Liebe KombinatorikerInnen,

herzlich willkommen zum 30. Kolloquium über Kombinatorik, das zum achten und vermutlich letzten Mal in Magdeburg stattfindet.

In diesem Jahr nehmen an KolKom insgesamt 88 Mathematikerinnen und Mathematiker aus 15 Ländern teil. Es sind insgesamt 61 Kurzvorträge angemeldet.

Wir bedanken uns bei allen Teilnehmerinnen und Teilnehmern für ihr kommen. Wir wünschen allen Gästen zwei bis drei angenehme Tage in Magdeburg, spannende Vorträge und interessante Gespräche.

Aller Voraussicht nach wird das nächste KolKom, wie im vorigen Jahr, in Saarbrücken stattfinden. In jedem Fall sind Sie schon jetzt recht herzlich zum 31. Kolloquium 2012 eingeladen!

Stefan Felsner
Alexander Pott

Räume

Hauptvorträge	:	G03-315
Sektionsvorträge	:	G02-109, G02-111, G03-106, G03-214
Tagungsbüro	:	G02-215
Bibliothek	:	Hauptbibliothek auf dem Campus
Kaffee/Tee/Erfrischungen	:	G02-215 und G02-210
Internet	:	G02-112

Das Tagungsbüro ist am Freitag von 8:00 bis 17:00 Uhr geöffnet, am Samstag von 8:00 bis 16:15 Uhr. Die Hauptbibliothek auf dem Campus ist am Freitag von 9 bis 21 Uhr und am Samstag von 9 bis 15 Uhr geöffnet.

Das gemeinsame Abendessen ist im *Ratskeller*, Alter Markt. Einlass ab 18:30, Beginn des Buffets um 19:00.

Unsere Universität bietet einen drahtlosen Internetzugang an. Eine begrenzte Anzahl Gastzugänge sowie CD's mit der benötigten Software sind im Tagungsbüro erhältlich. Zugang via eduroam ist ebenfalls möglich.

Freitag, 11.11.2011

9:15	**Ingo Schiermeyer (Freiberg)** (G03-315) "Rainbow numbers and minimum rainbow subgraphs "	
anschließend	*Kaffeepause*	
10:30	**Christine Bachoc (Bordeaux)** (G03-315) "The chromatic number of Euclidean space, Euclidean graph realizations, and linear programming"	
anschließend	*Mittagspause*	
13:00 - 14:30	**Sektionsvorträge**	
14:30 - 15:00	*Kaffeepause*	
15:00 - 16:30	**Sektionsvorträge**	
16:30 - 16:45	*kurze Kaffeepause*	
16:45 - 18:15	**Sektionsvorträge**	
19:00	*Gemeinsames Abendessen* im **Ratskeller** Alter Markt (Einlass ab 18:30).	

Samstag, 12.11.2011

08:45	**Peter J. Cameron (London)** (G03-315) "Regular and synchronizing transformation monoids "	
anschließend	*Kaffeepause*	
10:00 - 12:00	**Sektionsvorträge**	
anschließend	*Mittagspause*	
13:30 - 15:00	**Sektionsvorträge**	
15:00 - 15:15	*kurze Kaffeepause*	
15:15	**Daniel Král' (Prague)** (G03-315) "Perfect matchings in graphs "	

Kurzvorträge Freitag, 11.11.2011

Zeit	Sektion I G02-109	Sektion II G02-111	Sektion III G03-106	Sektion IV G03-214
13:00	**B. Doerr 1** Mastermind with Only Two Rows	**G. Belov 2** Fast tightening of knapsack inequalities	**M. Zeiner 3** Peaks and valleys in combinatorial sequences	**Y. Edel 4** On dimensional dual hyperovals over $\mathbb{F}_2$ with translation groups
13:30	**T. Miltzow 5** Tron, a combinatorial Game on abstract Graphs	**B. Gonska 6** Characterization of inscribable stacked polytopes	**Y. Person 7** A randomized version of Ramsey's theorem	**A. Pavan 8** Rank of Tensors over Finite Fields
14:00	**K. Knauer 9** The hull number of partial cubes	**P. Tittmann 10** Counting Repelling Matchings	**M.-L. Bruner 11** Counting multiset-permutations avoiding the pattern 122 and another pattern of length three	**P. Kaski 12** Fast zeta transforms for lattices with few irreducibles
14:30	*Kaffeepause*			
15:00	**K. Paluch 13** Using Half Edges for Simple Approximation of the Maximum Asymmetric Traveling Salesman Problem	**V. Tůma 14** Extending a precoloring of a face in a planar graph	**H. Harborth 15** Polychromatic vertex colorings of cube graphs	**T. Feulner 16** Classification of linear codes with prescribed minimum distance and new upper bounds
15:30	**J. Matuschke 17** Abstract Flows over Time	**J. Goedgebeur 18** Fast Generation of Fullerenes	**M. Sonntag 19** Neighborhood graphs of products of undirected graphs	**J.-Ch. Schlage-P. 20** Additive combinatorics in vector spaces of small dimension
16:00	**D.O. Theis 21** Some results and problems in Communication Complexity	**S. Möser 22** A topological representation theorem for tropical oriented matroids	**N. Van Cleemput 23** Generation of Delaney-Dress symbols	**J. Bierbrauer 24** Some funny questions concerning semifields
16:30	*Kaffeepause*			
16:45	**A. Panholzer 25** Analysis of strategies for the hiring problem	**S. Andres 26** On some heuristics for the binary paint shop problem	**V. Kraus 27** Associative and Commutative Tree Representations for Boolean Functions	**M. Kiermaier 28** New ring-linear two-weight codes
17:15	**P. Heinig 29** An asymptotic answer to a special case of an open conjecture of Bondy	**F. Simon 30** Splitting the Domi-nationpolynomial	**S. Kurz 31** α-roughly weighted monotone Boolean functions	**L. Storme 32** Functional codes arising from quadrics and Hermitian varieties
17:45	**33**	**B. Gittenberger 34** Enumeration of generalized BCI lambda-terms	**35**	**M. Bogaerts 36** Automorphisms of Permutation Arrays

Kurzvorträge Samstag, 14.11.2009

Zeit	Sektion I G02-109	Sektion II G02-111	Sektion III G03-106	Sektion IV G03-214
10:00	**V. Mészáros 37** The lower bound of long alternating paths and separated matchings	**E. Steffen 38** On the Petersen Coloring Conjecture	**J. Schröder 39** The Two-parameter Class of invertible Schröder Transformations	**M. Böhm 40** A Generalization of Completely Separating Systems
10:30	**I. Mustata 41** Drawing intersection free crosses in rectangle configurations	**J.-P. Bode 42** Minimum size of k-rainbow connected graphs of given order	**U. Püschmann 43** On the Structure of Pictures With Two Orbits	**M. Meszka 44** Almost resolvable cycle systems
11:00	**L. Mach 45** A new lower bound based on Gromov's method of selecting heavily covered points	**F. Pfender 46** Large Rainbow Matchings in Graphs	**M. Huq 47** Nonlinear Scalarization Functional for VOP: Theoretical Issues	**A. Kazemi 48** The upper k-tuple total domination number of a graph
11:30	**T. Hixon 49** Weak conflict free colourings	**M. Bode 50** Good graphs of average degree at most 3	**51**	**C. Deppe 52** Threshold group testing with density
12:00	*Mittagspause*			
13:30	**V. Blinovsky 53** One problem from the Extremal Combinatorics	**C. Lange 54** Linear extensions of partial orders and realisations of associahedra	**G. Averkov 55** On integer simplices with a single interior integer point	**H. Chen 56** Minimum vertex covers and the eigenvalue 1 of the normalized graph Laplacian
14:00	**K. Sperfeld 57** On the minimal monochromatic K_4-Density	**S. Felsner 58** News about Semiantichains and Unichain Coverings	**T. Rehn 59** What is known about lattice-free orbit polytopes?	**S. Reiß 60** Optimizing extremal eigenvalues of the weighted Laplacian of a graph
14:30	**G. Seitz 61** Local minima in trees	**H. Aydinian 62** Ahlswede-Zhang identity for regular posets	**J.-L. Michel 63** Polysimplices in Euclidean Spaces	**64**

Hauptvorträge

Christine Bachoc (Bordeaux) : The chromatic number of Euclidean space, Euclidean graph realizations, and linear programming
Peter J. Cameron (London) : Regular and synchronizing transformation monoids
Ingo Schiermeyer (Freiberg) : Rainbow numbers and minimum rainbow subgraphs
Daniel Král' (Prague) : Perfect matchings in graphs

Kurzvorträge

Stephan Dominique Andres (Hagen) : On some heuristics for the binary paint shop problem
Gennadiy Averkov (Magdeburg) : On integer simplices with a single interior integer point
Harout Aydinian (Bielefeld) : Ahlswede-Zhang identity for regular posets
Gleb Belov (Duisburg) : Fast tightening of knapsack inequalities
Jürgen Bierbrauer (Houghton) : Some funny questions concerning semifields
Vladimir Blinovsky (Bielefeld) : One problem from the Extremal Combinatorics
Jens-P. Bode (Braunschweig) : Minimum size of k-rainbow connected graphs of given order
Michel Bode (Magdeburg) : Good graphs of average degree at most 3
Matthias Böhm (Rostock) : A Generalization of Completely Separating Systems
Mathieu Bogaerts (Bruxelles) : Automorphisms of Permutation Arrays
Marie-Louise Bruner (Wien) : Counting multiset-permutations avoiding the pattern 122 and another pattern of length three
Hao Chen (Berlin) : Minimum vertex covers and the eigenvalue 1 of the normalized graph Laplacian
Christian Deppe (Bielefeld) : Threshold group testing with density
Benjamin Doerr (Saarbrücken) : Mastermind with Only Two Rows
Yves Edel (Ghent) : On dimensional dual hyperovals over $\mathbb{F}_2$ with translation groups
Stefan Felsner (Berlin) : News about Semiantichains and Unichain Coverings
Thomas Feulner (Bayreuth) : Classification of linear codes with prescribed minimum distance and new upper bounds
Bernhard Gittenberger (Wien) : Enumeration of generalized BCI lambda-terms
Jan Goedgebeur (Ghent) : Fast Generation of Fullerenes
Bernd Gonska (Berlin) : Characterization of inscribable stacked polytopes
Heiko Harborth (Braunschweig) : Polychromatic vertex colorings of cube graphs
Peter Heinig (München) : An asymptotic answer to a special case of an open conjecture of Bondy
Thomas Hixon (Berlin) : Weak conflict free colourings
Mahmudul Huq (Halle) : Nonlinear Scalarization Functional for VOP: Theoretical Issues
Petteri Kaski (Helsinki) : Fast zeta transforms for lattices with few irreducibles
Adel P. Kazemi (Ardabil) : The upper k-tuple total domination number of a graph

Michael Kiermaier (Bayreuth) : New ring-linear two-weight codes
Kolja Knauer (Berlin) : The hull number of partial cubes
Veronika Kraus (Wien) : Associative and Commutative Tree Representations for Boolean Functions
Sascha Kurz (Bayreuth) : α-roughly weighted monotone Boolean functions
Carsten Lange (Berlin) : Linear extensions of partial orders and realisations of associahedra
Lukáš Mach (Prague) : A new lower bound based on Gromov's method of selecting heavily covered points
Jannik Matuschke (Berlin) : Abstract Flows over Time
Viola Mészáros (Berlin) : The lower bound of long alternating paths and separated matchings
Mariusz Meszka (Krakow) : Almost resolvable cycle systems
Jean-Luc Michel (Brussels) : Polysimplices in Euclidean Spaces
Tillmann Miltzow (Berlin) : Tron, a combinatorial Game on abstract Graphs
Silke Möser (Braunschweig) : A topological representation theorem for tropical oriented matroids
Irina Mustata (Berlin) : Drawing intersection free crosses in rectangle configurations
Katarzyna Paluch (Wroclaw) : Using Half Edges for Simple Approximation of the Maximum Asymmetric Traveling Salesman Problem
Alois Panholzer (Wien) : Analysis of strategies for the hiring problem
Andrea Pavan (Padua) : Rank of Tensors over Finite Fields
Yury Person (Berlin) : A randomized version of Ramsey's theorem
Florian Pfender (Rostock) : Large Rainbow Matchings in Graphs
Ulrike Püschmann (Dresden) : On the Structure of Pictures With Two Orbits
Thomas Rehn (Rostock) : What is known about lattice-free orbit polytopes?
Susanna Reiß (Chemnitz) : Optimizing extremal eigenvalues of the weighted Laplacian of a graph
Jan-Christoph Schlage-Puchta (Ghent) : Additive combinatorics in vector spaces of small dimension
Joachim Schröder (Bloemfontein) : The Two-parameter Class of invertible Schröder Transformations
Georg Seitz (Wien) : Local minima in trees
Frank Simon (Mittweida) : Splitting the Dominationpolynomial
Martin Sonntag (Freiberg) : Neighborhood graphs of products of undirected graphs
Konrad Sperfeld (Rostock) : On the minimal monochromatic K_4-Density
Eckhard Steffen (Paderborn) : On the Petersen Coloring Conjecture
Leo Storme (Ghent) : Functional codes arising from quadrics and Hermitian varieties
Dirk Oliver Theis (Magdeburg) : Some results and problems in Communication Complexity
Peter Tittmann (Mittweida) : Counting Repelling Matchings
Vojtěch Tůma (Prague) : Extending a precoloring of a face in a planar graph
Nico Van Cleemput (Ghent) : Generation of Delaney-Dress symbols
Martin Zeiner (Wien) : Peaks and valleys in combinatorial sequences

Weitere TeilnehmerInnen

Nieke Aerts (Berlin),
Marie Albenque (Paris & Berlin),
Ayça Çeşmelioğlu Gül (Magdeburg),
Klaus Dohmen (Mittweida),
Anika Fricke (Hildesheim),
Matthias Henze (Magdeburg),
Katharina Jochemko (Berlin),
Christoph Josten (Frankfurt),
Jan-Philipp Kappmeier (Berlin),
Arnfried Kemnitz (Braunschweig),
Axel Kohnert (Bayreuth),
Ivica Martinjak (Zagreb),
Wilfried Meidl (Istanbul),
Andrea Munaro (Bonn),
Anders Sune Pedersen (Aarhus),
Britta Peis (Berlin),
Alexander Pott (Magdeburg),
Manja Reinwardt (Mittweida),
Hanns-Martin Teichert (Lübeck),
Carsten Thiel (Magdeburg),
Martin Trinks (Mittweida),
Qi Wang (Magdeburg),
Su Wei (Magdeburg),
Yue Zhou (Magdeburg)

KOLLOQUIUM ÜBER KOMBINATORIK – 11. UND 12. NOVEMBER 2011
OTTO-VON-GUERICKE-UNIVERSITÄT MAGDEBURG

Freitag, 11.11.2011 — Zeit: 09:15 — G03-315

Rainbow numbers and minimum rainbow subgraphs

INGO SCHIERMEYER (Freiberg)

In this talk we consider edge colourings of graphs. A subgraph H of a graph G is called *rainbow subgraph*, if all its edges are coloured distinct.

In the first part we will survey the computation of rainbow numbers. For given graphs G, H the rainbow number $rb(G, H)$ is the smallest number m of colours such that if we colour the edges of G with at least m different colours, then there is always a totally multicoloured or rainbow copy of H. For various graph classes of H we will list the known rainbow numbers if G is the complete graph and report about recent progress on the computation of rainbow numbers. Finally, new results on the rainbow numbers $rb(Q_n, Q_k)$ for the hypercube Q_n will be presented.

The generation of genome populations in bioinformatics can be solved by computing *Minimum Rainbow Subgraphs*. In the second part we will report about the MINIMUM RAINBOW SUBGRAPH problem (MRS):
Given a graph G, whose edges are coloured with p colours. Find a subgraph $H \subseteq G$ of G of minimum order $r^*(G)$ with $|E(H)| = p$ such that each colour occurs exactly once.

We will discuss several complexity results and show lower and upper bounds for $r^*(G)$. Finally, we will present some recent polynomial time approximation algorithms for the MRS problem.

Freitag, 11.11.2011 — Zeit: 10:30 — G03-315

The chromatic number of Euclidean space, Euclidean graph realizations, and linear programming

CHRISTINE BACHOC (Bordeaux)

The determination of the chromatic number of Euclidean space is a difficult problem in discrete geometry going back to 1950. It is closely related to the problem of realizing graphs in Euclidean space with edges of length one. After a discussion of the history of this problem we shall present recent results improving knowledge on the measurable chromatic number, that involve infinite dimensional linear programming.

Samstag, 12.11.2011 — Zeit: 08:45 — G03-315

Regular and synchronizing transformation monoids

PETER J. CAMERON (London)

Since the time of Jordan and Mathieu, we have a much better understanding of permutation groups, thanks in part to the Classification of Finite Simple Groups. The applications to geometrical and combinatorial problems are well-known. Recently, inspired by João Araújo, I have been working on some similar questions about transformation monoids.

In a transformation monoid, the elements which are permutations form a group. In order to apply what we know about permutation groups, we typically adjoin a non-permutation to a permutation group and ask about properties of the monoid that is generated. A monoid is *synchronizing* if it contains an element whose image is a singleton set; it is *regular* if every element x has a *quasi-inverse* y in the sense of von Neumann, that is, satisfying $xyx = x$ and $yxy = y$.

In the talk I will summarise our recent work on these topics, with emphasis on the combinatorial and geometric connections.

Samstag, 12.11.2011 — Zeit: 15:15 — G03-315

Perfect matchings in graphs

DANIEL KRÁL' (Prague)

Perfect matchings in graphs are intensively studied both from the point of view of structural graph theory as well as because of their many applications in algorithms. In this talk, we focus on properties that can be derived using the properties of the perfect matching polytopes. We consider cubic bridgeless graphs in particular and we present the role of perfect matchings in possible approaches to some of the famous open problems, e.g., Berge-Fulkerson conjecture, as well as we survey some of recent developments including the proof of Lovász-Plummer conjecture on the exponential number of perfect matchings in cubic bridgeless graphs. We will also briefly mention some of many proofs in structural graph theory that use perfect matchings as tools.

Freitag, 11.11.2011 — Zeit: 13:00

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1 — Sektion I — G02-109 — 13:00

Mastermind with Only Two Rows

BENJAMIN DOERR (Saarbrücken)

We analyze the classic board game of Mastermind with n holes and a constant number of colors. Chvátal (Combinatorica 3 (1983), 325–329), extending earlier work of Erdős and Rényi (Magyar Tud. Akad. Mat. Kutató Int. Közl. 8 (1963), 229–243) on the 2-color case, proved that Codebreaker can find the secret code with $\Theta(n/\log n)$ questions.

We analyze a variant of the game, where Codebreaker may only use two rows of the board. This means that to enter a new guess, he has remove one of the two previous guesses and the corresponding answer, forget both, and based on the remaining guess and answer only decide on the new guess. We show that, despite this restriction, $O(n/\log n)$ questions remain sufficient to find the secret code.

Besides being interesting in its own right, this result also disproves a conjecture of Droste, Jansen, and Wegener (Theory of Computing Systems 39 (2006), 525–544) on the memory-restricted black-box complexity of the OneMax function class.

This is joint work with Carola Winzen (MPI Saarbrücken).

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2 — Sektion II — G02-111 — 13:00

Fast tightening of knapsack inequalities

GLEB BELOV (Duisburg)

Valid inequalities for binary knapsack sets are widely used as cutting planes for various generalizations of knapsack problems, from orthogonal packing to general IPs. It is particularly important to have strong inequalities, which is usually addressed by lifting (e.g., *Hardin, Nemhauser, Savelsbergh: Strong valid inequalities for the resource-constrained scheduling problem with uniform resource requirements, Discrete Optimization 5(1), 19-35, 2008*.) The principle of lifting is to add new variables to a given inequality.

We consider a more general method to strengthen an inequality, namely by tightening its coefficients (also those of new variables). We propose two greedy heuristics, both producing maximal inequalities which dominate the original ones. For W denoting the knapsack capacity and n the number of items, the running times of the heuristics are $O(Wn)$ and $O(Wn^2)$, respectively. This is an improvement by a factor of n compared to the naive implementation.

This is joint work with Guntram Scheithauer, Technische Universität Dresden.

3 — Sektion III — G03-106 — 13:00

Peaks and valleys in combinatorial sequences

MARTIN ZEINER (Wien)

It is well known that the number of peaks in a randomly chosen permutation is asymptotically normal with mean $(n-2)/3$ and variance $2(n+1)/45$. Using combinatorial techniques we can prove analogous results for the number of peaks and/or valleys in number compositions, sequences generated by geometrically distributed random variables, and Stirling permutations, i.e, certain permutations on multisets.

This is joint work with Alois Panholzer

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4 — Sektion IV — G03-214 — 13:00

On dimensional dual hyperovals over $\mathbb{F}_2$ with translation groups

YVES EDEL (Ghent)

A *dimensional dual hyperoval* is a set $\mathcal{S}$ of n-dimensional subspaces in $U := \mathbf{F}_q^{n+m}$, such that any one-dimensional subspace of an $S \in \mathcal{S}$ is intersection of exactly two elements of $\mathcal{S}$. $\mathcal{S}$ is called *splitting* with respect to a m-dimensional subspace Y if $U = S \oplus Y$ for all $S \in \mathcal{S}$. A group $T \subseteq Aut(\mathcal{S}) \subseteq GL(U)$ is called a *translation group* of $\mathcal{S}$ if it acts sharply transitive on $\mathcal{S}$ and $\mathcal{S}$ splits with respect to $C_U(T)$, the space of fixed points of T in U.

We discuss some properties of dimensional dual hyperovals over $\mathbb{F}_2$ with translation groups.

This is joint work with Ulrich Dempwolff, University of Kaiserslautern

Freitag, 11.11.2011 — Zeit: 13:30

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5 — Sektion I — G02-109 — 13:30

Tron, a combinatorial Game on abstract Graphs

TILLMANN MILTZOW (Berlin)

We study the combinatorial two-player game `Tron`. We answer the extremal question on general graphs and also consider smaller graph classes. Bodlaender and Kloks conjectured PSPACE-completeness. We proof this conjecture. A full version with references is available on `http://arxiv.org/abs/1110.3211` .

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6 — Sektion II — G02-111 — 13:30

Characterization of inscribable stacked polytopes

BERND GONSKA (Berlin)

We characterize the stacked d-polytopes that are inscribable. Equivalently, we identify the triangulations of a simplex by stellar subdivisions that can be realized as Delaunay triangulations.

7 — Sektion III — G03-106 — 13:30

A randomized version of Ramsey's theorem

YURY PERSON (Berlin)

The classical theorem of Ramsey states that for all integers $k \geq 2$ there exists an integer $R(k)$ such that no matter how one colors the edges of the complete graph $K_{R(k)}$ with two colors, there will always be a monochromatic copy of K_k.
Here we consider the following problem recently suggested by Allen, Böttcher, Hladky and Piguet. Let $\mathcal{R}(n, q)$ be a random subset of all copies of F on a vertex set V_n of size n, in which every copy is present independently with probability q. For which functions $q = q(n)$ can we color the edges of the complete graph on V_n with r colors such that no monochromatic copy of F is contained in $\mathcal{R}(n, q)$?

We also discuss the usual randomization of Ramsey's theorem for random (hyper-)graphs and its connection to the problem above.

This is joint work with Luca Gugelmann, Angelika Steger and Henning Thomas.

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8 — Sektion IV — G03-214 — 13:30

Rank of Tensors over Finite Fields

ANDREA PAVAN (Padua)

The rank of a three-fold tensor τ is the minimum cardinality of a set of fundamental tensors whose span contains τ. Apart from its intrinsic interest, the notion has connections with the theory of algebraic complexity: a tensor can be thought of as a bilinear map, and its rank is related to the computational cost of evaluating such a map.
An easy argument shows that the rank of a tensor of size $n \times n \times n$ is at most n^2. In 1979, Atkinson and Stephens proved that over the complex numbers the bound can be strengthened to $\frac{1}{2}n^2 + O(n)$. The key step in their argument is the following.
Proposition *Let U and V be vector spaces of dimension n over $\mathbb{C}$, let $u_1, \ldots, u_n$ be a basis of U, and $v_1, \ldots, v_n$ a basis of V. For any two-dimensional subspace L of $U \otimes V$, there exist n pure tensors $\tau_1, \ldots, \tau_n$ such that L is contained in the span of the $u_i \otimes v_i$'s together with the τ_i's.*
It is apparent from the proof that $\mathbb{C}$ can be replaced with any field of characteristic zero. We discuss what happens over a finite field.

This is joint work with Michel Lavrauw and Corrado Zanella.

Freitag, 11.11.2011 — Zeit: 14:00

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9 — Sektion I — G02-109 — 14:00

The hull number of partial cubes

KOLJA KNAUER (Berlin)

A subgraph H of a graph G is said to be *convex* if no shortest path between any two vertices of H uses $G \backslash H$. The *convex hull* of a set of vertices V' of G is the smallest convex subgraph of G containing V'. The *hull number* of G is the size of a minimum vertex set V' of G whose convex hull is G.

I will show that determining the hull number is NP-complete even when restricted to isometric subgraphs of hypercubes. This remains NP-complete even when considering graphs of regions of the intersection of a polytope with a hyperplane arrangement.

A special case where we have a quasi-polynomial time algorithm is determining the dimension of a poset given all its linear extensions.

This is joint work with Marie Albenque.

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10 — Sektion II — G02-111 — 14:00

Counting Repelling Matchings

PETER TITTMANN (Mittweida)

Let $G = (V, E)$ be a finite undirected simple graph with vertex set V and edge set E. Let $N(v)$ be the set of vertices that are adjacent to v in G. Let $e = \{u, v\} \in E$ be an edge of G with end vertices u and v. Then we call the vertex set $N(u) \cup N(v)$ the *neighborhood* of e. An edge $e = \{u, v\} \in E$ is *close* to a non-adjacent edge $f \in E$ if u or v belong to the neighborhood of f. A matching $F \subseteq E$ of is called *repelling* if no two edges of F are close. The aim of this paper is to count the repelling matchings of G with respect to the number of edges.
For any graph G, we denote by $k(G)$ and $k_1(G)$ the number of components and isolated vertices of G, respectively. We introduce the polynomial

$$\psi(G; x, y, z) = \sum_{A \subseteq V} x^{|A|} y^{k(G[A])} z^{k_1(G[A])},$$

show a recurrence relation for this polynomial and derive the desired number of repelling matchings.

11 — Sektion III — G03-106 — 14:00

Counting multiset-permutations avoiding the pattern 122 and another pattern of length three

MARIE-LOUISE BRUNER (Wien)

The concept of pattern avoidance respectively containment in permutations can be extended to permutations on multisets in a straightforward way. In this talk I wish to present some results of my diploma thesis in which I was able to close a gap in a recent article of Heubach and Mansour and to complete the study of permutations on regular multisets avoiding a pair of patterns of length three. In all seven studied cases, closed enumeration formulae could be developed using generating trees, generating functions and the Kernel method. Well-known sequences emerge, e.g. (generalized) Catalan and Fibonacci numbers.

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12 — Sektion IV — G03-214 — 14:00

Fast zeta transforms for lattices with few irreducibles

PETTERI KASKI (Helsinki)

We investigate fast algorithms for changing between the standard basis and an orthogonal basis of idempotents for Möbius algebras of finite lattices. We show that every lattice with v elements, n of which are nonzero and join-irreducible (or, by a dual result, nonzero and meet-irreducible), has arithmetic circuits of size $O(vn)$ for computing the zeta transform and its inverse, thus enabling fast multiplication in the Möbius algebra.

This is joint work with Andreas Björklund (Lund University), Thore Husfeldt (ITU Copenhagen), Mikko Koivisto (University of Helsinki), Jesper Nederlof (University of Bergen), and Pekka Parviainen (University of Helsinki).

Freitag, 11.11.2011 — Zeit: 15:00

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13 — Sektion I — G02-109 — 15:00

Using Half Edges for Simple Approximation of the Maximum Asymmetric Traveling Salesman Problem

KATARZYNA PALUCH (Wroclaw)

We give a very simple approximation algorithm for the maximum asymmetric traveling salesman problem. The approximation guarantee of our algorithm is 2/3, which matches the best known approximation guarantee by Kaplan, Lewenstein, Shafrir and Sviridenko. Our algorithm is simple to analyze, and contrary to previous approaches, which need an optimal solution to a linear program, our algorithm is combinatorial and only uses maximum weight perfect matching algorithm.

This is joint work with Khaled Elbassioni and Anke van Zuylen.

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14 — Sektion II — G02-111 — 15:00

Extending a precoloring of a face in a planar graph

VOJTĚCH TŮMA (Prague)

A well known result states that every planar graph can be 4-colored. A natural generalization of the problem is that some vertices have prescribed color, and the question is whether this precoloring can be extended into the rest of the graph.

In this talk we deal with a special case: let G be a plane 3-colorable graph, such that the outer face of G has length at most 5. We describe which precolorings of the outer face of G with 4 colors can be extended.

The results are joint work with Zdeněk Dvořák.

15 — Sektion III — G03-106 — 15:00

Polychromatic vertex colorings of cube graphs

HEIKO HARBORTH (Braunschweig)

Let $g(n,k)$ denote the maximum number of colors for the vertices of the cube graph Q_n such that each subcube Q_k contains all colors. Some exact values of $g(n,k)$ are determined.

This is joint work with Jens-P. Bode.

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16 — Sektion IV — G03-214 — 15:00

Classification of linear codes with prescribed minimum distance and new upper bounds

THOMAS FEULNER (Bayreuth)

Starting from a linear $[n,k,d]_q$-code with dual distance $d^\perp$ we derive an $[n-d^\perp, k-d^\perp+1, \geq d]_q$-code with dual distance at least $\left\lceil \frac{d^\perp}{q} \right\rceil$ using construction Y_1.
The inverse gives a rule for the classification of all $[n,k,d]_q^{d^\perp}$ by adding $d^\perp$ further columns to the parity check matrices of the smaller codes. In my talk I will describe how isomorphism rejection is applied to guarantee a small search space for this iterative approach. Using the algorithm we are able to

- classify all linear codes in $\mathbb{F}_8^{10}$ with minimum distances $d, d^\perp \geq 4$ (a result which leads to the nonexistence of a selfdual doubly-even $[72,36,16]_2$-code with an automorphism of order 7),
- prove the nonexistence of linear codes for 17 open parameter sets $[n,k,d]_q$, which implies 391 new upper bounds for the minimum distance and establishes the exact value in 115 cases,
- construct a hitherto unknown $[17,11,6]_9$-code.

Freitag, 11.11.2011 — Zeit: 15:30

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17 — Sektion I — G02-109 — 15:30

Abstract Flows over Time

JANNIK MATUSCHKE (Berlin)

Abstract flows generalize classical network flows by replacing the underlying network by an abstract system of "paths", a family of linearly ordered sets on an arbitrary ground set, fulfilling a simple switching property: Whenever two paths P and Q intersect, there must be another path that is contained in the beginning of P and the end of Q. In contrast, *flows over time* augment the classical network flow model by a notion of time. Here, each edge is equipped with a travel time that specifies the time needed for its traversal.

In the talk, we will discuss *abstract flows over time*, i.e., a combination of these two concepts. We will illustrate difficulties that arise when travel times are added to the abstract path system, but also show that a maximum abstract flow over time can be obtained by solving a weighted abstract flow problem and constructing a temporally repeated flow from its solution. In the course of the proof, we also show that the relatively modest switching property of abstract path systems already captures many essential properties of classical networks.

This is joint work with Jan-Philipp Kappmeier and Britta Peis.

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18 — Sektion II — G02-111 — 15:30

Fast Generation of Fullerenes

JAN GOEDGEBEUR (Ghent)

We describe a new algorithm for the efficient generation of the Nobel Prize winning fullerenes. These are cubic plane graphs where all faces are either pentagons or hexagons. The algorithm generates all non-isomorphic fullerenes using the construction operations from [1]. We will provide details on the way isomorphism rejection is handled, and give some optimizations. Our implementation of this algorithm is more than 3 times faster than previous generators for fullerenes.

This is joint work with Gunnar Brinkmann and Brendan D. McKay.

[1] M. Hasheminezhad, H. Fleischner, and B. D. McKay. A universal set of growth operations for fullerenes. *Chem. Phys. Lett.*, 464:118–121, 2008.

19 — Sektion III — G03-106 — 15:30

Neighborhood graphs of products of undirected graphs

MARTIN SONNTAG (Freiberg)

Let $G = (V, E)$ be a simple undirected graph. $N(G) = (V, E^N)$ is the *neighborhood graph* of the graph G, if and only if $E^N = \{\{a, b\} \mid a \neq b \wedge \exists\, x \in V : \{x, a\} \in E \wedge \{x, b\} \in E\}$.
For several products $G_1 \circ G_2$ of simple undirected graphs G_1 and G_2, we investigate the relations between the neighborhood graphs of the factors G_1, G_2 and the neighborhood graph of their product $G_1 \circ G_2$.

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20 — Sektion IV — G03-214 — 15:30

Additive combinatorics in vector spaces of small dimension

JAN-CHRISTOPH SCHLAGE-PUCHTA (Ghent)

We consider questions of the following type: Let d be a fixed integer, p a large prime number, and consider a sequence $a_1, \ldots, a_n$ of elements in $\mathbb{F}_p^d$. What is the maximal value of n such that there does not exist a subsequence $a_{i_1}, \ldots, a_{i_p}$ of length p adding up to 0? The precise determination of this maximal value seems rather hopeless, however, here we shall derive some new upper bounds. We also consider the question how sequence of maximal length in dimension 3 look like.

Freitag, 11.11.2011 — Zeit: 16:00

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21 — Sektion I — G02-109 — 16:00

Some results and problems in Communication Complexity

DIRK OLIVER THEIS (Magdeburg)

The **biclique covering number** is the minimum number of bicliques needed to cover every edge of a given bipartite graph. In Communication Complexity, the logarithm of this number is known as the **nondeterministic communication complexity.** Lower bounds on this number are important in Combinatorial Optimization.

In this talk, some old problems and recent results about the nondeterministic communication complexity from the viewpoint of Combinatorial Optimization will be discussed.

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22 — Sektion II — G02-111 — 16:00

A topological representation theorem for tropical oriented matroids

SILKE MÖSER (Braunschweig)

Tropical oriented matroids were defined by Ardila and Develin in 2007. They are a tropical analogon of classical oriented matroids in the sense that they encode the properties of the types of points in an arrangement of tropical hyperplanes – in much the same way as the covectors of (classical) oriented matroids describe the types in arrangements of linear hyperplanes.

Not every oriented matroid can be realised by an arrangement of linear hyperplanes though. The famous topological representation theorem by Folkman and Lawrence, however, states that every oriented matroid can be represented as an arrangement of *pseudo*hyperplanes.

Similarly, there are non-realisable tropical oriented matroids. In the talk I will present a tropical analogon for the representation theorem.

23 — Sektion III — G03-106 — 16:00

Generation of Delaney-Dress symbols

NICO VAN CLEEMPUT (Ghent)

A Delaney-Dress symbol is a structure that encodes an equivariant tiling, i.e. a tiling together with its symmetry group. In this talk we will describe a generator for Delaney-Dress symbols and thus for tilings. We will give an introduction to Delaney-Dress symbols and discuss the structural properties that are used by the generation algorithm. We will also present some results already obtained at this point of the development.

This is joint work with Gunnar Brinkmann.

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24 — Sektion IV — G03-214 — 16:00

Some funny questions concerning semifields

JÜRGEN BIERBRAUER (Houghton)

Freitag, 11.11.2011 — Zeit: 16:45

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25 — Sektion I — G02-109 — 16:45

Analysis of strategies for the hiring problem

ALOIS PANHOLZER (Wien)

The hiring problem is a simple model of on-line decision making under uncertainty, which has been introduced by Broder et al. (2008) as an extension of the famous secretary problem. The employer is here looking for many candidates (e.g., to grow up a small company) rather than only one. The input is a sequence of scores of the candidates and a decision whether to hire or not must be taken for each instance depending on the subsequence examined so far, while nothing is known about the future. Here the goal is to design some hiring strategy to meet the demands of the employer, which essentially are to obtain a good quality staff at a reasonable hiring rate. We provide here an analysis of two hiring strategies, namely "hiring above the median" (where a new candidate is only hired if his score is better than the score of the median of the already hired staff) and "hiring above the m-th best" under the probabilistic model that the sequence of quality scores (i.e., ranks) of the candidates are forming random permutations.

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26 — Sektion II — G02-111 — 16:45

On some heuristics for the binary paint shop problem

STEPHAN DOMINIQUE ANDRES (Hagen)

In the *binary paint shop problem*, introduced by Epping et al. (2004), the letters of a given word of length $2n$ in which each character of an alphabet of size n occurs exactly twice are colored with two colors in such a way that each character is colored once by each color and the number of color changes between consecutive letters is minimized. This problem is known to be $\mathcal{APX}$-hard, however it is unknown whether there exists a constant factor approximation. The binary paint shop problem is, on the one hand, a special case of the paint shop problem which has arisen from an application in car manufacturing, and on the other hand, a special case of the paired min bisection problem and the necklace splitting problem. We determine asymptotically the expected number of color changes for three heuristics for this problem: $n/2$ for the greedy heuristic, $2n/3$ for the red-first heuristic resp. $2n/5$ for the recursive greedy heuristic.

This is joint work with Winfried Hochstättler.

27 — Sektion III — G03-106 — 16:45

Associative and Commutative Tree Representations for Boolean Functions

VERONIKA KRAUS (Wien)

Since the 90's, several authors have studied a probability distribution on the set of Boolean functions on n variables induced by some probability distributions on formulas built upon the connectors And and Or and the literals $\{x_1, \bar{x}_1, \ldots, x_n, \bar{x}_n\}$. These formulas rely on plane binary labelled trees, known as Catalan trees. We extend all the results, in particular the relation between the probability and the complexity of a Boolean function, to other models of formulas: non-binary or non-plane labelled trees (i.e. Polya trees). This includes the natural tree class where associativity and commutativity of the connectors And and Or are realised.

This is joint work with Antoine Genitrini, Bernhard Gittenberger and Cécile Mailler.

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28 — Sektion IV — G03-214 — 16:45

New ring-linear two-weight codes

MICHAEL KIERMAIER (Bayreuth)

Projective two-weight codes over finite fields are interesting because they generate stronly regular graphs. The same statement is true for certain two-weight codes over finite Frobenius rings with respect to the homogeneous weight. We will give a new familiy of projective homogeneous two-weight codes over the finite Frobenius ring $K \times L$, where K and L are two finite fields of the same characteristic.

This is joint work with Alison Sneyd.

Freitag, 11.11.2011 — Zeit: 17:15

29 — Sektion I — G02-109 — 17:15

An asymptotic answer to a special case of an open conjecture of Bondy

PETER HEINIG (München)

According to [*European J. Combin.* 6 (1985), no. 3, p. 256] A. Bondy conjectured in 1979 that for every $d \geq 3$ and every 3-connected graph X with minimum degree $\delta(X) \geq d$ and $n \geq 2d$ vertices, every circuit of X can be realized as a symmetric difference of circuits each of which has length at least $2d - 1$. It is still unknown whether this is true, and published partial results need to assume that, roughly, $n \geq 4d$. Recently I found a proof for a statement giving an asymptotic affirmative answer to the special case obtained when assuming that '$n \geq 2d$' in Bondy's conjecture is true as '$n = 2d$'. Moreover, if '$n \geq 2d$' is true as '$n = 2d + 1$', then one can make do with Hamilton circuits alone. In the talk I will outline the proof. A theorem of J. Böttcher, M. Schacht and A. Taraz [*Math. Ann.* (2009) 343: 175–205] guaranteeing spanning embeddings of low-bandwidth graphs into dense graphs plays a central role in the argument.

30 — Sektion II — G02-111 — 17:15

Splitting the Dominationpolynomial

FRANK SIMON (Mittweida)

The domination polynomial $D(G, x)$ of an undirected graph $G = (V, E)$ is given by

$$D(G, x) = \sum_{k \geq 0} d_k(G) x^k,$$

where $d_k(G)$ denotes the number of dominating sets of cardinality k in G. Let $v \in V$ be an articulation in G producing the subgraphs G^1 and G^2 with $G = G^1 \cup G^2$ and $G^1 \cap G^2 = (\{v\}, \emptyset)$. In this talk we present the splitting approach

$$D(G, x) = \sum_{i,j \in \{0,1,2\}} D(G^1 \oplus_v P_i, x) d(i, j) D(G^2 \oplus_v P_j, x).$$

Here $G^1 \oplus_v P_i$ and $G^2 \oplus_v P_j$ are the graphs emerging from G^1 and G^2 by appending paths P_i and P_j of lengths i and j to v.

31 — Sektion III — G03-106 — 17:15

α-roughly weighted monotone Boolean functions

SASCHA KURZ (Bayreuth)

A monotone Boolean function $f : 2^N \to \{0,1\}$ with $f(\emptyset) = 0$ and $f(S) \leq f(T)$ for all $S \subseteq T \subseteq N := \{1,\dots,n\}$ is called α-roughly weighted if there are weights $w_i \in \mathbb{R}$ fulfilling $\sum_{i\in S} w_i \geq 1$ for all $S \subseteq N$ with $f(S) = 1$ and $\sum_{i\in T} w_i \leq \alpha$ for all $T \subseteq N$ with $f(T) = 0$. The critical threshold value of f is given by the minimal $\alpha \geq 1$ such that f is α-roughly weighted. For the maximum critical threshold value we prove $\frac{\left\lfloor \frac{n^2}{4} \right\rfloor}{n} \leq s(n) \leq \frac{n}{3}$ and conjecture the lower bound to be tight. We present an integer linear programming approach to determine $s(n)$ for small values of n. The set of the possible critical threshold values is restricted by the spectrum of the determinants of binary $(n+1)\times(n+1)$ matrices.

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32 — Sektion IV — G03-214 — 17:15

Functional codes arising from quadrics and Hermitian varieties

LEO STORME (Ghent)

Let $\mathcal{X}$ be a fixed algebraic variety in PG(N,q), with point set $\{P_1,\dots,P_n\}$, where we normalize the coordinates of the points with respect to the leftmost non-zero coordinate. Let $\mathcal{F}_h$, resp. $\mathcal{F}_{Herm}$, be the set of the homogeneous polynomials in the variables $X_0,\dots,X_N$, of degree h, resp. of the form $(X_0 \ \cdots \ X_N)A(X_0^{\sqrt{q}} \ \cdots \ X_N^{\sqrt{q}})^t$, with A a Hermitian matrix, over the finite field $\mathbb{F}_q$, q square. The functional codes $C_h(\mathcal{X})$ and $C_{Herm}(\mathcal{X})$ are given by

$$C_h(\mathcal{X}) = \{(f(P_1),\dots,f(P_n)) \mid f \in \mathcal{F}_h\} \cup \{0\}, \qquad h \in \mathbb{N} \cup \{Herm\}.$$

Mostly, the algebraic variety $\mathcal{X}$ is chosen to be a non-singular quadric $\mathcal{Q}$ or a non-singular Hermitian variety $\mathcal{H}$. In this talk, we present new results on the minimum distance of the four functional codes $C_2(\mathcal{Q})$, $C_{Herm}(\mathcal{H})$, $C_2(\mathcal{H})$ and $C_{Herm}(\mathcal{Q})$.

Freitag, 11.11.2011 — Zeit: 17:45

33 — Sektion I — G02-109 — 17:45

34 — Sektion II — G02-111 — 17:45

Enumeration of generalized BCI lambda-terms

BERNHARD GITTENBERGER (Wien)

We study a class of enriched trees which has its origin in lambda terms which correspond to BCI logic where B, C, and I are a certain combinators used in combinatory logic, i.e. certain reduction rules for lambda calculus. Such lambda terms can be viewed as Motzkin trees where each unary node carries exactly one pointer to a leaf. Aiming at counting general lambda terms, where there is no restriction on the number of pointers, we consider the more general problem with exactly k pointers per unary node. To compute the number a_n of terms of size n we use translate the structure into functional equations for the generating functions of a_n. As a_n grows super-exponentially, these are only formal power series and so analytic methods do not apply. Nevertheless, we show that the functional equation admits a kind of linearisation which enables us to compute a_n asymptotically.

This is joint work with Olivier Bodini (LIAFA Paris), Danièle Gardy (Univ. Versailles), Alice Jacquot (LIAFA Paris)

35 — Sektion III — G03-106 — 17:45

36 — Sektion IV — G03-214 — 17:45

Automorphisms of Permutation Arrays

MATHIEU BOGAERTS (Bruxelles)

Let $Sym(n)$ be the group of all permutations of n elements. If p_1, p_2 are two permutations such that p_1 and p_2 coincide in λ positions, the Hamming distance between p_1 and p_2 is the integer $d_n(p_1, p_2) = n - \lambda$.

A permutation array (PA) $\Gamma_{(n,d)}$ of size s and minimum distance d is a set of s permutations of n elements such that the Hamming distance between any two permutations is at least d.

Some data-transmission codes use PA's of maximum size s with respect to n and d. We use the group $Iso(Sym(n))$ of isometries of $(Sym(n), d_n)$ to study, construct and classify PA's. We show new upper bounds for the maximal size of PA's $\Gamma_{(n,d)}$.

Samstag, 12.11.2011 — Zeit: 10:00

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37 — Sektion I — G02-109 — 10:00

The lower bound of long alternating paths and separated matchings

VIOLA MÉSZÁROS (Berlin)

Consider a $2n$-element colored point set in convex position in the plane where n points are red and n points are blue. Erdős posed the following problem. Estimate the number of points on the longest non-crossing path such that edges join points of different color and are straight line segments. Kynčl, Pach and Tóth in 2008 for an arbitrary coloring gave the $n+\Omega(\sqrt{n/\log n})$ lower bound and a construction showing the upper bound of $\frac{4}{3}n + O(\sqrt{n})$ points. With Péter Hajnal we improved the previous lower bound to $n + \Omega(\sqrt{n})$.

Separated matchings are closely related to alternating paths. A *separated matching* is a geometrically noncrossing matching where all edges can be crossed by a line. So far no one was concerned with low discrepancy colorings as low discrepancy means many alternations among the two colors, and that alone guarantees a long noncrossing, alternating path. However, when we consider separated matchings, it is reasonable to investigate this case. For discrepancies two and three we proved that there are at least $\frac{4}{3}n$ points in the maximum separated matching.

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38 — Sektion II — G02-111 — 10:00

On the Petersen Coloring Conjecture

ECKHARD STEFFEN (Paderborn)

In 1988, Jaeger formulated the following conjecture: (Petersen Coloring Conjecture) *Let G be a cubic graph with no bridge. Then there is a coloring of the edges of G using the edges of the Petersen graph so that any three mutually adjacent edges of G map to three mutually adjancent edges in the Petersen graph.*

If true, this conjecture would imply both the Berge-Fulkerson Conjecture and the Five Cycle Double Cover Conjecture.

We discuss the structure of a possible minimum counterexample to the Petersen Coloring Conjecture and prove it for some well known classes of cubic graphs, e.g. for the flower snarks and the Goldberg snarks.

This is joint work with Jonas Hägglund, Umeå University, Sweden.

39 — Sektion III — G03-106 — 10:00

The Two-parameter Class of invertible Schröder Transformations

JOACHIM SCHRÖDER (Bloemfontein)

Ernst Friederich Wilhelm Carl Schröder (1841 - 1902) is the originator of the counting sequence which is now called large Schröder numbers. We will use generalized Schröder numbers to construct infinite lower triangular matrices which represent a two-parameter class of invertible sequence transformations. Their inverses are given by infinite lower triangular matrices of coordination numbers. The two-parameter class of Schröder transformations is merged into a one-parameter class of stretched Riordan arrays, the left-inverses of which consist of matrices of crystal ball numbers. Schröder and inverse Schröder transforms of important sequences are calculated.

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40 — Sektion IV — G03-214 — 10:00

A Generalization of Completely Separating Systems

MATTHIAS BÖHM (Rostock)

A Completely Separating System (CSS) $\mathcal{C}$ on $[n]$ is a collection of blocks of $[n]$ such that for any pair of distinct points $x, y \in [n]$, there exist blocks $A, B \in \mathcal{C}$ such that $x \in A - B$ and $y \in B - A$. One possible generalization of CSSs are r-CSSs. A collection $\mathcal{T}$ of blocks is an r-CSS on $[n]$ if for all pairwise distinct points i, a_1, a_2, …, a_r there exists a block $T \in \mathcal{T}$ with $i \in T$ and $\{a_1, a_2, \ldots, a_r\} \cap T = \emptyset$, so a 1-CSS is a CSS. Additionally, if $\mathcal{T}$ is a subset of $\binom{[n]}{k}$ for some value k then $\mathcal{T}$ is called an r-(n, k)CSS. For given integers r, n, k, the value $R^r(n, k)$ is defined to be the minimum size of an r-(n, k)CSS.
In this talk we present some general results, determine the values $R^2(n, k)$ for given parameters $k \leq 5$ and n, present a construction using Latin squares and mention some open problems.

This is joint work with Karsten Schölzel.

Samstag, 12.11.2011 — Zeit: 10:30

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41 — Sektion I — G02-109 — 10:30

Drawing intersection free crosses in rectangle configurations

IRINA MUSTATA (Berlin)

Given a configuration of intersecting rectangles, a necessary and sufficient condition had been given such that it is possible to join the four corners of each rectangle with a cross within the rectangle so that the crosses are pairwise non-intersecting. We investigate the combinatorial structure of solvable cases. The cross of rectangle R divides the rectangle into four regions (which we will call N,S,E,W). A corner inside R has to be contained in one of these regions. We give a combinatorial necessary and sufficient condition for the region assignments.

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42 — Sektion II — G02-111 — 10:30

Minimum size of k-rainbow connected graphs of given order

JENS-P. BODE (Braunschweig)

A graph G is called k-rainbow connected if there exists a coloring of the edges of G with at most k colors such that any two vertices are connected by a path with edges of pairwise different colors. It is asked for the minimum number $t(n, k)$ of edges of a k-rainbow connected graph with n vertices. New upper bounds for $t(n, k)$ are given and $t(n, 3)$ is determined completely.

This is joint work with Heiko Harborth.

43 — Sektion III — G03-106 — 10:30

On the Structure of Pictures With Two Orbits

ULRIKE PÜSCHMANN (Dresden)

A *picture* is a simple, edge-coloured graph, such that every vertex is incident with exactly one edge of each colour. Its automorphisms are the graph automorphisms that preserve the colouring of the edges. Based on Cayley graphs, given an abstract group and some other parameters related to a generating set of that group, we construct special pictures, called *2CG*. We show a characterization result for 2CG: A connected picture is isomorphic to a 2CG if and only if a subgroup of its automorphism group acts semiregularly with precisely two orbits on the vertices. This implies, all pictures whose automorphism group has precisely two orbits can now be described in terms of 2CG.

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44 — Sektion IV — G03-214 — 10:30

Almost resolvable cycle systems

MARIUSZ MESZKA (Krakow)

A k-*cycle system* of order n is a pair $(X, \mathcal{C})$ where $\mathcal{C}$ is a collection of edge disjoint k-cycles which partition the edge set of the complete graph K_n with $V(K_n) = X$. A k-cycle system $(X, \mathcal{C})$ is *resolvable* if the cycles belonging to $\mathcal{C}$ can be partitioned into parallel classes.

If k does not divide n then we cannot have a parallel class of k-cycles in $(X, \mathcal{C})$. The closest we can come to a parallel class is a collection of $(n-1)/k$ vertex disjoint k-cycles; any such collection is called an *almost parallel class*. A k-cycle system of order n whose k-cycles can be partitioned into the maximum possible number of almost parallel classes, and the remaining k-cycles are vertex disjoint, is called *almost resolvable* and is denoted by k-ARCS(n).

The existence of 3-ARCSs was settled in 1993 by H. Hanani. In 2007, I. Dejter, C. Lindner C. Rodger and M. Meszka proved the existence of 4-ARCSs. A complete solutions for $k = 6$, $k = 10$, as well as a complete solution with one possible exception for $k = 14$, will be presented.

It the case of orders for which k-cycle systems cannot exist, an obvious question is how close to a k-cycle system one can get. A *maximum packing* of K_n with k-cycles is a collection of edge disjoint k-cycles of K_n such that the size of a set of edges not belonging to any of the k-cycles is as small as possible. Similarly, a *minimum covering* of K_n with k-cycles is a partition of a multigraph $K_n \cup P$ into k-cycles, where the set $\mathcal{P}$ is a subgraph of λK_n and $|\mathcal{P}|$ is as small as possible.

A complete solution to the problem of constructing almost resolvable maximum packings and almost resolvable minimum coverings for $k = 4$ will be presented.

This is joint work with Elizabeth Billington, Dean Hoffman, Curt Lindner and Alexander Rosa.

Samstag, 12.11.2011 — Zeit: 11:00

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45 — Sektion I — G02-109 — 11:00

A new lower bound based on Gromov's method of selecting heavily covered points

LUKÁŠ MACH (Prague)

Boros and Füredi (for $d = 2$) and Bárány (for arbitrary d) proved that there exists a positive real number c_d such that for every set P of n points in $\mathbf{R}^d$ in general position, there exists a point of $\mathbf{R}^d$ contained in at least $c_d\binom{n}{d+1}$ $(d+1)$-simplices with vertices at the points of P. Gromov improved the known lower bound on c_d by topological means. Using methods from extremal combinatorics, we improve one of the quantities appearing in Gromov's approach and thereby provide a new stronger lower bound on c_d for arbitrary d. In particular, we improve the lower bound on c_3 from 0.06332 to more than 0.07509; the best upper bound known on c_3 being 0.09375.

The results are joint work with Daniel Král' and Jean-Sébastien Sereni.

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46 — Sektion II — G02-111 — 11:00

Large Rainbow Matchings in Graphs

FLORIAN PFENDER (Rostock)

A *rainbow matching* in an edge-colored graph is a matching in which all the edges have distinct colors. Wang asked if there is a function $f(\delta)$ such that a properly edge-colored graph G with minimum degree δ and order at least $f(\delta)$ must have a rainbow matching of size δ. We answer this question in the affirmative; $f(\delta) = 6.5\delta$ suffices. Furthermore, the proof provides a $O(\delta(G)|V(G)|^2)$-time algorithm that generates such a matching.

This is joint work with Jennifer Diemunsch, Michael Ferrara, Casey Moffatt and Paul S. Wenger (University of Colorado, Denver).

47 — Sektion III — G03-106 — 11:00

Nonlinear Scalarization Functional for VOP: Theoretical Issues

MAHMUDUL HUQ (Halle)

In last couple of years several concepts for approximately efficient solutions of VOP have been developed. The reason for introducing approximately efficient solutions is the fact that numerical algorithms generate approximate efficient points, which always exist under very weak assumptions. This property makes the topic makes itself quite interesting. In this research paper I would like to discuss about the initial ideas of about my research on nonlinear scalarization functional for VOP.

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48 — Sektion IV — G03-214 — 11:00

The upper k-tuple total domination number of a graph

ADEL P. KAZEMI (Ardabil)

Let G be a graph with minimum degree at least $k \geq 1$. A vertex set is a k-tuple total dominating set of G if every vertex of G is adjacent to at least k vertices in it. We define the upper k-tuple total domination number $\Gamma_{\times k,t}(G)$ of G as the minimum cardinality of a minimal k-tuple total dominating set of G. Here, we derive basic properties and bounds for the upper k-tuple total domination number, and we prove a Vizing-like bound for the cartesian product of graph, and $\Gamma_{\times k,t}(G) = \Upsilon_k(H_G)$, where Υ_k is the upper k-transversal number in hypergraphs, and H_G is the open neighborhood hypergraph of graph G.

Samstag, 12.11.2011 — Zeit: 11:30

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49 — Sektion I — G02-109 — 11:30

Weak conflict free colourings

THOMAS HIXON (Berlin)

Given a set $P \subset \mathbb{R}^2$ of n points , and a set of regions F (a family of subsets of $\mathbb{R}^2$), we can define the hypergraph $G(P, F) = (V, E)$, where V corresponds to the set P and $A \subset P$ is an edge if there exists a region $f \in F$ such that $f \cap P = A$ (with $|A| \geq 2$).

A *weak conflict free colouring* of $G(P, F)$ is a colouring of the vertices such that no edge is monochromatic. i.e each edge contains vertices from at least two different colour classes.

Given a fixed set of regions, can we find a natural number c, such that for any set of points P we can find a weak conflict free colouring of $G(P, F)$ using only C colours? If so, then what is the smallest C such that this is possible? (This is the usual chromatic number for hypergraphs).

I will present some results in the cases where F is the set of bottomless rectangles and rectangles which all have a non empty intersection with a fixed horizontal line.

50 — Sektion II — G02-111 — 11:30

Good graphs of average degree at most 3

MICHEL BODE (Magdeburg)

A good edge labeling of a graph is an assignment of numbers to the edges such that for every ordered pair of distinct vertices (u, v) there is at most one path from u to v which uses the edges in a non-decreasing order of labels. Araújo, Cohen, Giroire and Havet conjecture that every graph of average degree less than 3 is good, unless it contains K_3 or $K_{2,3}$ as a subgraph. This talk reports on progress towards this conjecture. In particular, a proof is given for the special case when the girth is at least 5.

51 — Sektion III — G03-106 — 11:30

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52 — Sektion IV — G03-214 — 11:30

Threshold group testing with density

CHRISTIAN DEPPE (Bielefeld)

In contrast to the goal of classical group testing we want to find m defective elements among $D \geq m$ defective elements. We analyse threshold group testing with density. We give adaptive strategies and lower bounds for the number of tests and show that our strategy is optimal for $m = 1$

Samstag, 12.11.2011 — Zeit: 13:30

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53 — Sektion I — G02-109 — 13:30

One problem from the Extremal Combinatorics

VLADIMIR BLINOVSKY (Bielefeld)

We show how to reduce problem of obtaining the maximum number of permutations of finite set such that any pair has at least t common transpositions to the problem of obtaining the maximum number of permutations such that any pair has at least t common cycles.

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54 — Sektion II — G02-111 — 13:30

Linear extensions of partial orders and realisations of associahedra

CARSTEN LANGE (Berlin)

55 — Sektion III — G03-106 — 13:30

On integer simplices with a single interior integer point

GENNADIY AVERKOV (Magdeburg)

We study simplices S with integer vertices and a single interior integer point. It is known that S can be of size double exponentional in the dimension (the word 'size' stands for the volume, number of lattice points or the lattice diameter). We improve existing upper bounds on the size of S and also provide a result which shows that large simplices S are extremely 'anisotropic'. The presented results are motivated by applications in integer optimization and algebraic geometry.

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56 — Sektion IV — G03-214 — 13:30

Minimum vertex covers and the eigenvalue 1 of the normalized graph Laplacian

HAO CHEN (Berlin)

Minimum vertex cover is a classical NP-hard optimization problem. In trees, it is found to be strongly related to the eigenvalue 1 of the normalized graph Laplacian and its neighborhood in the graph spectra. I will demonstrate how to read from minimum vertex covers information about eigenvalues (multiplicity, value) and eigenvectors (vanishing points, nodal domains).

Samstag, 12.11.2011 — Zeit: 14:00

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57 — Sektion I — G02-109 — 14:00

On the minimal monochromatic K_4-Density

KONRAD SPERFELD (Rostock)

We use Razborov's flag algebra method to show a new asymptotic lower bound for the minimal density m_4 of monochromatic K_4's in any 2-coloring of the edges of the complete graph K_n on n vertices. The hitherto best known lower bound was obtained by Giraud in 1979, who proved that $m_4 > \frac{1}{46}$. Whereas the best known upper bound by Thomason from 1989 states that $m_4 < \frac{1}{33}$. We can show that $m_4 > \frac{1}{35}$.

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58 — Sektion II — G02-111 — 14:00

News about Semiantichains and Unichain Coverings

STEFAN FELSNER (Berlin)

Motivated by Dilworth's Theorem and a generalization known as Greene-Kleitman Theorem, Saks and West conjectured the following: for every product $P \times Q$ of partial orders, the maximum size of a semiantichain equals the minimum number of unichains needed to cover the product.

We discuss the statement, provide conditions on P and Q that make the statemant true and show an example that disproves the conjecture.

This is joint work with B. Bosek, K. Knauer and G. Matecki.

59 — Sektion III — G03-106 — 14:00

What is known about lattice-free orbit polytopes?

THOMAS REHN (Rostock)

Let G be an arbitrary permutation group acting on the coordinates of the vector space $\mathbf{R}^n$. For an integer vector $z \in \mathbf{Z}^n$ we call the convex hull $\mathrm{conv}\{\sigma(z) \ : \ \sigma \in G\}$ of the G-orbit of z an orbit polytope. We say that such a polytope is lattice-free if its only integer points are its vertices.

In this talk we will discuss what is known about lattice-free orbit polytopes for different kind of groups. For 2-transitive groups there are only finitely many lattice-free orbit polytopes up to translation. In the case of less transitivity this is not always true. There will be examples of infinite families of lattice-free orbit polytopes of cyclic groups in dimensions $n \geq 4$. Besides finiteness considerations we will also look at practical ways to test lattice-freeness.

Joint work with Katrin Herr and Achill Schürmann.

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60 — Sektion IV — G03-214 — 14:00

Optimizing extremal eigenvalues of the weighted Laplacian of a graph

SUSANNA REISS (Chemnitz)

In order to better understand spectral properties of the Laplace matrix of a graph, we optimize the edge weights so as to minimize the difference of the maximal and the second smallest eigenvalue of the weighted Laplacian. Using a semidefinite programming formulation, the dual program allows to interpret the dual solutions living in the optimized eigenspaces as a graph realization. We study connections between structural properties of the graph and geometrical properties of this graph realizations.

This is joint work with F. Göring and C. Helmberg.

Samstag, 12.11.2011 — Zeit: 14:30

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61 — Sektion I — G02-109 — 14:30

Local minima in trees

GEORG SEITZ (Wien)

Given a tree $\mathcal{T}$ whose nodes are labelled with distinct natural numbers, a node v of $\mathcal{T}$ is called a local minimum if all neighbours of v bear a larger label than v.

We study the number of local minima in different rooted tree families, and obtain both exact enumeration results for the number of trees of a given size with a certain number of local minima, and results on the (limiting) distribution of the number of local minima in random trees.

In addition, nice combinatorial relations to other tree statistics and to so-called up-down alternating trees show up.

This is joint work with Alois Panholzer.

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62 — Sektion II — G02-111 — 14:30

Ahlswede-Zhang identity for regular posets

HAROUT AYDINIAN (Bielefeld)

In 1990 Ahlswede and Zhang discovered an elegant combinatorial identity, called AZ-identity, which has several effective applications. In particular, AZ-identity can be regarded as a sharpening of the well-known LYM inequality. In the talk an extension of AZ-identity to the class of regular posets, as well as some of its consequences, will be presented.

63 — Sektion III — G03-106 — 14:30

Polysimplices in Euclidean Spaces

JEAN-LUC MICHEL (Brussels)

In d-dimensional Euclidean space, a polysimplex is a collection of d-dimensional regular simplices glued together along their facets. Polysimplices in 3-dimensional Euclidean space appear at various places in the scientific literature, mainly in condensed matter physics. One of these polysimplices is the so-called tetrahelix, which was studied and generalized in Euclidean spaces of any dimension by Coxeter in the 1980s.

A natural question arises: in d-dimensional Euclidean space, does there exist for $n \geq 3$ a sequence $(\Delta_0, \ldots, \Delta_{n-1})$ of d-dimensional regular simplices such that Δ_i and Δ_j have precisely one facet in common whenever $j \equiv i + 1 \pmod{n}$? In the talk I will answer that question.

I will also present a new way of representing polysimplices as edge-coloured graphs. This representation leads to a complete classification of polysimplices up to dilatations. Moreover, the automorphism group of every polysimplex can be read from its edge-coloured graph.

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64 — Sektion IV — G03-214 — 14:30

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