Math 288X — Automorphic forms and arithmetic statistics

Fall 2023

Logistics

Instructor:	Alex Cowan
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Location:	MF 3:00–4:15 in Science Center 112
Website:	https://people.math.harvard.edu/~cowan/topics2023f
Office hours:	Mondays 4:30–5:30 in Science Center 524, and by appointment

Resources

University disability resources: https://accessibility.harvard.edu
Behavioral health services: https://huhs.harvard.edu/behavioral-health

Overview

Many mysterious sequences of arithmetic interest, such as the number of divisors of integers or the number of points on an elliptic curve over prime fields, magically arise in the Fourier coefficients of certain very structured analytic objects called *automorphic forms*. This course is about answering questions in arithmetic statistics by extracting information from automorphic forms using methods from analytic number theory.

Learning these methods unguided can be daunting, as papers in the field are often long, technical, and dense with notation. This course focuses on building a strong foundation in the rather intuitive underlying techniques so that one can both more easily understand the literature as well as calculate for one's self, which is quite satisfying and maybe even a little fun.

Prerequisites

I'll assume knowledge of basic number theory, up to e.g. Dirichlet characters. Familiarity with a minimal amount of basic complex analysis, e.g. Cauchy's residue theorem, helps, but can be picked up on the fly.

References

I'll record videos that serve as notes and put them into a YouTube playlist. Additionally, I'll reference various papers and textbook sections for specific topics. A list of these references will be available on the course webpage.

Grading

Grades for those who need them will be based entirely on assignments.