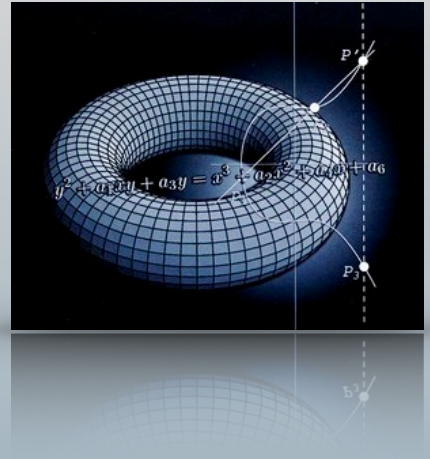


Number Theory and Combinatorics

November 18, 2022



Invited Speakers

Alp Bassa Boğaziçi University
Kağan Kurşungöz Sabancı University
Doğa Can Sertbaş Çukurova University

Contributed Talks

Sadık Eyidoğan Çukurova University
Berkay Kebeci Koç University

Poster Session

Çağatay Altuntaş İstanbul Technical University

Place: IZTECH, Mathematics Department, Seminar room 122

Time : 09:30-17:00

Registration deadline: November 14, 2022

For registrations visit : <https://math.iyte.edu.tr>

Organizers: Haydar Göral
Sinem Benli Göral
Mustafa Kutay Kutlu



TÜRK
MATEMATİK
DERNEĞİ



NUMBER THEORY AND
COMBINATORICS WORKSHOP

ABSTRACT BOOK

İZMİR INSTITUTE OF TECHNOLOGY
NOVEMBER 18, 2022

Dear Participants,

Number Theory and Combinatorics is a daily event, whose aim is to bring together the people working on topics related to number theory and combinatorics. At the meeting, both researchers and students talk on popular topics or current state of the art of their research areas. The roots of this workshop date back to the meeting Arithmetica İzmir 1-2-3, which was supported by the Turkish Mathematical Society two times. Our current workshop is also supported by the Turkish Mathematical Society, and we are very grateful and indebted to them once more. We also would like to thank all researchers who will contribute either by their talks or their participation. We believe this event will be a good opportunity for our participants to learn more about number theory and combinatorics. As a final word, welcome and enjoy!

Yours Sincerely, Organizing Committee

ORGANIZING COMMITTEE

Haydar Göral
Sinem Benli Göral
Mustafa Kutay Kutlu

İzmir Institute of Technology
İzmir Institute of Technology
İzmir Institute of Technology

PROGRAM

09:30–09:45: Opening

09:45–10:45: Alp Bassa

10:45–11:15: Coffee break

11:15–12:15: Kağan Kurşungöz

12:15–14:00: Lunch Break

14:00–15:00: Doğa Can Sertbaş

15:00–15:30: Coffee break

15:30–16:00: Berkay Kebeci

16:00–16:30: Sadık Eyidoğan

16:30–16:55: Çağatay Altuntaş

16:55–17:00: Closing

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Algebraic Curves and the Iterative Construction of Irreducible Polynomials over Finite Fields

Alp Bassa

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There are a variety of iterative constructions of irreducible polynomials over finite fields, the constructions using the Q -transform and the R -transform being the most prominent among these. Starting from a "suitable" irreducible polynomial, by iterative application of a transformation irreducible polynomials of arbitrary high degree can be constructed. We show how these constructions can be explained and unified by studying covers of curves corresponding to a given transformation and the use of Galois theory. In particular, we show how elliptic curves and their isogenies appear naturally in this context.

Combinatorial Constructions of Generating Functions of Cylindric Partitions with Small Profiles into Unrestricted or Distinct Parts

Kağan Kurşungöz

Sabancı University

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After giving some background on integer partitions and q -series as partition generating functions, we will define cylindric partitions due to Gessel and Krattenthaler. We will then consider cylindric partitions into profiles $c = (1, 1)$ and $c = (2, 0)$. The generating functions into unrestricted cylindric partitions and cylindric partitions into distinct parts with these profiles will be constructed. The constructions are combinatorial and they connect the cylindric partitions with ordinary partitions. The generating function of cylindric partitions with the said profiles turn out to be combinations of two infinite products. This is joint work with Halime Ömrüuzun Seyrek.

On Sequences Containing Arbitrarily Long Arithmetic Progressions

Doğa Can Sertbaş

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An *arithmetic progression of length k* is a k -term real sequence $\{a_1, \dots, a_k\}$ such that $a_1 < a_2 < \dots < a_k$ and the difference between each consecutive term is the same positive real number. In 1975, Szemerédi showed that any subset A of positive integers with positive upper density contains arbitrarily long arithmetic progressions; that is, for each positive integer k there is an arithmetic progression of length k in A . Since then, the length of the longest arithmetic progressions in a set with zero density has been widely studied. For instance, it was proved by Green and Tao that the set of prime numbers contains arbitrarily long arithmetic progressions. On the contrary, one can consider a corollary of the Darmon-Merel theorem which gives that the sequence $\{n^s\}_{n=1}^{\infty}$ does not contain an arithmetic progressions of length 4, when $s \in \mathbb{Z}_{\geq 2}$. In this talk, we will deal with the extensions of sequences $\{n^s\}_{n=1}^{\infty}$ where the corresponding sequence contains arbitrarily long arithmetic progressions. In particular, we will mention a classification of such sequences depending on some certain growth conditions. This is a joint work with Şermin Çam Çelik, Sadık Eyidoğan and Haydar Göral.

Aomoto Dilogarithms

Berkay Kebeci

Koç University
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One expects that the Hopf algebra of mixed Tate motives is isomorphic to the bi-algebra of Aomoto polylogarithms. In this talk, our aim is to understand the 2nd grade of this algebra, namely Aomoto dilogarithms. First we will give a short introduction on periods and give an idea about motives. Then, we will see the relation between Aomoto dilogarithms and the Bloch group given by dilogarithmic configurations.

Irreducibility in Differentiability Classes

Sadık Eyidođan

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We give criteria for the irreducibility of functions in $C^m [0, 1]$, where $m \in \{1, 2, 3, \dots\} \cup \{\infty\} \cup \{\omega\}$. We also discuss irreducibility in multivariable differentiability classes. Moreover, we characterize irreducible functions and maximal ideals in $C^\infty [0, 1]$. Finally, we give a variant of the Green-Tao theorem in differentiability classes for the several variable case. This talk is a joint work with A. Batal and H. Göral

Some Properties of the Generalized Harmonic Numbers

Çağatay Altuntaş

Istanbul Technical University
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Let p be a prime number and $J(p)$ denotes the set of positive integers n such that the numerator of the n^{th} harmonic number in the lowest terms is divisible by p . In this work, we consider an extension of this set to the generalized harmonic numbers and provide an upper bound for the number of elements in the set. Furthermore, we state an explicit condition on the finiteness of our set.