Dear combinatorialists,

the Colloquium on Combinatorics was established in 1981 and has since been held annually in seven cities throughout Germany. It has grown to an established conference that covers all areas of Combinatorics and Discrete Mathematics in a broad sense, including combinatorial aspects in Algebra, Geometry, Optimization and Computer Science.

It is our great pleasure to host the 35th Colloquium on Combinatorics for the first time in Paderborn. This year we welcome 70 participants. The program includes 45 contributed talks, organised in three parallel sessions, and five invited talks on a broad range of combinatorial topics.

Please note that we have allocated 25-minute slots for the contributed talks, which includes 20 minutes for the presentation, two minutes for discussion, and three minutes for room change.

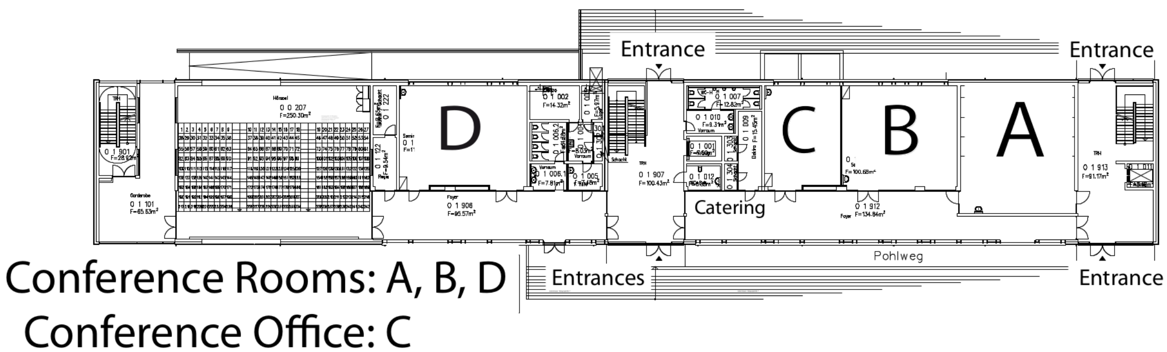
We sincerely thank our sponsors *Paderborn University*, the *Collaborative Research Centre (Sonderforschungsbereich 901) On-the-fly computing*, and *Lynx Consulting* for their technical and financial support.

We hope you enjoy the conference.

Kai-Uwe Schmidt
Eckhard Steffen

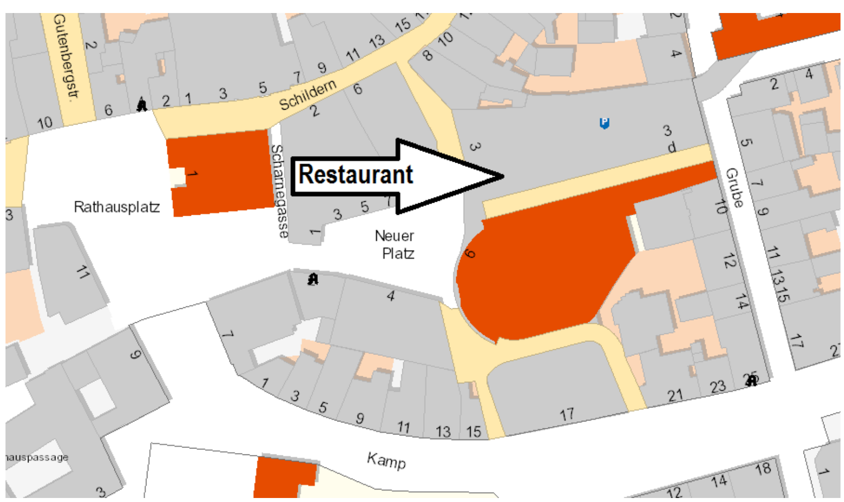
All **talks** will be in Building-O on the Main Campus

Invited talks	:	Room A
Contributed talks	:	Rooms A, B, D
Conference office	:	Room C
Coffee and snacks	:	Foyer
Library	:	Building-BI on the main campus



The **conference office** is open on Friday from 8:00 to 18:00 and on Saturday from 8:00 to 17:00. The **library** is open on Friday from 7:30 to 24:00 and on Saturday from 9:00 to 21:00.

The **dinner** will take place at the restaurant *Bobberts* (Neuer Platz 3, Downtown Paderborn) on Friday at 19:00.



Bus lines 4 (to Heinz-Nixdorf Wendeschleife) and 9 (to Hauptbahnhof) run from the university to the restaurant. The bus stops nearest to Bobberts are: *Kamp* and *Rathausplatz*.

Busses leave at bus stop *Uni/Südring* at 17:29 (Line 9), 17:47 (Line 4), 17:59 (Line 9), 18:17 (Line 4), 18:29 (Line 9), 18:47 (Line 4). It takes about 10 minutes to the restaurant.

(The complete bus schedule is available at `www.padersprinter.de`.)

Food options on campus

Location	Hours	Choice	Payment
Mensa Academica	11:15 – 13:30 (**only Friday**)	large variety	cash / DeliCard
Mensa Forum	11:15 – 13:30 (**only Friday**)	vegan/regular	**only DeliCard**
Grill/ Café	08:00 – 15:00 (**only Friday**)	burgers/steaks/salads	cash / DeliCard
One Way Snack	11:00 – 14:30 (**only Friday**)	sandwiches	**only DeliCard**
Caféte	08:00 – 15:45 on Friday 10:00 – 14:00 on Saturday	some variety	cash / DeliCard

More information: `http://www.studentenwerk-pb.de/en/food-services/`

Notice that **no cash payment** in the Mensa Forum (vegan Food) and One Way Snack is possible. You need a DeliCard. You can get a guest DeliCard at the DeliCard device, which is located in the entrance area of the Mensa.

Cost of the guest DeliCard: A deposit of 5 EUR plus the amount you top up.

Restitution of the unused amount: Use the same device to get back the unused money and the deposit.

(In case that the money return capacity is too low, a voucher will be issued. To get your money back, return this voucher to the staff in the Caféte before 14:00 on Saturday.)

Friday, 04 November 2016

09:00 - 09:05 *Opening*

09:05 - 10:00 **Xuding Zhu (Zhejiang Normal University)**
"Defective online list colouring of planar graphs"

10:00 - 10:30 *Coffee break*

10:30 - 12:05 **Parallel sessions**

12:05 - 13:15 *Lunch*

13:15 - 14:50 **Parallel sessions**

14:50 - 15:20 *Coffee break*

15:20 - 16:15 **Kathrin Klamroth (Universität Wuppertal)**
"Multiobjective combinatorial optimization"

16:15 - 16:25 *Short break*

16:25 - 17:20 **Ingo Schiermeyer (TU Bergakademie Freiberg)**
"On the chromatic number of $2K_2$-free graphs"

19:00 *Dinner* at **Bobberts** (Neuer Platz 3, Downtown Paderborn)

Saturday, 05 November 2016

08:50 - 10:00 **Parallel sessions**

10:00 - 10:30 *Coffee break*

10:30 - 12:05 **Parallel sessions**

12:05 - 13:15 *Lunch*

13:15 - 14:10 **Patric R. J. Östergård (Aalto University)**
"There is no $(4, 27, 2)$ partial geometry"

14:10 - 14:40 *Coffee break*

14:40 - 15:35 **Peter Bürgisser (Technische Universität Berlin)**
"No occurrence obstructions in geometric complexity theory"

15:35 - 15:40 *Farewell*

Detailed program on Friday, 04 November 2016

Time	Section I Room: A	Section II Room: B	Section III Room: D
09:00 - 09:05	*Opening*		
09:05 - 10:00	**Xuding Zhu** Defective online list colouring of planar graphs **Room: A**		
10:00 - 10:30	*Coffee break*		
10:30 - 10:50	**C. Zamfirescu** **1** Planar hypohamiltonian graphs	**K. Jansen** **2** Closing the gap for makespan scheduling via sparsification techniques	**C. Ikenmeyer** **3** New inequalities between plethysm coefficients and Kronecker coefficients via geometric complexity theory
10:55 - 11:15	**N. Van Cleemput** **4** On the number of hamiltonian cycles in triangulations with few separating triangles	**M. Rau** **5** Improved approximation for two dimensional strip packing with polynomial bounded width	**S. Li** **6** Fixed parameter parallel tractable problems
11:20 - 11:40	**D. Mourisse** **7** An isomorphism check for nanojoins	**S. D. Andres** **8** Game-perfect digraphs	**C. Deppe** **9** Adaptive two-sided search
11:45 - 12:05	**M. Schubert** **10** Circular flows on signed graphs	**M. Sonntag** **11** Niche hypergraphs of products of digraphs	**D. Frettlöh** **12** Noncongruent equidissections of the plane
12:05 - 13:15	*Lunch*		
13:15 - 13:35	**H. Harborth** **13** Matchstick graphs	**W. Hochstättler** **14** Sticky matroids and Kantor's conjecture	**Ch. Günther** **15** Merit factors of sequences derived from cyclotomy and difference sets
13:40 - 14:00	**H. Schrezenmaier** **16** Homothetic triangle contact representations	**M. Wilhelmi** **17** Hypermodular matroids	**A. Pott** **18** Functions on finite fields with many bent components
14:05 - 14:25	**M. Marangio** **19** Bounds for the sum choice number of graphs	**P. Tittmann** **20** Neighborhood oriented graph polynomials	**K. Tabak** **21** Normalized tiling conjecture, general abelian case
14:30 - 14:50	**T. Schweser** **22** Degree choosable signed graphs	**M. Ghebleh** **23** Ordering trees consisting of three paths according to closed walk counts	**D. Dumičić Danilović** **24** Application of a genetic algorithm on block designs
14:50 - 15:20	*Coffee break*		
15:20 - 16:15	**Kathrin Klamroth** Multiobjective combinatorial optimization **Room: A**		
16:15 - 16:25	*Short break*		
16:25 - 17:20	**Ingo Schiermeyer** On the chromatic number of $2K_2$-free graphs **Room: A**		

Detailed program on Saturday, 05 November 2016

Time	Section I Room: A	Section II Room: B	Section III Room: D
08:50 - 09:10	**J. Rollin** **25** Chromatic number of ordered graphs with forbidden ordered subgraphs	**P. Micek** **26** Planar posets have dimension linear in height	**M. Maksimović** **27** Construction of codes from orbit matrices of strongly regular graphs
09:15 - 09:35	**E. Rollová** **28** Perfect matchings of $\mathbb{Z}_2$-weighted regular bipartite graphs	**I. Albrecht** **29** Persistent violations in non-persistent gammoids.	**Y. Zhou** **30** On kernels and nuclei of rank metric codes
09:40 - 10:00	**M. Surmacs** **31** Improved bound on the oriented diameter of graphs		**U. Tamm** **33** Codes in the Shannon sphere and zero-error capacity
10:00 - 10:30	*Coffee break*		
10:30 - 10:50	**E. Lock** **34** A characterisation of g_B-perfect graphs	**A. Fischer** **35** Matroid optimisation problems with a set of upward complete monomials	**E. Triesch** **36** On competitive combinatorial group testing
10:55 - 11:15	**T. Lange** **37** Graph splitting for k-edge connected reliability	**F. Fischer** **38** Matroid optimisation problems with nested non-linear monomials in the objective function	**S. Jäger** **39** Relating domination, exponential domination, and porous exponential domination
11:20 - 11:40		**Y. Zhu** **41** A characterization of affine oriented matroid	**R. Scheidweiler** **42** Polynomials and the Erdős multiplication table problem
11:45 - 12:05		**Th. Böhme** **44** Graph metrics and crossing numbers	**L. Jin** **45** Cores, joins and the Fano-flow conjectures
12:05 - 13:15	*Lunch*		
13:15 - 14:10	**Patric R. J. Östergård** There is no $(4, 27, 2)$ partial geometry **Room: A**		
14:10 - 14:40	*Coffee break*		
14:40 - 15:35	**Peter Bürgisser** No occurrence obstructions in geometric complexity theory **Room: A**		
15:35 - 15:40	*Farewell*		

Invited talks

Peter Bürgisser (Technische Universität Berlin)	: No occurrence obstructions in geometric complexity theory
Kathrin Klamroth (Universität Wuppertal)	: Multiobjective combinatorial optimization
Patric R. J. Östergård (Aalto University)	: There is no $(4, 27, 2)$ partial geometry
Ingo Schiermeyer (TU Bergakademie Freiberg)	: On the chromatic number of $2K_2$-free graphs
Xuding Zhu (Zhejiang Normal University)	: Defective online list colouring of planar graphs

Contributed talks

Immanuel Albrecht (Hagen)	: Persistent violations in non-persistent gammoids.
Stephan Dominique Andres (Hagen)	: Game-perfect digraphs
Thomas Böhme (Ilmenau)	: Graph metrics and crossing numbers
Christian Deppe (Bielefeld)	: Adaptive two-sided search
Doris Dumičić Danilović (Rijeka)	: Application of a genetic algorithm on block designs
Anja Fischer (Göttingen)	: Matroid optimisation problems with a set of upward complete monomials
Frank Fischer (Kassel)	: Matroid optimisation problems with nested non-linear monomials in the objective function
Dirk Frettlöh (Bielefeld)	: Noncongruent equidissections of the plane
Mohammad Ghebleh (Safat/Kuwait)	: Ordering trees consisting of three paths according to closed walk counts
Christian Günther (Paderborn)	: Merit factors of sequences derived from cyclotomy and difference sets
Heiko Harborth (Braunschweig)	: Matchstick graphs
Winfried Hochstättler (Hagen)	: Sticky matroids and Kantor's conjecture
Christian Ikenmeyer (Saarbrücken)	: New inequalities between plethysm coefficients and Kronecker coefficients via geometric complexity theory
Simon Jäger (Ulm)	: Relating domination, exponential domination, and porous exponential domination
Klaus Jansen (Kiel)	: Closing the gap for makespan scheduling via sparsification techniques
Ligang Jin (Paderborn)	: Cores, joins and the Fano-flow conjectures
Thomas Lange (Mittweida)	: Graph splitting for k-edge connected reliability
Shouwei Li (Paderborn)	: Fixed parameter parallel tractable problems
Edwin Lock (Hagen)	: A characterisation of g_B-perfect graphs
Marija Maksimović (Rijeka)	: Construction of codes from orbit matrices of strongly regular graphs
Massimiliano Marangio (Braunschweig)	: Bounds for the sum choice number of graphs
Piotr Micek (Berlin)	: Planar posets have dimension linear in height

Dieter Mourisse (Ghent)	: An isomorphism check for nanojoins
Alexander Pott (Magdeburg)	: Functions on finite fields with many bent components
Malin Rau (Kiel)	: Improved approximation for two dimensional strip packing with polynomial bounded width
Jonathan Rollin (Karlsruhe)	: Chromatic number of ordered graphs with forbidden ordered subgraphs
Edita Rollová (Pilsen)	: Perfect matchings of $\mathbb{Z}_2$-weighted regular bipartite graphs
Robert Scheidweiler (Aachen)	: Polynomials and the Erdős multiplication table problem
Hendrik Schrezenmaier (Berlin)	: Homothetic triangle contact representations
Michael Schubert (Paderborn)	: Circular flows on signed graphs
Thomas Schweser (Ilmenau)	: Degree choosable signed graphs
Martin Sonntag (Freiberg)	: Niche hypergraphs of products of digraphs
Michel Surmacs (Aachen)	: Improved bound on the oriented diameter of graphs
Kristijan Tabak (Zagreb)	: Normalized tiling conjecture, general abelian case
Ulrich Tamm (Bielefeld)	: Codes in the Shannon sphere and zero-error capacity
Peter Tittmann (Mittweida)	: Neighborhood oriented graph polynomials
Eberhard Triesch (Aachen)	: On competitive combinatorial group testing
Nico Van Cleemput (Ghent)	: On the number of hamiltonian cycles in triangulations with few separating triangles
Aashish Venkatesh (Amsterdam)	: A SAT attack on killer sudokus
Michael Wilhelmi (Hagen)	: Hypermodular matroids
Carol T. Zamfirescu (Gent)	: Planar hypohamiltonian graphs
Yue Zhou (Augsburg)	: On kernels and nuclei of rank metric codes
Yida Zhu (Trier)	: A characterization of affine oriented matroid

Further participants

Razi Arshad (Magdeburg)
Hans-Jürgen Bandelt (Hamburg)
Saptarshi Bej (Paderborn)
Jens-P. Bode (Braunschweig)
Stefan Felsner (Berlin)
Pieter Goetschalckx (Gent)
Jochen Harant (Ilmenau)
Christoph Josten (Frankfurt)
Yingli Kang (Paderborn)
Kathlén Kohn (Berlin)
Alexandr Polujan (Magdeburg)
Kai-Uwe Schmidt (Paderborn)
Eckhard Steffen (Paderborn)
Michael Stiebitz (Ilmenau)

Friday, 04 Nov. 2016 — Time: 09:05 - 10:00 — Room: A

Defective online list colouring of planar graphs

XUDING ZHU (Zhejiang Normal University)

Given an integer k, the d-defective k-painting game on G is played by two players: Lister and Painter. Initially, each vertex has k tokens and is uncoloured. In each round, Lister chooses a set M of uncoloured vertices and removes one token from each chosen vertex. Painter colours a subset X of M which induces a subgraph $G[X]$ of maximum degree at most d. Lister wins the game if at the end of some round, a vertex v has no more tokens left, and is uncoloured. Otherwise, at some round, all vertices are coloured and Painter wins. We say G is d-defective k-paintable if Painter has a winning strategy in this game. We have the following results on this problem:

- Every planar graph is 3-defective 3-paintable, and this result is sharp, as there are planar graphs that are not 2-defective 3-paintable. (In contrary to the online case, it is known that every planar graph is 2-defective 3-choosable.)
- Every outerplanar graph is 2-defective 2-paintable, and this result is sharp.
- Every planar graph is 2-defective 4-paintable. We do not know if this is sharp. It is known that every planar graph is 1-defective 4-choosable.
- Every planar graph is 1-defective $(9, 2)$-paintable.

The talk contains joint work with Grzegorz Gutowski, Ming Han and Tomasz Krawczyk.

Friday, 04 Nov. 2016 — Time: 15:20 - 16:15 — Room: A

Multiobjective combinatorial optimization

KATHRIN KLAMROTH (Universität Wuppertal)

Multi-objective combinatorial optimization (MOCO) is a quickly growing field that is highly relevant for a multitude of application areas and at the same time highly challenging due to its inherent complexity. Typical examples of MOCO problems include multi-objective knapsack and assignment problems, the multi-objective TSP, and network problems like multi-objective minimum spanning tree, shortest path, and minimum cost flow problems. Formally, a general MOCO problem can be stated as $\min\{(f_1(x), \dots, f_q(x)) : x \in X\}$, where the feasible set X is a discrete set that usually has some combinatorial structure. We focus on the determination of Pareto optimal (or efficient) solutions which are those solutions for which none of the objectives can be improved without deterioration of at least one other objective. We discuss the complexity of MOCO problems, connectedness of Pareto solutions, specific biobjective problems on Matroids, and generic scalarization based algorithms. This leads to the question of concisely describing the search region and efficiently updating intersections of polyhedral cones.

Friday, 04 Nov. 2016 — Time: 16:25 - 17:15 — Room: A

On the chromatic number of $2K_2$-free graphs

INGO SCHIERMEYER (TU Bergakademie Freiberg)

In this talk we study the chromatic number of $2K_2$-free graphs. Our work was motivated by the following problem posed by Gyárfás. **Problem:** What is the order of magnitude of the smallest χ-binding function for $\mathcal{G}(2K_2)$? One of the earliest results is due to Wagon, who has considered graphs without induced matchings. **Theorem** Let G be a $2K_2$-free graph with clique number $\omega(G)$. Then $\chi(G) \leq \binom{\omega(G)+1}{2}$. In this talk we will show linear binding functions for several subclasses of $(2K_2, H)$-free graphs, where $H \in \{C_4, Diamond, House, Gem, Paw\}$. We will also present binding functions for $(2K_2, Claw)$-free graphs. Finally, we will discuss extensions of our results to subclasses of P_5-free graphs.

Saturday, 05 Nov. 2016 — Time: 13:15 - 14:10 — Room: A

There is no $(4, 27, 2)$ partial geometry

PATRIC R. J. ÖSTERGÅRD (Aalto University)

A *partial geometry* with parameters (s, t, α) consists of lines and points with the properties that (i) each line has $s + 1$ points and two distinct lines intersect in at most one point; (ii) each point is on $t + 1$ lines and two distinct points occur on at most one line; and (iii) for each point p that does not lie on a line l, there are exactly α lines through p that intersect l. The question whether there exists a (4,27,2) partial geometry has tantalized researchers for decades. Such a partial geometry would have 275 points and 1540 lines and its point graph would be a (275,112,30,56) strongly regular graph (srg). There is a unique srg with the aforementioned parameters called the *McLaughlin graph*. In this talk, a computer search for a (4,27,2) partial geometry starting from the McLaughlin graph is described. After 270 core-years and more than one physical year, the computers claim that there is no such partial geometry. This is joint work with Leonard Soicher.

Saturday, 05 Nov. 2016 — Time: 14:40 - 15:35 — Room: A

No occurrence obstructions in geometric complexity theory

PETER BÜRGISSER (Technische Universität Berlin)

The permanent versus determinant conjecture is a major problem in complexity theory that is equivalent to the separation of the complexity classes VP_{ws} and VNP. Mulmuley and Sohoni (SIAM J Comput, 2008) suggested to study a strengthened version of this conjecture over the complex numbers that amounts to separating the orbit closures of the determinant and padded permanent polynomials. In that paper it was also proposed to separate these orbit closures by exhibiting occurrence obstructions, which are irreducible representations of $GL_{n^2}(C)$, which occur in one coordinate ring of the orbit closure, but not in the other. We prove that this approach is impossible.

Friday, 04 Nov. 2016 — Time: 10:30 - 10:50

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1 — Section I — Room A — 10:30 - 10:50

Planar hypohamiltonian graphs

CAROL T. ZAMFIRESCU (Gent)

A graph is *hypohamiltonian* if it is not hamiltonian but, when removing an arbitrary vertex, it becomes hamiltonian. Chvátal asked in 1973 whether there exist planar hypohamiltonian graphs, while Grünbaum conjectured that these graphs do not exist. An infinite family of such graphs was subsequently found by Thomassen. In this talk, we (i) survey the progress made towards determining the order of the smallest planar hypohamiltonian graph, (ii) give two strengthenings of a theorem of Araya and Wiener (one of these strengthenings is joint work with Jooyandeh, McKay, Östergård, and Pettersson), (iii) extend in three directions Thomassen's result that every planar hypohamiltonian graph contains a cubic vertex, (iv) solve a problem of McKay (joint work with Goedgebeur), and (v) settle a recent question of Thomassen by proving that in planar hypohamiltonian graphs asymptotically the ratio of the minimum number of cubic vertices to the order of the graph vanishes.

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2 — Section II — Room B — 10:30 - 10:50

Closing the gap for makespan scheduling via sparsification techniques

KLAUS JANSEN (Kiel)

Makespan scheduling on identical machines is one of the most basic and fundamental packing problems studied in the discrete optimization literature. It asks for an assignment of n jobs to a set of m identical machines that minimizes the makespan. The problem is strongly NP-hard, and thus we do not expect a $(1+\epsilon)$-approximation algorithm run on a time that depends polynomially on $1/\epsilon$. Furthermore, Chen, Jansen and Zhang recently showed that a running time of $2^{(1/\epsilon)^{1-\delta}} + poly(n)$ for any $\delta > 0$ would imply that the Exponential Time Hypothesis (ETH) fails. A long sequence of algorithms have been developed that try to obtain low dependencies on $1/\epsilon$, the better of which achieves a running time of $2^{\tilde{O}(1/\epsilon^2)} + O(n \log n)$. In this talk we present an algorithm with a running time of $2^{\tilde{O}(1/\epsilon)} + O(n \log n)$, which is tight under ETH up to logarithmic factors on the exponent.
This is joint work with Kim-Manuel Klein (Kiel) und Jose Verschae (Santiago).

3 — Section III — Room D — 10:30 - 10:50

New inequalities between plethysm coefficients and Kronecker coefficients via geometric complexity theory

CHRISTIAN IKENMEYER (Saarbrücken)

Recent work with Greta Panova on no-go results in geometric complexity theory yields interesting new inequalities between plethysm coefficients and certain Kronecker coeffcients of the symmetric group. The proof uses methods from geometric complexity theory.

Friday, 04 Nov. 2016 — Time: 10:55 - 11:15

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4 — Section I — Room A — 10:55 - 11:15

On the number of hamiltonian cycles in triangulations with few separating triangles

NICO VAN CLEEMPUT (Ghent)

In 1931 Whitney proved that each triangulation containing no "separating triangles" is hamiltonian. One way how this classical result can be improved is to use the same prerequisites but prove a stronger lower bound for the number of cycles. The strongest result about the number of hamiltonian cycles so far was due to Hakimi, Schmeichel and Thomassen. They prove that in a 4-connected triangulation with n vertices there are at least $n/(\log_2 n)$ different hamiltonian cycles.
We introduce a new abstract counting technique for hamiltonian cycles in general graphs. This technique is based on a set of subgraphs, their overlap with the hamiltonian cycles and a switching function. Using this technique and the same subgraphs as Hakimi, Schmeichel and Thomassen used for their counting argument, we improved their bound to $\Omega(n)$. Using different types of subgraphs we were able to further improve the multiplicative and additive constants. We also show a linear bound in the case of plane triangulations with one separating triangle, and give computational results showing that the conjectured optimal value of $2n^2 - 12n + 16$ holds up to $n = 25$.
This is joint work with Gunnar Brinkmann, Annelies Cuvelier and Jasper Souffriau.

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5 — Section II — Room B — 10:55 - 11:15

Improved approximation for two dimensional strip packing with polynomial bounded width

MALIN RAU (Kiel)

We study the 2D-Strip-Packing problem. Given is a set of rectangular axis-parallel items and a strip of width W with infinite height. The objective is to find a packing of these items into the strip, which minimizes the packing height. Lately, it has been shown that the lower bound of $3/2$ of the absolute approximation ratio can be beaten when we allow a pseudo-polynomial running-time of type $(nW)^{f(1/\varepsilon)}$. If W is polynomially bounded by the number of items, this is a polynomial running-time. The currently best pseudo-polynomial approximation algorithm by Nadiradze and Wiese achieves an approximation ratio of $1.4 + \varepsilon$. We present a pseudo-polynomial algorithm with improved approximation ratio $4/3 + \varepsilon$.
Furthermore, the presented algorithm has a significantly smaller running-time as the $1.4 + \varepsilon$ approximation algorithm. An algorithm with the same approximation ratio was simultaneously achieved by Gálvez, Grandoni, Ingala, and Khan.

Fixed parameter parallel tractable problems

SHOUWEI LI (Paderborn)

In this talk, we propose a more restrictive class of parallelizable parameterized problems called *fixed-parameter parallel-tractable* (FPPT). For a problem to be in FPPT, it should possess an efficient parallel algorithm not only from a theoretical standpoint but in practice as well. We initiate the study of FPPT with a series of well-known problems, the monotone circuit value problem when the underlying graphs bounded by a constant genus and the parameterized vertex cover problem. Our results imply that given a P-complete or NP-complete problem, it is possible to find an algorithm that makes the problem fall into FPPT by fixing one or more parameters.

Friday, 04 Nov. 2016 — Time: 11:20 - 11:40

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7 — Section I — Room A — 11:20 - 11:40

An isomorphism check for nanojoins

DIETER MOURISSE (Ghent)

Nanojoins are finite substructures of a type of infinite chemical carbon molecule closely related to fullerenes and nanotubes. They can be represented by a finite plane graph. This graph can be uniquely extended by adding hexagons in a certain way to obtain an infinite 3-regular plane graph where most faces are hexagons, except for a finite number of pentagons and heptagons.
Two non-isomorphic finite nanojoins can still represent isomorphic infinite structures, so a concept of equivalence must be developed that tests whether finite nanojoins produce isomorphic infinite molecules. An algorithm was developed and implemented that takes a set of nanojoins as input and outputs the set that contains exactly one element for every isomorphism class of infinite structures.

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8 — Section II — Room B — 11:20 - 11:40

Game-perfect digraphs

STEPHAN DOMINIQUE ANDRES (Hagen)

We consider digraph variants of the maker-breaker graph colouring game proposed by Bodlaender which defines the game chromatic number. Two players, Maker and Breaker, alternately colour uncoloured vertices of a given digraph D with colours from a colour set C such that the vertex being coloured receives a different colour from its already coloured in-neighbours. The game ends as soon as no such move is possible any more; Maker wins if every vertex is coloured, otherwise Breaker wins. The smallest number of colours such that Maker has a winning strategy for the game played on D is called the *game chromatic number* of D. A digraph is *game-perfect* if, for any induced subdigraph, its game chromatic number equals the size of its largest symmetric clique. We provide partial results for the following problems: (i) the characterization of game-perfect digraphs by forbidden induced subdigraphs; (ii) the existence of kernels in subclasses of game-perfect digraphs; (iii) the complexity of recognition of game-perfect digraphs. The talk is (partially) based on joint work with Winfried Hochstättler and Edwin Lock.

Adaptive two-sided search

CHRISTIAN DEPPE (Bielefeld)

We introduce a new combinatorial search problem in networks. This search model can be viewed as an adaptive group testing in a graph, where a searching object, or target, occupies one of the vertices. However, unlike standard group testing problems, the target in our model can move to an adjacent vertex once after each test. The problem is to find the location of the target, with a certain accuracy, using minimum number of binary tests applied on the subsets of vertices of the underlying graph. We consider cycles and paths as underlying graphs. We give optimal search strategies for isolation of the target within a subset of vertices of a given size. We also considered a restricted case of the problem, when the number of moves of the target is limited. Finally we present a coding analogue of the proble

Friday, 04 Nov. 2016 — Time: 11:45 - 12:05

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10 — Section I — Room A — 11:45 - 12:05

Circular flows on signed graphs

MICHAEL SCHUBERT (Paderborn)

We study the flow spectrum of signed graphs. Let $r \geq 2$ be a real number and G be a graph. A set $X \subseteq E(G)$ is *r-minimal* if the signed graph (G, σ) with negative edges $N_\sigma = X$ has circular flow number r and any signed graph (G, σ') where $N_{\sigma'} \subset X$ has circular flow number $\neq r$. Let K_2^3 be the unique cubic graph on two vertices which are connected by three edges. Consider G to be cubic. We study the relation between 3- and 4-minimal sets and deduce that if G has a 1-factor and $G \neq K_2^3$, then $\{3, 4\}$ is a subset of its flow spectrum and of its integer flow spectrum. Furthermore, if $G \neq K_2^3$, then the following four statements about the *flow spectrum* $\mathcal{S}(G)$ and the *integer flow spectrum* $\overline{\mathcal{S}}(G)$ are equivalent: (1) G has a 1-factor. (2) $3 \in \mathcal{S}(G)$ (3) $3 \in \overline{\mathcal{S}}(G)$. (4) $4 \in \overline{\mathcal{S}}(G)$.

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11 — Section II — Room B — 11:45 - 12:05

Niche hypergraphs of products of digraphs

MARTIN SONNTAG (Freiberg)

If $D = (V, A)$ is a digraph, its *niche hypergraph* $N\mathcal{H}(D) = (V, \mathcal{E})$ has the edge set

$$\mathcal{E} = \{e \subseteq V \mid |e| \geq 2 \ \wedge \ \exists v \in V : e = N_D^-(v) \ \vee \ e = N_D^+(v)\}.$$

Niche hypergraphs generalize the well-known niche graphs (cf. C. CABLE, K.F. JONES, J.R. LUNDGREN AND S. SEAGER, *Niche graphs*, Discr. Appl. Math. **23(3)** (1989), 231–241) and are closely related to competition hypergraphs (cf. M. SONNTAG AND H.–M. TEICHERT, *Competition hypergraphs*, Discr. Appl. Math. **143** (2004), 324–329) as well as common enemy hypergraphs. For several products $D_1 \circ D_2$ of digraphs D_1 and D_2,we investigate the relations between the niche hypergraphs of the factors D_1, D_2 and the niche hypergraph of their product $D_1 \circ D_2$.

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12 — Section III — Room D — 11:45 - 12:05

Noncongruent equidissections of the plane

DIRK FRETTLÖH (Bielefeld)

In 2014 Nandakumar asked whether there is a tiling of the plane by pairwise non-congruent triangles of equal area and equal perimeter. Here a weaker result is obtained: there is a tiling of the plane by pairwise non-congruent triangles of equal area such that their perimeter is bounded by some common constant. Several variants of the problem are stated, some of them are answered.

Friday, 04 Nov. 2016 — Time: 13:15 - 13:35

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13 — Section I — Room A — 13:15 - 13:35

Matchstick graphs

HEIKO HARBORTH (Braunschweig)

A matchstick graph is a plane geometric graph in which every edge has length 1 and no two edges intersect each other. Thus these graphs can be realized by matchsticks on a table. In this connection sometimes a “Harborth graph” is mentioned. After a short personal history of its development a survey of partial results and open problems for k-regulr mathstick graphs is presented.

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14 — Section II — Room B — 13:15 - 13:35

Sticky matroids and Kantor’s conjecture

WINFRIED HOCHSTÄTTLER (Hagen)

A matroid is sticky if for any two of its extensions an amalgam exists. The sticky matroid conjecture (Polyak, Turzik 1982) asserts that a matroid is sticky if and only if it is modular.
Kantor conjectured 1974 that a finite rank 4 matroid where any two hyperplanes intersect in a line does not possess the Vamos-matroid as a restriction.
Bachem and Kern 1987 gave a (flawed) proof that a matroid which has a non-trivial extension decreasing the modular defect of a line and a hyperplane is not sticky. The flaw was fixed by Bonin 2011.
Conversely, we prove that a rank 4 matroid which does not admit a non-trivial extension is sticky.
As a consequence we get that the sticky matroid conjecture and Kantor’s conjecture are equivalent.
Moreover, we derive an example showing that the sticky matroid conjecture, like Kantor’s conjecture, fails in the infinite case.
This is joint work with Michael Wilhelmi.

15 — Section III — Room D — 13:15 - 13:35

Merit factors of sequences derived from cyclotomy and difference sets

CHRISTIAN GÜNTHER (Paderborn)

The problem of constructing binary sequences with large merit factor arises naturally in complex analysis, condensed matter physics, and digital communications engineering. Equivalent formulations involve the minimisation of the mean-squared aperiodic autocorrelations of binary sequences or the minimisation of the L^4 norm on the unit circle of polynomials with all coefficients 1 or -1. Most known constructions arise (sometimes in a subtle way) from difference sets, in particular from Paley and Singer difference sets. We consider the asymptotic merit factor of sequences constructed from other difference sets, providing the first essentially new examples since 1991. In particular we give a general theorem on the asymptotic merit factor of sequences arising from cyclotomy, which includes results on Hall and Paley difference sets as special cases. In addition, we establish the asymptotic merit factor of sequences derived from Gordon-Mills-Welch difference sets and Sidelnikov almost difference sets, proving two recent conjectures.

This is joint work with Kai-Uwe Schmidt

Friday, 04 Nov. 2016 — Time: 13:40 - 14:00

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16 — Section I — Room A — 13:40 - 14:00

Homothetic triangle contact representations

HENDRIK SCHREZENMAIER (Berlin)

We prove that every 4-connected planar triangulation admits a contact representation by homothetic triangles, i.e. triangles that can be mapped onto each other by translation and scaling.
There is a known proof of this result that is based on the Convex Packing Theorem by Schramm, a general result about contact representations of planar triangulations by convex shapes. The problem about this theorem is that the proof is purely existential.
Our approach, however, makes use of the combinatorial structure of triangle contact representations in terms of Schnyder Woods. We start with an arbitrary Schnyder Wood and produce a sequence of Schnyder Woods via face flips. We show that at some point the sequence has to reach a Schnyder Wood describing a representation by homothetic triangles.

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17 — Section II — Room B — 13:40 - 14:00

Hypermodular matroids

MICHAEL WILHELMI (Hagen)

A matroid M is hypermodular if any pair of hyperplanes intersects in a flat of rank r(M)-2. Kantor conjectured in 1974 that a finite hypermodular matroid of rank 4 does not contain the Vámos-matroid as a restriction minor.
Generalizing a result of Klaus Metsch we prove that any non-modular pair of lines in a hypermodular matroid of rank 4 either can be intersected or is contained in a set of 6 lines violating the bundle condition.
Moreover we show that any finite Matroid can be embedded in a (possibly infinite) hypermodular matroid and that any hypermodular matroid of rank four can be embedded in a matroid, in which each modular cut is a principal one.
We conjecture, that the last result holds for matroids in general. As applications we present infinite counterexamples to Kantor's conjecture and the sticky matroid conjecture.
This is joint work with Winfried Hochstättler.

Functions on finite fields with many bent components

ALEXANDER POTT (Magdeburg)

Bent functions are mappings $GF(2^n) \to GF(2)$ (where n is necessarily even) on a finite field which are maximum nonlinear with respect to several criteria, for instance the Hamming distance to all affine hyperplanes in $GF(2^n)$ is large. In this talk we present an interesting binomial mapping $F := GF(2^n) \to GF(2^n)$ such that $2^n - 2^{n/2}$ of its component functions are bent. We also show that this is the maximum number of component functions that can be bent. We propose to search for more functions having this maximum number of bent components.

This is joint work with Enes Pasalic, Amela Muratović-Ribić and Samed Bajrić.

Friday, 04 Nov. 2016 — Time: 14:05 - 14:25

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19 — Section I — Room A — 14:05 - 14:25

Bounds for the sum choice number of graphs

MASSIMILIANO MARANGIO (Braunschweig)

Let $G = (V, E)$ be a simple graph and for every vertex $v \in V$ let $L(v)$ be a list of available colors. G is called L-*colorable* if there is a proper vertex coloring c with $c(v) \in L(v)$ for all $v \in V$. A function $f : V \to \mathbb{N}$ is called a *choice function* of G if G is L-colorable for every list assignment L with $|L(v)| = f(v)$ for all $v \in V$. Set $\mathrm{size}(f) = \sum_{v \in V} f(v)$ and define the *sum choice number* $\chi_{sc}(G)$ as the minimum of $\mathrm{size}(f)$ over all choice functions f of G.

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20 — Section II — Room B — 14:05 - 14:25

Neighborhood oriented graph polynomials

PETER TITTMANN (Mittweida)

There are some well-known graph polynomials such as the domination polynomial, the neighborhood polynomial, the Ising polynomial, or the vertex cover polynomial, that are defined by the neighborhood of vertex sets in a graph. We investigate common properties of these polynomials, describe their relations, and present different representations and generalizations. We introduce the bipartition polynomial of a graph as unifying concept that encompasses all the above mentioned polynomials. In addition, it provides an easy way to count matchings, Eulerian subgraphs, cuts, colored bipartite subgraphs and numerous other structures. The bipartition polynomial can be considered as a very general ordinary generating function for wide class of subgraphs.

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21 — Section III — Room D — 14:05 - 14:25

Normalized tiling conjecture, general abelian case

KRISTIJAN TABAK (Zagreb)

We analyze coverings of abelian groups that are made of difference sets. We call such object difference set tiling. It's been noticed by several authors (Krčadinac et all.) that $(31, 6, 1)$ tiling of abelian group is normalized meaning that product of difference set elements in tiling is a group unit. Given this, authors post a conjecture that every difference set tiling in abelian group must be normalized. We call it NTC (normalized tiling conjecture). In this talk we prove that NTC is true for $(p, k, 1)$ tiling where p is prime and also we prove the same for general case (v, k, λ) depending on the nature of numerical multiplier of difference sets that are contained in tiling.

Friday, 04 Nov. 2016 — Time: 14:30 - 14:50

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22 — Section I — Room A — 14:30 - 14:50

Degree choosable signed graphs

THOMAS SCHWESER (Ilmenau)

A signed graph is a graph in which each edge is labeled with $+1$ or -1. A (proper) vertex coloring of a signed graph G is a mapping ϕ that assigns to each vertex $v \in V(G)$ a color $\phi(v) \in \mathbb{Z}$ such that every edge vw of G satisfies $\phi(v) \neq \sigma(vw)\phi(w)$, where $\sigma(vw)$ is the sign of the edge vw. For an integer $h \geq 0$, let $Z_{2h} = \{\pm 1, \pm 2, \ldots, \pm h\}$ and $Z_{2h+1} = Z_{2h} \cup \{0\}$. The chromatic number $\chi(G)$ of the signed graph G is the least integer k such that G admits a vertex coloring ϕ with $\text{im}(\phi) \subseteq Z_k$. As proved by Máčajová, Raspaud and Škoviera, every signed graph G satisfies $\chi(G) \leq \Delta(G) + 1$ and there are three types of signed connected simple graphs for which equality holds. We will present a list version of this result by characterizing degree choosable signed (multi-)graphs.

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23 — Section II — Room B — 14:30 - 14:50

Ordering trees consisting of three paths according to closed walk counts

MOHAMMAD GHEBLEH (Safat/Kuwait)

Spectral moments of adjacency matrix of a graph, which also represent counts of its closed walks, are useful objects in dealing with spectral radius and Estrada indices of graphs. For $k \geq 0$, let $M_k(G)$ denote the number of closed walks in G of length k. Let $G \preceq H$ denote that $M_k(G) \leq M_k(H)$ for all $k \geq 0$. For example, if $G \preceq H$ then the spectral radius and the Estrada index of G are smaller than or equal to the spectral radius and the Estrada index of H, respectively.
Let $P_{a,b,c}$ denote the tree obtained from the union of paths P_{a+1}, P_{b+1} and P_{c+1} by identifying one endvertex from each of the three paths. We show that for any a, b, c, d, e, f holds either

$$P_{a,b,c} \preceq P_{d,e,f} \quad \text{or} \quad P_{a,b,c} \succeq P_{d,e,f}.$$

This is well known in the case that $\min\{a, b, c\} = \min\{d, e, f\}$, but its proof needs to play with both characteristic polynomials and walk embeddings when $\min\{a, b, c\} + 1 = \min\{d, e, f\}$.

(This is joint work with A. Kanso and D. Stevanović.)

Application of a genetic algorithm on block designs

DORIS DUMIČIĆ DANILOVIĆ (Rijeka)

The genetic algorithm (GA) is an optimization and search technique based on natural biological selection. It is an evolutionary algorithm which operates on a population of potential solutions. GAs have been successfully applied to a wide variety of problems. In particular, they work very well on discrete combinatorial problems, such as combinatorial design construction. In this talk we will present results obtained by application of a genetic algorithm to unitals as subdesigns of block designs.
Joint work with Dean Crnković.

Saturday, 05 Nov. 2016 — Time: 08:50 - 09:10

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25 — Section I — Room A — 08:50 - 09:10

Chromatic number of ordered graphs with forbidden ordered subgraphs

JONATHAN ROLLIN (Karlsruhe)

It is well-known that the graphs not containing a given graph H as a subgraph have bounded chromatic number if and only if H is acyclic.
Surprisingly, the situation is very different for *ordered graphs*, that is, graphs equipped with a linear ordering $<$ on their vertex set.
Call an ordered graph H *unavoidable* if any ordered graph of sufficiently large chromatic number contains a copy of H, and *avoidable* otherwise.
As in the case of unordered graphs, any ordered graph that contains a cycle is avoidable.
However, we also give an infinite family of avoidable ordered forests. For example the ordered path with vertices $a < b < c < d$ and edges ab, ad, and bc is avoidable.
We completely characterize all avoidable ordered graphs that do not have crossing edges and reduce the case of connected ordered graphs to a well-behaved class of trees.
Although this identifies large classes of avoidable ordered forests, we don't know whether the matching with vertices $a < b < c < d < e < f$ and edges ac, be, df is avoidable.
This is joint work with Maria Axenovich and Torsten Ueckerdt.

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26 — Section II — Room B — 08:50 - 09:10

Planar posets have dimension linear in height

PIOTR MICEK (Berlin)

We prove that the dimension of planar posets is bounded by a linear function of their height: $dim(P) \Leftarrow 96h + 48$ for every planar poset P of height h. This improves on previous exponential bounds and is best possible up to a constant factor. Joint work with Gwenaël Joret and Veit Wiechert.

Construction of codes from orbit matrices of strongly regular graphs

MARIJA MAKSIMOVIĆ (Rijeka)

In this talk we will outline a method for constructing self-orthogonal codes from orbit matrices. We consider orbit matrices of strongly regular graphs admitting an automorphism group G which acts with orbits of length w, where w divides $|G|$.
We apply this method to construct self-orthogonal codes from orbit and adjacency matrices of the strongly regular graphs with at most 40 vertices. In particular,we consider graphs with parameters (36,15,6,6), (36,14,4,6), (35,16,6,8), (40,12,2,4) and their complements.
That completes the classifcation of self-orthogonal codes spanned by the adjacency matrices or orbit matrices of the strongly regular graphs with at most 40 vertices.
Some of the obtained codes are optimal, and some are best known for the given length and dimension.
This is joint work with D. Crnković, S.Rukavina and B. G. Rodrigues.

Saturday, 05 Nov. 2016 — Time: 09:15 - 09:35

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28 — Section I — Room A — 09:15 - 09:35

Perfect matchings of $\mathbb{Z}_2$-weighted regular bipartite graphs

EDITA ROLLOVÁ (Pilsen)

A perfect matching of a given graph G is a subset M of $E(G)$ such that every vertex of G is incident with exactly one edge of M. Every regular bipartite graph is known to have a perfect matching. We study weighted regular bipartite graphs where the weight function is $w : E(G) \to \mathbb{Z}_2$. We are interested in the following problem: do there exist perfect matchings M_0 and M_1 of G of weight 0 and 1, respectively, for any given weight function of G? With a use of signed graphs we prove that the answer is yes unless the weight function is equivalent to $w \equiv 0$, where two weight functions w_1 and w_2 are considered to be equivalent if $w_1 + w_2$ assigns 1 exactly to edges of an edge-cut of G.

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29 — Section II — Room B — 09:15 - 09:35

Persistent violations in non-persistent gammoids.

IMMANUEL ALBRECHT (Hagen)

Gammoids are a minor and duality closed class of matroids that arise from families of vertex disjoint paths in digraphs via Menger's theorem. We introduce a sufficient condition for the case that a matroid is not a gammoid.

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30 — Section III — Room D — 09:15 - 09:35

On kernels and nuclei of rank metric codes

YUE ZHOU (Augsburg)

Several interesting research topics in finite geometry, cryptography and coding theory can be framed in the context of rank metric codes. For this reason such codes have received great attention in recent years.
For each rank metric code $\mathcal{C} \subseteq \mathbb{K}^{m\times n}$, we can associate a translation structure, the kernel of which is showed to be invariant with respect to the equivalence on rank metric codes. When $\mathcal{C}$ is $\mathbb{K}$-linear, we also propose and investigate other two invariants called its middle nucleus and right nucleus. Kernel and nuclei can be used to show the equivalence of two codes and the automorphism group of a code. For several type of maximum rank distance codes and dimensional dual hyperovals, we prove the possible sizes of their kernels and nuclei.

Saturday, 05 Nov. 2016 — Time: 09:40 - 10:00

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31 — Section I — Room A — 09:40 - 10:00

Improved bound on the oriented diameter of graphs

MICHEL SURMACS (Aachen)

In 1939, Robbins – inspired by an application in traffic control – gave the classical result that a graph permits a strong orientation, if and only if it is bridgeless/2-edge-connected. The practical application of his result, in particular, naturally gives rise to the problem of finding such a strong orientation of smallest diameter. While, in 1978, Chvátal and Thomassen showed that the determination of the oriented diameter – i.e., the smallest diameter of a strong orientation – of a given bridgeless graph is NP-complete, over the last decades, the oriented diameter of several classes of graphs has been considered and bounds with respect to certain graph invariants were found. In 2015, for example, Bau and Dankelmann showed that every bridgeless graph of order n and minimum degree δ has an orientation of diameter at most $11\frac{n}{\delta+1}+9$. In this talk, we mainly consider a proof that is algorithmic in nature and implies that such an orientation with diameter less than $7\frac{n}{\delta+1}$ can be constructed in polynomial time.

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33 — Section III — Room D — 09:40 - 10:00

Codes in the Shannon sphere and zero-error capacity

ULRICH TAMM (Bielefeld)

The Shannon sphere was discussed by Golomb as a special metric obtained via clusters of cubes. Single error codes in this metric have some applications in the theory of integer codes. Golomb chose the name because the most basic case relates very much to Shannon's zero-error capacity. Actually, before Lovasz' determined the capacity of the C_5 via linear algebra methods best bounds on the zero-error capacity were obtained via codes in the Shannon sphere, which is widely forgotten today.

Saturday, 05 Nov. 2016 — Time: 10:30 - 10:50

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34 — Section I — Room A — 10:30 - 10:50

A characterisation of g_B-perfect graphs

EDWIN LOCK (Hagen)

We consider the following maker-breaker graph colouring game g_B played on an initially uncoloured simple graph with a set of colours C. Two players take turns to apply a colour from C to an uncoloured vertex such that adjacent vertices receive different colours. The game ends once such a move is no longer possible. The second player, the *maker*, wins if the graph is fully coloured, otherwise the first player, the *breaker*, wins. Our focus is the class of g_B-perfect graphs: graphs such that for every induced subgraph H, the game g_B played on H admits a winning strategy for the second player using no more than $\omega(H)$ colours, where $\omega(\cdot)$ denotes the clique number. We characterise g_B-perfect graphs in terms of forbidden induced subgraphs and by means of explicit structural descriptions, confirming that connected g_B-perfect graphs belong to a rich family of structures. In doing so, we resolve an outstanding open problem posed in [S. D. Andres. On characterizing game-perfect graphs by forbidden induced subgraphs. *Contributions to Discrete Math.*, 7(1):21?34, 2012].

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35 — Section II — Room B — 10:30 - 10:50

Matroid optimisation problems with a set of upward complete monomials

ANJA FISCHER (Göttingen)

In this talk we consider polynomial matroid optimisation problems where the non-linear monomials satisfy certain upward completeness conditions. The monomials are linearised by introducing new variables. Extending results of Edmonds we present a complete description for the linearised polytope. Indeed, apart from the standard linearisation in this case, one only needs appropriately strengthened rank inequalities. The separation problem of these inequalities reduces to a submodular function minimisation problem. These polyhedral results lead to a new hierarchy for solving general polynomial matroid optimisation problems. Finally, we give some suggestions for future work.
This is joint work with Frank Fischer and Thomas McCormick.

On competitive combinatorial group testing

EBERHARD TRIESCH (Aachen)

We consider the problem of finding a set of d defectives out of a set of n items by group tests, i.e., we may successively choose subsets of the set of all items and test whether they contain at least one defective. The goal is to minimize the number of tests needed to identify all defectives. In a certain competitiveness model, we present the first lower bound and the best known algorithm.

Saturday, 05 Nov. 2016 — Time: 10:55 - 11:15

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37 — Section I — Room A — 10:55 - 11:15

Graph splitting for k-edge connected reliability

THOMAS LANGE (Mittweida)

The k-edge connected reliability $R_{k-ec}(G,q)$ is the probability that a given graph $G=(V,E)$ remains k-edge connected when each edge $e \in E$ fails with given probability q_e. We consider a given graph splitting $G=(V_1,E_1)\cup(V_2,E_2)$ with $V_1 \cap V_2 = X$ and $E_1 \cap E_2 = \emptyset$. We derive a set of graphs $\mathcal{X}$ and a mapping $r : 2^E \to \mathcal{X}$ only depending on the set X and the value of k with the property $(V_1,F_1)\cup(V_2,F_2)$ is k-edge connected if and only if $r(F_1)\cup r(F_2)$ is k-edge connected or a single vertex. While this set of structures was previously reported for $k \le 2$, a general description was previously unknown. We show that for a fixed set X, the set $\mathcal{X}$ derived from our description is finite for $k \le 3$ and infinite for $k \ge 4$. While the problem to calculate $R_{k-ec}(G,q)$ in general is NP-hard for each $k \ge 1$, this result yields a polynomial time algorithms to calculate $R_{3-ec}(G,q)$ for graphs of bounded treewidth.

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38 — Section II — Room B — 10:55 - 11:15

Matroid optimisation problems with nested non-linear monomials in the objective function

FRANK FISCHER (Kassel)

We study matroid optimisation problems with a set of nested non-linear monomials in the objective function. These monomials are linearised by introducing a new variable for each of them. In this talk we present a complete description of the associated polytope. This is based on the standard linearisation of the new variables and on an extended version of the so called rank inequalities. The separation problem of these rank inequalities is equivalent to a submodular function minimisation problem. In the case of exactly one non-linear monomial we even completely characterise the facetial structure of the associated polytope. For this characterisation an extension of the concept of non-separability is needed.

Relating domination, exponential domination, and porous exponential domination

SIMON JÄGER (Ulm)

The domination number $\gamma(G)$ of a graph G, its exponential domination number $\gamma_e(G)$, and its porous exponential domination number $\gamma_e^*(G)$ satisfy $\gamma_e^*(G) \leq \gamma_e(G) \leq \gamma(G)$. We contribute results about the gaps in these inequalities as well as the graphs for which some of the inequalities hold with equality. Relaxing the natural integer linear program whose optimum value is $\gamma_e^*(G)$, we are led to the definition of the fractional porous exponential domination number $\gamma_{e,f}^*(G)$ of a graph G. For a subcubic tree T of order n, we show $\gamma_{e,f}^*(T) = \frac{n+2}{6}$ and $\gamma_e(T) \leq 2\gamma_{e,f}^*(T)$. Furthermore, we give a characterization of a large subclass of the class of those graphs G for which the exponential domination number of H equals the domination number of H for every induced subgraph H of G.

This is joint work with Michael A. Henning and Dieter Rautenbach.

Saturday, 05 Nov. 2016 — Time: 11:20 - 11:40

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41 — Section II — Room B — 11:20 - 11:40

A characterization of affine oriented matroid

YIDA ZHU (Trier)

Affine oriented matroids are a combinatorial abstraction of hyperplane arrangements, which arise as fundamental objects in various mathematical areas. Inequality systems in linear programming and facets of convex polytopes are special cases. Real hyperplane arrangements have also been studied in discrete geometry with respect to their combinatorial structure, that is, how they partition space. In 1992, Johan Karlander took a closer look at the parallel class of hyperplanes and gave a characterization of affine oriented matroids. Some recent studies have simplified this characterization.

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42 — Section III — Room D — 11:20 - 11:40

Polynomials and the Erdős multiplication table problem

ROBERT SCHEIDWEILER (Aachen)

Let

$$P_m(n) := \left\{ \prod_{i=1}^{n} i^{\alpha_i} \,\middle|\, \alpha_i \in \mathbb{N}_0 \text{ and } \sum_{i=1}^{n} \alpha_i = m \right\}$$

be the set of products of m numbers from the set $\{1, \ldots, n\}$ and denote by $p(m,n)$ its cardinality. In 1955 Erdős considered the problem of estimating $p(2,n)$ and showed that $p(2,n) = o(n^2)$.
Motivated by a graph coloring problem, Darda and Hujdurović asked whether, for fixed n, $p(m,n)$ is a polynomial in m of degree $\pi(n)$ - the number of primes not larger than n. They showed this to be true for $n = 1, ..., 10$. By interpreting $p(m,n)$ as the Hilbert function of some graded algebra, we show that the conjecture is true for each fixed n and m large. Moreover, we discuss a connection between Ehrhart Theory and Multiplication Tables.

This is joint work with Eberhard Triesch.

Saturday, 05 Nov. 2016 — Time: 11:45 - 12:05

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44 — Section II — Room B — 11:45 - 12:05

Graph metrics and crossing numbers

THOMAS BÖHME (Ilmenau)

A connected graph $G = (V, E)$ can be embedded into a metric space (M, d_M) with *distortion* $c \geq 1$ if there is an injection $f : V \to M$ such that

$$\frac{1}{c} \leq \frac{d_M(f(x), f(y))}{d_G(x, y)} \leq c$$

for all distinct vertices $x, y \in V$. (Here $d_G(x, y)$ denotes the graph theoretical distance of x and y in G, i.e. $d_G(x, y)$ is the number of edges of a shortest x-y-path in G.) Classes of graphs that can be embedded with bounded distortion into metric spaces (esp. the euclidean plane) were first considered in [1]. The topic of the talk is the relationship between bounded distortion embeddings of a graph and its crossing number.

[1] N. Linial, Y. Rabinovich, The geometry of graphs and some of its algorithmic applications, Combinatorica 15:2 (1995), 215–245.

(This is joint work with Steffen Fischer.)

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45 — Section III — Room D — 11:45 - 12:05

Cores, joins and the Fano-flow conjectures

LIGANG JIN (Paderborn)

The Fan-Raspaud Conjecture states that every bridgeless cubic graph has three perfect matchings with empty intersection. A weaker one than this conjecture is that every bridgeless cubic graph has two perfect matchings and one join with empty intersection. Both conjectures can be related to conjectures on Fano-flows. In this talk, we introduce cores and weak cores of a bridgeless cubic graph, and we show that these two conjectures are equivalent to some statements on cores and weak cores.
Furthermore, we disprove a conjecture proposed in [G. Mazzuoccolo, New conjectures on perfect matchings in cubic graphs, Electron. Notes Discrete Math. 40 (2013) 235-238], and we propose a new version of it under a stronger connectivity assumption. Finally, the weak oddness of a cubic graph is discussed.
This is joint work with Giuseppe Mazzuoccolo and Eckhard Steffen

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