Doctoral Program Discrete Mathematics

Univ.-Prof. Dr. W. Woess
Speaker

Univ.-Prof. Dr. A. Geroldinger
Univ.-Prof. Dr. J. Thuswaldner
Deputy Speakers

Dr. S. Lendl
Coordinator

Steyrergasse 30/III
A-8010 Graz
Austria

Tel. +43(0)316 873-7132
Fax +43(0)316 873-4507

discrete@tugraz.at
www.math.tugraz.at/discrete

Discrete Mathematics Day 2019

Friday, December 13, 2019

TU Graz, Steyrergasse 30,
Lecture Hall BE01 (ground floor)

Schedule and abstracts

$10:00 - 10:10$ **Opening**
Presentation of the Doctoral Program Discrete Mathematics

$10:10 - 11:00$ **Talk by Prof. Klavdija Kutnar (University of Primorska)**
Title: Lovász's Hamiltonicity Problem

Abstract: In 1969 Lászlo Lovász asked for a construction of a finite connected vertex-transitive graph without a simple path visiting all vertices of the graph – a Hamilton path. A commonly accepted phrasing of his question, based on lack of supporting examples, reads as follows: Does every finite connected vertex-transitive graph have a Hamilton path?
Not only that no connected vertex-transitive graph without a Hamilton path is known to exist, we know of just five connected vertex-transitive graphs without a Hamilton cycle – a simple cycle containing all vertices of the graph.
In this talk I will present a recent result proving that every connected vertex-transitive graph of order a product of two primes, other than the Petersen graph, contains a Hamilton cycle.
This is a joint work with Shaofei Du and Dragan Marušič.

$11:00 - 11:15$ **Musical interlude by Julian Zalla**

$11:15 - 11:45$ **Talk by Mahadi Ddamulira (DK-Project 09)**
Title: Repdigits as sums of three Padovan numbers

Abstract: A repdigit is a positive integer N that has only one distinct digit when written in base 10. That is, N is of the form $N = d\left(\frac{10^{\ell}-1}{9}\right)$ for some positive integers d and ℓ with $1 \leq d \leq 9$ and $\ell \geq 2$. Let $\{P_n\}_{n\geq 0}$ be the sequence of Padovan numbers defined by $P_0 = 0$, $P_1 = 1 = P_2$, and $P_{n+3} = P_{n+1} + P_n$ for all $n \geq 0$. In this talk, we find all repdigits in base 10 that can be written as a sum of three Padovan numbers.

$11:45 - 13:15$ **Lunch break** - warm buffet in front of HS BE01 (for all participants!)

$13:15 - 13:45$ **Talk by Irene Parada (DK-Project 11)**
Title: Extending drawings and arrangements

Abstract: Given a drawing D(G) of a graph G, we study the problem of inserting a set of missing edges (edges of the complement of G) into $D(G)$, such that certain properties of the drawing are preserved. A drawing of a graph is pseudolinear if the drawing of its edges can be extended to a pseudoline arrangement (in which two pseudolines cross exactly once). For a given pseudoline arrangement A and two points p and q that do not lie on the same pseudoline, Levi's Enlargement Lemma states that we can insert a new pseudoline into A containing p and q in a way such that the result is still a pseudoline arrangement. This implies that given a pseudolinear drawing of a graph we can insert any set of missing edges in a way such that the result is still a pseudolinear drawing. In contrast, given a simple drawing (in which two edges have at most one point in common) inserting a missing edge in a way such that the result is still a simple drawing is not always possible. We show that it is NP-complete to decide whether we can insert a missing edge in such a way. Moreover, the problem remains hard when restricting it to pseudocircular drawings. A drawing of a graph is pseudocircular the drawing of its edges can be extended to an arrangement of pseudocircles (in which two pseudocircles cross at most twice). Analogously to Levi's Enlargement Lemma, given an arrangement of pseudocircles and three points that do not lie on the same pseudocircle, we can insert a pseudocircle into the arrangement that contain the three given points and in a way such that the result is still an arrangement of pseudocircles. However, if we are given a pseudosegment s instead of three points, it is not always possible to insert a pseudocircle that contains s into the arrangement in such a way. We present a polynomial-time algorithm to decide whether it is possible. We finish the talk by showing some cases in which deciding whether we can insert a set of edges into a drawing while preserving certain properties of it is fixed-parameter tractable.

$13:45 - 14:00$ **Musical interlude by Julian Zalla**

$14:00 - 14:50$ **Talk by Prof. Stephan Wagner (Stellenbosch University)**
Title: Coefficients of graph polynomials associated with random trees and graphs

Abstract: There are many polynomials associated with graphs whose coefficients count substructures of different kinds. Examples include the matching polynomial (matchings), the independence polynomial (independent sets), the subtree polynomial (subtrees) and the characteristic polynomial of the Laplacian (rooted spanning forests).
In this talk, I will discuss the distribution of these coefficients in different families of random trees and graphs. One can prove limit laws for the coefficients of a variety of graph polynomials under different random models (and even in some deterministic cases). To give just one concrete example: the coefficients of the subtree polynomial asymptotically follow a normal distribution when uniformly random trees are considered, but a Poisson distribution for dense Erdős-Rényi random graphs.

$14:50 - 15:10$ **Musical finale by Julian Zalla**