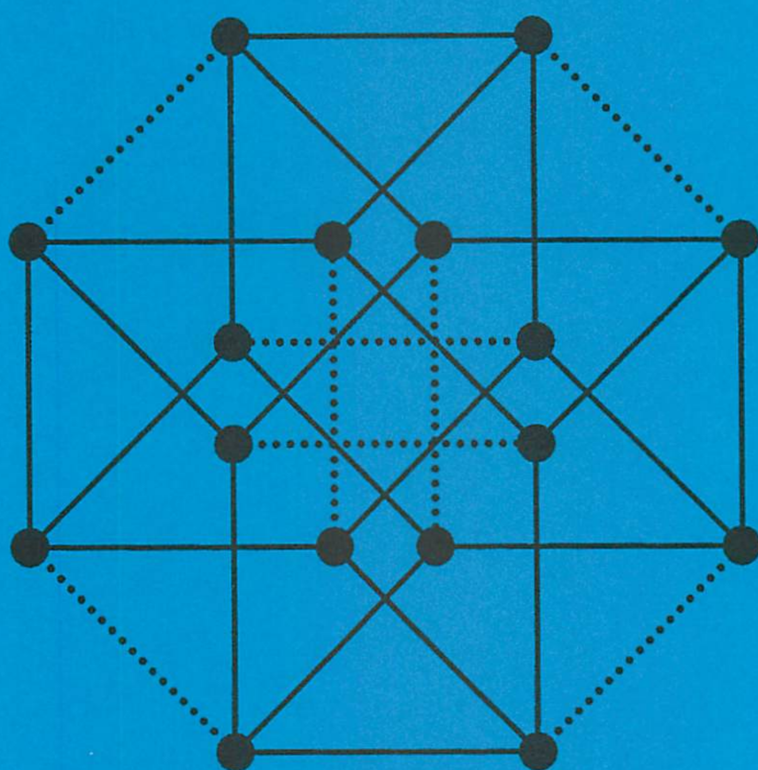
KOLLOQUIUM über KOMBINATORIK

15. - 16. November 1996



Diskrete Mathematik

TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG

KOLLOQUIUM ÜBER KOMBINATORIK – 15. UND 16. NOVEMBER 1996
DISKRETE MATHEMATIK – TU BRAUNSCHWEIG

Liebe Teilnehmerinnen und Teilnehmer:

Ein herzliches Willkommen zum 16. "Kolloquium über Kombinatorik", das zum fünften Mal in Braunschweig stattfindet, nach den zehn ersten Jahren in Bielefeld und dem Jahr 1994 in Hamburg. Über Ihre diesjährige Teilnahme freuen wir uns sehr.

Für die Hilfe bei der Organisation dieser nun schon traditionellen November–Tagung danken wir den vielen freiwilligen Helfern auch an dieser Stelle.

Besonderer Dank gilt auch dem Präsidenten unserer Technischen Universität Carolo-Wilhelmina, Herrn Professor Dr. Bernd Rebe, für seine finanzielle Unterstützung.

Bei interessanten Vorträgen und anregenden Gesprächen wünschen wir allen Teilnehmern ein erfolgreiches "Kolloquium über Kombinatorik" sowie einen angenehmen Aufenthalt in Braunschweig.

Heiko Harborth
Arnfried Kemnitz
Christian Thürmann
Hartmut Weiß

Diskrete Mathematik
Technische Universität Braunschweig

Freitag, 15. 11. 1996

9:30 **Eröffnung** (Hörsaal: PK 4.3)

9:40 **M. Skoviera** (Bratislava, Slowakei)
"Snarks" (Hörsaal: PK 4.3)

10:35 **Kaffeepause**

10:50 **V. T. Sós** (Budapest, Ungarn)
"On random and quasi–random graphs" (Hörsaal: PK 4.3)

11:45–13:00 **Mittagspause**

Zeit	Sektion I Raum PK 14.3	Sektion II Raum PK 14.4	Sektion III Raum PK 14.6	Sektion IV Raum PK 14.7	Sektion V Raum PK 14.8
13.00	R. Adomaitis Infinite Hamiltonian graphs	K. Waas Topologically end–faithful forests in infinite graphs	M. Sonntag Zur Summenzahl von Hyperbäumen	K. Reuter On the linear–extension–diameter of a poset	H. Lefmann The algorithmic aspects of uncrowded hypergraphs
13.30	M. Tewes Sufficient conditions for semicomplete multipartite digraphs to be Hamiltonian	K. Mosenthin Würfel–Ramsey–Zahlen	S. Böcker Einbettung vollständiger binärer Bäume in den Star–Graphen	U. Baumann Automorphisms of graphs with 1–factorizations	E. Prisner How many cliques are in intersection graphs of uniform hypergraphs?
14.00	G. Gancarzewicz Graphs with every k–matching in a Hamiltonian cycle	G. Brinkmann Motivations and methods for the generation of maximal trianglefree graphs	B. Balkenhol Problems in sequential and parallel game tree search	D. Hachenberger Modulstrukturen in endlichen Körpern	H.-M. Teichert Eigenschaften von Summenhypergraphen
14.30	I. H. Tuinstra Trees and Hamilton cycles in graphs	S. Brandt Experimental methods and asymptotics for Ramsey numbers $r(G, H)$	A. Flammenkamp Lange Perioden in Subtraktions–Spielen	V. B. Balakirsky On the number of irreducible ratios of polynomials over finite fields	T. Jordán An extremal graph theory problem in connectivity augmentation
15.00	J. Harant On Hamiltonian cycles in 4– and 5–connected plane triangulations	D. Rautenbach Some structural results on linear arboricity	E. Köhler An optimal algorithm for the minimum connected dominating set problem in trapezoid graphs	K. Dohmen Ein kombinatorischer Satz über Produkte von Differenzen in kommutativen Ringen	R. Labahn Small minimum communication graphs
15.30	**Kaffeepause**				
16.00	S. Thomassé Interval inversions for digraphs	B. Randerath 3–colorability for forbidden induced subgraphs	D. Wojzischke Über die Newtonsche Zahl von gleichschenkligen Dreiecken	I. Fabrici Subgraphs with restricted degrees of their vertices in planar graphs	M. Kaufman Graph layouts from matrices
16.30	Y. Guo Outpaths of arcs in regular multipartite tournaments	I. Schiermeyer 3–colourability and Ramsey theory	J. M. Wills Parametric density and crystal growth	T. Harmuth Construction of cubic planar maps with certain faces	K. Metsch Buekenhaut–Metz unitale
17.00	M. Ruszinkó How to reconstruct the correct labeling of a tournament	K. Jansen Approximation results for the optimum cost chromatic partition problem	R. Jaritz On reorientation classes of oriented matroids	V. Zverovich Domination perfect and upper domination perfect graphs	T.-K. Strempel Zur Erzeugung und Einbettung kombinatorischer Strukturen
17.30	I. Ziolo TT_n–maximal digraphs of minimum size	H. Kolberg Coloring of special distance graphs	K. Huber Set systems and matroids	P. Wittmann Longest cycles in tough graphs	B. Schmidt Zirkulante Hadamard–Matrizen
18.00	T. Harder Verteilung der Anzahl von Zirkulartriaden	B. Kreuter Uniquely colourable graphs of large girth and small order	F. Matúš Matroid representations via partitions and general quasigroup identities	P. Willenius Irreducible sequences and comparability graphs	U. Leimich An algorithm for efficiently computing linear extensions for realizers of partially ordered sets

19.30 **Gemeinsames Abendessen**
im Restaurant „Wirtshaus zur Hanse", Güldenstraße 7, Braunschweig

Sonnabend, 16. 11. 1996

9:30 **J. Bang–Jensen** (Odense, Dänemark)
"Generalizations of tournaments" (Hörsaal: PK 4.3)

10:25 **Kaffeepause**

10:40 **R. H. Schelp** (Memphis, USA)
"Edge colorings and the classical Ramsey number" (Hörsaal: PK 4.3)

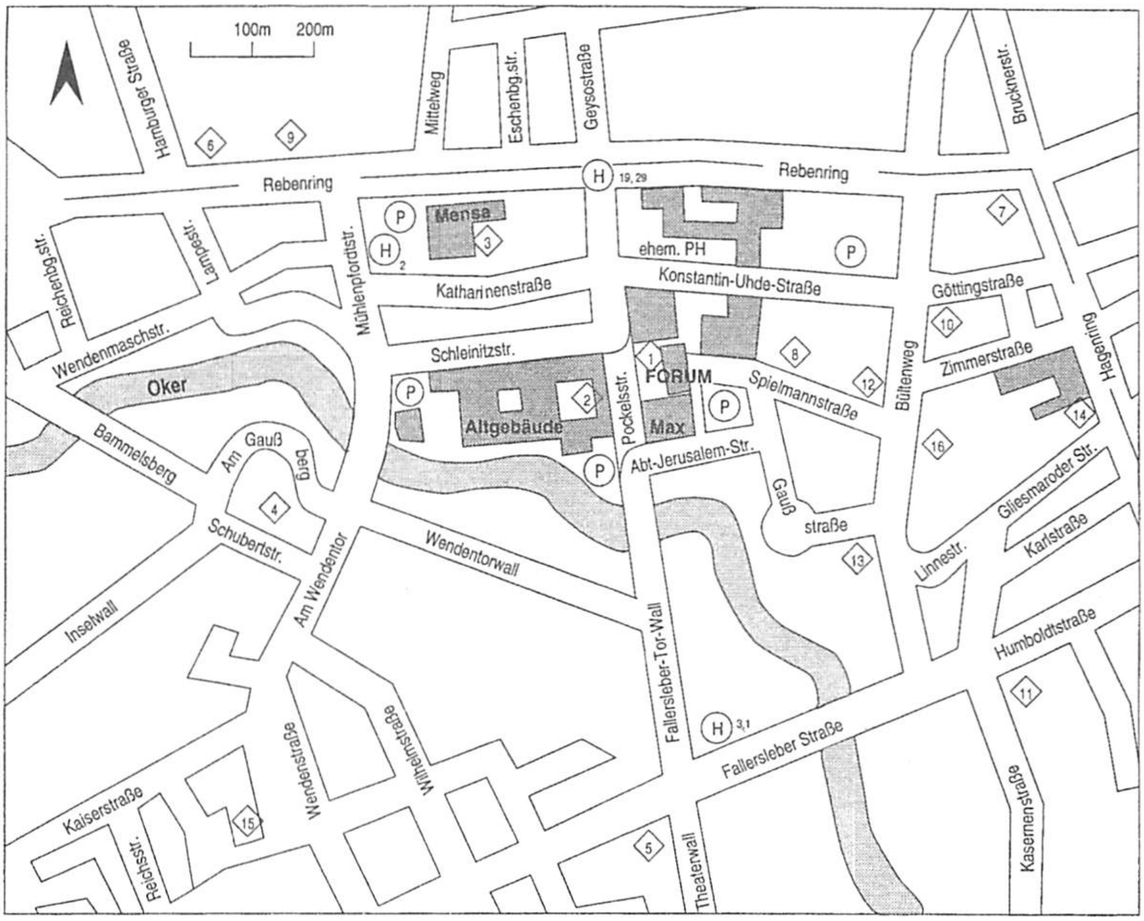
11:35–13:00 **Mittagspause**

Zeit	Sektion I Raum PK 14.3	Sektion II Raum PK 14.4	Sektion III Raum PK 14.6	Sektion IV Raum PK 14.7	Sektion V Raum PK 14.8
13.00	M. Kriesell Contractible non-edges in triangle-free graphs	A. Taraz 2-colourings of hypergraphs and even cycles in directed graphs	A. Žitnik Straight-ahead and alternating walks in Eulerian graphs	U. Tamm Perfect 3- and 4-shift designs and run-length limited codes	M. Hintz On grids in de Bruijn graphs
13.30	T. R. Jensen Hajós construction of critical graphs	M. Voigt (p,q,r)-choosability	V. Batagelj Inductive classes of Eulerian graphs	A. A. Sapozhenko On approximation of step functions; Boundary functional method for enumeration problems	S. Hartmann Partial transversal designs
14.00	T. Pisanski Prism graphs	W. Mader An extremal problem for subdivisions of K_5	M. Harborth Hamiltonian circuits on the octahedron	J. Quistorff Zur Verlängerung affiner MDS-Codes	C. Bey The Erdős-Ko-Rado bound for the function lattice
14.30	E. Steffen Some results about snarks	A. Pruchnewski On upper bounds for the dominating number of a bipartite graph	I. Vrťo Bipartite crossing numbers	U. Minne Über Lee-Fehler korrigierende Codes	M. Grüttmüller Über die Nichtexistenz von Pairwise Balanced Designs
15.00	M. Kochol Snarks without small cycles	S. de Vries New facets for the polytope of scheduling jobs of equal length within a tight planning horizon	R. Klimmek Small cycle decompositions of line graphs	L. Bäumer Aspects of authentication and cryptology	A. Wassermann Berechnung von t-designs
15.30	Kaffeepause				
16.00	W. Oberschelp Formeln für partielle Rekursionen mit (3×3)-Templates	A. Huck Cycle-double-covers in graphs without Petersen-graph-minor	S. Bezrukov Embedding of hypercubes into grids	R. Löwen Branching properties of projections onto polyhedra	R.-H. Schulz Konstruktion von divisiblen Designs aus nicht-desarguesschen Translationsebenen
16.30	V. P. Iljev On the rank functions of independence systems	V. Leck Orthogonale Doppelüberdeckungen durch Bäume (1)	S. Hougardy Small transversals in partitionable graphs	U. Eckhardt Topologisierung der digitalen Ebene	H. Gropp Constructions, realizations, and drawings of configurations
17.00	P. Knieper Discrepancy of arithmetic progressions	U. Leck Orthogonale Doppelüberdeckungen durch Bäume (2)	A. Hassanzadeh Eine neue Heuristik für das Bandweiteproblem auf Graphen	S. Felsner Pseudoline-arrangements and higher Bruhat orders	Z. Szigeti On optimal ear-decompositions of graphs
17.30				A. Andrzejak Relations between numbers of k-sets and numbers of j-facets	

Raumplan

Hauptvorträge	:	Hörsaal PK 4.3 (Altgebäude, Pockelsstraße 4)
Sektionsvorträge	:	Hörsäle PK 14.3 und PK 14.4 (Forum, 3. Stockwerk) Hörsäle PK 14.6, PK 14.7 und PK 14.8 (Forum, 5. Stockwerk)
Tagungsbüro	:	F 314 (Forum, Pockelsstraße 14, 3. Stockwerk)
Bibliothek	:	F 416 (Forum, 4. Stockwerk)
Cafeteria	:	F 314/315 (Forum, 3. Stockwerk)
Arbeitsraum	:	F 507 (Forum, 5. Stockwerk)
Fernsprecher	:	Erdgeschoß des Forumsgebäudes; Altgebäude, in der Nähe des Hörsaales PK 4.3; Pockelsstraße, gegenüber der Universitätsbibliothek (Münz- und Kartenfernsprecher)

Öffnungszeiten von Tagungsbüro, Bibliothek, Cafeteria und Arbeitsraum: Freitag, 9^{00}–19^{00}h; Sonnabend, 9^{00}–19^{00}h.



1 Forum, Pockelsstraße 14
2 Altgebäude, Pockelsstraße 4
3 Mensa, Katherinenstraße 1
4 Gaußdenkmal
5 Mephisto (ehem. Wolters am Wall), Fallerslebersstraße 35

6 Ana (Türkisch), Hamburger Straße 287, 10:00–1:00
7 Dialog (Bistro), Rebenring 48, 11:30–24:00
8 Eusebia (Bistro), Spielmannstraße 11, 9:00–2:00
9 Griechische Taverne, Rebenring 8a, 12:00–14:30, 17:30–0:00
10 Konfuzius (Chinesisch), Bültenweg 81, 11:30–15:00, 18:00–23:30
11 Da Paolo (Italienisch), Kasernenstraße 20, 11:30–15:00, 18:00–23:00
12 R. P. McMurphy (Irisch Pub), Bültenweg 10, 16:00–2:00
13 Pico's Bierladen (Türkisch), Bültenweg 6, 12:00–24:00
14 See Palast (Chinesisch), Gliesmaroderstraße 15, 11:30–15:00, 18:00–23:00
15 Teratai House (Indon.-Chin.), Wendenstraße 49/50, 12:00–15:00, 18:00–23:00
16 Viertel Nach (Bistro), Bültenweg 89, 9:00–2:00

WIRTSHAUS ZUR

Hanse

Suppen

Tomatencremesuppe mit Kräutersahne	*DM*	*5,50*
Festtagssuppe mit Fleischklößchen, Gemüse, Eierstich und Sternchennudeln	*DM*	*6,00*

Vegetarisch

Elsäßer Zwiebelkuchen, frisch aus dem Ofen mit Salatgarnitur und Kräuterschmand	*DM*	*8,50*
„Hanse-Salatplatte" Winterliche Salate mit gebratenen Putenbruststreifen	*DM*	*12,50*
Bunter Gemüseteller mit Petersilienkartoffeln und Kräuterrührei	*DM*	*14,50*

Fleischgerichte

Bratwurstschnecke mit frischem Marktgemüse und Bratkartoffeln	*DM*	*13,50*
„Braunschweiger Schlachteplatte" warme Wurstspezialitäten und Schweinebauch mit Sauerkraut und Bratkartoffeln	*DM*	*16,50*
Schweinefiletspitzen in Pilzrahmsoße mit Butternudeln und Beilagensalat	*DM*	*18,50*
„Güldenteller" Schweinemedaillons an Pfefferrahmsoße mit frischem Marktgemüse und Kartoffelgratin	*DM*	*23,00*

Fischgerichte

Geräuchertes Riddagshäuser Forellenfilet mit Salatgarnitur, Kräuterschmand und frischem Bauernbrot	*DM*	*12,50*
Lachssteak auf Blattspinat mit Kräuterreis und Weißweinsoße	*DM*	*24,50*

Dessert

Rote Grütze mit Vanillesoße	*DM*	*6,50*
Frischer Obstsalat mit Schlagsahne und geraspelten Mandeln	*DM*	*6,50*
Apfelstrudel mit Vanille-Eis	*DM*	*7,50*

Hauptvorträge

J. Bang-Jensen (Odense, Dänemark)	:	Generalizations of tournaments
R. H. Schelp (Memphis, USA)	:	Edge colorings and the classical Ramsey number
M. Skoviera (Bratislava, Slowakei)	:	Snarks
V. T. Sós (Budapest, Ungarn)	:	On random and quasi-random graphs

Kurzvorträge

R. Adomaitis (Hannover)	:	Infinite Hamiltonian graphs
A. Andrzejak (Zürich, Schweiz)	:	Relations between numbers of k-sets and numbers of j-facets
L. Bäumer (Bielefeld)	:	Aspects of authentication and cryptology
V. B. Balakirsky (Bielefeld)	:	On the number of irreducible ratios of polynomials over finite fields
B. Balkenhol (Bielefeld)	:	Problems in sequential and parallel game tree search
V. Batagelj (Ljubljana, Slowenien)	:	Inductive classes of Eulerian graphs
U. Baumann (Dresden)	:	Automorphisms of graphs with 1-factorizations
C. Bey (Rostock)	:	The Erdős-Ko-Rado bound for the function lattice
S. Bezrukov (Paderborn)	:	Embedding of hypercubes into grids
S. Böcker (Hamburg)	:	Einbettung vollständiger binärer Bäume in den Star-Graphen
S. Brandt (Berlin)	:	Experimental methods and asymptotics for Ramsey numbers $r(G, H)$
G. Brinkmann (Bielefeld)	:	Motivations and methods for the generation of maximal trianglefree graphs
K. Dohmen (Berlin)	:	Ein kombinatorischer Satz über Produkte von Differenzen in kommutativen Ringen
U. Eckhardt (Hamburg)	:	Topologisierung der digitalen Ebene
I. Fabrici (Ilmenau)	:	Subgraphs with restricted degrees of their vertices in planar graphs
S. Felsner (Berlin)	:	Pseudoline-arrangements and higher Bruhat orders
A. Flammenkamp (Bielefeld)	:	Lange Perioden in Subtraktions-Spielen
G. Gancarzewicz (Kraków, Polen)	:	Graphs with every k-matching in a Hamiltonian cycle
H. Gropp (Heidelberg)	:	Constructions, realizations, and drawings of configurations
M. Grüttmüller (Rostock)	:	Über die Nichtexistenz von Pairwise Balanced Designs
Y. Guo (Aachen)	:	Outpaths of arcs in regular multipartite tournaments
D. Hachenberger (Augsburg)	:	Modulstrukturen in endlichen Körpern
J. Harant (Ilmenau)	:	On Hamiltonian cycles in 4- and 5-connected plane triangulations
M. Harborth (Magdeburg)	:	Hamiltonian circuits on the octahedron
T. Harder (Bielefeld)	:	Verteilung der Anzahl von Zirkulartriaden
T. Harmuth (Bielefeld)	:	Construction of cubic planar maps with certain faces
S. Hartmann (Rostock)	:	Partial transversal designs
A. Hassanzadeh (Hamburg)	:	Eine neue Heuristik für das Bandweiteproblem auf Graphen
M. Hintz (Hamburg)	:	On grids in de Bruijn graphs
S. Hougardy (Berlin)	:	Small transversals in partitionable graphs
K. Huber (Bielefeld)	:	Set systems and matroids
A. Huck (Hannover)	:	Cycle-double-covers in graphs without Petersen-graph-minor
V. P. Iljev (Omsk, Rußland)	:	On the rank functions of independence systems
K. Jansen (Trier)	:	Approximation results for the optimum cost chromatic partition problem
R. Jaritz (Jena)	:	On reorientation classes of oriented matroids
T. R. Jensen (Chemnitz)	:	Hajós construction of critical graphs
T. Jordán (Odense, Dänemark)	:	An extremal graph theory problem in connectivity augmentation
M. Kaufman (Ljubljana, Slowenien)	:	Graph layouts from matrices
R. Klimmek (Berlin)	:	Small cycle decompositions of line graphs
P. Knieper (Berlin)	:	Discrepancy of arithmetic progressions
M. Kochol (Bratislava, Slowakei)	:	Snarks without small cycles
E. Köhler (Berlin)	:	An optimal algorithm for the minimum connected dominating set problem in trapezoid graphs
H. Kolberg (Braunschweig)	:	Coloring of special distance graphs
B. Kreuter (Berlin)	:	Uniquely colourable graphs of large girth and small order
M. Kriesell (Berlin)	:	Contractible non-edges in triangle-free graphs
R. Labahn (Rostock)	:	Small minimum communication graphs
U. Leck (Rostock)	:	Orthogonale Doppelüberdeckungen durch Bäume (2)
V. Leck (Rostock)	:	Orthogonale Doppelüberdeckungen durch Bäume (1)

H. Lefmann (Dortmund)	:	The algorithmic aspects of uncrowded hypergraphs
U. Leimich (Hamburg)	:	An algorithm for efficiently computing linear extensions for realizers of partially ordered sets
R. Löwen (Braunschweig)	:	Branching properties of projections onto polyhedra
W. Mader (Hannover)	:	An extremal problem for subdivisions of K_5
F. Matúš (Bielefeld)	:	Matroid representations via partitions and general quasigroup identities
K. Metsch (Giessen)	:	Buekenhaut–Metz unitale
U. Minne (Berlin)	:	Über Lee–Fehler korrigierende Codes
K. Mosenthin (München)	:	Würfel–Ramsey–Zahlen
W. Oberschelp (Aachen)	:	Formeln für partielle Rekursionen mit (3×3)–Templates
T. Pisanski (Ljubljana, Slowenien)	:	Prism graphs
E. Prisner (Hamburg)	:	How many cliques are in intersection graphs of uniform hypergraphs?
A. Pruchnewski (Ilmenau)	:	On upper bounds for the dominating number of a bipartite graph
J. Quistorff (Hamburg)	:	Zur Verlängerung affiner MDS–Codes
B. Randerath (Aachen)	:	3–colorability for forbidden induced subgraphs
D. Rautenbach (Aachen)	:	Some structural results on linear arboricity
K. Reuter (Hamburg)	:	On the linear–extension–diameter of a poset
M. Ruszinkó (Budapest, Ungarn)	:	How to reconstruct the correct labeling of a tournament
A. A. Sapozhenko (Bielefeld)	:	On approximation of step functions; Boundary functional method for enumeration problems
I. Schiermeyer (Cottbus)	:	3–colourability and Ramsey theory
B. Schmidt (Augsburg)	:	Zirkulante Hadamard–Matrizen
R.-H. Schulz (Berlin)	:	Konstruktion von divisiblen Designs aus nicht–desarguesschen Translationsebenen
M. Sonntag (Freiberg)	:	Zur Summenzahl von Hyperbäumen
E. Steffen (Bielefeld)	:	Some results about snarks
T.-K. Strempel (Darmstadt)	:	Zur Erzeugung und Einbettung kombinatorischer Strukturen
Z. Szigeti (Paris, Frankreich)	:	On optimal ear–decompositions of graphs
U. Tamm (Bielefeld)	:	Perfect 3– and 4–shift designs and run–length limited codes
A. Taraz (Berlin)	:	2–colourings of hypergraphs and even cycles in directed graphs
H.-M. Teichert (Lübeck)	:	Eigenschaften von Summenhypergraphen
M. Tewes (Aachen)	:	Sufficient conditions for semicomplete multipartite digraphs to be Hamiltonian
S. Thomassé (Bielefeld)	:	Interval inversions for digraphs
I. H. Tuinstra (Enschede, Niederlande)	:	Trees and Hamilton cycles in graphs
M. Voigt (Ilmenau)	:	(p, q, r)–choosability
S. de Vries (Trier)	:	New facets for the polytope of scheduling jobs of equal length within a tight planning horizon
I. Vrťo (Passau)	:	Bipartite crossing numbers
K. Waas (Chemnitz)	:	Topologically end–faithful forests in infinite graphs
A. Wassermann (Bayreuth)	:	Berechnung von t–designs
P. Willenius (Magdeburg)	:	Irreducible sequences and comparability graphs
J. M. Wills (Siegen)	:	Parametric density and crystal growth
P. Wittmann (Berlin)	:	Longest cycles in tough graphs
D. Wojzischke (Braunschweig)	:	Über die Newtonsche Zahl von gleichschenkligen Dreiecken
I. Ziolo (Kraków, Polen)	:	TT_n–maximal digraphs of minimum size
A. Žitnik (Ljubljana, Slowenien)	:	Straight–ahead and alternating walks in Eulerian graphs
V. Zverovich (Aachen)	:	Domination perfect and upper domination perfect graphs

Weitere Teilnehmer

T. Andreae (Hamburg), R. Bodendiek (Kiel), P. Braß (Greifswald), N. Cai (Bielefeld), C. Delhomme (Bielefeld), C. Deppe (Bielefeld), W. Deuber (Bielefeld), R. Diestel (Chemnitz), T. Dinski (Bielefeld), D. Dornieden (Braunschweig), K. Engel (Rostock), M. Erné (Hannover), D. Gernert (München), E. Girlich (Magdeburg), H. Harborth (Braunschweig), E. Harzheim (Düsseldorf), H. Hering (Köln), E. Hexel (Ilmenau), M. Hoeding (Magdeburg), H. D. Janetzko (Konstanz), C. Josten (Frankfurt), A. Kemnitz (Braunschweig), C. Kleinewächter (Bielefeld), G. Koester (Hamburg), R. Lang (Hamburg), G. Laßmann (Berlin), H. Lenz (Berlin), I. Mengersen (Braunschweig), H. Mielke (Berlin), E. N. Müller (Berlin), T. Niessen (Aachen), I. V. Ofenbakh (Omsk, Rußland), A. Pott (Augsburg), F. Recker (Berlin), J. Reinhold (Hannover), G. Renneberg (Braunschweig), A. Schelten (Cottbus), M. Schröder (Bielefeld), E. Sparla (Stuttgart), B. Strohmeier (Bielefeld), O. Sýkora (Passau), T. Tautenhahn (Magdeburg), C. Thomassen (Lyngby, Dänemark), C. Thürmann (Braunschweig), L. Volkmann (Aachen), K. Wagner (Köln), P. Weidl (Bielefeld), H. Weiß (Braunschweig), G. Zesch (Darmstadt), U. Zimmermann (Braunschweig)

Snarks

Martin Škoviera, Comenius University, Bratislava, Slovakia

For the last twenty five years there has been a considerable research on cubic graphs whose edges cannot be properly coloured with three colours. Because "non-trivial" examples of these graphs (such as the Petersen graph) have been very difficult to find, Martin Gardner, in a popular article on the subject, baptized them *snarks*. Snarks are related to several important conjectures in graph theory, and this relationship appears to be the main incentive for the research.

This talk will survey work that has been done on snarks, with particular emphasis on contructions of snarks and analysis of their structure.

Random and quasi-random graphs

by
VERA SÓS

Many attempts have been made how randomlike objects can be generated in a non-random way and when an individual event can be considered random. These type of questions are also investigated for graphs.

The theory of random graphs has an extensive literature. They play important role in many fields.

Quasi-random graphs are graphs resembling random graphs but are not necessarily random graphs. These are defined by a class of graph properties all possessed by random graphs and equivalent to each other in some well defined sense.

F. Chung, R.L. Graham, R. Wilson gave first a description of such properties. With Simonovits we have characterized quasi-randomness using the Szemerédi regularity lemma and the corresponding regular partitions.

Recemtly we have investigated properties which do not imply quasi-randomness on their own but do imply when assumed hereditarily.

Generalizations of tournaments

by
Jørgen Bang–Jensen

In 1990 Bang-Jensen introduced *locally semicomplete digraphs* as a new generalization of tournaments. These are those digraphs for which the set of in-neighbours as well as the set of out-neighbours of any vertex induces a semicomplete digraph. Locally semicomplete digraphs have turned out to be a very nice generalization of tournaments. In a series of more than 20 research papers and two Phd. theses (by Huang and Guo) various authors have shown that it is possible to extend a large portion of the significant results that are known for tournaments to this much larger class of digraphs. In 1993 Bang-Jensen and Huang studied another local structure generalization of tournaments, namely *quasi-transitive digraphs*(qtds): whenever $x \rightarrow y$ and $y \rightarrow z$ are arcs of D there must also be an arc between x and z. Quasi-transitive digraphs also share a significant portion of nice structure with tournaments. As an example of this Gutin proved that the Hamiltonian path and cycle problems are polynomially solvable for qtds. Bang-Jensen and Huang showed that Quasi-transitive digraphs can be constructed from transitive digraphs and semicomplete digraphs by means of repeated substitutions of smaller qtds starting from either a transitive digraph or a tournament. Using this nice structural relation to semicomplete digraphs, one can obtain characterizations of pancyclic and vertex pancyclic qtds and varios other interesting results. For example the so called *Two-path problem* is polynomially solvable for qtds. Bang-Jensen and Gutin later proved that there are much richer classes of digraphs which are build in a similar way as qtds for which one can still solve the Hamiltonian path and cycle problems in polynomial time.

The purpose of this talk is to desribe some of the most important results on these generalizations of tournaments.

Edge Colorings and the Classical Ramsey Number

by
R. H. Schelp
Dept. of Math. Sciences
University of Memphis
Memphis, TN 38152 USA

This lecture will focus on several recent edge coloring conjectures some of which have their origin in graphical Ramsey theory. In particular one of the conjectures is a modification of the statement for finding the classical Ramsey number implying that a monochromatic complete graph can be found under less restrictive colorings. Positive results will be given in support of each of the conjectures.

Infinite Hamiltonian Graphs

RÜDIGER ADOMAITIS
INSTITUT FÜR MATHEMATIK, UNIVERSITÄT HANNOVER

We call an (infinite) graph G hamiltonian, if G contains for every= finite set of vertices X a cycle C with $X \subseteq V(C)$. We present examples and apart fom results on the degrees the following= result: Every localfinite hamiltonian graph contains a spanning system of disjoint two-side infinite paths and also a spanning hamiltonian subgraph with maximum degree 4.

Relations between numbers of k-sets and numbers of j-facets

by
A. ANDRZEJAK
ETH Zürich, Departement Informatik, Schweiz

For a set S of n points in R^d a *k-set* is a set $P \subseteq S$, $|P| = k$ such that there is a hyperplane h with P on one side and $S \backslash P$ on the other side. A *j-facet* is an oriented hyperplane in R^d which contains d points of S and has j points on its positive side. Obtaining matching lower and upper bounds on the numbers of k-sets and j-facets is of considerable interest in combinatorial geometry. Let $e_k(S)$ and $f_j(S)$ be the number of k-sets of S and the number of j-facets of S, respectively, for $k \in \{1, \ldots, n-1\}$ and $j \in \{0, \ldots, n-d\}$. We show that in R^3 it is possible to calculate $\vec{e}(S) = (e_1(S), \ldots, e_{n-1}(S))$ if $\vec{f}(S) = (f_0(S), \ldots, f_{n-d}(S))$ is known and vice versa. (In higher dimensions no one-to-one correspondence between $\vec{e}(S)$ and $\vec{f}(S)$ exist).

Aspects of Authentication and Cryptology

Lars Bäumer, University of Bielefeld

Abstract - In the classical model of secret-key cryptology a relation between the measures for the security of a cipher is introduced. Concerning authentication theory the derivation of lower bounds on the opponent's probability for deception is revisited. Especially it is shown that a certain generalization of the *square-root bound* for P_S is not possible and a new proof for the necessary and sufficient conditions for equality in this bound is given.

On the Number of Irreducible Ratios of Polynomials over Finite Fields

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Proposition Let $I_n^{(2)}$ be the number of pairs of polynomials $(a(z), f(z))$, where

$$\begin{aligned} a(z) &= a_0 + a_1 \cdot z + \ldots + a_{n-1} \cdot z^{n-1} \\ f(z) &= f_0 + f_1 \cdot z + \ldots + f_n \cdot z^n, \\ f_0 = f_n &= 1, \end{aligned}$$

and $a_i, f_j \in GF(2)$, $i = 0, \ldots, n-1, j = 0, \ldots, n$, such that the greatest common divisor of $a(z)$ and $f(z)$ is equal to 1. Then

$$I_n^{(2)} = \frac{2}{3} \cdot 2^{2n-1} - \frac{1}{3}, \quad \text{for all } n \geq 1.$$

Hence,

(-) the number of irreducible ratios can be easily found for any n.

(-) if each coefficient $a_i, i = 0, \ldots, n-1$, and $f_i, i = 1, \ldots, n-1$, is obtained by random and independent selection from $\{0, 1\}$ with probability 1/2 then, for all n, the ratio $a(z)/f(z)$ is irreducible with the probability $\approx 2/3$.

The similar result can be also derived for the field $GF(q)$.

Problems in sequential and parallel game tree search

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Abstract

The α—β– algorithm is an efficient technique for searching game trees. As parallel computers become more available, it is important to have good parallel game tree search algorithms. Until now it is an open problem whether a linear speedup can be achieved with respect to sequential alpha-beta. We present a sample of game trees with distinct leaf values, which are easy for sequential alpha-beta – independent of the move ordering in the trees. We conjecture that these trees are difficult test cases for parallel algorithms.

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Inductive classes of Eulerian graphs

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In the paper inductive definitions of the class of all (simple / simple planar) Eulerian graphs are presented.

Automorphisms of Graphs with 1-Factorizations

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It is known that any finite group is the automorphism group of some 1-factorization of a finite graph. All abstract groups can be represented by 1-factorizations of special classes of graphs, e.g. regular graphs of degree 3 or complete graphs. This means that there is no structure theorem that applies to an (abstract) automorphism group of an arbitrary 1-factorization of a graph.

Another idea is the consideration of permutation groups which occur as automorphism groups of 1-factorizations. A first approach is the consideration of sets of fixed points of such automorphisms and the restriction to certain classes of 1-factorizations.

The main results concern the maximum number of fixed points of arbitrary 1-factorizations of complete graphs and of perfect 1-factorizations (1-factorizations for which the union of any two distinct 1-factors is connected) of arbitrary graphs.

The structure of minimal graphs having automorphisms with maximum number of fixed points is described.

Moreover the problem to characterize the structure of the group of automorphisms fixing every 1-factor (stated in D. Duncan and E. Ihrig, Automorphism Groups of 1-Factorizations, Congressus Numerantium 94(1993), pp. 89-97) is solved.

The Erdős-Ko-Rado bound for the function lattice

Christian Bey

The function lattice F_α^n consists of all n-tupel over the alphabet $\{0,1,...,\alpha\}$ endowed with the order relation defined by $(x_1,...,x_n) \le (y_1,...,y_n)$ iff $x_i = 0$ or $x_i = y_i$ for all $i = 1,...,n$. The rank of an element x of F_α^n is given by the number of nonzero elements in x. A subset $\mathcal{F}$ of F_α^n is called k-uniform t-intersecting if all elements of $\mathcal{F}$ have rank k and the infimum of every two elements of $\mathcal{F}$ has rank at least t.

We determine the least natural number $n_0(k,t)$ such that for all $n \ge n_0(k,t)$ the family $\mathcal{F}_0 := \{x \in F_\alpha^n : x = (x_1,...,x_n)$ has rank k and $x_1 = x_2 = ... = x_t = \alpha\}$ has maximum size among all k-uniform t-intersecting families.

Embedding of Hypercubes into Grids

S.L. Bezrukov, M. Röttger, U.-P. Schroeder
University of Paderborn

Abstract

We consider one-to-one embeddings of the n-dimensional hypercube into grids with 2^n vertices and present lower and upper bounds and asymptotic estimates for minimal dilation, edge-congestion, and their mean values.

Einbettung vollstaendiger binaerer Baeume in den Star-Graphen

Sebastian Böcker

Der Star-Graph ist als Kommunikations-Netzwerk eine interessante Alternative zum Hypercube. Die Einbettung vollstaendiger binaerer Baeume in den Star-Graphen gestaltet sich jedoch ungleich viel komplizierter als in den Hypercube. Es sollen *injektive* Einbettungen mit Ecken- und Kanten-Kongestion 1 vorgestellt werden. Ein vollstaendiger binaerer Baum der Hoehe

$$(n+1)\lfloor \log_2 n \rfloor - 2^{\lfloor \log_2 n \rfloor + 1} + 2 - \delta_{\lfloor \log_2 n \rfloor}$$

mit $\delta_p := (p+1)\lfloor \log_2 p \rfloor - 2^{\lfloor \log_2 p \rfloor + 1} + 1$ kann in den Star-Graph St_n der Dimension n mit Dilation 1 eingebettet werden. Diese Hoehe weicht asymptotisch um $0.557 \cdot n$ von der aus den Eckenzahlen ableitbaren oberen Schranke ab. Weiter wird eine Einbettung mit Dilation 2 eines binaeren Baumes konstruiert, dessen Hoehe asymptotisch nur $0.265 \cdot n$ von der oberen Schranke abweicht, und die durchschnittliche Dilation dieser Einbettung ist kleiner 1.01. Die gefundenen Ergebnisse lassen sich teilweise auf d-naere Baeume verallgemeinern.

Experimental methods and asymptotics for Ramsey numbers r(G,H)

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The growth of Ramsey numbers $r(G, H)$ is investigated for connected graphs H of bounded maximum degree. It will be shown that for every nonbipartite graph G the Ramsey number of well-expanding graphs H grows faster than expected, while for bipartite graphs G the Ramsey number behaves asymptotically in the expected way. These results contradict five conjectures offered by Burr, Erdős, and Faudree in various constellations.

The results for nonbipartite graphs were motivated by the wealth of small order Ramsey numbers $r(K_3, H)$, computed by G. Brinkmann, T. Harmuth and the author based on a computer program for generating maximal triangle-free graphs (cf. the talk of Gunnar Brinkmann presented at this conference). In particular, $r(K_3, H)$ was determined for all 273152 connected graphs H up to order 9. Examining the generated lists, the author first saw well-expanding graphs having largest Ramsey number among undense graphs.

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Motivations and Methods for the Generation of Maximal Trianglefree Graphs

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In the literature a lot of conjectures and theorems about trianglefree graphs can be found. So there would be no need to explain why **this** is an interesting class. Unfortunately the number of trianglefree graphs grows so fast, that complete lists are possible only for very small vertex numbers. So if one wants to test conjectures about trianglefree graphs, one does not get very far.
In this talk I will first give examples of statements that are true for all trianglefree graphs if and only if they are true for all maximal trianglefree graphs of the same order – motivating why the class of **maximal** trianglefree graphs is interesting too.
Then I will give a rough sketch of an algorithm to generate this class of graphs. It uses the concept of *McKay-type orderly generation.* A program based on this algorithm was e.g. used to compute Ramsey numbers $R(K_3, G)$.

Klaus Dohmen, Humboldt-Universität zu Berlin

Ein kombinatorischer Satz über Produkte von Differenzen in kommutativen Ringen

Bekannterweise gilt in kommutativen Ringen die Identität

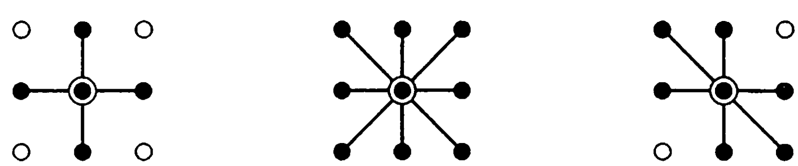
$$(x_1 - y_1)\cdots(x_n - y_n) = 3D \sum_{I \subseteq \{1,\ldots,n\}} (-1)^{|I|} \left(\prod_{i \notin I} x_i\right) \left(\prod_{i \in I} y_i\right) .$$

Wir zeigen, daß man sich bei der Summation auf die Teilmengen von $\{1,\ldots,n\}$ beschränken kann, die keine „gebrochenen Kreise“ umfassen. Wir präsentieren ein ähnliches Resultat bezüglich des Prinzips von Inklusion und Exklusion.

Topologisierung der digitalen Ebene

Ulrich Eckhardt und Longin Latecki
Universität Hamburg

Bei Anwendungen in der Bildverarbeitung versieht man die digitale Ebene $\mathbb{Z}^2$ mit einer Graphenstruktur, um Zusammenhang von Teilmengen der Ebene definieren zu können. Diese Graphenstruktur wird definiert als der transitive Abschluß einer Nachbarschaftsrelation. In den Anwendungen spielen drei Nachbarschaftsrelationen eine wichtige Rolle, die 4–, 8– und die 6–Nachbarschaft:



4–Nachbarschaft **8–Nachbarschaft** **6–Nachbarschaft**

Es ist bekannt, daß man unter diesen Nachbarschaftsstrukturen allein die 4–Nachbarschaft vermittels einer T_1–Topologie begründen kann.

Es wird gezeigt, daß es in der digitalen Ebene genau zwei Topologien gibt mit den Eigenschaften:

- Jede Teilmenge der digitalen Ebene, die aus zwei zueinander 4–benachbarten Punkten besteht, ist zusammenhängend im Sinne der Topologie.
- Eine Teilmenge der digitalen Ebene, die nicht 8–zusammenhängend ist, ist auch nicht topologisch zusammenhängend.

Die eine dieser Topologien ist die Marcus–Wyse–Topologie (1970), die andere die von Alexandroff und Hopf (1935) eingeführte Topologie (siehe auch Kovalevsky (1989), Khalimsky (1990)).

Eine Verallgemeinerung auf den $\mathbb{Z}^3$ ist möglich, jedoch nicht auf naheliegende Weise.

Subgraphs with restricted degrees of their vertices in planar graphs

IGOR FABRICI, TU Ilmenau

STANISLAV JENDROĽ, PJŠU Košice

Abstract

Every 3–connected planar graph G of order at least k contains a connected subgraph on k vertices each of which has degree at most $4k+3$; the bound $4k+3$ is the best possible.

Pseudoline-Arrangements and Higher Bruhat Orders

Stefan Felsner
Freie Universität Berlin

Abstract: Given a simple arrangement of n pseudolines in the Euclidean plane, associate with any three lines $i < j < k$ a sign + or − indicating whether the crossing of lines i and k is above or below line j. The function $\sigma : \binom{n}{3} \to \{+,-\}$ clearly encodes the arrangement. We characterize the functions σ corresponding to arrangements in the above sense. This naturally leads us to the Higher Bruhat orders defined by Manin and Schechtman and further studied by Ziegler. We show some relations between combinatorial properties of Higher Bruhat orders and geometric properties of arrangements.

Lange Perioden in Subtraktions-Spielen

Flammenkamp, Achim (Bielefeld)

AMS(MOS)-Klassifikation: 90D05

Zur Definition des Subtraktions-Spieles siehe: **E. R. Berlekamp, J. H. Conway, and R. K. Guy** *Winning Ways for Your Mathematical Plays*, Academic Press (1982), V 1, pp 33–38
German Edition: *GEWINNEN — Strategien für mathematische Spiele*, Vieweg, Braunschweig (1985)

Der Vortrag stellt neue Ergebnisse der Untersuchung von Subtraktions-Spielen mit Blickrichtung auf lange Perioden dar. Schärfere untere und obere Schranken der Periodenlängen, als bisher bekannt sind, werden angegeben. Der Begriff der symmetrischen Mengen wird eingeführt, deren Bedeutung herausgestellt und gut fundierte Vermutungen über Periodenlängen werden formuliert. Insbesondere scheint es nun überzeugend, daß es Familien von Subtraktions-Spielen gibt, deren Periodenlängen exponentiel in s wachsen, aber deren Zugwerte nur linear mit s anwachsen.

Graphs with every k-matching in a hamiltonian cycle

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Abstract

Using the property that being s-edge-hamiltonian is $(n+s)$-stable, we characterize all 3-connected graphs G of order $n \geq 3$, such that for all vertices $x, y \in V(G)$ we have:

$$\mathrm{d}(x,y) = 2 \Rightarrow \max\{\mathrm{d}(x), \mathrm{d}(y)\} \geq \frac{n+k}{2}$$

and there is a k-matching $M \subset G$, $(k \geq 0)$ which is not contained in any hamiltonian cycle of G.

CONSTRUCTIONS, REALIZATIONS, AND DRAWINGS OF CONFIGURATIONS

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A configuration (v_r, b_k) is an incidence structure with v points and b lines such that there are k points on each line, k lines through each point, and through 2 different points there is at most one line.

It will be discussed for which parameters v, r, b, k a configuration has been constructed or its nonexistence has been proved. The realization of such a configuration over a certain field is obtained by constructing a matrix with entries in the field such that certain determinants are 0 if and only if the corresponding points are collinear. The drawing of a configuration in the plane is given by mapping plane coordinates to each point such that (nearly) all lines are drawn as straight lines.

Über die Nichtexistenz von Pairwise Balanced Designs

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Ein Pairwise Balanced Design (PBD$[v, K]$) der Ordnung v mit Blocklängen aus K ($K \subset \mathbb{N}$, K endlich) ist ein Paar $(V, \mathcal{B})$, wobei $|V| = v$ und $\mathcal{B} \subseteq 2^V$, das die folgenden Eigenschaften erfüllt: 1.) falls $B \in \mathcal{B}$, gilt: $|B| \in K$ und 2.) jedes Paar von verschiedenen Elementen aus V kommt in genau einem Block von $\mathcal{B}$ vor. Sei $K' \subset K$, die Menge $F(K') = \{B \in \mathcal{B} : |B| \in K'\}$ heißt K'-Prestructure. Die Nichtexistenz eines PBD$[v, K]$ folgt bereits aus der Nichtexistenz einer entsprechenden Prestructure. Im Vortrag wird ein System von Gleichungen und Ungleichungen hergeleitet. Die Existenz einer Lösung dieses Systems ist notwendige Voraussetzung für die Existenz einer Prestructure. Es werden Resultate für $\{3\} \subset K \subseteq \{3, \ldots, 15\}$ und $K \cap \{11, 12, 14\} \neq \emptyset$ vorgestellt.

Outpaths of Arcs in Regular Multipartite Tournaments

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An outpath of an arc xy in a digraph is a directed path starting from xy and x doesn't dominate the endvertex of the directed path. We prove that every arc of a regular n-partite ($n \geq 3$) tournament has an outpath of length k for all k satisfying $2 \leq k \leq n-1$. Our result generalizes a theorem of Alspach [1] for tournaments (it states that every regular tournament is arc-pancyclic).

References

[1] B. ALSPACH, Cycles of each length in regular tournaments, *Canad. Math. Bull.* **10** (1967), 283–286.

[2] Y. GUO, Outpaths of vertices in semicomplete multipartite digraphs, submitted.

Modulstrukturen in Endlichen Körpern

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Als eine der grundlegendsten Strukturen der Diskreten Mathematik spielen Endliche Körper in reinen Gebieten wie Endliche Geometrie oder Kombinatorik, sowie in angewandten Gebieten wie Codierungstheorie, Kryptographie und Signalverarbeitung eine große Rolle.

Da sich Normalbasen in Endlichen Körpern in den letzten Jahren sehr bewährt haben, um die Arithmetik in Endlichen Körpern effizient durchführen zu können, ist die explizite Konstruktion von (speziellen) Normalbasen zu einem der Hauptforschungszweige in der Theorie Endlicher Körper geworden. In meinem Vortrag werde ich einige neue Ergebnisse über Normalbasen präsentieren, die zu wichtigen Erkenntnissen über (simultane) Modulstrukturen der additiven Gruppe des algebraischen Abschlußes eines Endlichen Körpers geführt haben. Für eine ausführliche Darstellung darf ich verweisen auf die in Kürze erscheinende Monographie *Dirk Hachenberger, FINITE FIELDS: Normal Bases and Completely Free Elements, Kluwer Academic Publishers, Boston Dordrecht London.*

ON HAMILTONIAN CYCLES IN 4- AND 5-CONNECTED PLANE TRIANGULATIONS

Jochen Harant, Technische Universität Ilmenau

It will be shown that the following holds and that this is not true for 4-connected plane triangulations.

1. Let T be a 5-connected plane triangulation, and let $\mathcal{F}$ be a set of faces of T such that any two distinct faces in $\mathcal{F}$ have distance at least three. Then there is a Hamiltonian cycle of T containing two edges of each face of $\mathcal{F}$.
2. Let T be a 5-connected plane triangulation, and let $\mathcal{E}$ be a set of edges of T such that any two distinct edges of $\mathcal{E}$ have distance at least three. Then there is a Hamiltonian cycle of T containing $\mathcal{E}$.

This is joint work with T. Böhme (Ilmenau) and M. Tkáč (Košice).

Hamiltonian Circuits on the Octahedron

by
MARTIN HARBORTH
Magdeburg

We consider the problem of counting unlabeled Hamiltonian circuits on the octahedron. The interpretation of different Hamiltonian circuits on the n-dimensional octahedron as different drawings of cubic Hamiltonian graphs with $2n$ vertices may lead to a better understanding of the numbers growing process. Results and open questions as well as connections to other numbers will be given.

Verteilung der Anzahl von Zirkulartriaden (ZT)

by
THEODOR HARDER
Bielefeld

Ein Graph mit n Knoten hat $\binom{n}{2}$ paarweise Verbindungen (Kanten). Zwischen den Knoten i und j bestehe die Beziehung $(i \to j)$ oder $(j \to i)$. Es gibt also insgesamt die $2^{\binom{n}{2}}$ gerichteten Graphen. Jede der Triaden eines solchen Graphes ist entweder zirkulär oder nicht–zirkulär. Die Anzahl der ZT sei x, die Anzahl der Graphen mit xZT sei $h_{n,x}$; dann ist die entsprechende Wahrscheinlichkeitsdichte $W_{n,x} = 2^{-\binom{n}{2}}$. Ein rekursiver Algorithmus zur Berechnung von $h_{n,x}$ wird entwickelt. Beispiel: $h_{8,11} = 14755328$.

Construction of cubic planar maps with certain faces

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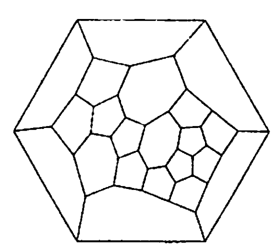
In this talk I will present a complete method to generate simple connected cubic planar maps (*SCCP-Graphs*) where only some faces are allowed, e.g. only pentagons, hexagons and heptagons. The method is based on the concept of *Petrie paths* which cut a SCCP–Graph into two or three pieces. These pieces are called *patches*. We construct a SCCP–Graph by gluing patches into a Petrie path. The main task is to generate all possible patches without generating too many patches that do not fit into a Petrie path.



Partial transversal designs

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In a transversal design TD with $k \geq 3$ groups $G_1, \ldots, G_k$ each pair of elements from different groups occures in exactly one block. Thus, all groups have the same group size $g_1 = \ldots = g_k = g$, each element has degree g and the number b of blocks equals g^2. In a partial transversal design PTD with k groups $G_1, \ldots, G_k$ each pair of elements from different groups occures in atmost one block. In addition, we want the degrees of the elements in each group to be as equal as possible, i.e. $\lfloor b/g_i \rfloor$ or $\lceil b/g_i \rceil$ for the elements in group G_i. The questions are: For which group sizes $g_1, \ldots, g_k$ does a PTD with b blocks exist? Which is the maximum number of blocks in a PTD with group sizes $g_1, \ldots, g_k$? We give first results for $k = 3$ and 4.

Eine neue Heuristik für das Bandweiteproblem auf Graphen

Anahita Hassanzadeh, Rainer Lang,
FB Informatik,
Universität Hamburg

Das Bandweiteproblem für Graphen lautet:

GRAPHEN-BANDWEITE:

Gegeben: Ein Graph $G = (V, E)$.

Gesucht: Eine Numerierung $f : V \xrightarrow{1-1} \{1, 2, 3, \ldots, |V|\}$, so daß die Bandweite

$$B_f(G) = \max\{|f(u) - f(v)| \mid (u, v) \in E\}$$

minimal ausfällt.

Für dieses NP-schwere Optimierungsproblem sind eine Reihe von Heuristiken bekannt, z.B. der Level-Structure-Algorithmus von Cuthill and McKee. Im Vortrag wird eine neue Heuristik vorgestellt, die in gewissen Fällen bessere Resultate als andere bekannte Algorithmen liefert.

On Grids in de Bruijn Graphs

Martin Hintz
Universität Hamburg

Let $B(d,n)$ be the undirected de Bruijn graph of degree $2d$ and diameter n and let $M(r_1,\dots,r_m)$ be the m-dimensional grid of side lengths $r_1,\dots,r_m$, where $d,n,m,r_1,\dots,r_m \geq 2$ are integers. We consider the extremal problem of determining, for every given grid $M = M(r_1,\dots,r_m)$ and every given n, the least integer $d = d(M,n)$ such that M is a subgraph of $B(d,n)$. For the case that either $n \geq 4$ or $n = 3, m \geq 3$, this problem has been solved by Heydemann, Opatrny, Sotteau (1991) and Andreae, Hintz, Nölle, Schreiber, Schuster, Seng (1995): in this case one finds that, in general, the ratio $\rho := |B(d(M,n),n)| / |M|$ is much bigger than 1. Here we present the solution for the case $m = n = 2$ by stating that $d(M,2) = \lceil \sqrt{r_1 r_2} \rceil$ for $M = M(r_1,r_2)$, which means that the ratio ρ is 1 or nearly 1. In addition, we determine $d(M,2)$ for the case that M is a hypercube, i.e., $M = M(2,2,\dots,2)$.

Small transversals in partitionable graphs

by
STEFAN HOUGARDY
Berlin

Lovàsz famous characterization of perfect graphs states that a graph G is perfect if and only if $\alpha(H)\omega(H) \geq |H|$ for all induced subgraphs H of G. A graph is called *minimal imperfect* if it is not perfect but all its induced subgraphs are. Berge's Strong Perfect Graph Conjecture (SPGC) states that the only minimal imperfect graphs are the odd cycles ≥ 5 and their complements.

A graph satisfying $\alpha(H)\omega(H) = |H| + 1$ is called *partitionable*. By Lovàsz characterization minimal imperfect graphs are partitionable. In attempting to prove the SPGC many properties of minimal imperfect graphs have been proven with the hope that the only graphs satisfying all these properties are the odd cycles ≥ 5 and their complements. However, it turned out that all but two of these properties are also satisfied by partitionable graphs and there exist many partitionable graphs that are not minimal imperfect.

We study the property of having a small transversal which is satisfied by all minimal imperfect graphs as was observed by Chvàtal. We present some results that indicate that small transversals are powerful enough to prove the SPGC.

Set Systems and Matroids

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For a finite set X and a set system $\mathcal{C} \subseteq \mathcal{P}(X)$, we define the $\mathcal{C}$-closure of a subset $A \subseteq X$ to be the intersection of all the sets of $\mathcal{C}$ that contain A, denoted by $\langle A \rangle$, and the $\mathcal{C}$-kernel of A to be the intersection of all the subsets $B \subseteq A$ such that $\langle A \rangle = \langle B \rangle$, denoted by $Y(A)$. It can be shown that the set system $\underline{\mathcal{A}}(\mathcal{C})$ of all the subsets A of X with $A = Y(\langle B \rangle)$ for *some* subset $B \subseteq X$ and the set system $\overline{\mathcal{A}}(\mathcal{C})$ of all the subsets of X which coincide with their *own* $\mathcal{C}$-kernel are simplicial complexes and that $\underline{\mathcal{A}}(\mathcal{C}) \subseteq \overline{\mathcal{A}}(\mathcal{C})$ always holds. Now the following question arises: Given a pair of simplicial complexes $\mathcal{X}' \subseteq \mathcal{X} \subseteq \mathcal{P}(X)$, is there a set system $\mathcal{C} \subseteq \mathcal{P}(X)$ such that $\underline{\mathcal{A}}(\mathcal{C}) = \mathcal{X}'$ and $\overline{\mathcal{A}}(\mathcal{C}) = \mathcal{X}$? We will show that, in general, the answer is no, but if we take $\mathcal{X}$ to be the set of independent sets of a matroid defined on X and $\mathcal{X}' := \mathcal{X}$, then such a set system $\mathcal{C}$ always exists.

Cycle–double–covers in graphs without Petersen–graph–minor

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The well-known cycle-double-cover-conjecture states that each bridgeless graph G has a k-cycle-double-cover $(C_1, ..., C_k)$ for some integer k, i.e. each C_i is an Eulerian subgraph of G (not necessarily connected) and each edge of G is contained in C_i for exactly two indices $i \leq k$. A stronger version states that each bridgeless graph even contains a 5-cycle-double-cover. It is proved that this version is valid for all cubic bridgeless graphs not containing the Petersen-graph as a minor. Moreover, some approaches to the non cubic case are presented.

ON THE RANK FUNCTIONS OF INDEPENDENCE SYSTEMS

V.P.Il'ev, I.V.Ofenbakh

An *independence system* over a finite set U is a family $\mathcal{J}$ of subsets of U with the following property: $I \subseteq J \in \mathcal{J} \Leftarrow I \in \mathcal{J}$. There are two rank functions of the independence system. For each subset $W \subseteq U$ we define the *lower rank* $lr(W)$ and the *upper rank* $ur(W)$ as the cardinality of the smallest and the largest base of W, i.e. the maximal (under inclusion) independence subset of W, respectively.

The definition of the independence system in terms of these functions is obtained. Some new structural characteristics of independence systems are introduced. With using of these characteristics interconnection between two rank functions is investigated.

These results are used to obtain the error estimation of the greedy algorithm for maximisation of additive function over independence systems.

Approximation results for the optimum cost chromatic partition problem

Klaus Jansen[1]

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In this talk, we give an overview about the optimum cost chromatic partition (OCCP) problem for several graph classes. The OCCP problem can be formulated as follows: Given a graph $G = (V, E)$ with n vertices and a sequence of coloring costs $(k_1, \ldots, k_n)$, find a partition into independent sets $U_1, \ldots, U_s$ with $s \leq n$ such that the costs $\sum_{c=1}^{s} k_c \cdot |U_c|$ are minimum.

We prove that there exists no polynomial approximation algorithm with ratio $O(|V|^{0.5-\epsilon})$ for the OCCP problem restricted to bipartite and interval graphs, unless $P = NP$. Furthermore, we propose approximation algorithms with ratio $O(|V|^{0.5})$ for bipartite, interval and unimodular graphs. Finally, we prove that there exists no polynomial approximation algorithm with ratio $O(|V|^{1-\epsilon})$ for the OCCP problem restricted to split, chordal, permutation and comparability graphs, unless $P = NP$.

On reorientation classes of oriented matroids

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Each oriented matroid $\mathcal{M} = (E, \chi)$ of rank r with underlying (simple) matroid $M = M(E)$ can be described as $\mathcal{M} = (M, \omega)$ where ω is a harmonic and strict order function on M called an orientation on M. Chirotope χ and order function ω correspond via the following rule: If H is some hyperplane of M spanned by points $p_1, \ldots, p_{r-1}$ and a, b are points not in H then $\omega(H, a, b) = \chi(a, p_1, \ldots, p_{r-1}) \cdot \chi(b, p_1, \ldots, p_{r-1})$. A reorientation $\mathcal{M}_{-R} = (E, \chi_{-R})$ of $\mathcal{M}$ on $R \subseteq E$ is described in terms of order functions as $\mathcal{M}_{-R} = (M, \omega_{-R})$ where $\omega_{-R}(H, x, y) = (-1)^{|R \cap \{x,y\}|}\, \omega(H, x, y)$. If ω is an orientation we deduce a hyperplane separating function $\tau_\omega : \mathcal{H}^{4*} \to \{-1, +1\}$ from it where $\mathcal{H}^{4*}$ denotes some set of quadruples of comodular hyperplanes and show:
An oriented matroid $\mathcal{M}'$ is a reorientation of $\mathcal{M}$ if and only if the hyperplane separating functions of $\mathcal{M}$ and $\mathcal{M}'$ coincide.

Hájos construction of critical graphs

by
TOMMY JENSEN
Chemnitz

Abstract G. Hajós asked whether every critical graph of chromatic number $k > 0$ allows a Hajós construction starting from the complete graph K_k, such that all graphs obtained at intermediary steps are also critical. The answer is clearly positive for $k \leq 3$.
The answer to the question is known to be negative for $k = 8$. This may be shown by P. Catlin's counterexample to Hajós' conjecture on K_k-subdivisions in k-chromatic graphs. We have proved that the answer is negative for every $k \geq 4$. The example showing this for $k = 4$ can also be used to show that also the answer to the corresponding question, when replacing Hajós construction with Ore's construction, is negative for every $k \geq 4$. Our 4-chromatic example is very simply explained: It is the graph obtained from the dodecahedron graph by adding new edges between all pairs of antipodal vertices.
This is joint work with Gordon F. Royle, University of Western Australia.

AN EXTREMAL GRAPH THEORY PROBLEM IN CONNECTIVITY AUGMENTATION

Tibor Jordán

Department of Mathematics and Computer Science
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Béla Bollobás posed the following problem in his book *Extremal Graph Theory* (page 49., Problem 34.)

Let $1 \leq k < l < n$. Determine the minimal integer e for which to every k-connected graph of order n it is possible to add at most e edges such that the resulting graph is l-connected. Determine the analogous minimum for edge-connectivity.

Depending on whether we deal with graphs or digraphs and vertex- or edge-connectivity, four different versions of this problem can be formulated. We will present the complete answer for three of them and solve the special case $k + 1 = l$ of the remaining (undirected vertex-connectivity) version.

Kalhoff, Franz
FMI, Universität Passau / FB Mathematik, Universität Dortmund

Orientierungen und Ordnungsfunktionen in Matroiden

Wie in letzter Zeit von einer Reihe von Autoren bemerkt wurde, lassen sich Orientierungen von Matroiden mit Hilfe von Seiteneinteilungen beschreiben, die im wesentlichen der von Sperner 1948 begründeten und von Karzel, Joussen, Glock und anderen weitergeführten Theorie der Ordnungsfunktionen genügen. Die Objekte dieser "klassischen" Theorie, wie Halbordnungen, Anordnungen und die Ordnungsfunktionen selbst, sind im Matroidfall als Homomorphismen zugrundeliegender Tuttegruppen im Sinne von Dress interpretierbar. Für Matroide vom Rang drei erlauben es die klassischen Ergebnisse insbesondere,

- einen neuen Beweis für das topologische Darstellungstheorem von Folkman und Lawrence zu geben und
- die von Goodman et al. präsentierte Verifizierung einer Vermutung von Grünbaum zur reellen Einbettbarkeit von Pseudogeraden-Arrangements deutlich zu verschärfen.

Graph Layouts from Matrices

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Abstract

The first neighbours interactions in a molecule are modelled by the adjacency matrix $A(G)$ of the related molecular graph G. As shown by Manolopoulos, Fowler, Shawe-Taylor and Pisanski especially chosen eigenvectors of A and Laplacean matrix of a graph are able to generate rather realistic 3-dimensional layouts of molecules, especially fullerenes. Here we introduce the ***distance power matrices*** $D^{(\alpha)}(G)$ as the means to model higher neighbours interactions in a molecule. These matrices are defined on graph-distances in a graph G and their (α)-powers. ***Distance power 3-dimensional layouts*** of a series of (molecular) graphs are generated here and the transformations of layouts with the parameter α are studied. Results are compared to those obtained by some other methods for determining (molecular) graph layouts. Some possible generalisations of the method presented here are also discussed.

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Small Cycle Decomposition of Line Graphs

Hajós conjectured that any eulerian graph on n vertices can be decomposed into at most $\left\lfloor \frac{n-1}{2} \right\rfloor$ cycles. The general case of this old conjecture is still unsettled, but various special cases have been proven: The conjecture is right for graphs with maximum degree $\Delta \leq 4$ (O.Favaron and M.Kouider) and for planar eulerian graphs (K.Seyffarth).

In the case of line graphs, I could show that the conjecture holds, that is, if G is an eulerian graph or a graph with only odd degrees with m edges, then the edge set of its line graph can be decomposed into a set of at most $\left\lfloor \frac{m-1}{2} \right\rfloor$ cycles.

Further Bondy's Conjecture that any bridgeless graph on n vertices can be double-covered by at most $n-1$ cycles can be shown for the line graphs of much bigger classes of graphs.

Discrepancy of Arithmetic Progressions

PETRA KNIEPER
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Let $\mathcal{A}$ be a family of subsets of a finite set Ω and let $\chi : \Omega \to \{-1, +1\}$ be a 2-colouring of Ω. For any subset $X \subseteq \Omega$ define $\chi(X) := \sum_{x \in X} \chi(x)$. Then the *discrepancy* of $\mathcal{A}$ is defined by $disc(\mathcal{A}) = \min_\chi \max_{A \in \mathcal{A}} \mid \chi(A) \mid$. Let $\Omega = \{1, \ldots, N\}$ and let $\mathcal{A}$ be the set of arithmetic progressions in Ω. In 1994 Matoušek and Spencer proved that the discrepancy of this set system is at most $cN^{1/4}$, for an absolute constant c. This showed that the lower bound $c'N^{1/4}$, for an absolute constant c', proven by Roth in 1964, is up to a constant best possible.
In this talk we generalize this problem. We consider arithmetic progressions on the $N \times N$ grid and show that the discrepancy of this set system is at most $cN^{1/2} \log N$, for an absolute constant c.
(Joint work with A. Srivastav.)

Snarks without Small Cycles

by
MARTIN KOCHOL

Snarks are non-trivial cubic graphs whose edges cannot be colored with three colors. (By non-trivial we mean cyclically 6-edge- connected with girt at least 5). Jaeger and Swart conjectured that any snark has girth (the length of the shortest cycle) at most 6. This problem is also known as the Girth Conjecture of snarks. The aim of this paper is to give a negative solution of this conjecture and construct snarks with arbitrarily large girths. For instance, if we use known constructions of cubic graphs with large girths, then we can explicitly construct cyclically 5-edge-connected snarks of order n and with girth at least $(4/3 \pm o(1)) \log_2 n$.

An Optimal Algorithm for the Minimum Connected Dominating Set Problem in Trapezoid Graphs

Ekkehard Köhler
Technische Universität Berlin

Trapezoid graphs are a class of cocomparability graphs, containing both interval graphs and permutation graphs. They were introduced by Dagan, Golumbic and Pinter in 1988.

Several algorithms exist for the problem of finding a minimum connected dominating set in trapezoid graphs. Srinivasan et al. gave an $O(m+n\log(n))$ algorithm for the weighted case of this problem and Liang presented an $O(n+m)$ algorithm for the cardinality case.

We take a new approach to this problem and present an $O(n)$ time algorithm for finding a minimum cardinality connected dominating set in a trapezoid graph, given the trapezoid diagram.

Coloring of special distance graphs

Halka Kolberg

Abstract

An integer distance graph is a graph G(D) with the set of integers as vertex set and with an edge joining two vertices u and v if and only if $|u-v| \in$ D where D is a subset of the positive integers. We determine the chromatic number χ(D) of G(D) for some finite distance sets D such as sets of consecutive integers and special distance sets of cardinality 4.

Uniquely colourable graphs of large girth and small order

Bernd Kreuter
Humboldt-Universität zu Berlin

In 1976, BOLLOBÁS and SAUER showed that there exists a uniquely k-colourable graphs of girth at least g (for integers k and g). We present a new probabilistic construction which gives a bound of $k^{12(g+1)}$ on the order of such graphs. This is best possible up to the constant in the exponent.

A consequence of this result is that the problem to decide whether a given graph is k-colourable remains hard even when restricted to graphs of large girth.

The talk is based on joint work with T. Emden-Weinert and S. Hougardy.

Contractible non-edges in triangle-free graphs

MATTHIAS KRIESELL, Berlin

THOMASSEN has proved that every triangle-free k-connected graph contains a pair of *adjacent* vertices whose identification yields again a k-connected graph. We study the existence of a pair of *nonadjacent* vertices whose identification preserves k-connectivity.

Small Minimum Communication Graphs

ROGER LABAHN

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A graph on an even number of vertices, n, is called a *minimum broadcast/gossip/periodic gossip graph* (n-mgb/mgg/mpgg) iff it allows to perform broadcasting from any vertex/gossiping/periodic gossiping within the minimum number of time steps, $\lceil \log_2 n \rceil$, and has the minimum number of edges, $B(n)/G(n)/PG(n)$, among all such graphs.

While in general, only very few values of these functions are known, it is easy to compute them for graphs on $n \leq 16$ vertices. In this range, we are seeking all mgb/mgg/mpgg, mainly in order to find characteristic graph-theoretical properties and construction ideas which might be generalized.

In the talk, we present our results on the numbers of non-isomorphic n-mgb/mgg/mpgg for even $n \leq 16$, and show interesting and typical examples of such graphs. Moreover, for $n = 16$, we explain an algorithm which eventually yields all 16-mgg from the standard one - the 4-dimensional hypercube.

Orthogonale Doppelüberdeckungen durch Bäume

Uwe Leck und Volker Leck, Rostock

Eine Orthogonale Doppelüberdeckung des vollständigen Graphen K_n (ODC) ist eine Menge $\mathcal{P} = \{P_1, \ldots, P_n\}$ von spannenden Untergraphen, die die folgenden beiden Bedingungen erfüllt:

1. Jede Kante des K_n ist in genau zwei Graphen aus $\mathcal{P}$ enthalten.
2. Je zwei Graphen aus $\mathcal{P}$ haben genau eine gemeinsame Kante.

Sind alle Graphen aus $\mathcal{P}$ isomorph zu einem Graphen G, so heißt $\mathcal{P}$ ein ODC durch G. Es wird vermutet, daß für jeden Baum B (bis auf den Weg mit 3 Kanten) ein ODC durch B existiert. Im Vortrag werden Konstruktionen vorgestellt, die es ermöglichen, die Richtigkeit dieser Vermutung für einige Klassen von Bäumen zu bestätigen.

The Algorithmic Aspects of Uncrowded Hypergraphs

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Abstract

We consider the problem of finding deterministically a large independent set of guaranteed size in a hypergraph on n vertices and with m edges. With respect to the Turán bound, the quality of our solutions is for hypergraphs with not too many small cycles by a logarithmic factor in the input size better. The algorithms are fast. Namely, they often have a running time of $O(m) + o(n^3)$. Indeed, the denser the hypergraphs the more close are the running times to the linear ones. This gives for some combinatorial problems algorithmic solutions with state-of-the-art quality, solutions of which so far only the existence was known. In some cases, the corresponding upper bounds match the lower bounds up to constant factors. The involved concepts are uncrowded hypergraphs. Various applications will be given concerning Sidon sets, independence number of Steiner-systems, Ramsey numbers, geometric selection problems, graph coloring problems and Turán numbers for random graphs.

An algorithm for efficiently computing linear extensions for realizers of partially ordered sets

Utz Leimich
Universität Hamburg

The large number of linear extensions often makes the algorithmic construction of a realizer and computation of the dimension or fractional dimension difficult. The problem can be reduced by considering only *saturated* linear extensions which reverse maximal sets of critical pairs. The presented algorithm computes an in a certain sense optimal subset of the saturated linear extensions of a poset. The (fractional) dimension can be computed using this set, which usually is much smaller than the total number of linear extensions. There are even families of posets for which the size of Λ_S grows polynomially but the total number of linear extensions grows exponentially with the number of elements of the poset.

Branching properties of projections onto polyhedra

Rainer Löwen, Braunschweig

We present a simple proof of a theorem of Ralph (1994) on combinatorial properties of projection maps onto polyhedra in Euclidean space. Consider the subdivision into domains of linearity of such a map. Ralph's theorem asserts that each codimension 2 face of this polyhedral subdivision is contained in precisely 4 maximal faces. Subdivisions with this property are interesting because piecewise linear maps defined on them are bijective if and only if their local determinants have uniform sign (Kuhn and Löwen, 1987). As a consequence, we obtain a theorem of Robinson (1992) characterizing bijective maps of the form $f \circ p + \mathrm{id} - p$, where p is a projection and f is linear. This result in turn has applications in Operations Research.

W. Mader: An extremal problem for subdivisions of K_5.

G.A. Dirac conjectured in 1964 that every graph of order $n \geqq 3$ with at least $3n - 5$ edges contains a subdivision of the complete graph on five vertices. We prove this conjecture and determine all extremal graphs.

Matroid representations via partitions and general quasigroup identities.

Dr. František Matúš
Universität Bielefeld

A matroid on the ground set N with the rank function r is said to be partition (p-) representable of degree $d \geq 2$ if partitions ξ_i, $i \in N$, of a finite set Ω of the cardinality $d^{r(N)}$, exist such that the meet-partition $\xi_I = \bigwedge_{i \in I} \xi_i$ has $d^{r(I)}$ blocks of the same cardinality for every $I \subset N$. Two equivalent definitions of p-representability will be presented, one of them in terms of a system of generalized quasigroup equations read out of the matroid cycle structure. A special morphism of p-representations, called p-isotopy, can be introduced. For a few matroids, the p-isotopy classes of p-representations can be completely classified. A profusion of excluded minors for the p-representability is constructed.

Buekenhout-Metz Unitale

KLAUS METSCH
Giessen

Buekenhout-Metz Unitale (BM-Unitale) sind Unitale in $PG(2, q^2)$, die mit Hilfe von quadratischen Formen in $PG(4, q)$ konstruiert werden. Nachdem zunaechst die Konstruktion der BM-Unitale vorgestellt wird, werden einige neuere Resultate ueber BM-Unitale zusammengefasst. Eines dieser Resultate ist ein einfaches Kriterium, um zu erkennen, ob ein BM-Unital ein klassisches Unital ist.

Über Lee-Fehler korrigierende Codes

Ute Minne
FU Berlin

Im Rahmen der Codierungstheorie erweist sich zur Beschreibung des Abstands zweier Wörter $(x_1, \ldots, x_n)$, $(y_1, \ldots, y_n) \in \mathbb{Z}_q^n$ die von C.Y Lee 1958 definierte und später nach ihm benannte Lee-Metrik $d_L(x, y) := \sum_{i=1}^{n} min\, \{|x_i - y_i|,\, q - |x_i - y_i|\}$ als besonders geeignet für phasenmodulierte Kanäle. Im Mittelpunkt des Vortrags stehen Aussagen über die Existenz bzw. Nichtexistenz von Codes, die unidirektionale Fehler bzgl. der Lee-Metrik korrigieren können (UEC-Codes) und zudem perfekt sind. Es werden u.a. alle perfekten UEC-Codes der Länge $n = 2$ charakterisiert.

Würfel - Ramsey - Zahlen

Katja Mosenthin

Die klassische Ramsey Theorie beschäftigt sich mit der Färbung von vollständigen Graphen. Legt man den d-dimensionalen Würfelgraphen zugrunde, so ergibt sich eine weitere interessante Menge von Ramsey-Zahlen, die Menge der Würfel-Ramsey-Zahlen.

Die Würfel-Ramsey-Zahl $r_Q(T)$ ist die minimale Dimension, in welcher jede Zweifärbung der Kanten des d-dimensionalen Würfelgraphen Q_d einen fest vorgegebenen einfarbigen Teilgraphen T enthält.

Es werden bekannte und neue Ergebnisse vorgestellt. Anhand von $r_Q(K_{s,t}) = 2s - 1$ mit $s \geq t$ wird eine für kreisfreie Graphen mit Durchmesser $D \leq 4$ häufig verwendete Beweisstruktur erläutert.

Formeln für partielle Rekursion mit (3×3)-Templates

Walter Oberschelp, RWTH Aachen

Wir geben eine Summenformel zur Berechnung der Größen einer partiellen Rekursion mit konstanten Koeffizienten, die bis zur Tiefe 2 in jeder der beiden Variablen zurückreichen kann (incl. gemischter Fall). Eine weitere Verallgemeinerung ist möglich.

Hierzu werden die erzeugenden Funktionen für die Spalten und die Zeilen des Tableaus bestimmt. Das Ergebnis hat die Form einer Mehrfachsumme über Binomialkoeffizienten, die nur in Spezialfällen zu einem hypergeometrischen Term vereinfacht werden kann. Beschränkt man den Rückgriff einer der beiden Variablen auf die Tiefe 1, so zerfällt das Ergebnis in zwei wohlbekannte Teilprobleme (verallgemeinertes Euler- bzw. Fibonacci-Problem).

Die gewonnene Formel enthält praktisch alle bisher betrachteten Formeln für partielle Rekursionen als Spezialfall.

Prism Graphs

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Abstract

The so-called prism graphs form a special class of planar cubic graphs. A prism graph is obtained from a prism by adding a series of horizontal edges on lateral faces. Cubic 3-connected graphs of bandwidth 3 are characterised using a special class of prism graphs, known as Fibonacci prisms.

How many cliques are in intersection graphs of uniform hypergraphs?

ERICH PRISNER *
Universität Hamburg

15. November 1996
Kombinatorik Kolloquium, Braunschweig

It is shown that k-uniform hypergraphs with m edges contain at most $O(m^{\binom{2k}{k}})$ maximal sets of pairwise intersecting hyperedges, and ℓ-intersection graphs $G = (V, E)$ of k-uniform hypergraphs contain $O(|V|^{\binom{2k-2\ell+2}{k-\ell+1}})$ maximal cliques. In case $k = 3$ and $\ell = 1$, the result is improved to $O(|V||E|)$. For every fixed k, the results imply polynomial-time algorithms for computing maximum sets of pairwise intersecting hyperedges in k-uniform hypergraphs, respectively maximum cliques in their intersection graphs.

On upper bounds for the dominating number of a bipartite graph

Anja Pruchnewski, Technische Universität Ilmenau

Let G be a bipartite graph with the two colour classes V_1 and V_2.
For $i = 1, 2$ let n_i and δ_i be the cardinality of V_i and the minimum degree in V_i, respectively.
Upper bounds for the dominating number of G in terms of $n_1, n_2, \delta_1, \delta_2$ are presented.
This is joint work with J. Harant (Ilmenau) .

Jörn Quistorff
Universität der Bundeswehr Hamburg

Zur Verlängerung affiner MDS-Codes

Ist K eine q-elementige Menge, so heißt $C \subseteq K^n$ ein $(n, 2)$-MDS-Code oder nach Karzel/Maxson auch ein affiner MDS-Code der Ordnung q, falls gilt: Zu $x_1, x_2 \in \{1, 2, ..., n\}$ mit $x_1 \neq x_2$ und $y_1, y_2 \in K$ existiert genau ein $w = (w_1, ..., w_n) \in C$ mit $w_{x_1} = y_1$ und $w_{x_2} = y_2$.

Wird an jedes Codewort $w \in C$ eine konstante Anzahl von Zeichen aus K angehängt, so spricht man von einer Verlängerung des Codes. Zhang, Shrikhande und Bruck geben in der Sprache anderer kombinatorischer Objekte hinreichende Bedingungen dafür an, daß aus einem affinen MDS-Code durch Verlängerung ein affiner MDS-Code maximaler Länge gewonnen werden kann. Das Ergebnis von Zhang wird eingehender diskutiert.

3-Colorability by Forbidden Induced Subgraphs

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Abstract

In this talk we will determine pairs (A, B) of graphs such that a graph G is 3-colorable if G does not admit neither A nor B as an induced subgraph. Obviously a necessary condition for a graph to be 3-colorable is the absence of the complete subgraph K_4. Therefore A must be an induced subgraph of the K_4 and we have two non-trivial cases $A = K_4$ and $A = K_3$.
Only two contributions towards the second case are known: Sumner proved in 1981 that every triangle-free graph not containing an induced path of order five is 3-colorable , and the result that every triangle-free graph not containing a star $K_{1,4}$ is 3-colorable, which is easily deduced from the well-known theorem of Brooks. We will extend both results.

Some structural Results on Linear Arboricity

by
DIETER RAUTENBACH
RWTH Aachen

Abstract. A linear forest-factor G of a graph G is a spanning subgraph of G whose components are paths of lenth $l \geq 0$. A linear forest-decomposition of G is a collection $\mathcal{F} = \{F_1, ..., F_k\}$ of linear forest-factors of G such that the edge set $E(G)$ of G is the disjoint union of $E(F_1), ..., E(F_k)$. The linear arboricity $la(G)$ of G is the minimum cardinality of a linear forest-decomposition of G. In this paper we evolve a method to construct a small linear forest-decomposition of a graph G from given linear forest-decompositions of two subgraphs that are linked by a cut vertex of G. As an application we determine the linear arboricity of block-cactus graphs which extends a result of Zelinka from 1986. The presented material stands in close connection with the "linear arboricity conjecture" of Akiyama, Exoo and Harary from 1980.

On the Linear-Extension-Diameter of a Poset

Klaus Reuter * (joint with Stefan Felsner) †

An important graph related to linear extensions of a poset P has all linear extensions as vertices with two of these being connected if they differ in an adjacent pair. This graph contains the complete information of the extension lattice of P and has been studied under various point of views. We have investigated its diameter, which we have called the linear-extension-diameter of P or LED(P) for short. As a little surprise it turns out that LED(P) equals the number of incomparable pairs of a minimal 2-dimensional extension of P. Finding such minimal 2-dimensional extensions is interesting in its own right. It provides us with a very promising drawing method of posets, which will be demonstrated in the talk. Moreover, we shall report on general bounds, partial results of the LED of Boolean lattices, and a formula for the case of generalized crowns.

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How to Reconstruct the Correct Labeling of a Tournament?

Noga Alon * Miklós Ruszinkó †

November 5, 1996

Abstract

An *isomorphism certificate* of a labeled tournament T is a labeled subdigraph of T which together with an unlabeled copy of T allows the errorless reconstruction of T. It is shown that any tournament on n vertices contains an isomorphism certificate with at most $n \log_2 n$ edges. This answers a question of Fishburn, Kim and Tetali. A *score certificate* of T is a labeled subdigraph of T which together with the score sequence of T allows its errorless reconstruction. It is shown that there is an absolute constant $\epsilon > 0$ so that any tournament on n vertices contains a score certificate with at most $(1/2 - \epsilon)n^2$ edges.

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On approximation of step functions

W.Deuber, A.V.Rasskazov, and A.A.Sapozhenko

Bielefeld University and Moscow State University

Applications in VLSI modelling suggest the following problem. Let L_n be graph of the decreasing unit step function with "corners" $(i, n-i+1)$ for $i = 1, \cdots, n$. The problem is to find good approximations of L_n by step functions G with less than n corners. Two measures for the quality of approximation are considered: the area of symmetric difference of G and L_n and the area of the largest rectangle containing in the figure between the curves G and L_n). A complete solution of the approximation problems is obtained.

Boundary functional method for enumeration problems

A.A.SAPOZHENKO

Moscow State University

We consider the enumeration problems which are reducible to estimation the sums of type $T(X, f) = \sum_{A \subseteq X} f(A)$, where f is so called boundary functional (BF) on X, and the summation is over all subsets of X or over some its subfamily. An evolution of the n-cube, the percolation problem, the problem of computation of the matchings number and the independent sets number, the monotone Boolean functions number, the binary codes number and so on (see and examples below) are among such problems. The goal of the talk is to obtain asymptotics for $T(X, f)$.

3-Colourability and Ramsey Theory

by
INGO SCHIERMEYER
Cottbus

Motivated by the Grötzsch/Mycielski graph we construct classes of graphs with chromatic number 4. We apply a ramsey argument for a 3-colouring of an odd cycle to show that these graphs are not 3-colourable. For graphs with a bounded number of different cycle lengths we prove the following theorem: A graph G with k different odd (even) cycle lengths has chromatic number at most $2k + 2(2k + 3)$, where equality holds iff G contains $K_{(2k+2)}(K_{(2k+3)})$ as a subgraph. For the odd case this had been conjectured by Bollobas and Erdős in 1990.

Zyklische Hadamard-Matrizen

Bernhard Schmidt, Augsburg

Eine Hadamard-Matrix ist eine Matrix mit Einträgen ± 1, so daß je zwei Zeilen orthogonal sind. Eine Matrix heißt zirkulant, falls alle Zeilen aus der ersten Zeile durch "Verschieben" hervorgehen. Ein Beispiel einer zirkulanten Hadamard-Matrix ist

$$\begin{pmatrix} -1 & 1 & 1 & 1 \\ 1 & -1 & 1 & 1 \\ 1 & 1 & -1 & 1 \\ 1 & 1 & 1 & -1 \end{pmatrix}.$$

Eine berühmte Vermutung besagt, daß dieses Beispiel (bis auf triviale Umformungen) die einzige zyklische Hadamard-Matrix ist. Für diese Vermutung gibt es in der Literatur mehrere falsche Beweise; ein korrekter Beweis ist noch lange nicht in Sicht. Ich werde einige neue (hoffentlich korrrekte) Resultate über diese Vermutung vorstellen.

Konstruktion von Divisiblen Designs aus nicht-desarguesschen Translationsebenen

Ralph-Hardo Schulz (FU Berlin)

Sei R eine Äquivalenzrelation auf einer Menge L und G eine $2-R$-homogene Permutationsgruppe auf L, d.h. eine die Äquivalenzklassen von R respektierende Gruppe, die auf der Menge $\{\{g,h\} \mid g,h \in$L, g nicht äquivalent $h\}$ transitiv operiert. A.G. Spera hat gezeigt, daß für eine k–transversale Teilmenge B von L (d.h. eine k–Teilmenge von L, deren Elemente paarweise nicht–äquivalent sind,) gilt: $(G, B^G, \in)$ ist ein (s,k,λ)–Divisibles Design. Auf diese Weise konnten A.G. Spera und ich (s,k,λ)–Divisible Designs auf der Menge L der Geraden von endlichen Translationsebenen T (mit der Parallelitätsrelation als R) unter der Voraussetzung finden und untersuchen, daß T eine Kollineationsgruppe G mit einer 2-transitiven Bahn auf der uneigentlichen Geraden zuläßt, z.B. $G \cong Sz(q)$ im Fall der Lüneburg–Ebenen.

Zur Summenzahl von Hyperbäumen

Martin Sonntag
TU Bergakademie Freiberg

31. Oktober 1996

Ein Hypergraph $\mathcal{H}$ heißt genau dann *Summenhypergraph*, wenn es eine endliche Menge $S \subset I\!N^+$ und $d_1, d_2 \in I\!N^+$ mit $1 < d_1 \leq d_2$ so gibt, daß $\mathcal{H}$ isomorph zum Hypergraphen $\mathcal{H}^+_{d_1,d_2}(S) = (V,\mathcal{E})$ ist, wobei $V := S$ und

$\mathcal{E} := \{\{x_1, x_2, \ldots, x_k\} \,:\, k \in \{d_1, d_1+1, \ldots, d_2\} \wedge (i \neq j \Rightarrow x_i \neq x_j) \wedge \sum_{i=1}^{k} x_i \in S\}$.

Sei $\mathcal{H} = (V,\mathcal{E})$ ein *Hyperbaum* (d.h. ein nichttrivialer, zusammenhängender und kreisfreier Hypergraph), $d_{min} := min\{|e| \,:\, e \in \mathcal{E}\}$, $d_{max} := max\{|e| \,:\, e \in \mathcal{E}\}$ und $3 \leq d_{min} \wedge d_{max} < 2d_{min} - 1$. Mit Hilfe eines Algorithmus zeigen wir, daß (in Analogie zum Fall der Graphen) der Hyperbaum $\mathcal{H}$ die Summenzahl 1 hat, d.h. daß $\mathcal{H}' := (V \cup \{x\}, \mathcal{E})$ ein Summenhypergraph ist, wenn $x \notin V$ ein isolierter Knoten ist.

Some Results about Snarks

Eckhard Steffen *

A *snark* is a simple, cubic, bridgeless graph with chromatic index 4. These graphs play an important role in graph theory since if there are minimal counterexamples to some well known conjectures (e.g. Tutte's 5-flow conjecture; Double Cycle Cover Conjecture) then they are snarks.
Therefore snarks are of interest in itself and the study of their structure is directly related to questions about their reducibility.
This talk is about the following topics:
- a sufficient condition for snarks having a nowhere-zero 5-flow
- the reducibility of snarks
- enumeration of snarks with less than 30 vertices.

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TORSTEN KARL STREMPEL
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Die Suche nach einer triangulierten, orientierbaren 2-Mannigfaltigkeit, die nicht durchdringungsfrei im R^3 eingebettet werden kann, war die Motivation zur algorithmischen Aufz"ahlung alle triangulierten 2-Mannigfaltigkeiten von vorgegebener Anzahl von Punkten, Kanten und Dreiecken (f_0, f_1, f_2) und vorgegebener Eulercharakteristik (χ). Durch den Vergleich der Darstellungen verschiedener kombinatorischer Strukturen (triangulierte Mannigfaltigkeiten, orientierte Matroide und Block-Designs) erhalten wir Isomorphieaussagen f"ur spezielle Klassen der jeweiligen kombinatorischen Strukturen.

F"ur die Einbettung orientierbarer, triangulierter 2-Mannigfaltigkeiten im R^3 kommt ein heuristisches Verfahren zum Einsatz. Wir bestimmen zu einer vorgegebenen triangulierten 2-Mannigfaltigkeit triangulierte 3-Sp"aren, die die 2-Mannigfaltigkeit im 2-Skelett enthalten und versuchen die 3-Sph"are und somit die (kombinatorisch) eingebettete 2-Mannigfaltigkeit durch Federdiagramme zu realisieren.

ON OPTIMAL EAR-DECOMPOSITIONS OF GRAPHS

Zoltán Szigeti

An ear-decomposition of a graph G is called *optimal* if it contains minimum number $\varphi(G)$ of even ears. For important classes of graphs in matching theory there exist optimal ear-decompositions with a few even ear ($\varphi \leq 1$). By the result of Lovász, a graph is factor-critical if and only if $\varphi(G) = 0$. For matching-covered graphs $\varphi(G) = 1$, moreover, by a result of Little, any two edges of a matching-covered graph can be in the starting even ear of an optimal ear-decomposition. We shall generalize this result for any (non factor-critical) 2-edge-connected graph. It will turn out that the relation $\sim$ ($e \sim f$ if and only if e and f can be in the starting even ear of an optimal ear-decomposition) is an equivalence relation and the equivalence classes defined by $\sim$ are the connected components of a matroid. This matroid was introduced earlier by the author.

Perfect 3- and 4- Shift Designs and Run–Length Limited Codes

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In digital storage media (like CD's or hard discs) information is stored using so called (d,k)–run–length–limited (RLL) codes consisting of $\{0,1\}$–sequences in which between two 1's there are at least d and at most k many consecutive 0's.
Vinck and Levenshtein [1] studied perfect t–shift RLL–codes capable of correcting a single shift of a 1 to the left or to the right in at most t positions.
As the basic combinatorial tool they introduced the concept of a perfect t–shift N–design, which is a subset $\mathcal{H} = \{h_1, \ldots, h_N\} \subset Z_{2tN+1}$ with the property that all the $2tN$ elements $\pm j \cdot h_i$ are different and not equal to zero. They also gave constructions of perfect t–shift designs for the parameters $1, 2$, and $\frac{p-1}{2}$ (where p is a prime number).
We shall completely characterize perfect t–shift N–designs for $t = 3$ and $t = 4$. It will be shown that perfect 3– and 4–shift N–designs must consist of certain subgroups of Z_{2tN+1} and its conjugacy classes. Depending on the fact if 2 is on the orbit of $3 \cdot 2^{-1}$ conditions on the number N in order to assure the existence of a 3– or 4–shift N–design are derived.

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2-colourings of hypergraphs and even cycles in directed graphs

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A simple application of the Lovász Local Lemma shows that, for $d \geq 9$, the vertices of every d-regular d-uniform hypergraph can be 2-coloured in such a way that no edge is monochromatic. Thomassen's result on the existence of even cycles in directed regular graphs shows that this is actually true if $d \geq 4$, which is best-possible. The question whether 2-colourings of such hypergraphs can actually be constructed in polynomial time was first addressed using algorithmic versions of the Lovász Local Lemma developed by Beck and Alon. This leads to a polynomial algorithm for sufficiently large d. The aim of this talk is to show that one can in fact 2-colour d-regular d-uniform hypergraphs in polynomial time as soon as $d \geq 4$.

On 3–uniform sum hypergraphs

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Abstract

Let $S \subset \mathbb{N}^+$ be finite. $\mathcal{H}_3^+(S) = (V, \mathcal{E})$ is called the 3–uniform sum hypergraph of S iff $V = S$ and $\mathcal{E} = \{\{x_1, x_2, x_3\} \in \mathcal{P}(S) : (i \neq j \Rightarrow x_i \neq x_j) \wedge x_1 + x_2 + x_3 \in S\}$. Corresponding to known results for sum graphs we determine for $\mathcal{H}_n^+ := \mathcal{H}_3^+(\{1, \ldots, n\})$ all vertex degrees and the number of edges and give for arbitrary S an upper bound for $|\mathcal{E}|$.

Sufficient conditions for semicomplete multipartite digraphs to be Hamiltonian

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A semicomplete multipartite digraph (SMD) is obtained by replacing each edge of a complete multipartite graph by an arc or by two mutually opposite arcs. In 1995 Yeo analysed the structure of spanning subgraphs consisting of disjoint cycles in SMD. This enabled him, among others, to prove that every regular SMD is Hamiltonian, which had been conjectured by C.-Q. Zhang. Using Yeos structure-results we generalized this theorem. Further a new sufficient condition for SMD to be Hamiltonian is presented.

Interval Inversions for Digraphs

Abderrahim Boussaïri
Pierre Ille
Gérard Lopez
Stéphan Thomassé

Abstract

Given L and L' two linear orders on the same set of vertices, one can get L' from L by inversing a sequence of intervals (they are *interval inversion equivalent*, I.I.E.). For example if $L = \{a < b < c < d\}$ and $L' = \{d < a < c < b\}$, one sequence is $L = \{a < b < c < d\}, \{a < d < c < b\}, \{d < a < c < b\} = L'$. Let D be a digraph, $I \subseteq V(D)$ is an *interval* if $\forall x, y \in I, \forall z \notin I, (xz \in E(D) \Leftrightarrow yz \in E(D)) \wedge (zx \in E(D) \Leftrightarrow zy \in E(D))$. This definition generalizes intervals of linear orders. Gallai proved that two finite partially ordered sets have the same comparability graph iff they are I.I.E. We extend the result of Gallai to digraphs by giving a necessary and sufficient condition for D and D' to be I.I.E. A corollary of our result is that two tournaments T and T' are I.I.E. iff they have same cycles on three vertices. Thus, the 3-uniform hypergraph which represents the set of 3-cycles of a tournament is exactly the analog of the comparability graph of a partially ordered set.

Trees and Hamilton Cycles in Graphs

by
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A spanning tree T of a connected graph G is called an independence tree if the set of end vertices of T (vertices with degree one in T) is an independent set in G. We show that independence trees can be seen as 'blocking objects' in the context of finding Hamilton cycles and that 'almost all' graphs have an independence tree. We present some NP-complete/NP-hard problems on independence trees. We discuss an analogue of a well-known sufficient condition for hamiltonicity due to Chvátal and Erdös. Further, we introduce a new concept concerning independence trees which generalizes the concept of a Hamilton cycle. We present three theorems on this new concept. Two of them are generalizations of Ore's Theorem, and the third is an analogue of a closure theorem due to Bondy and Chvátal.

Ir. H. Tuinstra (joint work with dr. ir. H.J. Broersma)

(p,q,r)-choosability

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Let p, q, r be natural numbers, and $G = (V, E)$ a graph with vertex set V and edge set E. A *(p, r)-assignment* of G is a collection $\mathcal{L} = \{L(v) \mid v \in V\}$ of lists assigned to the vertices such that $|L(v)| = p$ for all $v \in V$, and $|L(u) \cup L(v)| \geq p + r$ for all $uv \in E$.
An *$\mathcal{L}$-admissible q-set coloring* of G is a collection $\mathcal{F} = \{F(v) \mid v \in V\}$ such that $F(v) \subseteq L(v)$ for all $v \in V$, $|F(v)| = q$ for all $v \in V$, and $|F(u) \cap F(v)| = \emptyset$ for all $uv \in E$.
The graph G is said to be *(p,q,r)-choosable* if it admits a q-set coloring for every (p, r)-assignment $\mathcal{L}$.

Some results on this topic with special consideration of planar graphs will be given.

Authors: Sven de Vries, Graduiertenkolleg Mathematische Optimierung der Uni Trier; Oliver Suhr and Hans-Jürgen Bandelt, Mathematisches Seminar der Uni-Hamburg
Title: New Facets for the Polytope of Scheduling Jobs of Equal Length within a Tight Planning Horizon
Abstract:
We have a single machine and n jobs each of which needs p time units for processing. All jobs have to be completed within the planning horizon of $np + p - 1$ time units, they must not be interrupted, there are no precedence constraints and the machine can work only on one job in every time-unit. The cost of processing a job is an arbitrary function of its start time. The goal is to schedule all jobs so as to minimize the sum of the processing costs. The problem is NP-hard. We give a time-indexed formulation and present a partial polyhedral description as well as some new families of facets of exponential size.

Bipartite Crossing Numbers

(Abstract)

Lecturer: Imrich Vrťo (joint work with Ondrej Sýkora)

The *bipartite crossing number* of a bipartite graph $G = (V_0, V_1, E)$ is the minimum number of crossings of edges when the vertices V_0, V_1 are placed on two parallel lines, respectively and edges are drawn as straight line segments. This problem was introduced by Harary and Schwenk (1972). The bipartite crossing number is NP-complete problem. Most effort in this area has been devoted to the design of algorithms and heuristics for the restricted problem when the positions of vertices of V_0 are fixed. We study the original problem and develop two lower bound techniques. The first one is suited for bounded degree graphs while the second one for "well stuctured graphs". Applications of methods for standard graphs are shown, including trees, meshes and hypercubes. Particularly, for the complete binary tree and $3 \times n$ mesh we give exact results on bipartite crossing numbers.

Title: Topologically end-faithful forests in infinite graphs

Author: Kerstin Waas, Fakultät f. Mathematik, TU Chemnitz-Zwickau

Abstract

Reinhard Diestel conjectures that an infinite graph contains a topologically end-faithful forest if and only if its end space is metrizable. We prove this conjecture for uniform end-spaces.

Berechnung von t-Designs

Alfred Wassermann, Bayreuth

Recently considerable progress in the computation of simple t-designs with $t \geq 3$ has been made. It has been useful to concentrate the search on designs with a prescriped automorphism group. Then with the theorem of Kramer and Mesner the size of the incidence matrix of the design can be reduced dramatically. It remains to compute all $\{0, 1\}$-solutions of the resulting system of linear equations. This is possible with methods based on lattice basis reduction with the LLL-algorithm. Meanwhile these methods are efficient enough to be able to find several new t-designs with $t = 7$. More information is available at `http://www.mathe2.uni-bayreuth.de/betten/DISCRETA/Index.html`.

Irreducible Sequences and Comparability Graphs

Heidemarie Bräsel
Martin Harborth
Per Willenius

Abstract

The general open shop problem with makespan criteria can be interpreted as follows: Given is an vertice weighted induced subgraph H of $K_m \times K_n$, find an orientation of H with smallest maximum path weight.

A minimal comparability graph which contains H as subgraph is called irreducible. For each choice of vertice weights there exist an irreducible graph G such that each transitive orientation of G corresponds to an optimal orientation of H.

We give some necessary and sufficient conditions for a graph to be irreducible and characterise all subgraphs of the Hamming graph $K_m \times K_n$ which have the property that only one irreducible graph exists.

Sphere Packings and Crystal Growth

Abstract Theory of crystal growth can be divided into phenomenological and atomic theory, and clearly a joined approach of both theories would be desirable.

The parametric density introduced in 1993 and largely developed during the last years, permits such a joined approach. On one hand it is possible to simulate the minimum energy principle of Gibbs (1878) and Curie (1885), which leads to the Wulff–Shape, a realistic polytopal model of ideal crystals. With additional assumptions (on–line packings) one can also simulate needle–like and prismatic crystal growth. Finally also local packings and small clusters of atoms can be simulated as in the case of classical atomic models, e.g. the Stranski- and Kossel–models, the Lennard–Jones and Morse potential.

We give a survey on the results and several applications.

Jörg M. Wills (Siegen)

Longest cycles in tough graphs

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We establish bounds for the length $c(G)$ of a longest cycle in a graph G in terms of the minimum degree $\delta(G) = \delta$ and the toughness $t(G) = t = \min(\frac{|S|}{\omega(G-S)} : S \subset V(G),\ \omega(G-S) > 1)$, where $\omega(G-S)$ denotes the number of components of $G - S$.

Theorem 1 *If G is a 2-connected graph, then $c(G) \geq min((t+1)\delta + t, n)$.*

A result of this type has been conjectured by v. d. Heuvel [4]. He asked if there is a constant $A(t)$ such that $c(G) \geq (t+1)\delta - A(t)$ for every t-tough nonhamiltonian graph G $(t \geq 1)$.

Theorem 1 can be considered as a common generalization of the following two results.

Theorem 2 (Dirac [2]) *Let G be a 2-connected graph of minimum degree δ. Then the length of a longest cycle C in G satisfies $|C| \geq min(2\delta, n)$.*

Theorem 3 (Bauer et al. [1]) *Let G be a t-tough graph on $n \geq 3$ vertices such that $n < (t+1)\delta + t + 1$. Then G is hamiltonian.*

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Über die Newtonsche Zahl von gleichschenkligen Dreiecken

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Die Newtonsche Zahl $N(K)$ eines konvexen Körpers K is die maximale Anzahl von verschiedenen kongruenten Kopien (Nachbarn) von K, die alle jeweils K berühren, aber untereinander und mit K keine gemeinsamen inneren Punkte besitzen.
In der Ebene ist $N(K)$ nur für einige spezielle konvexe Scheiben bekannt, z. B. für reguläre n-Polygone P_n, Kreise C, REULEAUX-Polygone R_{2n+1} und spezielle Rechtecke R:
$N(P_3) = 12$, $N(R_4) = 8$, $N(R_n) = 6$ für $n \geq 5$, $N(C) = 6$, $N(R_3) = 7$, $N(R_{2n+1}) = 6$ für $n \geq 2$, $N(R) = 2n + 1$ für Rechtecke R mit den Kantenlängen a und b und $\frac{a}{b} = n + r$, $n \in \mathbb{N}$, $0 \leq r \leq \frac{1}{2}$ oder $\frac{\sqrt{3}}{2} \leq r \leq 1$.
Im Vortrag werden untere und obere Schranken für die Newtonsche Zahl von gleichschenkligen Dreiecken angegeben. Es zeigt sich, daßes Klassen von gleichschenkligen Dreiecken gibt, in denen untere und obere Schranke übereinstimmen.

TT_n-maximal digraphs of minimum size

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Let TT_n be the transitive tournament of order n. We say that a dirgaph D is *TT_n-maximal* if D does not contain TT_n and if the addition of any arc to D results in a digraph D that does contain TT_n. We study the problem of finding TT_n-maximal digraphs of order m ($m \geq n$) and of minimum size. The problem is solved for $n = 3$ and for $m = n$, $m = n + 1$. We state a conjecture relative to the size and the structure of such digraphs.

Straight-ahead and alternating walks in Eulerian graphs

Arjana Žitnik, University of Ljubljana, Slovenia

A ***straight-ahead walk*** or a SAW in the embedded Eulerian graph G always passes from an edge to the opposite edge adjacent to the same vertex. An *Eulerian directed graph* is a graph together with a directed Eulerian circuit in the graph. Alternating walks in Eulerian directed graphs will be studied.

Some properties of straight-ahead walks will be characterized, especially for (planar) 4-valent graphs. The relationship between straight-ahead and alternating walks will be explored. Using alternating walks, a special family of graphs will be defined and several interesting questions raised. (This is a joint work with T. Pisanski and T.W. Tucker.)

Domination Perfect and Upper Domination Perfect Graphs

Vadim E. Zverovich

Let $\gamma(G)$, $i(G)$, $\beta(G)$ and $\Gamma(G)$ be the domination number, the independent domination number, the independence number and the upper domination number of a graph G, respectively. Sumner and Moore (1979) defined a graph G to be *domination perfect* if $\gamma(H) = i(H)$, for every induced subgraph H of G. They also posed the problem of charecterizing the entire class of domination perfect graphs. A graph G is called *upper domination perfect* if $\beta(H) = \Gamma(H)$, for every induced subgraph H of G. A characterization of domination perfect graphs in terms of forbidden induced subgraphs and a characterization of upper domination perfect graphs in terms of forbidden semi-induced subgraphs are given.

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