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 36th Colloquium on Combinatorics. This year we welcome 70 participants. The program includes 47 contributed talks, organised in three parallel sessions, and four 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*.

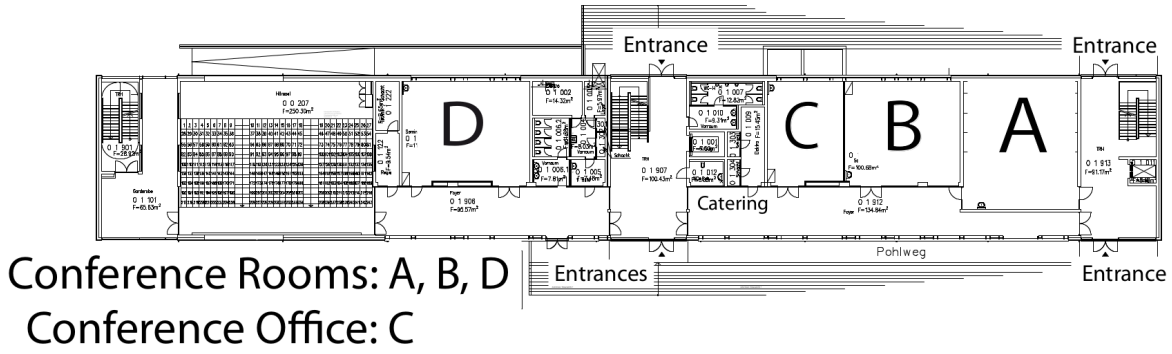
We hope you enjoy the conference.

Kai-Uwe Schmidt
Eckhard Steffen

COLLOQUIUM ON COMBINATORICS — 24/25 NOVEMBER 2017
DISCRETE MATHEMATICS — PADERBORN UNIVERSITY

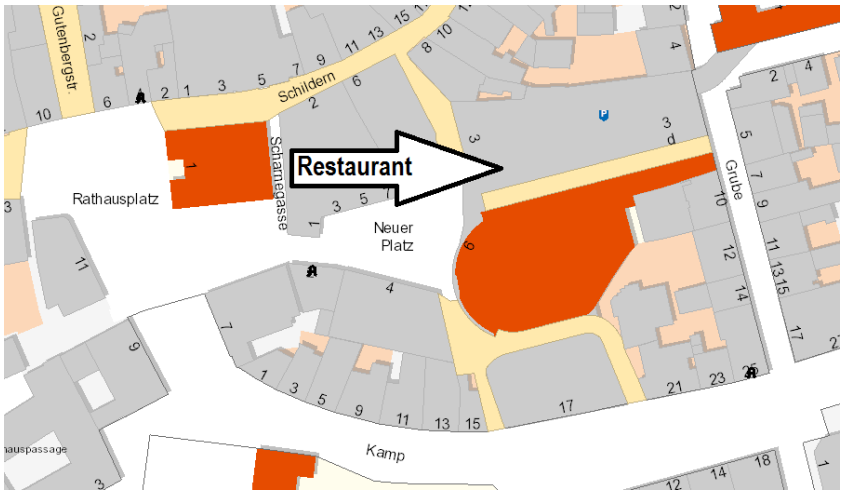
All **talks** will be in Building-O on the Main Campus

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 16:59 (Line 9), 17:16 (Line 4), 17:29 (Line 9), 17:46 (Line 4), 17:59 (Line 9), 18:16 (Line 4), 18:29 (Line 9). 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, 24 November 2017

09:00 - 09:05 *Opening*

09:05 - 10:00 **Gunnar Brinkmann (Ghent)**
"A formal approach to operations on polyhedra"

10:00 - 10:30 *Coffee break*

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

12:05 - 13:15 *Lunch*

13:15 - 15:15 **Parallel sessions**

15:15 - 15:45 *Coffee break*

15:45 - 16:40 **Cun-Quan Zhang (Morgantown)**
"Flows of signed graphs - a survey"

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

Saturday, 25 November 2017

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 **Dieter Jungnickel (Augsburg)**
"On block codes of Steiner triple systems"

14:10 - 14:40 *Coffee break*

14:40 - 15:35 **Carsten Thomassen (Lyngby)**
"Colorings, flows, and decompositions of graphs"

15:35 - 15:40 *Farewell*

Detailed program on Friday, 24 November 2017

Time	Section I Room: A	Section II Room: B	Section III Room: D
09:00 - 09:05	*Opening*		
09:05 - 10:00	**Gunnar Brinkmann** A formal approach to operations on polyhedra **Room: A**		
10:00 - 10:30	*Coffee break*		
10:30 - 10:50	**G. Mazzuoccolo** **1** Colourings of cubic graphs inducing isomorphic monochromatic subgraphs	**S. Mohr** **2** On Selkow's bound on the independence number of graphs	**A. Fischer** **3** The traveling salesman problem with forbidden neighborhoods on regular grids
10:55 - 11:15	**E. Máčajová** **4** A generalisation of the Fulkerson conjecture	**S. Cambie** **5** Maximum Wiener indices of unicylic graphs of given matching number	**M. Gyetvai** **6** Optimization of transition rules in a Bonus-Malus system
11:20 - 11:40	**L. Jin** **7** 1-factor coverings of cubic graphs	**T. Schweser** **8** Hypergraph partitions and variable degeneracy	**V. Bindewald** **9** Robust recoverable matchings on a budget
11:45 - 12:05	**D. Labbate** **10** 2-factors of regular graphs: an update	**S. Das** **11** Erdős–Rothschild for intersecting systems	**I. Beckenbach** **12** A hypergraphic generalization of the network simplex algorithm
12:05 - 13:15	*Lunch*		
13:15 - 13:35	**Y. Kang** **13** Hajós-like theorem for signed graphs	**Q. Shakir** **14** Sparsity and tightness for graphs drawn on surfaces	**M. Mohammadpour Sabet** **15** Connected zero forcing number of some families of graphs
13:40 - 14:00	**L. P. Majd** **16** On the spectrum of signed complete and complete bipartite graphs	**J. Beisegel** **17** New vertex ordering characterisations of AT-free graphs	**K. Cs. Ágoston** **18** Cutting stock problem with the possibility of welding
14:05 - 14:25	**M. Schubert** **19** Flows on signed graphs	**T. Lange** **20** Irrelevant edges for k-connectivity	**U. Tamm** **21** Block chains in finance
14:30 - 14:50	**J. Goedgebeur** **22** On minimal triangle-free 6-chromatic graphs	**Ch. Josten** **23** Symmetry vs complexity: a geometric look at inaccessible graphs	**V. Lebedev** **24** Adaptive q-ary search with lies
14:55 - 15:15	**H. Harborth** **25** Gaps for numbers of crossings	**A. Rostami** **26** Strong rainbow coloring and rainbow coloring of unicycle graphs	**S. D. Andres** **27** Autotopism stabilized generalized Latin square colouring games
15:15 - 15:45	*Coffee break*		
15:45 - 16:40	**Cun-Quan Zhang** Flows of signed graphs - a survey **Room: A**		

Detailed program on Saturday, 25 November 2017

Time	Section I Room: A	Section II Room: B	Section III Room: D
08:50 - 09:10	**G. Rinaldi** **28** Rainbow spanning tree decompositions in complete graphs colored by 1-factorizations	**M. Šimac** **29** LDPC codes constructed from Moore graphs with diameter 2	**F. Hommelsheim** **30** Assignment problems with few failure resources
09:15 - 09:35	**N. Van Cleemput** **31** Non-Hamiltonian and non-traceable regular 3-connected planar graphs	**R. Arshad** **32** Almost perfect nonlinear functions	**R. Scheffler** **33** The distance orientation problem
09:40 - 10:00	**F. Fischer** **34** Counting degree sequences of spanning trees in bipartite graphs: a graph theoretic proof	**S. Hu** **35** A bound on the Shannon capacity via a linear programming variation	**L. van Rooijen** **36** A combinatorial approach to the separation problem for regular languages
10:00 - 10:30	*Coffee break*		
10:30 - 10:50	**I. Schiermeyer** **37** Gallai Ramsey number for K_4	**A. Svob** **38** t-designs and strongly regular graphs constructed from some linear groups	**T. Mészáros** **39** Shattering-extremal set systems
10:55 - 11:15	**J. Rollin** **40** Minimal ordered Ramsey graphs	**V. Krčadinac** **41** An updated table of quasi-symmetric designs	
11:20 - 11:40	**W. Hochstättler** **43** Algebraic NL-flows and a polynomial	**S. Li** **44** A construction of strong external difference families	
11:45 - 12:05	**R. Steiner** **46** Neumann-Lara-flows and the Two-Colour-Conjecture	**Ch. Günther** **47** Spectral properties of character polynomials	
12:05 - 13:15	*Lunch*		
13:15 - 14:10	**Dieter Jungnickel** On block codes of Steiner triple systems **Room: A**		
14:10 - 14:40	*Coffee break*		
14:40 - 15:35	**Carsten Thomassen** Colorings, flows, and decompositions of graphs **Room: A**		
15:35 - 15:40	*Farewell*		

Invited talks

Gunnar Brinkmann (Ghent) : A formal approach to operations on polyhedra
Dieter Jungnickel (Augsburg) : On block codes of Steiner triple systems
Carsten Thomassen (Lyngby) : Colorings, flows, and decompositions of graphs
Cun-Quan Zhang (Morgantown) : Flows of signed graphs - a survey

Contributed talks

Jesse Beisegel (Cottbus) : New vertex ordering characterisations of AT-free graphs
Kolos Csaba Ágoston (Budapest) : Cutting stock problem with the possibility of welding
Stephan Dominique Andres (Hagen) : Autotopism stabilized generalized Latin square colouring games
Razi Arshad (Magdeburg) : Almost perfect nonlinear functions
Isabel Beckenbach (Berlin) : A hypergraphic generalization of the network simplex algorithm
Viktor Bindewald (Dortmund) : Robust recoverable matchings on a budget
Shagnik Das (Berlin) : Erdős–Rothschild for intersecting systems
Anja Fischer (Dortmund) : The traveling salesman problem with forbidden neighborhoods on regular grids
Frank Fischer (Kassel) : Counting degree sequences of spanning trees in bipartite graphs: a graph theoretic proof
Dirk Frettlöh (Bielefeld) : Bounded distance equivalence of one-dimensional Delone sets
Jan Goedgebeur (Ghent) : On minimal triangle-free 6-chromatic graphs
Christian Günther (Paderborn) : Spectral properties of character polynomials
Márton Gyetvai (Budapest) : Optimization of transition rules in a Bonus-Malus system
Heiko Harborth (Braunschweig) : Gaps for numbers of crossings
Winfried Hochstättler (Hagen) : Algebraic NL-flows and a polynomial
Felix Hommelsheim (Dortmund) : Assignment problems with few failure resources
Sihuang Hu (Aachen) : A bound on the Shannon capacity via a linear programming variation
Yingli Kang (Paderborn) : Hajós-like theorem for signed graphs
Vedran Krčadinac (Zagreb) : An updated table of quasi-symmetric designs
Ligang Jin (Zhejiang) : 1-factor coverings of cubic graphs
Christoph Josten (Frankfurt a.M.) : Symmetry vs complexity: a geometric look at inaccessible graphs
Domenico Labbate (Potenza) : 2-factors of regular graphs: an update
Thomas Lange (Mittweida) : Irrelevant edges for k-connectivity
Vladimir Lebedev (Moscow) : Adaptive q-ary search with lies

Shuxing Li (Magdeburg)	: A construction of strong external difference families
Edita Máčajová (Bratislava)	: A generalisation of the Fulkerson conjecture
Leila Parsaei Majd (Theran)	: On the spectrum of signed complete and complete bipartite graphs
Giuseppe Mazzuoccolo (Verona)	: Colourings of cubic graphs inducing isomorphic monochromatic subgraphs
Tamás Mészáros (Berlin)	: Shattering-extremal set systems
Samuel Mohr (Ilmenau)	: On Selkow's bound on the independence number of graphs
Gloria Rinaldi (Modena)	: Rainbow spanning tree decompositions in complete graphs colored by 1-factorizations
Lorijn van Rooijen (Paderborn)	: A combinatorial approach to the separation problem for regular languages
Jonathan Rollin (Karlsruhe)	: Minimal ordered Ramsey graphs
Amin Rostami (Mashhad)	: Strong rainbow coloring and rainbow coloring of unicycle graphs
Maryam Mohammadpour Sabet (Tehran)	: Connected zero forcing number of some families of graphs
Robert Scheffler (Cottbus)	: The distance orientation problem
Ingo Schiermeyer (Freiberg)	: Gallai Ramsey number for K_4
Michael Schubert (Paderborn)	: Flows on signed graphs
Thomas Schweser (Ilmenau)	: Hypergraph partitions and variable degeneracy
Qays Shakir (Galway)	: Sparsity and tightness for graphs drawn on surfaces
Marina Šimac (Rijeka)	: LDPC codes constructed from Moore graphs with diameter 2
Stijn Cambie (Nijmegen)	: Maximum Wiener indices of unicylic graphs of given matching number
Raphael Steiner (Hagen)	: Neumann-Lara-flows and the Two-Colour-Conjecture
Andrea Švob (Rijeka)	: t-designs and strongly regular graphs constructed from some linear groups
Ulrich Tamm (Bielefeld)	: Block chains in finance
Nico Van Cleemput (Ghent)	: Non-Hamiltonian and non-traceable regular 3-connected planar graphs

Further participants

Barbara Altenbokum (Hagen)
Christian Deppe (Bielefeld)
Arnfried Kemnitz (Braunschweig)
Antje Klopp (Paderborn)
Lukas Nölke (Bremen)
Alexander Pott (Magdeburg)
Robert Scheidweiler (Aachen)
Kai-Uwe Schmidt (Paderborn)
Eckhard Steffen (Paderborn)
Michael Stiebitz (Ilmenau)
Charlene Weiß (Paderborn)

Friday, 24 Nov. 2017 — Time: 09:05 - 10:00 — Room: A

A formal approach to operations on polyhedra

GUNNAR BRINKMANN (Ghent)

Local operations on polyhedra that preserve the symmetries of the polyhedra have a long history. Already the names of the Archimedean solids – e.g. truncated cube or snub dodecahedron – say how they can be obtained: by applying an operation to a Platonic solid. Nevertheless it is not quite clear whether the names date back to Archimedes or were introduced by Keppler, who rediscovered the Archimedean solids. When asked what a "local symmetry preserving operation" is, a typical answer would not be a rigid definition, but very untypical for mathematics: an example – e.g. "for example truncation." Even the Conway notation is just a naming scheme for some operations and does not provide a definition. Of course without a proper definition, properties of the class of such operations cannot be studied. In this talk we will describe approaches of Goldberg, Caspar, Klug and Coxeter to decorate polyhedra, show that the famous Goldberg/Coxeter operation was in fact never proposed by Goldberg, but later by Caspar and Klug, show that the often cited paper by Goldberg has an – obvious – error and finally use the (corrected) approach by Goldberg for a formal approach to local operations on polyhedra that preserve symmetries.

This is joint work with Stan Schein (University of California, Los Angeles) and Pieter Goetschalckx (Ghent University)

Friday, 24 Nov. 2017 — Time: 15:45 - 16:40 — Room: A

Flows of signed graphs - a survey

CUN-QUAN ZHANG (Morgantown)

Integer 6-flow conjecture for signed graphs is one of well-known open problems in flow theory. This survey talk will cover some recent results towards this conjecture (and other relevant open problems) conducted by the group at West Virginia University.

Saturday, 25 Nov. 2017 — Time: 13:15 - 14:10 — Room: A

On block codes of Steiner triple systems

DIETER JUNGNICKEL (Augsburg)

In 1978, Doyen, Hubaut and Vandensavel proved that only the binary and ternary codes of Steiner triple systems can be interesting: for primes $p \neq 2, 3$, the p-ary code of any STS(v) has full rank v. They also proved that the 2-rank of a Steiner triple system on $2^n - 1$ points is at least $2^n - 1 - n$, with equality only for the classical point-line design in the projective geometry $PG(n-1, 2)$. Finally, they gave an analogous result for the ternary case, that is, for STS(3^n), where the classical examples are the point-line designs in ternary affine spaces. In 1995, Ed Assmus proved that the incidence matrices of all Steiner triple systems on v points which have the same 2-rank generate equivalent binary codes, and gave an explicit description of a generator matrix for such a code.

I will report on a systematic study of the binary and ternary block codes of Steiner triple systems in recent joint work with Vladimir Tonchev, where we obtained considerably simpler proofs for the results just described and also gave results analogous to those of Assmus for the ternary case. In all these cases, we provide explicit parity check matrices for the codes in question.

We have also applied these results to the enumeration problem for STS on $2^n - 1$ or 3^n points with a prescribed 2-rank or 3-rank, respectively. In particular, we could prove a general formula for the number of *distinct* STS$(2^n - 1)$ with 2-rank at most $2^n - 1 - n + t$ contained in the relevant code, which then leads to both lower and upper bounds for the number of *isomorphism classes* of STS$(2^n - 1)$ with 2-rank exactly (or at most) $2^n - 1 - n + t$. We also proved corresponding results for the ternary case. In both cases, the lower bounds appear to be quite strong and show the expected combinatorial explosion even for STS with small rank.

Our results provide the first two infinite families of 2-designs for which one has non-trivial lower and upper bounds for the number of non-isomorphic examples with a prescribed p-rank in almost the entire range of possible ranks. (The only cases where our bounds do not apply are for designs having full 2-rank v, or 3-rank $v - 1$.)

Saturday, 25 Nov. 2017 — Time: 14:40 - 15:35 — Room: A

Colorings, flows, and decompositions of graphs

CARSTEN THOMASSEN (Lyngby)

We discuss recent results on the root distribution of the Tutte polynomial and the chromatic polynomial, the Merino-Welsh conjecture on orientations, and applications of Jaeger's circular flow conjecture (now a theorem except that the best edge-connectivity is not known) to graph decomposition, graph factors modulo k, and the 1-2-3-conjecture.

Friday, 24 Nov. 2017 — Time: 10:30 - 10:50

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

Colourings of cubic graphs inducing isomorphic monochromatic subgraphs

GIUSEPPE MAZZUOCCOLO (Verona)

At the beginning of the nineties, Ando conjectured that every cubic graph admits a (not necessarily proper) 2-colouring of the vertices such that the two induced monochromatic subgraphs are isomorphic. Similarly, Wormald conjectured, few years before, that every cubic graph of order a multiple of four admits a (not proper) 2-edge-colouring such that the two induced monochromatic subgraphs are isomorphic. Both conjectures are still largely open. Here, we present some new results on these conjectures. Moreover, we discuss the relation between them and another conjecture of Ban and Linial about the existence of a bisection of the vertices of a bridgeless cubic graph such that the two parts have all connected components of order at most two. In particular, we furnish some evidence to support these and some related conjectures. Finally, we give a negative answer to a related question of Jackson and Wormald about certain decompositions of cubic graphs into linear forests.

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

On Selkow's bound on the independence number of graphs

SAMUEL MOHR (Ilmenau)

For a graph G with vertex set $V(G)$ and independence number $\alpha(G)$, S. M. Selkow (Discrete Mathematics, 132(1994)363–365) established the famous lower bound

$$\sum_{v\in V(G)} \frac{1}{d(v)+1}\Big(1+\max\Big\{\frac{d(v)}{d(v)+1}-\sum_{u\in N(v)}\frac{1}{d(u)+1},0\Big\}\Big)$$

on $\alpha(G)$, where $N(v)$ and $d(v) = |N(v)|$ denote the neighborhood and the degree of a vertex $v \in V(G)$, respectively. However, Selkow's original proof of this result is incorrect. We give a new probabilistic proof of Selkow's bound here.
This is joint work with Jochen Harant.

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

The traveling salesman problem with forbidden neighborhoods on regular grids

ANJA FISCHER (Dortmund)

In this talk we study the Traveling Salesman Problem with Forbidden Neighborhoods (TSPFN) on regular grids. Given points in the Euclidean plane the TSPFN looks for a shortest Hamiltonian cycle over these points where edges between two points are forbidden if they are too close to each other. We study the structure of optimal solutions for points arranged along regular grids depending on the given minimal distance and present optimal solutions in several cases. Some results are related to the Knight's Tour Problem. Finally we extend our results to the 3D case.

Friday, 24 Nov. 2017 — Time: 10:55 - 11:15

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

A generalisation of the Fulkerson conjecture

EDITA MÁČAJOVÁ (Bratislava)

The Fulkerson conjecture asserts that every bridgeless cubic graph contains a family of six perfect matchings that together cover every edge exactly twice. This statement is equivalent to the statement that if we double edges of a bridgeless cubic graph, the resulting graph will be 6-edge-colourable. We propose a stronger conjecture stating that if we take an edge disjoint union of two cubic graphs on the same set of vertices the resulting graph will be 6-edge-colourable unless it has a 2- or 4-edge cut which separates an odd number of vertices. The well known Shannon's theorem for edge-colouring of multigraphs implies that the conjecture is true if we replace the constant 6 by 9. In this paper we prove that the conjecture is true if we replace 6 by 7. Moreover, we characterise graphs which are an edge disjoint union of two cubic graphs with the same set of vertices and have the chromatic index exactly 8.

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

Maximum Wiener indices of unicylic graphs of given matching number

STIJN CAMBIE (Nijmegen)

The total distance or Wiener index $W(G)$ of a connected graph G is the sum of distances between all unordered pairs of vertices, i.e.

$$W(G) = \sum_{\{u,v\} \subset V(G)} d(u,v).$$

The minimum and maximum possible Wiener indices of a connected graph of order n with matching number m was determined by Dankelmann (1994). The graphs that attain the maximal Wiener indices are trees, while the graphs that attain the minimal Wiener indices contain many cycles. Hence two natural questions arise. What is the minimal Wiener index for trees? What is the maximal Wiener index for the graphs that are not trees? In the latter case, the graphs will necessarily be unicyclic. For graphs that contain multiple cycles, we can take a maximal matching and deleting an edge not contained in the matching such that the graph is still connected, will increase the Wiener index. Du and Zhou (2010) solved the first question and also determined the minimal Wiener index for unicyclic graphs. In this talk, we sketch the proof for the remaining question 'What are the maximal Wiener indices for unicyclic graphs with given order n and matching number m?' We also give some thoughts about another problem related to the Wiener index, the conjecture of DeLaViña and Waller.

6 — Section III — Room D — 10:55 - 11:15

Optimization of transition rules in a Bonus-Malus system

MÁRTON GYETVAI (Budapest)

Optimizing Bonus-Malus systems is a well-known problem in actuarial sciences. In Bonus-Malus systems (BMS) there are several classes and the classification of the policyholders depends on the class in the previous period and the number of claims reported in the present period. Designing a BMS requires choosing the transition rules between the classes and their number, the scale of premiums and the initial class. Usually the number of classes, the transition rules and the initial class are fixed while the scale of premiums are considered in the optimization process. We present an Integer Programming model for designing an irreducible Bonus-Malus system where the transition rules are considered in the optimization process with a fixed scale of premiums. Furthermore we extend the scope of our investigation to the joint optimization of the transition rules and the number of classes.

Friday, 24 Nov. 2017 — Time: 11:20 - 11:40

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

1-factor coverings of cubic graphs

LIGANG JIN (Zhejiang)

The parameter $\mu_3(G)$ is recently introduced as a measurement of edge-uncolorability of a cubic graph G. It is defined to be the least number of edges uncovered by the union of three 1-factors of G. So G is 3-edge-colorable if and only if $\mu_3(G) = 0$. In this talk, we verify the Fan-Raspaud conjecture for cubic graphs with relatively small μ_3. Then with the viewpoint of μ_3, we consider the Petersen coloring conjecture, which is much stronger than Fan-Raspaud conjecture.

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

Hypergraph partitions and variable degeneracy

THOMAS SCHWESER (Ilmenau)

A *p-partition* of a hypergraph H is a sequence $(H_1, H_2, \ldots, H_p)$ of pairwise disjoint induced subhypergraphs of H such that $V(H) = V(H_1) \cup V(H_2) \cup \ldots \cup V(H_p)$. In this talk, we regard p-partitions with boundings on variable degeneracy. Let $f = (f_1, f_2, \ldots, f_p)$ be a vector-function with $f_i \geq 0$ for all $i \in \{1, 2, \ldots, p\}$ and let H be a hypergraph such that $d_H(v) \leq f_1(v) + f_2(v) + \ldots + f_p(v)$ for all $v \in V(H)$. We show that there exists a p-partition $(H_1, H_2, \ldots, H_p)$ of H such that for any $i \in \{1, 2, \ldots, p\}$ it holds that each non-empty subhypergraph H of H_i contains a vertex v satisfying $d_H(v) < f_i(v)$ if and only if (H, f) is not a so-called *hard pair*. This is an extension of a theorem by Borodin, Kostochka and Toft for simple graphs. Furthermore, we present some applications of this theorem.
This is joint work with Michael Stiebitz.

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

Robust recoverable matchings on a budget

VIKTOR BINDEWALD (Dortmund)

We investigate the problem of making a given perfect matching in a bipartite graph robust against the deletion of at most k edges by adding at most ℓ edges. To the best of our knowledge, this problem has not been considered before and we present a number of complexity results. We prove that determining the robustness level of a given matching is NP-hard, a problem related to a specialized matching preclusion problem. Furthermore, we show that for $k = 1$ the problem is NP-complete and W[2]-hard when parametrized by ℓ. In addition, we show that the problem remains hard if budget restrictions on repairing the matching are imposed, unless the budget is very small. We also show that for a suitable restriction of the input graphs the problem becomes tractable.

Joint work with Moritz Mühlenthaler.

Friday, 24 Nov. 2017 — Time: 11:45 - 12:05

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

2-factors of regular graphs: an update

DOMENICO LABBATE (Potenza)

A 2–factor of a graph G is a 2–regular spanning subgraph of G. We give an updated survey on results on the structure of 2–factors in regular graphs obtained in the last few years by the author jointly with several other colleagues.

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

Erdős–Rothschild for intersecting systems

SHAGNIK DAS (Berlin)

The typical extremal problem asks how large a structure can be, provided it satisfies certain restrictions. For instance, the classic theorem of Erdős, Ko and Rado determines the largest size of a k-uniform family of subsets of $[n]$ that does not contain a disjoint pair of sets. This theorem has since been extended to several different settings, including intersecting families of vector subspaces.
The Erdős–Rothschild extension of an extremal problem asks for the maximum number of r-colourings a structure can have, provided every colour class satisfies the given restriction. In recent years, the Erdős–Rothschild extension of the Erdős–Ko–Rado Theorem has been studied. We will present some unified proofs that extend previous results, and address a question of Hoppen, Lefmann and Odermann concerning colourings of vector spaces.
This is joint work with Dennis Clemens and Tuan Tran.

A hypergraphic generalization of the network simplex algorithm

ISABEL BECKENBACH (Berlin)

We show how the network simplex algorithm can be adapted to solve the minimum cost flow problem on so called graph-based hypergraphs which occur in modelling coupling activities in railway rotation planning. In such hypergraphs each hyperedge corresponds to a set of vertex disjoint arcs of a given digraph.
In contrast to the graph case, finding a minimum cost integral flow on graph-based hypergraphs is $\mathcal{NP}$-hard. Thus, we only look at minimum cost fractional hyperflows, which can be computed using standard linear programming techniques. However, we show that it is also possible to solve the minimum cost hyperflow problem using a more combinatorial method similar to the network simplex algorithm. It turns out that the simplex bases correspond to special kinds of spanning forests. Using this structure we design algorithms to decide whether a basis is optimal, and, if it is not optimal, to determine hyperedges leaving and entering the basis.

Friday, 24 Nov. 2017 — Time: 13:15 - 13:35

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

Hajós-like theorem for signed graphs

YINGLI KANG (Paderborn)

In 1961, Hajós proved a result on the chromatic number of graphs, which is one of the classical results in the field of graph colorings. We design five graph operations, and prove that every signed graph with chromatic number q can be obtained from all-positive complete graphs $(K_q, +)$ by repeatedly applying these operations. This result gives a signed version of the Hajós theorem, emphasizing the role of all-positive complete graphs played in the class of signed graphs, as played in the class of unsigned graphs.

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

Sparsity and tightness for graphs drawn on surfaces

QAYS SHAKIR (Galway)

For positive integers $l \leq k$ we say that a graph $G = (V, E)$ is (k, l)-sparse if every subset W of V spans at most $k|W| - l$ edges. If, in addition, $|E| = k|V| - l$, we say that G is (k, l)-tight. These conditions play a key role in geometric rigidity theory. We present some new results on such graphs that can be embedded without edge crossings in a compact orientable surface. In particular we discuss the case where $l = k = 2$ and the surface is the torus. Our main result is an inductive characterisation of this class of graphs using generalised vertex splitting operations. This is joint work with James Cruickshank, Derek Kitson and Stephen Power.

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

Connected zero forcing number of some families of graphs

MARYAM MOHAMMADPOUR SABET (Tehran)

Let G be a graph where each vertex is colored black or white. By zero forcing set, we mean a subset of black vertices which can dynamically change the color of the remaining vertices according to the following rule: if a black vertex v has exactly one white neighbor u, then it changes the color of u to black. A connected zero forcing set is a zero forcing set which induces a connected graph. Connected zero forcing number, denoted by $Z_c(G)$, is the cardinality of the smallest connected zero forcing set. In this talk, we study the connected zero forcing number of graph products and some other families of graphs.

Friday, 24 Nov. 2017 — Time: 13:40 - 14:00

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

On the spectrum of signed complete and complete bipartite graphs

LEILA PARSAEI MAJD (Theran)

In this paper, we obtain the spectrum of signed complete and complete bipartite graphs whose negative edges form a matching. Moreover, we show that the balanced signed complete and complete bipartite graphs are uniquely determined by their spectrums.

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

New vertex ordering characterisations of AT-free graphs

JESSE BEISEGEL (Cottbus)

An asteroidal triple free graph is a graph such that for every independent triple of vertices no path between any two avoids the third. In a recent result by Corneil and Stacho these graphs were characterised through a linear vertex ordering called an AT-free order. Here, we use techniques from abstract convex geometry to improve on this result by giving a vertex order characterisation with stronger structural properties and thus resolve an open question Corneil and Stacho. These orderings are generated by a modification of BFS which runs in polynomial time. Furthermore, we give a linear time algorithm which employs multiple applications of (L)BFS to compute AT-free orders in claw-free AT-free graphs and a generalisation of these.

18 — Section III — Room D — 13:40 - 14:00

Cutting stock problem with the possibility of welding

KOLOS CSABA ÁGOSTON (Budapest)

The cutting stock problem is widely studied in operations research. The problem was originally formulated as one dimensional. In this paper we extend the original problem: we consider the problem when welding is allowed, but at most only once for every piece. This problem arises from a real world problem, it is a regulation in fire sprinkler systems.
We show how one can reduce the cutting stock problem with welding to a one dimensional cutting stock problem with multiple stock sizes —so that the algorithms and softwares (solvers) available for the cutting stock problem can be used for the cutting stock with welding as well. We describe how the patterns in the cutting stock problem can be transformed to a pattern in the welding problem. We discuss the limitation of this reduction.

Friday, 24 Nov. 2017 — Time: 14:05 - 14:25

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

Flows on signed graphs

MICHAEL SCHUBERT (Paderborn)

A signed graph is a graph that has either positive or negative edges. Positive edges can be oriented in the ordinary way, whereas negative edges can be oriented extroverted or introverted. A nowhere-zero r-flow on a signed graph (G, σ) is given by an orientation of the edges and a function $\phi : E(G) \to [1, r-1]$ such that for each vertex the sum of incoming values equals the sum of outgoing values. Let G be a planar graph and G' be a corresponding dual graph. Tutte proved, that G has a nowhere-zero k-flow if and only if G' has a k-face-coloring. In order to motivate flows on signed graphs we briefly show that nowhere-zero flows on signed graphs establish a generalization on non-orientable surfaces. Let p and q be integers. We show that if $(\frac{p}{q} + 1)$ is the minimum value of r for that (G, σ) has a nowhere-zero r-flow, then (G, σ) has a nowhere-zero flow such that all of its flow values are multiples of $\frac{1}{2q}$. Furthermore, we show some applications for this theorem.

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

Irrelevant edges for k-connectivity

THOMAS LANGE (Mittweida)

An edge e of the graph G is essential for k-(edge) connectivity, if G is k-(edge) connected but $G - e$ is not. If all edges of a graph G are essential, the graph G is minimally k-(edge) connected. It is clear that every essential edge of G must be contained in every minimally k-(edge) connected spanning subgraph of G. An edge is relevant for k-(edge) connectivity, if it is contained in at least one minimally k-(edge) connected spanning subgraph of G – otherwise it is called irrelevant. In this talk we will study some connections between essential and irrelevant edges, especially whether a l-(edge) connected graph can contain irrelevant edges for k-(edge) connectivity.

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

Block chains in finance

ULRICH TAMM (Bielefeld)

Recently, there is a big hype about block chains, mainly due to its potential applications in finance. Actually, a block chain is basically a data structure - the good old pointer, provided with an additional security mechanism which allows authentication via a hash function. It is mainly known as the backbone of bitcoin but allows further applications.
(joint work with Rainer Lenz)

Friday, 24 Nov. 2017 — Time: 14:30 - 14:50

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

On minimal triangle-free 6-chromatic graphs

JAN GOEDGEBEUR (Ghent)

A graph with chromatic number k is called *k-chromatic*. Using computational methods, we show that the smallest triangle-free 6-chromatic graphs have at least 32 and at most 40 vertices.
We also determine the complete set of all triangle-free 5-chromatic graphs up to 23 vertices and all triangle-free 5-chromatic graphs on 24 vertices with maximum degree at most 7. This implies that Reed's conjecture holds for triangle-free graphs up to at least 24 vertices. Next to that, we determine that the smallest regular triangle-free 5-chromatic graphs have 24 vertices. Finally, we show that the smallest 5-chromatic graphs of girth at least 5 have at least 29 vertices.

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

Symmetry vs complexity: a geometric look at inaccessible graphs

CHRISTOPH JOSTEN (Frankfurt a.M.)

Inaccessible graphs are among the most intricate objects that are still symmetric and locally finite. They reveal their complexity in the long run – in their end structure. Although Dunwoody constructed several of these with group-theoretical methods, no geometric representation is known. We consider two examples by Mller and Jung for further insight. And we show that graphs failing the finite cycle condition of Hamann have a cycle tower as subgraph. Several open questions and conjectures will be mentioned.

Adaptive q-ary search with lies

VLADIMIR LEBEDEV (Moscow)

The Ulam problem can be formulated as follows: How many questions should be asked with "yes-no" answers in order to find a number from 1 to M, if there can be not more than t wrong answers in the worst case. We consider the generalization of this problem to the q-ary case, when a set of M elements is divided into q subsets and the answer shows in which group the desired number is located. In [1] a rubber algorithm was proposed that yields an asymptotically exact answer for $1/q \leq \tau \leq 1/2$, where $\tau = t/n$ is the error proportion (n is the number of questions). A generalization of the algorithm is proposed (it use z information zeroes).

Theorem. The generalized algorithm works for t wrong answers and

$$M = \binom{n - 2t - \lceil \log_{q-1} \binom{z+t}{z} \rceil}{z} \cdot (q-1)^{n-2t-\lceil \log_{q-1} \binom{z+t}{z} \rceil - z}.$$

Theorem. The generalized algorithm is asymptotically better then the rubber algorithm in interval $(\tau^*, 1/(q+1))$, where $\tau^* = \frac{\log_q \lambda - \log_q(q-1)}{3\log_q \lambda - 2\log_q(q-1)}$.

This is joint work with Christian Deppe (University of Bielefeld).

[1] R. Ahlswede, C. Deppe, and V. Lebedev, Non-binary error correcting codes with noiseless feedback, localized errors, or both, Annals of the European Academy of Sciences, No. 1, 285-309, 2005.

Friday, 24 Nov. 2017 — Time: 14:55 - 15:15

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25 — Section I — Room A — 14:55 - 15:15

Gaps for numbers of crossings

HEIKO HARBORTH (Braunschweig)

For different types of drawings of graphs in the plane there exist corresponding minimum and maximum numbers of crossings. Which numbers of crossings do exist in between these two extremal numbers? For some special graphs and for some classes of graphs it will be reported on crossing number gaps within these intervals.

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26 — Section II — Room B — 14:55 - 15:15

Strong rainbow coloring and rainbow coloring of unicycle graphs

AMIN ROSTAMI (Mashhad)

An edge coloring path is called rainbow if no two edges of it are colored the same. An edge coloring graph G is rainbow coloring if every two vertices are connected by rainbow path. A rainbow coloring of G which for each two vertices u and v, there is a rainbow path with length $d(u, v)$ between them, is called strong rainbow coloring. The minimum number of colors such that G be rainbow coloring or strong rainbow coloring is denoted by rc(G) and src(G), respectively. In this talk, we find the exact value of rc(G), $src(G)$ when G is an unicyclic graph.

27 — Section III — Room D — 14:55 - 15:15

Autotopism stabilized generalized Latin square colouring games

STEPHAN DOMINIQUE ANDRES (Hagen)

A *Latin hyperrectangle* is a d-dimensional finite array filled by integers (which are considered as *colours*) such that in any coordinate direction row every integer appears at most once as an entry. This generalizes the 2-dimensional case which includes $(n \times n)$-Latin squares. An *autotopism* of a Latin hyperrectangle H consists of permutations of the rows in every coordinate and a permutation of the finite set of integer symbols that leave H invariant.
The *colouring game* on an array is played by two players, Maker and Breaker, who alternately assign a colour from a given set to an empty entry of the array such that there are no two colours in any coordinate row. Maker tries to achieve a completely filled array, i.e. a Latin hyperrectangle, Breaker tries to make avoid it. The smallest size of a colour set such that Maker has a winning strategy is the *game chromatic number* of the array.
We consider a modified game with the additional condition that the partial colourings must respect in a certain sense the invariance under the extension of a given autotopism. We discuss conditions under which this generalization leads to a well-defined game, develop a general orbit contraction principle and determine the game chromatic numbers of some small arrays w.r.t. feasible sets of permutations.
This is joint work with Raúl Falcón.

Saturday, 25 Nov. 2017 — Time: 08:50 - 09:10

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

Rainbow spanning tree decompositions in complete graphs colored by 1-factorizations

GLORIA RINALDI (Modena)

A $1-$factorization of a complete graph on n vertices, K_n, is a decomposition of the edge set of K_n into perfect matchings. Such a decomposition exists when n is even and yields a proper edge coloring of K_n with $n-1$ colors. Given an edge coloring (not necessarily proper) of K_n, a spanning tree Γ of K_n is called rainbow if its edges have distinct colors. In 1996 R.A. Brualdi and S. Hollingsworth conjecture that when $n \geq 6$ and even, the edge set of a K_n colored by a $1-$factorization can be partitioned into $\frac{n}{2}$ edge disjoint rainbow spanning trees. We examine the state of art on this conjecture and show that in some cases it is possible to construct $\frac{n}{2}$ edge disjoint rainbow spanning trees when the $1-$factorization has a non trivial automorphism group.

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

LDPC codes constructed from Moore graphs with diameter 2

MARINA ŠIMAC (Rijeka)

The main subject of this talk are low-density parity-check (LDPC) codes based on adjacency matrices of strongly regular graphs with parameters $(v, k, 0, 1)$. We will analyze absorbing set structures in the LDPC codes arising from the graphs. We will identify and enumerate the smallest absorbing sets in the Tanner graphs of the codes. Furthermore, we will give an expression for the variance of a syndrome weight of an LDPC code constructed from a strongly regular graph with parameters $(v, k, 0, 1)$.

30 — Section III — Room D — 08:50 - 09:10

Assignment problems with few failure resources

FELIX HOMMELSHEIM (Dortmund)

Many real-life planning problems require making a priori decisions before all parameters of the problem have been revealed. Uncertainty may arise in the availability of the resources (structural-robustness) or in the cost functions of the problem (cost-robustness). The task is to compute solutions, which are cost-minimal and feasible in any scenario (structural-robustness) or cost-minimal in the worst case (cost-robustness).
In this talk, we deal with four different structural-robust versions of the famous assignment problem. The focus is on the special case with only two scenarios, each consisting of one failure resource. It turns out that two of them are NP-hard, while the remaining two problems are solvable in polynomial time.
Furthermore, we discuss the complexity of the cost-robust counterpart of assignment problems when only a constant number of resources are subject to uncertainty.

Joint work with David Adjiashvili, Viktor Bindewald and Dennis Michaels.

Saturday, 25 Nov. 2017 — Time: 09:15 - 09:35

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

Non-Hamiltonian and non-traceable regular 3-connected planar graphs

NICO VAN CLEEMPUT (Ghent)

By Euler's formula, there are k-regular 3-connected planar graphs for three values of k: 3, 4, or 5. Denote by c_k, resp. p_k, the order of the smallest non-hamiltonian, resp. non-traceable, k-regular 3-connected planar graph.
Tait conjectured in 1884 that every 3-regular 3-connected planar graph is hamiltonian. This conjecture became famous because it implied the Four Colour Theorem (which at that time was still the Four Colour Problem). However, Tait's conjecture turned out to be false and the first to construct a counterexample was Tutte in 1946. The smallest counterexample is due to Lederberg (and independently, Bosák and Barnette) and has order 38. That this is indeed the smallest possible counterexample was shown by Holton and McKay after a long series of papers by various authors, e.g., Butler, Barnette and Wegner, and Okamura. This settles that $c_3 = 38$. Combining work of Knorr and T. Zamfirescu, it has been shown that $54 \leq p_3 \leq 88$.
Non-hamiltonian 4-regular 3-connected planar graphs have been known for a long time. Following work of Walther and Sachs, Zaks proved that there exists a non-hamiltonian 4-regular 3-connected planar graph of order 209. Applying a technique by Sachs to transform a non-hamiltonian 3-regular 3-connected planar graph into a non-hamiltonian 4-regular 3-connected planar graph, Bosk showed that $c_4 \leq 171$. Using the same technique by Sachs and the non-traceable 3-regular 3-connected planar graph on 88 vertices by T. Zamfirescu, it can be shown that $p_4 \leq 396$.
Zaks showed for the 5-regular case that $c_5 \leq 532$ and that $p_5 \leq 1232$. Owens strongly improved these bounds for non-hamiltonian and non-traceable 5-regular 3-connected planar graphs. More specifically, he showed that $c_5 \leq 76$ and that $p_5 \leq 128$.
The main focus of the talk will be the 4-regular case for which we show that there exists a non-hamiltonian 4-regular 3-connected planar graph with 39 vertices. We also present the result of computations that show that every non-hamiltonian 4-regular 3-connected planar graph has at least 34 vertices. This implies that $34 \leq c_4 \leq 39$. Using similar building blocks, we also construct a non-traceable 4-regular 3-connected planar graph on 78 vertices which improves the upper bound of p_4 to $p_4 \leq 78$. Furthermore, we discuss a small improvement to the 5-regular non-traceable case by showing that $p_5 \leq 120$.
This is joint work with Carol T. Zamfirescu.

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

Almost perfect nonlinear functions

RAZI ARSHAD (Magdeburg)

Many symmetric key encryption systems are based on the highly nonlinear functions. One possibility of highly nonlinear function is realized by the so called almost perfect nonlinear (APN) functions. A function $F : \mathbb{F}_2^n \to \mathbb{F}_2^n$ is APN, if $F(x + a) + F(x) = b$ has at most two solutions for all $a, b \in \mathbb{F}_2^n$, $a \neq 0$. In this talk, we discuss the number of weight 4 code words in codes related to APN functions. We give an explicit formula for the computation of number of weight 4 code words in codes related to vectorial bent functions and plateaued functions. We discuss the vectorial bent function contained in the APN functions proposed by Dillon for $n = 6$.
This is a joint work with Alexander Pott.

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

The distance orientation problem

ROBERT SCHEFFLER (Cottbus)

We study the Distance Orientation Problem, which has applications in Computer Vision. Given a graph $G = (V, E)$ with a distance function $d : E \to \mathbb{R}^+$. Is there a height function $h : V \to \mathbb{R}$, such that $|h(x) - h(y)| = d(x, y)\ \forall\{x, y\} \in E$? This problem can also be formulated as a problem of finding a special orientation of G. We will give some complexity results for planar graphs. Furthermore we will show that outerplanar embeddings have a special property in respect to this problem, which characterizes them.

Saturday, 25 Nov. 2017 — Time: 09:40 - 10:00

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

Counting degree sequences of spanning trees in bipartite graphs: a graph theoretic proof

FRANK FISCHER (Kassel)

Given a bipartite graph $G = (S \dot\cup T, E)$ each spanning tree in G has a degree sequence on S and one on T. Lhne and Rudloff showed that the number of possible degree sequences on S equals the number of possible degree sequences on T. Their proof uses a non-trivial characterization of degree sequences by G-draconian sequences based on polyhedral results of Postnikov. In this talk we present a purely graph theoretic proof of their result.

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35 — Section II — Room B — 09:40 - 10:00

A bound on the Shannon capacity via a linear programming variation

SIHUANG HU (Aachen)

We prove an upper bound on the Shannon capacity of a graph via a linear programming variation. We show that our bound can outperform both the Lovász theta number and the Haemers minimum rank bound. As a by-product, we also obtain a new upper bound on the broadcast rate of Index Coding.

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

A combinatorial approach to the separation problem for regular languages

LORIJN VAN ROOIJEN (Paderborn)

A class of regular languages may be defined by properties of the automata or the semigroups recognizing these languages, or as a logical fragment. Understanding the expressive power of such a class amounts to solving the membership problem, i.e. to finding a method to decide for every input language, whether it is in the class S. In this talk, we look at a generalization of the membership problem called the separation problem.

The separation problem, for a class S of languages, asks the following: given two input languages, does there exist a language in S that contains the first language and that is disjoint from the second language? The separation problem provides more detailed information about the class, and recent advances on the separation problem have led to new results on longstanding open membership problems.

A language in S that separates two input languages explains, in terms of S (typically a simple class), why the two input languages are disjoint. Such a language can be seen as an over-approximation of the first input language by a language in S, which still avoids the forbidden second input language.

Historically, the separation problem emerged in different contexts, and has been studied in the past, for specific classes of languages, using involved topological and algebraic methods. In this talk, we will discuss an approach to the separation problem that only uses elementary combinatorial arguments. Another advantage of this approach is that it gives a description of a separating language, in case it exists. We will illustrate our approach for the fragment of first-order logic that uses only two variable names.

Saturday, 25 Nov. 2017 — Time: 10:30 - 10:50

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

Gallai Ramsey number for K_4

INGO SCHIERMEYER (Freiberg)

Given a graph H, the k-coloured Gallai Ramsey number $gr_k(K_3 : H)$ is defined to be the minimum integer n such that every k-colouring (using all k colours) of the complete graph on n vertices contains either a rainbow triangle or a monochromatic copy of H. Recently, Fox, Grinshpun, and Pach conjectured the value of the Gallai Ramsey numbers for complete graphs [2]. The case when $H = K_3$ was actually verified in 1983 by Chung and Graham [1]. We verify this conjecture for the first open case, when $H = K_4$.
This is joint work with Colton Magnant and Akira Saito.

[1] F. R. K. Chung and R. L. Graham, *Edge-colored complete graphs with precisely colored subgraphs*, Combinatorica **3** (3-4) (1983) 315–324.

[2] J. Fox, A. Grinshpun, and J. Pach, *The Erdős-Hajnal conjecture for rainbow triangles*, J. Combin. Theory Ser. B, **111** (2015) 75–125.

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

t-designs and strongly regular graphs constructed from some linear groups

ANDREA ŠVOB (Rijeka)

In this talk we describe a method for constructing transitive t-designs from finite groups. We apply this method to classify t-designs, $t \geq 2$, admitting a transitive action of the linear groups $L(2, q), q \leq 23$, up to 35 points. Some of the constructed t-designs have not been know before. Furthermore, we construct strongly regular graphs admitting a transitive action of the linear groups $L(2, q), q \leq 23$. The constructed structures will be analysed and described.
This is a joint work with Dean Crnković.

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

Shattering-extremal set systems

TAMÁS MÉSZÁROS (Berlin)

We say that a set system $\mathcal{F} \subseteq 2^{[n]}$ shatters a given set $S \subseteq [n]$ if the elements of $\mathcal{F}$ intersect S in every possible way. The Sauer-Shelah lemma states that in general, a set system $\mathcal{F}$ shatters at least $|\mathcal{F}|$ sets. Here we concentrate on the case of equality and call a set system $\mathcal{F}$ shattering-extremal if it shatters exactly $|\mathcal{F}|$ sets. A conjecture of Rónyai and Mészáros and of Litman and Moran states that if a family is shattering-extremal then one can remove its elements one-by-one so that the resulting families will be always shattering-extremal. In this talk we desrcibe how can one construct shattering-extremal set systems from Sperner families and prove the above conjecture in a special case.
This is joint work with Christopher Kusch.

Saturday, 25 Nov. 2017 — Time: 10:55 - 11:15

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

Minimal ordered Ramsey graphs

JONATHAN ROLLIN (Karlsruhe)

An *ordered graph* is a graph equipped with a linear ordering of its vertex set. A pair of ordered graphs is *Ramsey finite* if it has only finitely many minimal ordered Ramsey graphs and *Ramsey infinite* otherwise. Here an ordered graph F is an *ordered Ramsey graph* of a pair (H, H') of ordered graphs if for any coloring of the edges of F in colors red and blue there is either a copy of H with all edges colored red or a copy of H' with all edges colored blue. Such an ordered Ramsey graph is *minimal* if neither of its proper subgraphs is an ordered Ramsey graph of (H, H'). If $H = H'$ then H itself is called Ramsey finite.
By applying the hypergraph container method to random graphs we prove that each Ramsey finite ordered graph H has a pseudoforest as a Ramsey graph and therefore is a star forest with strong restrictions on the positions of the centers of the stars. In particular we show that a connected ordered graph is Ramsey finite if and only if it is a star with center being the first or the last vertex in the vertex order. In the asymmetric case we see that (H, H') is Ramsey finite whenever H is a so-called monotone matching. Moreover, there are Ramsey finite pairs of ordered stars and ordered caterpillars of arbitrary diameter.

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

An updated table of quasi-symmetric designs

VEDRAN KRČADINAC (Zagreb)

Neumaier published a table of admissible parameters of exceptional quasi-symmetric 2-designs in 1986. It sparked a lot of research about the topic. Updated and extended tables were published by Tonchev (1986., 1993.), Calderbank (1988.), and Shrikhande (2007.). We survey results about quasi-symmetric designs published in the last 10 years and present a new, updated table. Some omissions are corrected and the remaining interesting open cases are pointed out.

Saturday, 25 Nov. 2017 — Time: 11:20 - 11:40

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

Algebraic NL-flows and a polynomial

WINFRIED HOCHSTÄTTLER (Hagen)

Let $D = (V, A)$ be a digraph and k an integer. An *acyclic k-colouring of D* is a partition of V into k sets which induce acyclic subdigraphs. Let G be an Abelian group with identity element e. An *(algebraic)* NEUMANN-LARA *G-flow* (an NL-G-flow for short) is a map $\varphi : A \to G$ satisfying Kirchhoff's law of flow conservation such that $D/\varphi^{-1}(G \setminus \{e\})$ is strongly connected. For acyclic colorings of digraphs the NL-flows play a similar role as NZ-flows do for ordinary graph colorings. We derive analogues to two classical theorems for NZ-flows: There exists an NL-Z-flow using only values from $\{0, \ldots, \pm(k-1)\}$ if and only if there exists an NL-G-flow for some resp. all groups G of order k. Secondly, the number of NL-G-flows is a polynomial in the order of G.
(Joint work with Barbara Altenbokum, FernUniversität in Hagen)

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

A construction of strong external difference families

SHUXING LI (Magdeburg)

Strong external difference family (SEDF) is a new combinatorial configuration motivated by cryptography applications. In this talk, we present a construction of one specific SEDF, whose parameter is (243,11,22,20). This is the first and the only known example of SEDF, which contains more than two subsets. The construction is a combination of various mathematical objects, including partial difference sets, projective geometry and sporadic finite simple group.

Saturday, 25 Nov. 2017 — Time: 11:45 - 12:05

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

Neumann-Lara-flows and the Two-Colour-Conjecture

RAPHAEL STEINER (Hagen)

A famous problem in graph theory, answered positively by Appel and Haken in 1976, is the Four-Colour-Conjecture, which states that every simple planar graph is 4-colourable. In this talk, we are concerned with a directed version of this conjecture, the so-called Two-Colour-Conjecture. A k-colouring of a digraph according to Victor Neumann-Lara is defined to be a decomposition of the vertex set into k subsets each of them inducing an acyclic subdigraph. The conjecture now states that every orientation of a simple planar graph admits a 2-colouring.
Here, we give an overview about partial results and progress on this problem. We furthermore relate the concept of digraph-colourings to the dual concept of Neumann-Lara-flows, which is a directed version of Nowhere-Zero-flows as considered in Seymour's 6-Flow-Theorem and the 5- and 4-flow conjecture, and discuss positive and negative results for non-planar digraphs in this dual case.

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

Spectral properties of character polynomials

CHRISTIAN GÜNTHER (Paderborn)

There are various old unsolved problems, mostly due to Littlewood and Erdős, that ask for polynomials with coefficients ± 1 that provide a good approximation to a function that is constant on the complex unit circle, and in particular have a small L^q norm on the complex unit circle. Such problems are closely related to questions about the minimisation of the mean-squared aperiodic autocorrelations of binary sequences. After giving some background and surveying known results, we consider polynomials whose coefficients are obtained from additive and multiplicative characters of finite fields. We give explicit and recursive formulas for the limit of the ratio of L^q and L^2 norm of these polynomials when q is an even positive integer and the degree tends to infinity. To our knowledge, these are the first results that give these limiting values for specific sequences of nontrivial polynomials with coefficients in ± 1 and infinitely many q. These results vastly generalise earlier results on the L^4 norm of these polynomials.

This is joint work with Kai-Uwe Schmidt.

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Speakers

Friday, 24 Nov. 2017, Section I, Room A

Chair: Eckhard Steffen

Zeit	
10:30 – 10:50	**Giuseppe Mazzuoccolo** **1** Colourings of cubic graphs inducing isomorphic monochromatic subgraphs
10:55 – 11:15	**Edita Máčajová** **4** A generalisation of the Fulkerson conjecture
11:20 – 11:40	**Ligang Jin** **7** 1-factor coverings of cubic graphs
11:45 – 12:05	**Domenico Labbate** **10** 2-factors of regular graphs: an update

Friday, 24 Nov. 2017, Section II, Room B

Chair: Michael Schubert

Zeit	
10:30 – 10:50	**Samuel Mohr** **2** On Selkow's bound on the independence number of graphs
10:55 – 11:15	**Stijn Cambie** **5** Maximum Wiener indices of unicylic graphs of given matching number
11:20 – 11:40	**Thomas Schweser** **8** Hypergraph partitions and variable degeneracy
11:45 – 12:05	**Shagnik Das** **11** Erdős–Rothschild for intersecting systems

Friday, 24 Nov. 2017, Section III, Room D

Chair: Stephan Dominique Andres

Zeit	
10:30 – 10:50	**Anja Fischer** **3** The traveling salesman problem with forbidden neighborhoods on regular grids
10:55 – 11:15	**Márton Gyetvai** **6** Optimization of transition rules in a Bonus-Malus system
11:20 – 11:40	**Viktor Bindewald** **9** Robust recoverable matchings on a budget
11:45 – 12:05	**Isabel Beckenbach** **12** A hypergraphic generalization of the network simplex algorithm

Friday, 24 Nov. 2017, Section I, Room A

Chair: Ingo Schiermeyer

Zeit	
13:15 – 13:35	**Yingli Kang** **13** Hajós-like theorem for signed graphs
13:40 – 14:00	**Leila Parsaei Majd** **16** On the spectrum of signed complete and complete bipartite graphs
14:05 – 14:25	**Michael Schubert** **19** Flows on signed graphs
14:30 – 14:50	**Jan Goedgebeur** **22** On minimal triangle-free 6-chromatic graphs
14:55 – 15:15	**Heiko Harborth** **25** Gaps for numbers of crossings

Friday, 24 Nov. 2017, Section II, Room B

Chair: Lorijn van Rooijen

Zeit	
13:15 – 13:35	**Qays Shakir** **14** Sparsity and tightness for graphs drawn on surfaces
13:40 – 14:00	**Jesse Beisegel** **17** New vertex ordering characterisations of AT-free graphs
14:05 – 14:25	**Thomas Lange** **20** Irrelevant edges for k-connectivity
14:30 – 14:50	**Christoph Josten** **23** Symmetry vs complexity: a geometric look at inaccessible graphs
14:55 – 15:15	**Amin Rostami** **26** Strong rainbow coloring and rainbow coloring of unicycle graphs

Friday, 24 Nov. 2017, Section III, Room D

Chair: Christian Günther

Zeit	
13:15 – 13:35	**Maryam Mohammadpour Sabet** **15** Connected zero forcing number of some families of graphs
13:40 – 14:00	**Kolos Csaba Ágoston** **18** Cutting stock problem with the possibility of welding
14:05 – 14:25	**Ulrich Tamm** **21** Block chains in finance
14:30 – 14:50	**Vladimir Lebedev** **24** Adaptive q-ary search with lies
14:55 – 15:15	**Stephan Dominique Andres** **27** Autotopism stabilized generalized Latin square colouring games

Saturday, 25 Nov. 2017, Section I, Room A

Chair: Ligang Jin

Zeit	
08:50 – 09:10	**Gloria Rinaldi** **28** Rainbow spanning tree decompositions in complete graphs colored by 1-factorizations
09:15 – 09:35	**Nico Van Cleemput** **31** Non-Hamiltonian and non-traceable regular 3-connected planar graphs
09:40 – 10:00	**Frank Fischer** **34** Counting degree sequences of spanning trees in bipartite graphs: a graph theoretic proof

Saturday, 05 Nov. 2017, Section II, Room B

Chair: Kai-Uwe Schmidt

Zeit	
08:50 – 09:10	**Marina Šimac** **29** LDPC codes constructed from Moore graphs with diameter 2
09:15 – 09:35	**Razi Arshad** **32** Almost perfect nonlinear functions
09:40 – 10:00	**Sihuang Hu** **35** A bound on the Shannon capacity via a linear programming variation

Saturday, 25 Nov. 2017, Section III, Room D

Chair: Anja Fischer

Zeit	
08:50 – 09:10	**Felix Hommelsheim** **30** Assignment problems with few failure resources
09:15 – 09:35	**Robert Scheffler** **33** The distance orientation problem
09:40 – 10:00	**Lorijn van Rooijen** **36** A combinatorial approach to the separation problem for regular languages

Saturday, 25 Nov. 2017, Section I, Room A

Chair: Michael Stiebitz

Zeit		
10:30 – 10:50	**Ingo Schiermeyer** Gallai Ramsey number for K_4	**37**
10:55 – 11:15	**Jonathan Rollin** Minimal ordered Ramsey graphs	**40**
11:20 – 11:40	**Winfried Hochstättler** Algebraic NL-flows and a polynomial	**43**
11:45 – 12:05	**Raphael Steiner** Neumann-Lara-flows and the Two-Colour-Conjecture	**46**

Saturday, 25 Nov. 2017, Section II, Room B

Chair: Alexander Pott

Zeit	
10:30 – 10:50	**Andrea Švob** **38** t-designs and strongly regular graphs constructed from some linear groups
10:55 – 11:15	**Vedran Krčadinac** **41** An updated table of quasi-symmetric designs
11:20 – 11:40	**Shuxing Li** **44** A construction of strong external difference families
11:45 – 12:05	**Christian Günther** **47** Spectral properties of character polynomials

Saturday, 25 Nov. 2016, Section III, Room D

Chair: Christian Deppe

Zeit	
10:30 – 10:50	**Tamás Mészáros** **39** Shattering-extremal set systems