts. Then, I will define linear operators on Hilbert spaces and some related properties in order to demonstrate the spectral theorem while drawing parallels to the finite-dimensional case.

Fundamentals of Complex Analysis

Deangelo Suguru Brasen

Mentor: Romain Speciel

My talk will focus on the residue theorem, an important subject motivated by determining the closed form of real integrals that are incredibly difficult to determine with standard calculus techniques. Using the ideas of holomorphic and meromorphic functions, we will establish the contour integral and its applications in the complex plane. From this, we will build the residue theorem and compute some interesting integrals that can be computed in the complex plane if time permits. This then leads back to how to solve such advanced real integrals with the residue theorem in the complex plane.

Fundamental Ring Theoretic Concepts

Eric Chen

Mentor: JungTao (Ronnie) Cheng

In this talk, I'll go over some fundamental ring theoretic concepts including terminology, the proofs of Hilbert Basis Theorem and Nullstellensatz. I'll briefly define Ring Modules, their finiteness conditions, and prove a few exercises. Then, I'll go into the extension of ring theory into affine varieties, which form the basis of algebraic geometry. In particular, I'll cover important terminology and propositions about polynomial maps and rational functions.

An Introduction to the Proof of the Consistency of the Axiom of Choice from ZF: Constructibility, Meta-Theories, and Arithmetization

Alvaro Diaz Ramos

Mentor: Spencer Dembner

Since the early 20th century, the most widely used axiomatization for set theory has been that of Zermelo and Fraenkel (ZF). In 1938, Gödel showed that the axiom of choice is consistent with this axiomatization. In this brief talk, I will give an outline of this important proof. Furthermore, I will explore the concept of a "meta-theory" and the role of arithmetization when discussing constructibility.

Sharing Shamir's Secret

Julian Darve, Alex Perry

Mentor: Daniel Kim

Let's say a group of people want to share a secret among themselves - in this case a secret integer - but they need at least a certain number of people to come together to be able to uncover the secret value. Well, there is a great mathematical way to do this discovered by Adi Shamir in 1979, using something called Polynomial Interpolation. With even one too few people, they know nothing about the secret value, however, with just the right amount of people, using math, it can be discovered

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