Liebe KombinatorikerInnen,

herzlich willkommen zum 31. Kolloquium über Kombinatorik, das in diesem Jahr an der TU Berlin stattfindet.

Registriert haben sich 103 Mathematikerinnen und Mathematiker aus 16 Ländern. Neben den 4 geladenen Hauptvorträgen haben wir 67 eingereichte Kurzvorträge.

Wir bedanken uns bei allen Teilnehmerinnen und Teilnehmern für ihr Kommen. Wir wünschen allen Gästen zwei bis drei angenehme Tage in Berlin, spannende Vorträge und interessante Gespräche. Für die Unterstützung danken wir dem Graduiertenkolleg *Methods for Discrete Structures*.

Stefan Felsner
Alexander Pott

# Räume

| | | |
|---|---|---|
| **Hauptvorträge** | : | MA 004 |
| **Sektionsvorträge** | : | MA 548, MA 549, MA 550, MA 551 |
| **Kaffee/Tee/Erfrischungen** | : | MA 621, MA 622, MA 623 |
| **Rechnerraum mit Terminals** | : | MA 641 |
| **WLAN und Arbeitsraum** | : | MA 642 |

Die Räume 5xx befinden sich im 5ten, die Räume 6xx im 6ten Stock des Mathematikgebäudes MA.

Die Anmeldung ist am Donnerstag in der Tiergartenquelle und am Freitag Vormittag vor dem Hörsaal MA 004 möglich. Wer später am Freitag kommt kann seine Tagungsunterlagen im Sekretariat MA 501 erhalten. Am Samstag wird das Tagungsbüro im 6ten Stock bei Bedarf geöffnet, wenden sie sich gegebenenfalls an die Locals, das sind die Leute mit den grünen Namensschildern.

Zum gemeinsame Abendessen am Freitag Abend treffen wir uns im *Café Campus* hinter den Mathegebäude, das ist die Nummer (3) auf der Karte am Ende des Heftes. Einlass ab 18:15, Beginn des Buffets um 19:00.

Die TU Berlin ist an eduroam beteiligt, wer das nutzen kann hat überall auf dem Campus drahtlosen Netzzugang. Zusätzlich haben wir im Raum MA 642 einen WLAN-Router aufgestellt der dort einen unkomplizierten Netzzugang ermöglicht.

# Freitag, 16.11.2012

| | | |
|---|---|---|
| **9:15** | **Tibor Szabó (Berlin)**<br>"On rainbow matchings " | (MA 004) |
| | *Kaffeepause* | |
| **10:30** | **Mihyun Kang (Graz)**<br>"Phase transition in random discrete structures " | (MA 004) |
| | *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 **Café Campus** | |

# Samstag, 17.11.2012

| | | |
|---|---|---|
| **08:45** | **Dieter Rautenbach (Ulm)**<br>"Independence in Graphs " | (MA 004) |
| | *Kaffeepause* | |
| **10:00 - 12:00** | **Sektionsvorträge** | |
| **12:00 - 13:30** | *Mittagspause* | |
| **13:30 - 15:30** | **Sektionsvorträge** | |
| **15:30 - 15:45** | *kurze Kaffeepause* | |
| **15:45** | **Andreas Winter (Barcelona)**<br>"The rise and rise of Lovasz' theta:<br>Quantum zero-error information theory and semidefinite optimization" | (MA 004) |

# Kurzvorträge Freitag, 16.11.2012

| Zeit | Sektion I MA 548 | Sektion II MA 549 | Sektion III MA 550 | Sektion IV MA 551 |
|---|---|---|---|---|
| **13:00** | **P. Tittmann 1** Domination Polynomials of Graphs | **H. Harborth 2** Extremal Maximum Rectilinear Crossing Numbers of 2-regular Graphs | **A. Panholzer 3** Label-patterns in mappings | **J. Goedgebeur 4** Ramsey numbers $R(K_3, G)$ for graphs of order 10 |
| **13:30** | **K. Dohmen 5** From broken circuits to broken neighbourhoods | **K. Knauer 6** Topological representation of planar partial cubes | **Su Wei 7** The Balancedness of Elementary Symmetric Boolean Functions | **S. Radziszowski 8** New Computational Upper Bounds for Ramsey Numbers $R(3, k)$ |
| **14:00** | **M. Sonntag 9** Neighborhood graphs of products of undirected graphs | **T. Miltzow 10** Trees in Polygons | **S. Hartung 11** Metric Dimension is W[2]-complete | **R. v. Bevern 12** How applying Myhill-Nerode methods to hypergraphs helps mastering the Art of Trellis Decoding |
| **14:30** | *Kaffeepause* | | | |
| **15:00** | **D. Clemens 13** On the largest tournament Maker can build | **C. Lange 14** Realizations of associahedra and linear extensions of posets | **C. Deppe 15** Group Testing with Two Defectives | **A. Garber 16** The Voronoi conjecture on parallelohedra via generating cycles of a graph |
| **15:30** | **B. Doerr 17** Mastermind With Many Colors | **K. Jochemko 18** Marked order polytopes, monotone triangle reciprocity, and partial colorings of graphs | **H. Aydinian 19** A note on the problem of nonnegative $k$-subset sums | **J. Chen 20** A characterization of the single-crossing domain |
| **16:00** | **A. Liebenau 21** A fast winning strategy for Maker in the Spanning tree game | **V. Wiechert 22** The Dimension of Posets with Planar Cover Graphs | **G. Kyureghyan 23** On a problem about the modular inversion | **N. Van Cleemput 24** Spherical tilings by congruent quadrangles |
| **16:30** | *Kaffeepause* | | | |
| **16:45** | **N. Megow 25** Instance-sensitive robustness guarantees for sequencing problems | **M. Tsuruga 26** Constructing Complicated Spheres as Test Examples for Homology Algorithms | **B. Gittenberger 27** Infinite dimensional Gaussian limiting distributions in combinatorics | **J. Kalcsics 28** The Maximum Dispersion Problem |
| **17:15** | **J. A. Soto 29** Matroid Secretary Problems: Free Order Model and Laminar Case | **M. Walter 30** On Simple Extended Formulations of Polytopes | **L. Theran 31** Algebraic and combinatorial approaches to low-rank matrix completion | **E. Lehtonen 32** Reconstructing functions of several arguments from identification minors |
| **17:45** | **C. Telha 33** A competitive algorithm for the Economic Lot Sizing Problem | **C. Trabandt 34** Containment Problems for Polytopes and Spectrahedra | **K.-U. Schmidt 35** Low autocorrelation sequences | **R. Kang 36** For almost all graphs H, almost all H-free graphs have a linear homogeneous set. |

# Kurzvorträge Samstag, 17.11.2012

| Zeit | Sektion I<br>MA 548 | Sektion II<br>MA 549 | Sektion III<br>MA 550 | Sektion IV<br>MA 551 |
|---|---|---|---|---|
| **10:00** | **M. Axenovich 37**<br>On visibility representations of directed graphs | **T. Friedrich 38**<br>Randomized Rumor Spreading in Social Networks | **M. Schacht 39**<br>On the KŁR conjecture for sparse random graphs | **S. Andres 40**<br>On a Strong Perfect Digraph Theorem |
| **10:30** | **J. Matuschke 41**<br>Degree-constrained orientations of embedded graphs | **G. Istrate 42**<br>Minimum Entropy Submodular Optimization (and Fairness in Cooperative Games) | **J. Bierbrauer 43**<br>A bound on permutation codes | **A. Bień 44**<br>The methods of reduction of simple and weighted singular graphs |
| **11:00** | **M. Albenque 45**<br>New bijection between bipolar orientations and blossoming trees | **M. Kovše 46**<br>On graph identification problems and the special case of identifying vertices using paths | **G. Lassmann 47**<br>Non-trivial lower bounds for packing problems | **N. Lichiardopol 48**<br>Proof of Caccetta-Häggkvist conjecture for in-tournaments. Pancyclicity |
| **11:30** | **D. O. Theis 49**<br>Improper choosability of planar graphs | **F. Joos 50**<br>Random subgraphs in Cartesian powers of regular graphs | **Yue Zhou 51**<br>$(2^n, 2^n, 2^n, 1)$-relative difference sets, projective planes and $Z_4$-linear Kerdock codes | **M. Schubert 52**<br>The circular flow numbers of regular graphs |
| **12:00** | *Mittagspause* | | | |
| **13:30** | **J. Nakagawa 53**<br>Mathematical Core Technology for a Traffic Flow System Using the Model Predictive Control of Large and Complex Networks | **F. Frick 54**<br>Vertex-transitive triangulations of the 3-sphere with edge valences bounded by five | **Qi Wang 55**<br>Skew Hadamard Difference Sets from Dickson Polynomials of Order 7 | **S. Messuti 56**<br>Minimum degree conditions for homomorphisms into odd cycles |
| **14:00** | **F. Lutz 57**<br>Combinatorial roundness of grains in cellular microstructures | **L. Kozma 58**<br>Shattering, graph orientations, and connectivity | **C. Hering 59**<br>Naive Configurations | **R. Hildenbrandt 60**<br>A k-server problem with parallel requests and unit distances |
| **14:30** | **M. Huq 61**<br>Adaptive Algorithms for Solving Non-Linear Vector Approximation Problems : Discussion on Application of Separation Theorem | **U. Schwerdtfeger 62**<br>The Height Distribution of Discrete Excursions | **A. Pott 63**<br>Vectorial bent functions | **Y. Person 64**<br>Higher Inclusion Matrices |
| **15:00** | | **R. Glebov 65**<br>On bounded degree spanning trees in the random graph process | **T. Kalinowski 66**<br>Maximal regular antichains of small regularity | **L. Narins 67**<br>Ryser's Conjecture and Home-Base Hypergraphs |

# Hauptvorträge

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|---|---|
| Mihyun Kang (Graz) | : Phase transition in random discrete structures |
| Dieter Rautenbach (Ulm) | : Independence in Graphs |
| Tibor Szabó (Berlin) | : On rainbow matchings |
| Andreas Winter (Barcelona) | : The rise and rise of Lovasz' theta: Quantum zero-error information theory and semidefinite optimization |

# Kurzvorträge

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|---|---|
| Marie Albenque (Paris) | : New bijection between bipolar orientations and blossoming trees |
| Stephan Dominique Andres (Hagen) | : On a Strong Perfect Digraph Theorem |
| Maria Axenovich (Karlsruhe) | : On visibility representations of directed graphs |
| Harout Aydinian (Bielefeld) | : A note on the problem of nonnegative $k$-subset sums |
| René van Bevern (Berlin) | : How applying Myhill-Nerode methods to hypergraphs helps mastering the Art of Trellis Decoding |
| Anna Bień (Katowice) | : The methods of reduction of simple and weighted singular graphs |
| Jürgen Bierbrauer (Michigan) | : A bound on permutation codes |
| Jiehua Chen (Berlin) | : A characterization of the single-crossing domain |
| Nico Van Cleemput (Ghent) | : Spherical tilings by congruent quadrangles |
| Dennis Clemens(Berlin) | : On the largest tournament Maker can build |
| Christian Deppe (Bielefeld) | : Group Testing with Two Defectives |
| Benjamin Doerr (Saarbrücken) | : Mastermind With Many Colors |
| Klaus Dohmen (Mittweida) | : From broken circuits to broken neighbourhoods |
| Florian Frick (Berlin) | : Vertex-transitive triangulations of the 3-sphere with edge valences bounded by five |
| Tobias Friedrich (Jena) | : Randomized Rumor Spreading in Social Networks |
| Alexey Garber (Moscow) | : The Voronoi conjecture on parallelohedra via generating cycles of a graph |
| Bernhard Gittenberger (Wien) | : Infinite dimensional Gaussian limiting distributions in combinatorics |
| Roman Glebov (Berlin) | : On bounded degree spanning trees in the random graph process |
| Jan Goedgebeur (Ghent) | : Ramsey numbers $R(K_3, G)$ for graphs of order 10 |
| Heiko Harborth (Braunschweig) | : Extremal Maximum Rectilinear Crossing Numbers of 2-regular Graphs |

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|---|---|
| Sepp Hartung (Berlin) | : Metric Dimension is W[2]-complete |
| Christoph Hering (Tübingen) | : Naive Configurations |
| Regina Hildenbrandt (Ilmenau) | : A k-server problem with parallel requests and unit distances |
| Mahmudul Huq (Halle) | : Adaptive Algorithms for Solving Non-Linear Vector Approximation Problems : Discussion on Application of Separation Theorem |
| Gabriel Istrate (Timişoara) | : Minimum Entropy Submodular Optimization (and Fairness in Cooperative Games) |
| Katharina Jochemko (Berlin) | : Marked order polytopes, monotone triangle reciprocity, and partial colorings of graphs |
| Felix Joos (Ulm) | : Random subgraphs in Cartesian powers of regular graphs |
| Jörg Kalcsics (Clausthal-Zellerfeld) | : The Maximum Dispersion Problem |
| Thomas Kalinowski (Rostock) | : Maximal regular antichains of small regularity |
| Ross Kang (Amsterdam) | : For almost all graphs H, almost all H-free graphs have a linear homogeneous set. |
| Kolja Knauer (Berlin) | : Topological representation of planar partial cubes |
| Matjaž Kovše (Leipzig) | : On graph identification problems and the special case of identifying vertices using paths |
| Laszlo Kozma (Saarbrücken) | : Shattering, graph orientations, and connectivity |
| Gohar Kyureghyan (Magdeburg) | : On a problem about the modular inversion |
| Carsten Lange (Berlin) | : Realizations of associahedra and linear extensions of posets |
| Gunter Lassmann (Berlin) | : Non-trivial lower bounds for packing problems |
| Erkko Lehtonen (Luxembourg) | : Reconstructing functions of several arguments from identification minors |
| Nicolas Lichiardopol (Salon) | : Proof of Caccetta-Häggkvist conjecture for in-tournaments. Pancyclicity |
| Anita Liebenau (Berlin) | : A fast winning strategy for Maker in the Spanning tree game |
| Frank H. Lutz (Berlin) | : Combinatorial roundness of grains in cellular microstructures |
| Jannik Matuschke (Berlin) | : Degree-constrained orientations of embedded graphs |
| Nicole Megow (Berlin) | : Instance-sensitive robustness guarantees for sequencing problems |
| Silvia Messuti (Hamburg) | : Minimum degree conditions for homomorphisms into odd cycles |
| Tillmann Miltzow (Berlin) | : Trees in Polygons |
| Junichi Nakagawa (Futtsu) | : Mathematical Core Technology for a Traffic Flow System Using the Model Predictive Control of Large and Complex Networks |
| Lothar Narins (Berlin) | : Ryser's Conjecture and Home-Base Hypergraphs |
| Alois Panholzer (Wien) | : Label-patterns in mappings |
| Yury Person (Berlin) | : Higher Inclusion Matrices |
| Alexander Pott (Magdeburg) | : Vectorial bent functions |

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|---|---|
| Stanisław Radziszowski (Rochester) | : New Computational Upper Bounds for Ramsey Numbers $R(3, k)$ |
| Mathias Schacht (Hamburg) | : On the KŁR conjecture for sparse random graphs |
| Kai-Uwe Schmidt (Magdeburg) | : Low autocorrelation sequences |
| Michael Schubert (Paderborn) | : The circular flow numbers of regular graphs |
| Uwe Schwerdtfeger (Chemnitz) | : The Height Distribution of Discrete Excursions |
| Martin Sonntag (Freiberg) | : Neighborhood graphs of products of undirected graphs |
| José A. Soto (Berlin) | : Matroid Secretary Problems: Free Order Model and Laminar Case |
| Claudio Telha (Louvain) | : A competitive algorithm for the Economic Lot Sizing Problem |
| Dirk Oliver Theis (Magdeburg) | : Improper choosability of planar graphs |
| Louis Theran (Berlin) | : Algebraic and combinatorial approaches to low-rank matrix completion |
| Peter Tittmann (Mittweida) | : Domination Polynomials of Graphs |
| Christian Trabandt (Frankfurt am Main) | : Containment Problems for Polytopes and Spectrahedra |
| Mimi Tsuruga (Berlin) | : Constructing Complicated Spheres as Test Examples for Homology Algorithms |
| Matthias Walter (Magdeburg) | : On Simple Extended Formulations of Polytopes |
| Qi Wang (Magdeburg) | : Skew Hadamard Difference Sets from Dickson Polynomials of Order 7 |
| Su Wei (Magdeburg) | : The Balancedness of Elementary Symmetric Boolean Functions |
| Veit Wiechert (Berlin) | : The Dimension of Posets with Planar Cover Graphs |
| Yue Zhou (Magdeburg) | : $(2^n, 2^n, 2^n, 1)$-relative difference sets, projective planes and $Z_4$-linear Kerdock codes |

# Weitere TeilnehmerInnen

Nieke Aerts (Berlin)
Therese Biedl (Salzburg)
Pierre-Yves Bienvenu (Evry)
Márcia Rodrigues Cappelle Santana (Goiânia-GO)
Jiehua Chen (Berlin)
Markus Dod (Mittweida)
Stefan Felsner (Berlin)
Dirk Frettlöh (Bielefeld)
Francesco Grande (Berlin)
Codrut Grosu (Berlin)
Daniel Heldt (Berlin)
Thomas Hixon (Berlin)
Udo Hoffmann (Berlin)
Daniel Johannsen ()
Christoph Josten (Frankfurt)
Franz Király (Berlin)
Stefan Kratsch (Saarbrücken)
Stephan Kreutzer (Berlin)
Martina Kubitzke (Frankfurt)
Anton Malevich (Magdeburg)
Minglai Cai (Bielefeld)
Wilfried Meidl (Istanbul)
Viola Mészáros (Berlin)
Irina Mustata (Berlin)
Ning Cai (Bielefeld)
Manja Reinwardt (Mittweida)
Moritz W. Schmitt (Berlin)
Joachim Schröder (Bloemfontein)
Achill Schürmann (Rostock)
Hanns-Martin Teichert (Lübeck)
Manh Tuan Tran (Berlin)
Gerhard J. Woeginger (Berlin)

**Freitag, 16.11.2012 — Zeit: 09:15 — MA004**

# On rainbow matchings

TIBOR SZABÓ (Berlin)

Given a multihypergraph $H$ with an edge-coloring, a matching of $H$ is called rainbow if all its edges have distinct colors. Rainbow matchings come up naturally in many combinatorial problems. In the talk we survey some of the results and conjectures involving rainbow matchings, ranging from classical design theory to extremal combinatorics. We elaborate on an extremal problem of Aharoni and Berger about the existence of rainbow $t$-matchings in edge-colored multihypergraphs where each color class itself is a $t$-matching.

This represents joint work with Roman Glebov and Benny Sudakov.

**Freitag, 16.11.2012 — Zeit: 10:30 — MA004**

# Phase transition in random discrete structures

MIHYUN KANG (Graz)

Random discrete structures have been extensively studied during the last few decades and have become one of the central themes of contemporary mathematics. This is partly because they are useful for modelling, analysing and solving structural and algorithmic problems arising from mathematics, theoretical computer science and natural sciences, and they provide a wide potential range of applications. The phase transition and its critical behaviour is a fascinating phenomenon observed in various contexts. The phase transition deals with an abrupt change in the properties of a large structure by altering critical parameters. The phase transition in random discrete structures has captured the attention of many scientists, and its intense study has brought together different fields such as discrete mathematics, probability theory and theoretical computer science as well as statistical physics. In this talk we discuss phase transitions in random discrete structures including Ising model, percolation, random graphs and random walks.

**Samstag, 17.11.2012 — Zeit: 08:45 — MA004**

# Independence in Graphs

DIETER RAUTENBACH (Ulm)

In this talk I will survey recent results inspired by classical bounds on the independence number of a graph.

**Samstag, 17.11.2012 — Zeit: 15:45 — MA004**

# The rise and rise of Lovasz' theta: Quantum zero-error information theory and semidefinite optimization

ANDREAS WINTER (Barcelona)

The Lovasz' number (theta) is one of the most famous graph parameters, being efficiently computable as a semidefinite programme, but sandwiched between the independence number and chromatic number - which are both NP-hard. Due to other nice properties it is even an upper bound on the zero-error ("Shannon") capacity of a graph.
I will review recent work with T Cubitt, R Duan, D Leung, W Matthews and S Severini on extensions of Shannon's and Lovasz' theory to the quantum setting: (1) Lovasz' theta is also an upper bound on the zero-error capacity assisted by entanglement; (2) the latter can be strictly larger than without entanglement; (3) there is a hierarchy of semidefinite relaxations characterizing the entanglement-assisted zero-error capacity of a graph; (4) there exists a natural extension of zero-error information theory to genuine quantum channels, including the Lovasz number; (5) linear and semidefinite programs also govern zero-error communication assisted by other "non-local" correlation resources.

# Freitag, 16.11.2012 — Zeit: 13:00

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1 — Sektion I — MA548 — 13:00

## Domination Polynomials of Graphs

PETER TITTMANN (Mittweida)

The domination polynomial $D(G, x)$ of an undirected finite graph $G$ is the ordinary generating function for the number of dominating sets of $G$. We give an overview of properties of this polynomial, show some representations of the domination polynomial using Möbius inversion techniques, prove relations to other graph polynomials, and develop methods for the computation of $D(G, x)$.

The results have been obtained by joint work with Martin Trinks, Frank Simon (Mittweida), James Preen (Cape Breton, Canada), and Tomer Kotek (Haifa, Israel).

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2 — Sektion II — MA549 — 13:00

## Extremal Maximum Rectilinear Crossing Numbers of 2-regular Graphs

HEIKO HARBORTH (Braunschweig)

The minimum m(n,2) and the maximum M(n,2) of the maximum rectilinear crossing numbers for all 2-regular graphs of order n are determined completely.

3 — Sektion III — MA550 — 13:00

# Label-patterns in mappings

ALOIS PANHOLZER (Wien)

We consider $n$-mappings, i.e., functions from the finite set $[n] := \{1, 2, \ldots, n\}$ into itself and study the occurrence and avoidance of interesting label-patterns in the iteration orbit $(i, f(i), f^2(i), \ldots)$ of elements. In particular, we study the exact and asymptotic behaviour of the number of records and runs and enumerate alternating $n$-mappings, i.e., functions, where each element satisfies either $i < f(i) > f^2(i) < f^3(i) > \cdots$ or $i > f(i) < f^2(i) > f^3(i) < \cdots$.
A combinatorial treatment of these problems naturally yields a study of certain first order linear and quasi-linear PDEs.

4 — Sektion IV — MA551 — 13:00

# Ramsey numbers $R(K_3, G)$ for graphs of order 10

JAN GOEDGEBEUR (Ghent)

The Ramsey number $R(G, H)$ is the smallest integer $r$ such that every graph $F$ with at least $r$ vertices contains $G$ as a subgraph, or its complement $F^c$ contains $H$ as a subgraph. We determined the triangle Ramsey numbers $R(K_3, G)$ of nearly all of the 12 005 168 graphs of order 10, except for 10 of the hardest cases. We will present the list of the 10 remaining graphs. Most likely these graphs need approaches focusing on each individual graph in order to determine their triangle Ramsey number. The results were obtained by combining new computational and theoretical results.
We developed an optimised algorithm for generating maximal triangle-free graphs and triangle Ramsey graphs. We will give details about the algorithm. It allowed us to determine all Ramsey numbers up to 30. We also proved some theoretical results which allowed us to determine several triangle Ramsey numbers larger than 30. These theoretical results will also be presented.
We hope that other researchers will help to complete this list of triangle Ramsey numbers for graphs of order 10 as this is very likely the last complete list of of triangle Ramsey numbers that can possibly be determined for a very long time.

This is joint work with Gunnar Brinkmann and Jan-Christoph Schlage-Puchta.

# Freitag, 16.11.2012 — Zeit: 13:30

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5 — Sektion I — MA 548 — 13:30

## From broken circuits to broken neighbourhoods

KLAUS DOHMEN (Mittweida)

A well-known theorem of Whitney (1932) states that the coefficient of $\lambda^{n-k}$ in the chromatic polynomial of an $n$-vertex graph counts (up to sign) the number of $k$-subsets of its edge-set including no broken circuit, where a *broken circuit* arises from the edge-set of a cycle by removing its maximum edge according to some fixed linear ordering relation on the edge-set of the graph.
In this talk, we review some related results and present a new analogue of Whitney's broken circuit theorem in the context of domination reliability, which is the probability that a finite network whose nodes are subject to random and independent failure and whose edges are perfectly reliable is functioning in the sense that the operating nodes constitute a dominating set.

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6 — Sektion II — MA 549 — 13:30

## Topological representation of planar partial cubes

KOLJA KNAUER (Berlin)

Partial cubes are isometric subgraphs of hypercubes. Many graph classes are partial cubes. One example are tope graphs of oriented matroids. By the Topological Representation Theorem for Oriented Matroids [Folkman, Lawrence '78] tope graphs may be represented as region graphs of pseudo-sphere arrangements in $S^d$, but no graph theoretical characterization is known. In the case of rank at most $3$ oriented matroids, tope graphs were characterized as planar partial cubes such that for each vertex $v$ there is a unique vertex $w$ such that their distance is the diameter of the graph [Fukuda, Handa '93]. In other words these so-called *antipodal* planar partial cubes correspond to region graphs of pseudo-sphere arrangements in $S^2$.
Generalizing this result, we present a topological representation theorem for general planar partial cubes in terms of region graphs of arrangements of simple closed curves in $S^2$ such that every pair of curves intersects in at most $2$ points.

7 — Sektion III — MA 550 — 13:30

# The Balancedness of Elementary Symmetric Boolean Functions

SU WEI (Magdeburg)

The elementary symmetric polynomial $\sigma_{n,d}$ is balanced if and only if $\sum_{i=0}^{n} \binom{n}{i}(-1)^{\binom{i}{d}} = 0$, where $\sigma_{n,d} = \bigoplus_{1\le i_1<\cdots<i_d\le n} x_{i_1}x_{i_2}\cdots x_{i_d}$ for positive integers $n$ and $1 \le d \le n$. Therefore, the existence of balanced elementary symmetric Boolean functions is related to the problem of bisecting binomial coefficients of the equation $\sum_{i=0}^{n} x_i\binom{n}{i} = 0$, where $x_i \in \{-1, 1\}$.

In 2008, Cusick *et al.* conjectured that certain elementary symmetric Boolean functions of the form $\sigma_{2^{t+1}l-1,2^t}$ are the only nonlinear balanced ones, where $t$ and $l$ are any positive integers. Towards this conjecture, some results have been obtained. By analyzing the weight of $\sigma_{n,2^t}$ and $\sigma_{n,d}$, we prove that $\mathrm{wt}(\sigma_{n,d}) < 2^{n-1}$ holds in most cases, and so does the conjecture. In particular, our results not only cover the most known results, but also contain some new cases. Thus, we can reduce the conjecture to few remaining cases. We do not fully solve the conjecture, but we also consider the weight of $\sigma_{n,2^t+2^s}$ and also give some experimental results on it.

This is joint work with Xiaohu Tang and Alexander Pott.

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8 — Sektion IV — MA 551 — 13:30

# New Computational Upper Bounds for Ramsey Numbers $R(3,k)$

STANISŁAW RADZISZOWSKI (Rochester)

Using computational techniques we derive 6 new upper bounds on the classical two-color Ramsey numbers: $R(3,10) \le 42$, $R(3,11) \le 50$, $R(3,13) \le 68$, $R(3,14) \le 77$, $R(3,15) \le 87$, and $R(3,16) \le 98$. All of them are improvements by one over the results listed by Lesser in 2001. Let $e(3,k,n)$ denote the minimum number of edges in any triangle-free graph on $n$ vertices without independent sets of order $k$. The new upper bounds on $R(3,k)$ are obtained by completing the computation of the exact values of $e(3,k,n)$ for all $n$ with $k \le 9$ and for all $n \le 33$ for $k = 10$, and by establishing new lower bounds on $e(3,k,n)$ for most of the open cases for $10 \le k \le 15$. We prove that the known critical graph for $R(3,9)$ on 35 vertices is unique up to isomorphism. For the case of $R(3,10)$, first we establish that $R(3,10) = 43$ iff $e(3,10,42) = 189$, or equivalently, that if $R(3,10) = 43$ then every critical graph is regular of degree 9. Then, using computations, we disprove the existence of the latter, and thus show that $R(3,10) \le 42$.

This is joint work with Jan Goedgebeur (Ghent University).

# Freitag, 16.11.2012 — Zeit: 14:00

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9 — Sektion I — MA 548 — 14:00

## Neighborhood graphs of products of undirected graphs

MARTIN SONNTAG (Freiberg)

If $G = (V, E)$ is a simple undirected graph, its *neighborhood hypergraph* $\mathcal{N}(G) = (V, \mathcal{E}^{\mathcal{N}})$ has the vertex set $V$ and $e \subseteq V$ is an edge of $\mathcal{N}(G)$ iff $|e| \geq 1$ and there is a vertex $v \in V$, such that $e$ is the neighborhood of the vertex $v$ in the graph $G$. For several products $G_1 \circ G_2$ of simple undirected graphs $G_1$ and $G_2$, we investigate the question whether $G_1$, $G_2$, $\mathcal{N}(G_1) = (V_1, \mathcal{E}_1^{\mathcal{N}})$ or $\mathcal{N}(G_2) = (V_2, \mathcal{E}_2^{\mathcal{N}})$ can be reconstructed from $\mathcal{N}(G_1 \circ G_2)$ or not. Vice versa, we solve the problem how $\mathcal{N}(G_1 \circ G_2)$ can be obtained from $G_1$, $G_2$, $\mathcal{N}(G_1) = (V_1, \mathcal{E}_1^{\mathcal{N}})$ and $\mathcal{N}(G_2) = (V_2, \mathcal{E}_2^{\mathcal{N}})$.

This is joint work with Hanns-Martin Teichert (Universität zu Lübeck).

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10 — Sektion II — MA 549 — 14:00

## Trees in Polygons

TILLMANN MILTZOW (Berlin)

We prove that every simple polygon contains a degree 3 tree encompassing a prescribed set of vertices. We give tight bounds on the minimal number of degree 3 vertices. We apply this result to reprove a result from Bose *et al.* that every set of disjoint line segments in the plane admits a binary tree.

11 — Sektion III — MA 550 — 14:00

# Metric Dimension is W[2]-complete

SEPP HARTUNG (Berlin)

The NP-hard METRIC DIMENSION problem is to decide for a given graph and a positive integer $k$ whether there is a size at most $k$ vertex subset that *separates* all vertex pairs. Therein, a vertex $v$ separates a pair $\{u, w\}$ if the distance (length of a shortest path) between $v$ and $u$ is different from the distance of $v$ und $w$. We prove that METRIC DIMENSION is W[2]-complete with respect to $k$ even on graphs with maximum degree three. This answers an open question of Díaz et al. [ESA'12] concerning the parameterized complexity of METRIC DIMENSION. Additionally, it shows that unless the widely believed conjecture FPT $\neq$ W[2] fails, for any function $f$ there cannot be an algorithm solving METRIC DIMENSION on a $n$-vertex graph in $f(k) \cdot n^{O(1)}$ time. Furthermore, from the details of our W[2]-hardness proof it follows together with a result of Chen et al. [Inf. Comput. 2005] that METRIC DIMENSION cannot be solved in $n^{o(k)}$ time unless the exponential time hypothesis fails. This proves that a trivial $O(n^k)$ algorithm is probably asymptotically optimal.

12 — Sektion IV — MA 551 — 14:00

# How applying Myhill-Nerode methods to hypergraphs helps mastering the Art of Trellis Decoding

RENÉ VAN BEVERN (Berlin)

A *trellis* is a graph associated with a linear code that is used for maximum-likelihood decoding. The decoding complexity of a linear code is strongly influenced by the *state complexity* of the trellis, which highly depends on the coordinate permutation of the linear code. The problem of finding the coordinate permutation of a linear code such that the state complexity of the associated trellis is at most $k$ has been referred to as the *Art of Trellis Decoding* and is NP-hard. We show that it linear-time solvable if $k$ is constant. To this end, we identify the problem as equivalent to HYPERGRAPH CUTWIDTH, which we show to be fixed-parameter tractable by, for the first time, applying an analog of the Myhill-Nerode theorem from formal language theory to a hypergraph problem.

This is joint work with Michael R. Fellows (Charles Darwin University), Serge Gaspers (University of New South Wales) and Frances Rosamond (Charles Darwin University).

# Freitag, 16.11.2012 — Zeit: 15:00

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13 — Sektion I — MA 548 — 15:00

## On the largest tournament Maker can build

DENNIS CLEMENS (Berlin)

Two players, called Maker and Breaker, play the following game. Given a tournament $T$ (an orientation of the complete graph) on $k$ vertices, the players claim edges alternately from the complete graph $K_n$ on the $n$ vertices, with Maker also choosing a direction for her edge. Maker wins the game if her digraph contains a copy of $T$. In 2008, Beck showed that the largest undirected clique Maker can build is of order $k_c = (2 - o(1)) \log n$. Given $n$ large enough, we show that Maker is able to build a tournament of order $k = k_c - 10 = (2 - o(1)) \log n$. That is, building a tournament is almost as easy for Maker as building an undirected clique. This improves the lower bound of $0.5 \log n$ (Beck 2008) and $\log n$ (Gebauer 2010). In particular, our result shows that a normal "random graph intuition" fails for the tournament game.

Joint work with Heidi Gebauer and Anita Liebenau.

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14 — Sektion II — MA 549 — 15:00

## Realizations of associahedra and linear extensions of posets

CARSTEN LANGE (Berlin)

There are many realizations of associahedra such that the normal fan is a coarsening of the normal fan of the classical permutahedron. One such family, constructed by Hohlweg and Lange in 2007, is parametrized by Coxeter elements of the symmetric group. As described by Morton, Pachter, Shiu, Sturmfels and Wienand in the context of convex rank tests and generalized permutahedra in 2009, the vertices of these realizations correspond to certain posets and their linear extensions encode the maximal cones of the permutahedron's normal fan that form maximal cones of the associahedron's normal fan.
Using a new description of these realizations by Pilaud and Santos from 2011, I explicitly construct these vertex-labelings by posets for any given Coxeter element. Moreover, a formula for the number of total orderings among the posets used by such a labeling is given. It turns out that this is a unifying formula to count the ideals of the natural partial order for a given equivalence class of maximal reduced decompositions. Galambos and Reiner gave an explicit formula for a special case in 2008.

15 — Sektion III — MA 550 — 15:00

# Group Testing with Two Defectives

CHRISTIAN DEPPE (Bielefeld)

We consider the classical group testing problem to find $D = 2$ defective elements of $N$ elements. We present adaptive algorithm such that the $(2, w_t)$ problem can be solved with $t$ tests. We show that for any $\epsilon > 0$ there exist constant k and an algorithm such that $w_t \to (1-\epsilon)2^{(t+1)/2}$ if $t$ tends to infinity.

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16 — Sektion IV — MA 551 — 15:00

# The Voronoi conjecture on parallelohedra via generating cycles of a graph

ALEXEY GARBER (Moscow)

A convex $d$-dimensional polytope $P$ is called *parallelohedron* if $\mathbb{R}^d$ can be tiled into parallel copies of $P$. One of the main conjectures in parallelohedra theory is the Voronoi conjecture that claims that every $d$-dimensional parallelohedron is an affine image of Dirichlet-Voronoi polytope of some $d$-dimensional lattice.
In this talk we will describe the general idea how to prove the Voronoi conjecture for a new class of parallelohedra using topological properties of their surface without certain faces of codimension 2. Also we will show how one can check this condition for all three- and four-dimensional parallelohedra using edge graph of dual polytopes.

This is joint work with A. Gavrilyuk and A. Magazinov from Steklov Mathematical Institute, Moscow and Delone lab.

# Freitag, 16.11.2012 — Zeit: 15:30

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17 — Sektion I — MA 548 — 15:30

## Mastermind With Many Colors

BENJAMIN DOERR (Saarbrücken)

A long-standing open problem dating back to the eighties is to determine how many guesses are needed to solve the Mastermind game with $n$ positions and $n$ colors (V. Chvátal. Mastermind. *Combinatorica*, 3:325–329, 1983). Chvátal's upper bound of $2n\log n+4n$ was subsequently improved by Chen, Cunha, and Homer (1996) to $2n\lceil\log n\rceil+2n+3$, then by Goodrich (2009) to $n\lceil\log n\rceil+3n-1$, and last year by Jäger and Peczarski to $n\lceil\log n\rceil+n$. We now show that $O(n\log\log n)$ guesses suffice.

This is joint work with Reto Spöhel (Berner FH), Henning Thomas (ETH Zürich), and Carola Winzen (LIAFA Paris).

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18 — Sektion II — MA 549 — 15:30

## Marked order polytopes, monotone triangle reciprocity, and partial colorings of graphs

KATHARINA JOCHEMKO (Berlin)

Stanley considered the problem of counting order preserving maps from a finite poset $P$ into the $n$-chain. He showed that their number is given by a polynomial in the positive integer $n$. We consider the following more general problem: Given a finite poset $P$, a subposet $A$ which contains all minimal and maximal elements of $P$, and an order preserving map $\lambda\colon A\to\mathbb{Z}$. What is the number of integral valued order preserving maps with domain $P$ extending $\lambda$? Such extensions naturally correspond to lattice points in certain polytopes parametrized by $\lambda$. We show that the function counting integral valued extensions is a piecewise polynomial in the values of $\lambda$ and we give an interpretation for evaluation at order reversing maps. We use these results to give a geometric proof of a combinatorial reciprocity for monotone triangles due to Fischer and Riegler (2011) and we extend results of Herzberg and Murty (2007) regarding completions of partial colorings of graphs.

This is joint work with Raman Sanyal.

19 — Sektion III — MA 550 — 15:30

# A note on the problem of nonnegative $k$-subset sums

HAROUT AYDINIAN (Bielefeld)

Given a set of $n$ real numbers with nonnegative sum, consider the family of all its $k$-element subsets with nonnegative sums. What is the minimum size $f(n,k)$ of this family? This question was first asked by Bier in 1984. Manickam and Miklós (1987) conjectured that $f(n,k) = \binom{n-1}{k-1}$ for all $n \geq 4k$. Recently Alon et al. (2012) obtained currently the best result in this direction, proving that the conjecture holds for $n \geq 33k^2$. In this talk we show that this problem is closely related to a problem raised by Ahlswede and Khachatrian (2001), which in a special case can be formulated as follows: determine the minimal number $g(n,k)$, such that any $k$-uniform hypergraph on $n$ vertices having $g(n,k)+1$ edges has a perfect fractional matching. We show that $f(n,k) \geq \binom{n}{k} - g(n,k)$ and thus results obtained for $g(n,k)$ can be applied for the former problem. Moreover, we conjecture that these problems have in general the same solution, namely $f(n,k) = \binom{n}{k} - g(n,k) = \min_{1 \leq a \leq n-1} \sum_{i \geq ak/n} \binom{a}{i}\binom{n-a}{k-i}$.
This is joint work with Vladimir Blinovsky.

20 — Sektion IV — MA 551 — 15:30

# A characterization of the single-crossing domain

JIEHUA CHEN (Berlin)

We characterize single-crossing preference profiles in terms of two forbidden substructures, one of which contains three voters and six (not necessarily distinct) alternatives, and one of which contains four voters and four (not necessarily distinct) alternatives. We also provide an efficient way to decide whether a preference profile is single-crossing.

This is joint work with Robert Bredereck (TU Berlin) and Gerhard J. Woeginger (TU Eindhoven).

# Freitag, 16.11.2012 — Zeit: 16:00

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21 — Sektion I — MA 548 — 16:00

## A fast winning strategy for Maker in the Spanning tree game

ANITA LIEBENAU (Berlin)

For strong positional games, hardly any explicit strategies are known. However, fast winning strategies for Maker in weak games can, if applied suitably, yield explicit strategies for the first player in the corresponding strong game. In this talk, after defining weak and strong games, we explain this connection introduced by Ferber and Hefetz and present almost optimal fast winning strategy when Maker's goal is to claim the edge set of a given spanning tree.

This is joint work with Dennis Clemens, Asaf Ferber, Roman Glebov and Dan Hefetz.

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22 — Sektion II — MA 549 — 16:00

## The Dimension of Posets with Planar Cover Graphs

VEIT WIECHERT (Berlin)

Kelly showed that there exist planar posets of arbitrarily large dimension, and Streib and Trotter showed that the dimension of a poset with a planar cover graph is bounded in terms of its height. We continue the study of conditions that bound the dimension of posets with planar cover graphs. We show that if $P$ is poset with a planar comparability graph, then the dimension of $P$ is at most four. We also show that if $P$ has an outerplanar cover graph, then the dimension of $P$ is at most four. Both inequalities are best possible.

This is a joint work with Stefan Felsner and William T. Trotter

23 — Sektion III — MA 550 — 16:00

# On a problem about the modular inversion

GOHAR KYUREGHYAN (Magdeburg)

The classical modular inversion considers the problem of inverting all integers $d$ modulo a fixed integer $m$ such that $\gcd(m, d) = 1$. Motivated by some applications arisen in the study of special mappings on finite fields, we consider a dual problem: Given a fixed integer $d$ and a prime $p$, find the inverse of $d$ modulo all $p^n - 1$ explicitly. In the talk we present some general observations on this problem and describe several classes of integers $d$ for which it could be solved.

This is joint work with V. Suder (INRIA Paris-Rocquencourt).

24 — Sektion IV — MA 551 — 16:00

# Spherical tilings by congruent quadrangles

NICO VAN CLEEMPUT (Ghent)

A spherical tiling is an edge-to-edge partition of the unit sphere into spherical polygons. Each spherical polygon is called a tile. If all tiles are congruent, then it follows from Euler's formula that those tiles are either 3-, 4- or 5-gons.
In 2002, Ueno and Agaoka completed the classification of spherical tilings by congruent triangles. Using their result, Akama and Sakano recently completed the classification of spherical tilings by congruent quadrangles that can be divided into two congruent triangles.
In this talk we will explain the planned approach to classify the remaining spherical tilings by congruent quadrangles and we will give some results which have been obtained at this point.

This is joint work with Akama Yohji and Gunnar Brinkmann

# Freitag, 16.11.2012 — Zeit: 16:45

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25 — Sektion I — MA 548 — 16:45

## Instance-sensitive robustness guarantees for sequencing problems

NICOLE MEGOW (Berlin)

Sequencing problems with an unknown covering or packing constraint appear in various applications, e.g., in computing environments with uncertain run-time availability. A sequence is called $\alpha$-robust when, for any possible constraint, the maximal or minimal prefix of the sequence that satisfies the constraint is at most a factor $\alpha$ from an optimal packing or covering. It is known that the covering problem always admits a $4$-robust solution, and there are instances for which this factor is tight. For the packing variant no such constant robustness factor over all instances is possible. However, in both cases, many problem instances allow for a much better robustness guarantee than the pathological worst-case instances.Therefore, we aim for more meaningful, instance-sensitive robustness guarantees. We present an algorithm that constructs for each instance a solution with a robustness factor arbitrarily close to optimal. We hope that the idea of instance-sensitive performance guarantees inspires to revisit other optimization problems and design algorithm tailored to perform well for each individual instance.

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26 — Sektion II — MA 549 — 16:45

## Constructing Complicated Spheres as Test Examples for Homology Algorithms

MIMI TSURUGA (Berlin)

Recent advances in computing the homology of simplicial complexes employ random discrete Morse theory as a preprocess. Research in this area has lead to the need to calculate a complicatedness factor for these complexes. We present an infinite series of examples with “highcomplicatedness that have been constructed to test some of the latest algorithms under development. This family of 4-spheres (known as the Akbulut-Kirby spheres) are, apart from the first few examples, candidate examples for exotic 4-spheres, i.e., potential counterexamples for the smooth Poincaré conjecture in dimension 4. We also present the construction of Mazur’s 4-manifold, a contractible combinatorial 4-manifold different from a 4-ball.

27 — Sektion III — MA 550 — 16:45

# Infinite dimensional Gaussian limiting distributions in combinatorics

BERNHARD GITTENBERGER (Wien)

We study random combinatorial structures involving an infinite number of parameters. The random variables are encoded in generating functions satisfying a (possibly infinite) system of functional equations. We prove sufficient conditions under which these random variables tend to an infinite dimensional Gaussian limiting distribution.

This is joint work with Michael Drmota and Johannes Morgenbesser

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28 — Sektion IV — MA 551 — 16:45

# The Maximum Dispersion Problem

JÖRG KALCSICS (Clausthal-Zellerfeld)

In the maximum dispersion problem, a given set of objects has to be partitioned into a number of groups. Each object has a non-negative weight and each group has a different target weight. In addition to meeting the target weight of each group, all objects assigned to the same group should be as dispersed as possible with respect to some distance measure between pairs of objects. We develop a linear programming formulation for the problem and study a specific relaxation that enables us to derive tight bounds that improve the effectiveness of the formulation. Thereby, we obtain an upper bound by finding cliques of given size in an auxiliary graph. A lower bound is derived based on the relation of the optimal solution of the relaxation to the chromatic number of a series of auxiliary graphs. Finally, we propose an exact solution scheme for the maximum dispersion problem and present computational experiments to assess its efficiency.

This is joint work with Elena Fernández (Universitat Politècnica de Catalunya, Barcelona, Spain) and Stefan Nickel (Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany).

# Freitag, 16.11.2012 — Zeit: 17:15

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29 — Sektion I — MA 548 — 17:15

## Matroid Secretary Problems: Free Order Model and Laminar Case

JOSÉ A. SOTO (Berlin)

In the standard matroid secretary problem we want to incrementally construct an independent set of large weight on a matroid in which the weights are revealed in random order. A well-known conjecture claims the existence of a constant-factor approximation for this problem.
The free order model is a relaxed version of the problem above with the only difference that one can choose the order in which elements reveal their weights. In this talk, we will present the first constant factor approximation for this relaxed version.
If time permits, we will also discuss the standard matroid secretary problem on laminar matroids. Recently, a constant factor approximation using a clever but rather involved method and analysis was found by Im and Wang. We give an alternative stronger and simpler algorithm based on reducing the problem to a matroid secretary problem on a partition matroid.

This is joint work with Patrick Jaillet (MIT) and Rico Zenklusen (Johns Hopkins University).

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30 — Sektion II — MA 549 — 17:15

## On Simple Extended Formulations of Polytopes

MATTHIAS WALTER (Magdeburg)

We introduce the *simple extension complexity* of a polytope $P$ as the smallest number of facets of any *simple* polytope which can be projected onto $P$.
In this talk we will briefly sketch some examples of compact simple extended formulations and then turn to techniques for showing lower bounds on the simple extension complexity. It turns out that several classes of polytopes have a simple extension complexity in the order of the number of vertices. Among them are the $k$-hypersimplex in $\mathbb{R}^n$, the spanning tree polytope of the complete graph $K_n$ on $n$ nodes, the flow polytopes for non-trivial directed acyclic graphs, and the perfect matching polytope of the $K_{2n}$. To obtain the matching result we improve a result of Padberg and Rao on the adjacency structures of perfect matching polytopes.

Joint work with Volker Kaibel, OvGU

31 — Sektion III — MA 550 — 17:15

# Algebraic and combinatorial approaches to low-rank matrix completion

LOUIS THERAN (Berlin)

Let $A$ be an $m \times n$ matrix of known rank $r$. A question that comes from machine learning is: *which sets of entries determine the entire matrix* $A$? If the matrix $A$ is generic, then matrix completability is a property of the bipartite graph that has vertex set $[m] \cup [n]$ and an edge $\{i, j\}$ if the corresponding entry is known. I'll discuss some combinatorial properties of completable graphs and the relationship to framework rigidity and matroids.

Joint with with Franz Király, Ryota Tomioka, and Takeaki Uno.

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32 — Sektion IV — MA 551 — 17:15

# Reconstructing functions of several arguments from identification minors

ERKKO LEHTONEN (Luxembourg)

This talk reports our recent study [1] of the problem whether a function $f\colon A^n \to B$ can be reconstructed from its identification minors, i.e., functions derived from $f$ by identifying a pair of arguments. We focus on functions with a unique identification minor. We show that totally symmetric functions are reconstructible, provided that $n \geq |A| + 2$. We also show that the class of functions (of sufficiently large arity) that are weakly determined by the order of first occurrence is weakly reconstructible; furthermore, in the case that $|A| = 2$, this class is reconstructible.

**References**

[1] E. LEHTONEN, On the reconstructibility of totally symmetric functions and of other functions with a unique identification minor, arXiv:1208.3110.

# Freitag, 16.11.2012 — Zeit: 17:45

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33 — Sektion I — MA 548 — 17:45

## A competitive algorithm for the Economic Lot Sizing Problem

CLAUDIO TELHA (Louvain)

In the Economic Lot Sizing Problem (ELS), a facility faces variable demands over a discrete and finite time horizon. The objective is to find production times so that this demand is satisfied at minimum overall ordering and holding costs. We consider an on-line version of this problem where the decision to produce at a certain time must be committed without having any information about future demands. In this setting, Bitran, Magnanti and Yanasse gave a simple deterministic algorithm that is 2-competitive. Later, Van den Heuvel and Wagelmans showed that no deterministic algorithm can be d-competitive for any $d < 2$. In this talk we present a randomized algorithm for the on-line ELS problem which is, in expectation, d-competitive for some $d < 2$.

Joint work with M. Van Vyve.

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34 — Sektion II — MA 549 — 17:45

## Containment Problems for Polytopes and Spectrahedra

CHRISTIAN TRABANDT (Frankfurt am Main)

Spectrahedra are the feasible regions of semidefinite programs. In this talk we study the computational questions whether a given polytope or spectrahedron $S_A$ (as given by a linear matrix pencil $A(x)$) is contained in another one $S_B$.
Our results both concern the computational complexity (extending results on the polytope/polytope-case by Gritzmann and Klee) as well as sufficient conditions to certify containment (whose study was initiated by Ben-Tal, Nemirovski and Helton, Klep, McCullough).

35 — Sektion III — MA 550 — 17:45

# Low autocorrelation sequences

KAI-UWE SCHMIDT (Magdeburg)

The identification of binary sequences with small mean-squared aperiodic autocorrelation (or, equivalently, with large merit factor) is an old problem of complex analysis and combinatorial optimisation, with practical importance in digital communications engineering and condensed matter physics. It has been known since 1988 that there exists a family of binary sequences whose merit factors equal $6$ asymptotically and it was conjectured that $6$ is indeed an asymptotic upper bound for all binary sequences. However, in 2004, Borwein, Choi, and Jedwab presented a construction of binary sequences whose merit factors are consistently greater than $6$ and conjectured that these sequences break the 1988 record. I will show that this conjecture is true and therefore disprove the conjecture that $6$ is the largest possible asymptotic merit factor. The methods include finite fields and character sums and can be applied to settle further conjectures in this area.

(This is joint work with Jonathan Jedwab and Daniel J. Katz.)

36 — Sektion IV — MA 551 — 17:45

# For almost all graphs H, almost all H-free graphs have a linear homogeneous set.

ROSS KANG (Amsterdam)

There have been various structural attacks upon a conjecture of Erdos and Hajnal from extremal graph theory. This notorious open problem is concerned with understanding how the exclusion from G a fixed graph H as an induced subgraph affects the maximum size of a homogenous set (a clique or stable set) in G. I will focus on recent asymptotic, probabilistic formulations of the conjecture, proved using Szemerédi regularity, one of which is joint work with Colin McDiarmid, Bruce Reed and Alex Scott.

# Samstag, 17.11.2012 — Zeit: 10:00

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37 — Sektion I — MA 548 — 10:00

## On visibility representations of directed graphs

MARIA AXENOVICH (Karlsruhe)

A k-bar visibility representation of a digraph G assigns each vertex at most k horizontal segments in the plane so that G has an arc uv if and only if some segment for u "sees" some segment for v above it by a vertical line of sight. The (bar) visibility number b(G) of a digraph G is the least k permitting such a representation.
In this talk we shall discuss b(G) for general digraphs as well as for planar digraphs and transitive tournaments.

This is a joint work with Andrew Beveridge, Joan Hutchinson and Douglas West.

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38 — Sektion II — MA 549 — 10:00

## Randomized Rumor Spreading in Social Networks

TOBIAS FRIEDRICH (Jena)

Understanding structural and algorithmic properties of complex networks is important not only because of the huge economic impact of the internet. It has been observed that information spreads extremely fast in social networks. We analyze how news spread in the preferential attachment (PA) model of Barabasi/Albert. For a simple synchronous protocol, we prove a rumor spreading time of Theta(log n/loglog n) on PA graphs with n nodes, which is less than on most other graph topologies. Moreover, we prove that introducing asynchrony reduces this time even further.

39 — Sektion III — MA 550 — 10:00

# On the KŁR conjecture for sparse random graphs

MATHIAS SCHACHT (Hamburg)

The KŁR conjecture of Kohayakawa, Łuczak, and Rödl is a statement that allows one to prove that asymptotically almost surely all subgraphs of the random graph $G(n,p)$ satisfy an embedding lemma which complements the sparse version of Szemerédi's regularity lemma for subgraphs of $G(n,p)$. We prove a variant of this conjecture which is sufficient for most applications to random graphs. In particular, our result implies a number of recent probabilistic threshold results for random graphs and has several further applications.

This is joint work with Conlon, Gowers, and Samotij

40 — Sektion IV — MA 551 — 10:00

# On a Strong Perfect Digraph Theorem

STEPHAN DOMINIQUE ANDRES (Hagen)

For a digraph $D = (V, A)$, the *symmetric part* $S(D)$ is the digraph $(V, A_2)$, where $(v, w) \in A_2$ if $(v, w) \in A$ and $(w, v) \in A$. Graphs can be identified with digraphs $D$ with the property $D = S(D)$. Replacing the chromatic number resp. the clique number by Neumann-Lara's dichromatic number resp. the size of the largest symmetric clique, we extend the notion of perfect graphs to arbitrary digraphs. We prove that a digraph $D$ is perfect if, and only if, $D$ does not contain induced directed cycles of length $\geq 3$ and $S(D)$ is a perfect graph. Using the Strong Perfect Graph Theorem we obtain as a corollary an explicit characterization of perfect digraphs by a set of forbidden induced subdigraphs. The result also implies that any polynomial algorithm for $k$-colouring of perfect graphs can be used for $k$-colouring of perfect digraphs. Furthermore, in contrast to the case of perfect graphs, we prove that the recognition of perfect digraphs is co-$\mathcal{NP}$-complete.

This is joint work with Winfried Hochstättler.

# Samstag, 17.11.2012 — Zeit: 10:30

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41 — Sektion I — MA 548 — 10:30

## Degree-constrained orientations of embedded graphs

JANNIK MATUSCHKE (Berlin)

We consider the problem of orienting the edges of an embedded graph in such a way that the in-degrees of both the nodes and faces meet given values. We show that the number of feasible solutions is bounded by $2^{2g}$, where $g$ is the genus of the embedding, and all solutions can be determined within time $O(2^{2g}|E|^2+|E|^3)$. In particular, for planar graphs the solution is unique if it exists and in general the problem of finding a feasible orientation is fixed-parameter tractable in $g$. In sharp contrast to these results, we show that the problem becomes NP-complete even for a fixed genus if only upper and lower bounds on the in-degrees are specified instead of exact values.

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42 — Sektion II — MA 549 — 10:30

## Minimum Entropy Submodular Optimization (and Fairness in Cooperative Games)

GABRIEL ISTRATE (Timişoara)

We study minimum entropy submodular optimization, that combines the minimum entropy set cover problem, Halperin and Karp (2005) Cardinal et al. (2008) with the submodular set cover problem (Wolsey (1982), Fujita (2000) , etc). We give a general bound of the approximation performance of the greedy algorithm. The main result shows that the performance of the algorithm depends on a packing constant $\alpha \geq 1$ that measures the quality of transformingthe optimal into the greedy solution. This packing constant has an interpretation in terms of a particular type of biased network flows. As an application we rederive known results for the Minimum Entropy Set Cover and Orientation problems, and obtain a new bound for a new problem called Minimum Entropy Spanning Tree. Our approach is motivated by a worst-case approach to fairness in concave cooperative games. Further connections with the theory of (poly)matroids will be discussed.

Joint work with Cosmin Bonchiş (West University of Timişoara)

# A bound on permutation codes

JÜRGEN BIERBRAUER (Michigan)

A **permutation code** of length $n$ is a subset of the symmetric group $S_n$. A permutation code of minimum distance $n-1$ has at most $n(n-1)$ elements, with equality if and only if a projective plane of order $n$ exists. A distance $n-1$ permutation code of size $n(n-1)$ is a sharply 2-transitive set of permutations. Call a distance $n-1$ code **embeddable** if it is contained in a sharply 2-transitive set and call $\delta = n^2 - n - |C|$ the **deficiency** of the distance $n-1$ permutation code $C$. Quistorff (2006) showed that each deficiency 1 permutation code is embeddable. We show the following: (1) Each deficiency 2 permutation code of length $n$ is embeddable. (2) Each deficiency $\delta$ permutation code of length $n$ is embeddable provided $(\delta^2-1)(\delta+1)^2 < 27(n+2)/16$. Most interesting are the cases when it is known that no projective plane of order $n$ exists. For $n = 6$, the largest cardinality of a distance 5 permutation code is known to be 18, see [4, 5]. For $n = 10$ the largest known such code has 49 codewords, see [3]. The new upper bound is 87.
Our proof is an adaptation of the method used by Bruck for the celebrated theorem which states that a set of $n-1-\delta$ pairwise orthogonal latin squares of order $n$ is embeddable in a complete set provided $\delta$ is small with respect to $n$.
Motivation for studying permutation codes comes from data transmission over power lines, see [8, 2, 1]. There is also an application to the design of block ciphers [7]. (This is joint work with Klaus Metsch.)

[1] W. Chu, C. Colbourn, P. Dukes: *Constructions for permutation codes in powerline communications, Designs, Codes and Cryptography* **32** (2004), 51-64.
[2] H.C. Ferreira, A.J.H. Vinck: *Inference cancellation with permutation trellis arrays, Proc. IEEE Vehtcular Technology Conf.* 2000, 2401-2407.
[3] I. Janiszczak, R. Staszewski: *An improved bound for permutation arrays of length 10,* manuscript.
[4] T. Kløve, *Classification of permutation codes of length 6 and minimum distance 5 Internat. Symposium on Info. Theory and its Applications*, Honolulu 2000, 465-468.
[5] T. Kløve: *A combinatorial problem motivated by a data transmission application,* CRC Press 2004.
[6] J. Quistorff: *A survey on packing and covering problems in the Hamming permutation space, Electron. J. Comb.* (2006), A1.
[7] D.R. de la Torre, C.J. Colbourn, A.C.H. Ling: *An application of permutation arrays to block ciphers, Congr. Numer.* **145** (2000), 5-7.
[8] A.J. Han Vinck: *Codes modulation for powerline communications, AE Int. J. of Electr. and Commun.* **54** (2000), 45-49.



# The methods of reduction of simple and weighted singular graphs

ANNA BIEŃ (Katowice)

We consider the problem of singularity for simple and weighted graphs, and present a solution to the problem for planar grids. In order to prove the formula for calculating the determinant of any planar grid, we introduce the method of contracting $P_5$ paths.
The methods of adding and subtracting vertices are applied for transforming weighted graphs. In particular, to calculate the determinant of the adjacency matrix of a weighted path and a weighted cycle. Further, simple graphs are treated as weighted graphs whose weight is a binary function. We allow that a simple graph is transformed to a weighted graph and use given methods. The formula of Harary can be applied to calculate the determinant of the adjacency matrix of a graph with a sufficiently small set of sesquivalent spanning subgraphs.
The methods of adding and subtracting vertices are applied to prove the non-singularity of a certain class of hexagonal chains.

# Samstag, 17.11.2012 — Zeit: 11:00

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45 — Sektion I — MA 548 — 11:00

## New bijection between bipolar orientations and blossoming trees

MARIE ALBENQUE (Paris)

I will present in this talk a generic construction to obtain one-to-one correspondences between blossoming trees and planar maps. This construction is motivated by the fact that bijective constructions between trees and planar maps are often powerful tools to enumerate planar maps and more generally to get a better insight at their structure.
An application of this construction to bipolar orientations will then be described and we will see how the blossoming trees obtained can be encoded by non-intersecting triple of paths. This yields a new bijection between bipolar orientations and triple of paths as well as a new proof for the enumeration of bipolar orientations.

This is joint work with Dominique Poulalhon.

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46 — Sektion II — MA 549 — 11:00

## On graph identification problems and the special case of identifying vertices using paths

MATJAŽ KOVŠE (Leipzig)

In this talk we aim to study the new optimization problem of identifying the vertices of a graph by means of paths, which we call the identifying path cover problem. We first relate this problem to a large number of other problems related to this study and review a part of the associated literature on minimum test cover problem (also known as minimum test collection problem, minimum test set problem) minimum identification problem, discriminating code problem, minimum set cover problem, identifying code problem and watching systems. We investigate the identifying path cover problem in some families of graphs such as paths, cycles, trees, hypercubes. We give some lower and upper bounds on the minimum size of an identifying path cover for general graphs, and discuss their tightness. We further investigate the computational complexity of the associated optimization problem.

This is joint work with Florent Foucaud (Univ. Bordeaux)

47 — Sektion III — MA 550 — 11:00

# Non-trivial lower bounds for packing problems

GUNTER LASSMANN (Berlin)

The problem of packing equal objects (i.e circles, squares, triangles...) in a minimal container (i.e. circle, square, triangles...) has been investigated for many years and has produced many results. Most results show best packings, only few results obtain non-trivial lower bounds of the size of the container. For example Erich Friedman shows in his survey about squares in squares a list of non-trivial lower bounds.

We present a method, combining packing and covering, to compute non-trivial lower bounds. We obtain 2-layer tiles: The first layer is the original non-overlapping figure, the second layer is another overlapping figure. The overlapping figure also is allowed to overlap across the boundary of the container. We discuss the proper choice of the form of 2-layer tile and its consequences to the lower bound. The method results many new results for Erich Friedmann's list for squares in squares, and non-trivial lower bounds for circles in squares, circles in circles, circles in triangles, circles in hexagons, squares in circles. In many cases the lower bounds are tight.

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48 — Sektion IV — MA 551 — 11:00

# Proof of Caccetta-Häggkvist conjecture for in-tournaments. Pancyclicity

NICOLAS LICHIARDOPOL (Salon)

In 1998, M. Tewes and L. Volkmann proved (see [1]) that for an integer $k \geq 3$, every in-tournament of minimum in-degree $d \geq 1$ and of order at most $kd$ contains a directed cycle of length at most $k$. In other words, they proved that the Caccetta-Häggkvist conjecture (relatively to the minimum in-degree) is true for in-tournaments. In the same paper, they proved also that every strong in-tournament of minimum in-degree $d$ and of order at most $3d$ is pancyclic. In our paper, we prove that for an integer $k \geq 3$, every in-tournament of minimum out-degree $d \geq 1$ and of order at most $kd$ contains a directed cycle of length at most $k$, which means that the Caccetta-Häggkvist conjecture (relatively to the minimum out-degree) is true for in-tournaments. We prove also that every strong in-tournament of minimum out-degre $d$ and of order at most $3d$ is pancyclic.

[1] M. Tewes, L. Volkmann, On the cycle structure of in-tournaments, Australas. Journ. of Combinatorics, 18 (1998), 293-301.

# Samstag, 17.11.2012 — Zeit: 11:30

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49 — Sektion I — MA 548 — 11:30

## Improper choosability of planar graphs

DIRK OLIVER THEIS (Magdeburg)

A graph $G$ is *improper* $(k,d)$*-choosable,* if, for every selection of a set of $k$ colors for each vertex of $G$, there is a choice of one of those colors for each vertex such that no vertex has more than $d$ neighbors of the same color. (In other words, the graphs induced by the color classes have maximum degree $d$.) We study $(3,1)$-choosability of planar graphs. Improving on known results, we show that every $C_4$-free planar graph is $(3,1)$-choosable. We also discuss a number of open problems. (With Babak Farzad, Brock University, ON)

50 — Sektion II — MA 549 — 11:30

## Random subgraphs in Cartesian powers of regular graphs

FELIX JOOS (Ulm)

Let $G$ be a connected $d$-regular graph with $k$ vertices. We investigate the behaviour of a spanning random subgraph $G_p^n$ of $G^n$, the $n$-th Cartesian power of $G$, which is constructed by deleting each edge independently with probability $1-p$. We prove that $\lim_{n\to\infty} P[G_p^n \text{ is connected}] = e^{-\lambda}$, if $p = p(n) = 1 - \left(\frac{\lambda_n^{1/n}}{k}\right)^{1/d}$ and $\lambda_n \to \lambda > 0$ as $n \to \infty$. This extends a result of L. Clark, Random subgraphs of certain graph powers, *Int. J. Math. Math. Sci.*, 32(5):285-292, 2002.

51 — Sektion III — MA 550 — 11:30

# $(2^n, 2^n, 2^n, 1)$-relative difference sets, projective planes and $Z_4$-linear Kerdock codes

YUE ZHOU (Magdeburg)

Let $G$ be a group of order $\nu = mn$, $N \subseteq G$ and $|N| = n$. A $k$-subset $D$ of $G$ is called a *relative difference set* with parameters $(m, n, k, \lambda)$ (abbreviated to $(m, n, k, \lambda)$-RDS), if the list of differences of $D$ covers every element in $G \setminus N$ exactly $\lambda$ times, and the elements in $N \setminus \{0\}$ not at all. One important case is the $(q, q, q, 1)$-RDS, because Ganley showed that it can be uniquely extended to a projective plane $\Pi$.
In this talk, we concentrate on the case $q = 2^n$. First we show that every $(2^n, 2^n, 2^n, 1)$-RDS in $\mathbb{Z}_4^n$ relative to $\mathbb{Z}_2^n$ can also be represented by a polynomial $f(x) \in \mathbb{F}_{2^n}[x]$, if $f(x + a) + f(x) + xa$ is a permutation for each nonzero $a$. We call such $f$ *planar function* on $\mathbb{F}_{2^n}$. Actually, they are equivalent to $\mathbb{Z}_4$-linear Kerdock codes. Secondly, we obtain sufficient and necessary conditions of $\Pi$ to be a semifield plane. Finally we show the nonexistence of the planar function with exactly two elements in its image set.

52 — Sektion IV — MA 551 — 11:30

# The circular flow numbers of regular graphs

MICHAEL SCHUBERT (Paderborn)

In this talk, we determine the circular flow numbers of regular graphs. Let $\mathcal{F}^c$ be the set of the circular flow numbers of graphs, and $\mathcal{F}^c_d$ be the set of the circular flow numbers of $d$-regular graphs. If $d$ is even, then $\mathcal{F}^c_d = \{2\}$. For $d = 2k+1$ $(k \geq 1)$ it is known that $\mathcal{F}^c_{2k+1} \cap (2 + \frac{1}{k}; 2 + \frac{2}{2k-1}) = \emptyset$. We show that $\mathcal{F}^c_{2k+1} = (\mathcal{F}^c - [2; 2 + \frac{2}{2k-1})) \cup \{2 + \frac{1}{k}\}$. Hence the interval $(2 + \frac{1}{k}; 2 + \frac{2}{2k-1})$ is the only gap for circular flow numbers of $(2k+1)$-regular graphs between $2 + \frac{1}{k}$ and $5$. Furthermore, if Tutte's 5-flow conjecture is false, then it follows, that gaps for circular flow numbers of graphs in the interval $[5; 6]$ are due for all graphs not just for regular graphs.

This is joint work with Eckhard Steffen

# Samstag, 17.11.2012 — Zeit: 13:30

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53 — Sektion I — MA 548 — 13:30

## Mathematical Core Technology for a Traffic Flow System Using the Model Predictive Control of Large and Complex Networks

JUNICHI NAKAGAWA (Futtsu)

Traffic jams have caused a lot of adverse effects on our society regarding fuel consumption, exhaust gas, noise, physical distribution, and so on. An important theme of FIRST, Aihara Innovative Mathematical Modeling Project that is a big national project in Japan, is the establishment of mathematical core technologies regarding traffic control.
We study the real-time optimization of large scale and complex systems along with controls for multiscalability between micro-scale objects that correspond to vehicles and macro-scale ones that correspond to traffic flow. Our goal regarding this project is as follows.
(1) Mathematical modeling for complex systems integrated by traffic flow, road and traffic signal networks, and sensor networks.
(2) Establishment of mathematical core technology for the control of large-scale and complex systems.

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54 — Sektion II — MA 549 — 13:30

## Vertex-transitive triangulations of the $3$-sphere with edge valences bounded by five

FLORIAN FRICK (Berlin)

A simplicial $3$-sphere, where every edge is contained in at most five tetrahedra admits a natural metric that is everywhere positively curved. This local curvature bound implies that there exist only finitely many distinct combinatorial types of such $3$-spheres and these $4761$ complexes were completely enumerated by Frank Lutz and John M. Sullivan. In this talk we want to investigate those ten examples whose combinatorial symmetry group acts transitively on the vertices. In particular, we will present one example that allows no edge contractions and is not even weakly vertex-decomposable. The polytopality of this ten-vertex triangulation has not been decided thus far. Moreover, we will make comments towards a complete description of all these $4761$ $3$-spheres.

55 — Sektion III — MA 550 — 13:30

# Skew Hadamard Difference Sets from Dickson Polynomials of Order 7

QI WANG (Magdeburg)

Skew Hadamard difference sets are an interesting topic of study for over seventy years. A few families of new skew Hadamard difference sets have been discovered since 2006. Using the first kind of Dickson polynomials of order 7, we obtain a new family of skew Hadamard difference sets in $(\mathrm{GF}(3^m), +)$, where $m$ is odd and $m \not\equiv 0 \pmod 3$.

This is joint work with Cunsheng Ding and Alexander Pott.

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56 — Sektion IV — MA 551 — 13:30

# Minimum degree conditions for homomorphisms into odd cycles

SILVIA MESSUTI (Hamburg)

We study minimum degree conditions under which a graph with given odd girth has a simple structure. For example, the classical work of Andrásfai, Erdős and Sós implies that $n$-vertex graphs with odd girth $2k+1$ and minimum degree $\frac{2}{2k+1}$ must be bipartite. It seems natural to investigate the structure of graphs with given odd girth and a more relaxed minimum degree condition. Generalizing a result from Häggkvist and Jin for the case $k = 3$, we show that every $n$-vertex graph with odd girth $2k + 1$ and minimum degree $\frac{3}{4k}n$ is homomorphic to $C_{2k+1}$. Similar results were obtained by Brandt and Ribe-Baumann.

This is joint work with Mathias Schacht.

# Samstag, 17.11.2012 — Zeit: 14:00

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57 — Sektion I — MA 548 — 14:00

## Combinatorial roundness of grains in cellular microstructures

FRANK H. LUTZ (Berlin)

Polycrystalline materials are composed of crystal grains of varying size and shape, with some of the occurring grain types being more frequent than others. Almost all grains are combinatorially isomorphic to simple 3-dimensional polytopes for which the boundary surfaces of their duals are triangulated 2-dimensional spheres.
We will observe that these 2-spheres are "round" in the following combinatorial sense: there are no "short" separating cycles that partition the respective triangulations into two parts of similar sizes. In other words, almost all the examples are stacked with few vertices, flag, or close to flag.

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58 — Sektion II — MA 549 — 14:00

## Shattering, graph orientations, and connectivity

LASZLO KOZMA (Saarbrücken)

We present a connection between two seemingly disparate fields: VC theory and graph theory. This connection yields natural correspondences between fundamental concepts in VC theory, such as shattering and VC dimension, and well-studied concepts of graph theory related to connectivity, forbidden subgraphs and others. Our main tool is a generalization of the Sauer-Shelah lemma. Using this tool we derive a series of inequalities and equalities related to properties of orientations of a graph. Some of these results appear to be new, for others we give new and simple proofs.
The connection may be fruitful in the other direction as well: we show that a wide range of properties related to network flow and distance exemplify a class of extremal systems known as shattering-extremal (also known as lopsided) systems. As the understanding of these systems is considered to be incomplete, linking them to a better-understood setup in graph theory can be helpful.

This is joint work with Shay Moran.

59 — Sektion III — MA 550 — 14:00

# Naive Configurations

CHRISTOPH HERING (Tübingen)

In this talk we describe a new geometric way to construct finite projective planes and finite symmetric configurations. It concerns a first choice construction that is very elementary. Notably, it produces an interesting finite incidence geometry $\mathcal{E}(n)$ for every rational integer $n$. The structure $\mathcal{E}(n)$ is a symmetric configuration of order $n$, that is, an incidence geometry $\mathcal{E}(n) = (\mathcal{P}, \mathcal{B})$ consisting of a non-empty set $\mathcal{P}$ of elements, which we call *points*, and a set $\mathcal{B}$ of subsets of $\mathcal{P}$, which we call *blocks*, such that

(i) if $b$ and $b'$ are blocks, then $|b \cap b'| \leq 1$,

(ii) $|b| = n + 1$ for all $b \in \mathcal{B}$, and

(iii) every point $p \in \mathcal{P}$ is contained in exactly $n + 1$ blocks in $\mathcal{B}$.

Here $|\mathcal{P}| \geq n^2 + n + 1$. If $|\mathcal{P}| = n^2 + n + 1$ and $n \geq 2$, then $(\mathcal{P}, \mathcal{B})$ actually is a projective plane.
In infinitely many cases, our construction leads to the symmetric configuration $\mathcal{E}(n)$ very rapidly. We obtain, for example, a completely geometric construction of the projective planes PG(2,16) and PG(2,256) (and thereby of GF(16) and GF(256)) without requiring any algebraic foundations. In the general case, however, the calculations can be long.
But we can easily prove that for every integer $k \geq 1$ there exists a symmetric configuration with $k$ points on each line (if we allow a sufficiently large number of points).
In light of the fact that there do not exist projective planes of the orders 6 or 10, we are lead to the problem of determining $\mathcal{E}(6)$ and $\mathcal{E}(10)$. It might be interesting to know what these symmetric configurations are. Although it is possible and indeed simple to calculate $\mathcal{E}(5)$, already for $\mathcal{E}(6)$ we needed 3 months of computer time on a usual desktop PC.
With some further effort, the method can be generalized to general (possibly not symmetric) configurations. Then we obtain a much wider variety of geometries. In particular, we find many more cases which can be finished after a rather short computation. For example, we find point-line geometries of higher dimensional projective spaces, Steiner triple systems and the like.

This is joint work with Andreas Krebs and Thomas B. Edgar.

60 — Sektion IV — MA 551 — 14:00

# A k-server problem with parallel requests and unit distances

REGINA HILDENBRANDT (Ilmenau)

We consider k-server problems with parallel requests where several servers can also be located on one point. We will distinguish the surplus-situation where the request can be completely fulfilled by means of the k servers and and the scarcity-situation where the request cannot be completely met.
We use the method of the potential function in order to prove that a corresponding Harmonic algorithm is competitive for the more general k-server problem in the case of unit distances.

# Samstag, 17.11.2012 — Zeit: 14:30

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61 — Sektion I — MA 548 — 14:30

## Adaptive Algorithms for Solving Non-Linear Vector Approximation Problems : Discussion on Application of Separation Theorem

MAHMUDUL HUQ (Halle)

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62 — Sektion II — MA 549 — 14:30

## The Height Distribution of Discrete Excursions

UWE SCHWERDTFEGER (Chemnitz)

We compute the limiting distribution of height of a random discrete excursion with steps from an arbitrary finite set of integers. The result is the supremum of a Brownian excursion. With the help of the kernel method Bousquet-Mélou (2008) gave the length and height generating function in terms of Schur polynomials in the roots of the kernel. Analytic estimates on these roots allow to put the generating function in an asymptotic form amenable to a Mellin transform analysis.

This is joint work with C. Banderier.

$\boxed{\text{63 — Sektion III — MA 550 — 14:30}}$

# Vectorial bent functions

ALEXANDER POTT (Magdeburg)

Let $q$ be a prime power and let $\mathbb{F}_q$ denote the finite field with $q$ elements. An $(n, m)$ bent function $f : \mathbb{F}_q^n \to \mathbb{F}_q^m$ is a mapping such that $f(x + a) - f(x) = b$ has $q^{n-m}$ solutions for all $b \in \mathbb{F}_q^m$ and all $a \in \mathbb{F}_q^n$, $a \neq 0$. One motivation to study such functions is that they are *highly nonlinear*: For a linear mapping $f$, the mapping $f(x + a) - f(x) = b$ has $q^n$ solutions if $b = f(a)$ and $0$ otherwise. The bent function is called *quadratic* if $f(x + a) - f(x)$ is $\mathbb{F}_q$-linear. Quadratic $(n, 1)$ bent functions are easy to classify. Moreover, a classical result due to Menichetti classifies $(3, 3)$ quadratic bent functions if $q$ is . In my talk, I will discuss $(n, 2)$ quadratic bent functions, in particular the case that $q$ is odd and $n = 3$.

This is joint work with Ferruh Özbudak.

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$\boxed{\text{64 — Sektion IV — MA 551 — 14:30}}$

# Higher Inclusion Matrices

YURY PERSON (Berlin)

Let $n \geq r \geq s \geq 0$. The higher inclusion matrix $M_s^r(\binom{[n]}{r})$ is a $\{0, 1\}$-matrix whose rows are indexed by all $r$-element subsets of $[n] := \{1, 2, \ldots, n\}$ and and columns are indexed by all $s$-subsets of $[n]$ and the entry corresponding to an $r$-set $R$ and an $s$-set $S$ is $1$ if $S \subseteq R$ and $0$ otherwise.
Gottlieb's theorem from 1966 states that $M_s^r(\binom{[n]}{r})$ has the rank $\min\{\binom{n}{r}, \binom{n}{s}\}$ over $\mathbb{Q}$. Keevash asked how many rows one has to delete from $M_s^r(\binom{[n]}{r})$ to reduce its rank by $1$. We answer his question for large $n$ and study some generalizations of this problem.

Joint work with Codrut Grosu and Tibor Szabó.

**Samstag,17.11.2012 — Zeit: 15:00**

65 — Sektion II — MA 549 — 15:00

# On bounded degree spanning trees in the random graph process

ROMAN GLEBOV (Berlin)

The appearance of certain spanning subgraphs in the random graph is a well-studied phenomenon in probabilistic graph theory. In this talk, we present results on the threshold for the appearance of bounded-degree spanning trees in G(n,p) as well as for the corresponding universality statements. In particular, we show hitting time thresholds for some classes of bounded degree spanning trees.

Joint work with Daniel Johannsen and Michael Krivelevich.

66 — Sektion III — MA 550 — 15:00

# Maximal regular antichains of small regularity

THOMAS KALINOWSKI (Rostock)

Let $n \geqslant 3$ be a natural number. We study the problem to find the smallest $r$ such that there is a family $\mathcal{A}$ of 2-subsets and 3-subsets of $[n] = \{1, 2, \ldots, n\}$ with the following properties: (1) $\mathcal{A}$ is an antichain, i.e. no member of $\mathcal{A}$ is a subset of any other member of $\mathcal{A}$, (2) $\mathcal{A}$ is maximal, i.e. for every $X \in 2^{[n]} \setminus \mathcal{A}$ there is an $A \in \mathcal{A}$ with $X \subseteq A$ or $A \subseteq X$, and (3) $\mathcal{A}$ is $r$-regular, i.e. every point $x \in [n]$ is contained in exactly $r$ members of $\mathcal{A}$. We prove lower bounds on $r$, and we describe constructions for regular maximal antichains with small regularity.

This is joint work with Uwe Leck, Ian Roberts and Christian Reiher.

67 — Sektion IV — MA 551 — 15:00

# Ryser's Conjecture and Home-Base Hypergraphs

LOTHAR NARINS (Berlin)

Ryser's Conjecture states that any $r$-partite $r$-uniform hypergraph has a vertex cover of size at most $r - 1$ times the size of the largest matching. For $r = 2$, the conjecture is simply König's Theorem. It has also been proven for $r = 3$ by Aharoni using topological methods. Our ambitious goal is to try to extend Aharoni's proof to $r = 4$. We are currently still far from this goal, but we start by characterizing those hypergraphs which are tight for the conjecture for $r = 3$. These all have a very special structure, and we call hypergraphs with this structure home-base hypergraphs. Our proof of this characterization is also based on topological machinery, particularly utilizing results on the (topological) connectedness of the independence complex of the line graph of a graph.

This is joint work with Penny Haxell and Tibor Szabó.

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# Vortragende

## Restaurants close to the conference site

Here we list a couple of possibilities where you can eat on the conference days but you may find many other options in the neighbouring streets. The numbers correspond to the numbers on the map.

(1) Personalkantine at TU Berlin (open only on Friday)
Math building, 9th floor, Strasse des 17 Juni 136, 10623 Berlin.
The restaurant can easily accommodate 30 people.

(2) Cafeteria at TU Berlin (open only on Friday)
Math building, Ground floor, Strasse des 17 Juni 136, 10623 Berlin.
Up to 20 people could take this option.

(3) Café Campus (open only on Friday)
Marchstraße 6–8, 10587 Berlin.
A group up to 15–20 people could have lunch in this cafe.

(4) Restaurant/Cafeteria at the University Library
Fasanenstr. 88, 10623 Berlin.
There is sufficient capacity for about 20–25 people.

(5) TU-Mensa (open only on Friday
Hardenbergstraße 34, 10623 Berlin
Infinite capacity but no cash.

(6) Cafeteria "Skyline" (open only on Friday)
TU-Hochhaus, Ernst-Reuter-Platz 7, 10587 Berlin
Can easily accommodate 20 people.

(7) Capt'n Schillow
Straße des 17. Juni 113, 10623 Berlin.
This is a smaller restaurant for about 10 people to choose.

(8) Brot und Butter Feinkost
Hardenbergstraße 4, 10623 Berlin.
This is a smaller restaurant. Up to 5-7 people could take this option.

(9) Pasta eccetera
Ernst-Reuter-Platz 3-5, 10587 Berlin
A fast food place for about 10 people.

(10) Schweinske
Ernst-Reuter-Platz 3-5, 10587 Berlin.
This can accommodate a larger group of up to 25.

(11) Café Hardenberg
Hardenbergstraße 10, 10623 Berlin.
This cafe can easily serve 20 people.

(12) Manjurani Restaurant
Knesebeckstraße 4, 10623 Berlin.
About 15 people could safely choose this place.

(13) Ming Dynastie
Otto-Suhr Allee 11-13, 10623 Berlin 10585.
There is sufficient capacity for 15.

# Freitag, 16.11.2012, Sektion I, MA 548

## Chair:

| **Zeit** | | |
|---|---|---|
| **13:00** | **Peter Tittmann**<br>Domination Polynomials of Graphs | **1** |
| **13:27** | **Klaus Dohmen**<br>From broken circuits to broken neighbourhoods | **5** |
| **13:55** | **Martin Sonntag**<br>Neighborhood graphs of products of undirected graphs | **9** |

# Freitag, 16.11.2012, Sektion I, MA 548

Chair:

| **Zeit** | | |
|---|---|---|
| **15:00** | **Dennis Clemens**<br>On the largest tournament Maker can build | **13** |
| **15:30** | **Benjamin Doerr**<br>Mastermind With Many Colors | **17** |
| **16:00** | **Anita Liebenau**<br>A fast winning strategy for Maker in the Spanning tree game | **21** |

# Freitag, 16.11.2012, Sektion I, MA 548

## Chair:

| Zeit | | |
|---|---|---|
| **16:45** | **Nicole Megow**<br>Instance-sensitive robustness guarantees for sequencing problems | **25** |
| **17:15** | **José A. Soto**<br>Matroid Secretary Problems: Free Order Model and Laminar Case | **29** |
| **17:45** | **Claudio Telha**<br>A competitive algorithm for the Economic Lot Sizing Problem | **33** |

# Freitag, 16.11.2012, Sektion II, MA 549

Chair:

| Zeit | | |
|---|---|---|
| **13:00** | **Heiko Harborth**<br>Extremal Maximum Rectilinear Crossing Numbers of 2-regular Graphs | **2** |
| **13:27** | **Kolja Knauer**<br>Topological representation of planar partial cubes | **6** |
| **13:55** | **Tillmann Miltzow**<br>Trees in Polygons | **10** |

# Freitag, 16.11.2012, Sektion II, MA 549

Chair:

| **Zeit** | | |
|---|---|---|
| **15:00** | **Carsten Lange**<br>Realizations of associahedra and linear extensions of posets | **14** |
| **15:30** | **Katharina Jochemko**<br>Marked order polytopes, monotone triangle reciprocity, and partial colorings of graphs | **18** |
| **16:00** | **Veit Wiechert**<br>The Dimension of Posets with Planar Cover Graphs | **22** |

# Freitag, 16.11.2012, Sektion II, MA 549

Chair:

| **Zeit** | | |
|---|---|---|
| **16:45** | **Mimi Tsuruga**<br>Constructing Complicated Spheres as Test Examples for Homology Algorithms | **26** |
| **17:15** | **Matthias Walter**<br>On Simple Extended Formulations of Polytopes | **30** |
| **17:45** | **Christian Trabandt**<br>Containment Problems for Polytopes and Spectrahedra | **34** |

# Freitag, 16.11.2012, Sektion III, MA 550

## Chair:

| **Zeit** | | |
|---|---|---|
| **13:00** | **Alois Panholzer**<br>Label-patterns in mappings | **3** |
| **13:27** | **Su Wei**<br>The Balancedness of Elementary Symmetric Boolean Functions | **7** |
| **13:55** | **Sepp Hartung**<br>Metric Dimension is W[2]-complete | **11** |

# Freitag, 16.11.2012, Sektion III, MA 550

Chair:

| Zeit | | |
|---|---|---|
| **15:00** | **Christian Deppe**<br>Group Testing with Two Defectives | **15** |
| **15:30** | **Harout Aydinian**<br>A note on the problem of nonnegative $k$-subset sums | **19** |
| **16:00** | **Gohar Kyureghyan**<br>On a problem about the modular inversion | **23** |

# Freitag, 16.11.2012, Sektion III, MA 550

Chair:

| **Zeit** | | |
|---|---|---|
| **16:45** | **Bernhard Gittenberger**<br>Infinite dimensional Gaussian limiting distributions in combinatorics | **27** |
| **17:15** | **Louis Theran**<br>Algebraic and combinatorial approaches to low-rank matrix completion | **31** |
| **17:45** | **Kai-Uwe Schmidt**<br>Low autocorrelation sequences | **35** |

# Freitag, 16.11.2012, Sektion IV, MA 551

Chair:

| **Zeit** | | |
|---|---|---|
| **13:00** | **Jan Goedgebeur**<br>Ramsey numbers $R(K_3, G)$ for graphs of order 10 | **4** |
| **13:27** | **Stanisław Radziszowski**<br>New Computational Upper Bounds for Ramsey Numbers $R(3, k)$ | **8** |
| **13:55** | **René van Bevern**<br>How applying Myhill-Nerode methods to hypergraphs helps mastering the Art of Trellis Decoding | **12** |

# Freitag, 16.11.2012, Sektion IV, MA 551

Chair:

| **Zeit** | | |
|---|---|---|
| **15:00** | **Alexey Garber**<br>The Voronoi conjecture on parallelohedra via generating cycles of a graph | **16** |
| **15:30** | **Jiehua Chen**<br>A characterization of the single-crossing domain | **20** |
| **16:00** | **Nico Van Cleemput**<br>Spherical tilings by congruent quadrangles | **24** |

# Freitag, 16.11.2012, Sektion IV, MA 551

## Chair:

| **Zeit** | | |
|---|---|---|
| **16:45** | **Jörg Kalcsics**<br>The Maximum Dispersion Problem | **28** |
| **17:15** | **Erkko Lehtonen**<br>Reconstructing functions of several arguments from identification minors | **32** |
| **17:45** | **Ross Kang**<br>For almost all graphs H, almost all H-free graphs have a linear homogeneous set. | **36** |

# Samstag, 17.11.2012 , Sektion I, MA 548

## Chair:

| Zeit | | |
|---|---|---|
| 10:00 | **Maria Axenovich**<br>On visibility representations of directed graphs | **37** |
| 10:30 | **Jannik Matuschke**<br>Degree-constrained orientations of embedded graphs | **41** |
| 11:00 | **Marie Albenque**<br>New bijection between bipolar orientations and blossoming trees | **45** |
| 11:30 | **Dirk Oliver Theis**<br>Improper choosability of planar graphs | **49** |

# Samstag, 17.11.2012 , Sektion I, MA 548

Chair:

| Zeit | |
|---|---|
| **13:30** | **Junichi Nakagawa** **53**<br>Mathematical Core Technology for a Traffic Flow System Using the Model Predictive Control of Large and Complex Networks |
| **14:00** | **Frank H. Lutz** **57**<br>Combinatorial roundness of grains in cellular microstructures |
| **14:30** | **Mahmudul Huq** **61**<br>Adaptive Algorithms for Solving Non-Linear Vector Approximation Problems : Discussion on Application of Separation Theorem |

# Samstag, 17.11.2012 , Sektion II, MA 549

Chair:

| Zeit | | |
|---|---|---|
| **10:00** | **Tobias Friedrich**<br>Randomized Rumor Spreading in Social Networks | **38** |
| **10:30** | **Gabriel Istrate**<br>Minimum Entropy Submodular Optimization (and Fairness in Cooperative Games) | **42** |
| **11:00** | **Matjaž Kovše**<br>On graph identification problems and the special case of identifying vertices using paths | **46** |
| **11:30** | **Felix Joos**<br>Random subgraphs in Cartesian powers of regular graphs | **50** |

# Samstag, 17.11.2012 , Sektion II, MA 549

Chair:

| Zeit | | |
|---|---|---|
| 13:30 | **Florian Frick**<br>Vertex-transitive triangulations of the $3$-sphere with edge valences bounded by five | **54** |
| 14:00 | **Laszlo Kozma**<br>Shattering, graph orientations, and connectivity | **58** |
| 14:30 | **Uwe Schwerdtfeger**<br>The Height Distribution of Discrete Excursions | **62** |
| 15:00 | **Roman Glebov**<br>On bounded degree spanning trees in the random graph process | **65** |

# Samstag, 17.11.2012 , Sektion III, MA 550

## Chair:

| **Zeit** | | |
|---|---|---|
| **10:00** | **Mathias Schacht**<br>On the KŁR conjecture for sparse random graphs | **39** |
| **10:30** | **Jürgen Bierbrauer**<br>A bound on permutation codes | **43** |
| **11:00** | **Gunter Lassmann**<br>Non-trivial lower bounds for packing problems | **47** |
| **11:30** | **Yue Zhou**<br>$(2^n, 2^n, 2^n, 1)$-relative difference sets, projective planes and $Z_4$-linear Kerdock codes | **51** |

# Samstag, 17.11.2012 , Sektion III, MA 550

Chair:

| Zeit | | |
|---|---|---|
| **13:30** | **Qi Wang**<br>Skew Hadamard Difference Sets from Dickson Polynomials of Order 7 | **55** |
| **14:00** | **Christoph Hering**<br>Naive Configurations | **59** |
| **14:30** | **Alexander Pott**<br>Vectorial bent functions | **63** |
| **15:00** | **Thomas Kalinowski**<br>Maximal regular antichains of small regularity | **66** |

# Samstag, 17.11.2012 , Sektion IV, MA 551

Chair:

| Zeit | | |
|---|---|---|
| **10:00** | **Stephan Dominique Andres**<br>On a Strong Perfect Digraph Theorem | **40** |
| **10:30** | **Anna Bień**<br>The methods of reduction of simple and weighted singular graphs | **44** |
| **11:00** | **Nicolas Lichiardopol**<br>Proof of Caccetta-Häggkvist conjecture for in-tournaments. Pancyclicity | **48** |
| **11:30** | **Michael Schubert**<br>The circular flow numbers of regular graphs | **52** |

# Samstag, 17.11.2012 , Sektion IV, MA 551

Chair:

| **Zeit** | | |
|---|---|---|
| **13:30** | **Silvia Messuti**<br>Minimum degree conditions for homomorphisms into odd cycles | **56** |
| **14:00** | **Regina Hildenbrandt**<br>A k-server problem with parallel requests and unit distances | **60** |
| **14:30** | **Yury Person**<br>Higher Inclusion Matrices | **64** |
| **15:00** | **Lothar Narins**<br>Ryser’s Conjecture and Home-Base Hypergraphs | **67** |