Liebe KombinatorikerInnen,

herzlich willkommen zum 23. Kolloquium über Kombinatorik, das 2003 zum zweiten Mal in Magdeburg stattfindet! Die Teilnehmerzahl ist etwa so groß wie im letzten Jahr, und viele Teilnehmer des letzten Jahres haben sich auch 2003 wieder angemeldet.

Auch in diesem Jahr wird an zwei Tagen wieder eine Mischung unterschiedlicher Aspekte der Diskreten Mathematik präsentiert. Dazu gehören über 70 Kurzvorträge, die von vier Hauptvorträgen umrahmt werden.

Für das wissenschaftliche Programm des Kolloquiums 2003 sind, wie im letzten Jahr, die beiden Unterzeichner verantwortlich. Die lokale Organisation liegt in den Händen der Magdeburger "Diskreten Mathematik" am Institut für Algebra und Geometrie.

Wir hoffen, Sie fühlen sich bei uns in Magdeburg wohl und der Besuch des Kolloquiums über Kombinatorik ist für Sie perönlich erfolgreich. Allen TeilnehmerInnen, die durch ihre Vorträge und ihr Kommen zum Gelingen der Tagung beitragen, sei an dieser Stelle ganz herzlich gedankt.

Bedanken möchten wir uns auch bei allen Studierenden, MitarbeiterInnen und Sekretärinnen, die bei der Vorbereitung und Durchführung dieser Veranstaltung geholfen haben.

Stefan Felsner
Alexander Pott

Räume

Hauptvorträge	:	G03-315
Sektionsvorträge	:	G03-315, G03-223, G03-106 G02-109, G02-111
Tagungsbüro	:	G02-215
Bibliothek	:	G02-223 sowie Hauptbibliothek auf dem Campus
Kaffee/Tee/Erfrischungen	:	G02-215 und G02-210
Internet	:	G02-212

Das Tagungsbüro ist am Freitag von 9 bis 18 Uhr geöffnet, am Samstag von 9 bis 16 Uhr. In dieser Zeit ist auch Zugang zum Internet in G02-212 möglich. Die Bibliothek ist am Freitag von 9 bis 17 Uhr geöffnet. Wer die Bibilothek auch am Samstag nutzen möchte, wende sich bitte ans Tagungsbüro. Ferner ist die neue, sehenswerte Hauptbibliothek auf dem Campus am Freitag und Samstag geöffnet. Das gemeinsame Abendessen ist in der Gaststätte *Zum Treibhaus* in der Leiterstraße 1.

Freitag, 14.11.2003

9:30	**András Frank (Budapest)** “Supermodular functions and connectivity of graphs”	(G03-315)
anschließend	*Kaffeepause*	
10:45	**Dieter Jungnickel (Augsburg)** “Some geometric applications of abelian groups”	(G03-315)
anschließend	*Mittagspause*	
13:00 - 15:30	**Sektionsvorträge**	
15:30 - 16:00	*Kaffeepause*	
16:00 - 18:00	**Sektionsvorträge**	
19:30	*Gemeinsames Abendessen* im Restaurant **Zum Treibhaus** in der Leiterstraße 1.	

Samstag, 15.11.2003

9:00	**Angelika Steger (Zürich)** “Extremal random graph theory”	(G03-315)
anschließend	*Kaffeepause*	
10.15 - 12:15	**Sektionsvorträge**	
anschließend	*Mittagspause*	
13:45 - 14:45	**Sektionsvorträge**	
anschließend	*Kaffeepause*	
15:00	**Jiří Matoušek (Prag)** “Crossing number, pair-crossing number, and expansion”	(G03-315)

Kurzvorträge Freitag, 14.11.2003

Zeit	Sektion I G03-315	Sektion II G03-223	Sektion III G03-106	Sektion IV G02-109	Sektion V G02-111
13:00	**T. Böhme 1** Learning winning strategies in terminal games	**A. Kohl 2** Distance list coloring	**S. Giese 3** Decomposition of Divisible Designs	**S. Brandt 4** Cycles in expanding graphs and digraphs	**S. Fekete 5** Online searching with turn cost
13:30	**Ch. Deppe 6** Q-ary Ulam-Renyi game with constrained lies	**A. Kemnitz 7** Circular Total Colorings of Graphs	**O. Heden 8** The super dual of perfect codes	**J. Feng 9** Hamiltonian problem on almost distance-hereditary graphs	**D. Cieslik 10** The Steiner Ratio
14:00	**M. de Longueville 11** Towards constructive consensus-$\frac{1}{k}$-division	**R. Waters 12** Consecutive choosability	**M. Cajkova 13** Classifying (partial) ovoids in generalized quadrangles using maximum clique algorithms	**I. Schiermeyer 14** Ore's Theorem: Counting the number of missing edges	**M. Kyureghyan 15** Monotonicity Checking in the Linear Model
14:30	**A. Kohnert 16** On the Numbers of Graphical Partitions	**M. Marangio 17** Chromatische Zahlen von Distanzgraphen	**J. Katriel 18** Weights of spin and permutational-symmetry adapted states for arbitrary elementary spins	**P. Holub 19** Forbidden subgraphs and the hamiltonian index of graphs	**A. Wagler 20** The Normal Graph Conjecture and Circulant Graphs
15:00	**M. Kutz 21** Angels With Broken Wings	**H. Gropp 22** Configurations and matroids	**Chr. Bey 23** On perfect 2-codes in the odd graphs	**M. Sonntag 24** Domination hypergraphs of digraphs	**A. Poenitz 25** A unified approach to the computation of graph invariants
15:30	*Kaffeepause*				
16:00	**M. Braun 26** Blocking sets, minihypers and optimal linear codes	**P. Tittmann 27** Chromatic Polynomials and Clique Partition Polynomials	**W. Oberschelp 28** Convolution Techniques for demographic Population Numbers	**A. Pruchnewski 29** Finding total dominating sets in a graph using continuous multivariable polynomial formulations	**S. Werth 30** Multi-color Discrepancy of Rectangles
16:30	**N. Hebbinghaus 31** Discrepancy of linear Hyperplanes in $\mathbb{F}_q^r$	**D. Osthus 32** Large planar subgraphs and spanning triangulations	**T. Bier 33** Notion of Numerical Isomerism for Graphs	**P.D. Vestergaard 34** Packing paths into a graph	**A. Waßmer 35** A quantified version of the Borsuk-Ulam Theorem
17:00	**H. Haanpää 36** Minimum Sum and Difference Covers of Small Abelian Groups	**F. Lutz 37** Graph Colorings and Sphere Bundles	**B. Fiedler 38** Investigation of algebraic curvature tensors by means of tools of Algebraic Combinatorics	**J. Bang-Jensen 39** Decomposing tournaments into strong spanning subdigraphs	**J.-P. Bode 40** Directed paths of diagonals within polygons
17:30	**M. Grüttmüller 41** Pairwise Balanced Designs whose Block Size Set Contains Seven and Thirteen	**C. Lange 42** On generalised Kneser colouring theorems	**N. Benschop 43** On log-arithmetic, Fermat and the powers of 3 (mod 2^k)	**M. Kriesell 44** Disjoint A-Paths in Digraphs	**D. van Dyck 45** Algorithms for filtering Yutsis graphs

Kurzvorträge Samstag, 15.11.2003

Zeit	Sektion I G03-315	Sektion II G03-223	Sektion III G03-106	Sektion IV G02-109	Sektion V G02-111
10:15	**H. Harborth 46** Number of ones in general binary Pascal triangles	**U. Leck 47** Self-orthogonal graph decompositions	**A. Winterhof 48** Cyclotomic $\mathcal{R}$-Orthomorphisms of Finite Fields	**D. Kühn 49** Extremal connectivity for topological cliques	**T. Voigt 50** Edge Expansion of Abstract Cubical Complexes
10:45	**M. Nielsen 51** Finding complementary cycles in locally semicomplete and quasi-transitive digraphs	**L. Heinrich-Litan 52** Computing geometric medians	**G. Helden 53** Maximal planar graphs with minimum degree four	**Chr. Grothaus 54** On the Constructive Enumeration of Fusenes and Benzenoids with Perfect Matchings	**A. Taraz 55** Canonical colourings with many colours
11:15	**S. Kurz 56** A bijection between the d-dimensional simplices with all distances in $\{1, 2\}$ and the partitions of $d + 1$	**D. Ilsen 57** Translinear Networks: Constructive Combinatorics for Analog Microelectronics	**P. Östergård 58** Resolving the Existence of Full-Rank Tilings of Binary Hamming Spaces	**G. Brinkmann 59** Applications of structure enumeration in fullerene chemistry	**R. Mechtel 60** The Simplex-Algorithm in Dimension Three
11:45	**J. Quistorff 61** New upper bounds on Enomoto-Katona's coding type problem	**T. Kalinowski 62** Multileaf collimator field segmentation with interleaf collision constraint	**L. Jørgensen 63** Rank of regular $(0, 1)$ matrices and an application to graphs	**C. Justus 64** Numbers of faces in disordered patches	**M. Köppe 65** Integer Programming with group relaxations
12:15	*Mittagspause*				
13:45	**K. Dohmen 66** From Toothpaste Tubes to Abstract Tubes	**S. Krause 67** Blocking shortest paths by deleting minimal edge sets	**P. Kaski 68** One-Factorizations of Regular Graphs of Order 12	**M. Ficon 69** A classification of half-tubes	**S. King 70** A Topological Approach to Polytopal and Shellable Triangulations of S^3
14:15	**W. Zudilin 71** On a combinatorial problem of Asmus Schmidt	**T. Biyikoglu 72** Faber-Krahn Type Inequalities for Trees	**U. Tamm 73** The Berlekamp–Massey Algorithm and Combinatorics	**S. Hell 74** On Tverberg–type theorems	**A. Paffenholz 75** New Polytopes derived from Products

Hauptvorträge

András Frank (Budapest)	: Supermodular functions and connectivity of graphs
Dieter Jungnickel (Augsburg)	: Some geometric applications of abelian groups
Jiří Matoušek (Prag)	: Crossing number, pair-crossing number, and expansion
Angelika Steger (Zürich)	: Extremal random graph theory

Kurzvorträge

Jørgen Bang-Jensen (Odense)	: Decomposing tournaments into strong spanning subdigraphs
Nico F. Benschop (Geldrop)	: On log-arithmetic, Fermat and the powers of 3 (mod 2^k)
Christian Bey (Magdeburg)	: On perfect 2-codes in the odd graphs
Thomas Bier (Kuala Lumpur)	: Notion of Numerical Isomerism for Graphs
Türker Biyikoglu (Wien)	: Faber-Krahn Type Inequalities for Trees
Jens-P. Bode (Braunschweig)	: Directed paths of diagonals within polygons
Thomas Böhme (Ilmenau)	: Learning winning strategies in terminal games
Stephan Brandt (Ilmenau)	: Cycles in expanding graphs and digraphs
Michael Braun (Bayreuth)	: Blocking sets, minihypers and optimal linear codes
Gunnar Brinkmann (Bielefeld)	: Applications of structure enumeration in fullerene chemistry
Miroslava Cajkova (Ghent)	: Classifying (partial) ovoids in generalized quadrangles using maximum clique algorithms
Dietmar Cieslik (Greifswald)	: The Steiner Ratio
Christian Deppe (Bielefeld)	: Q-ary Ulam-Renyi game with constrained lies
Klaus Dohmen (Mittweida)	: From Toothpaste Tubes to Abstract Tubes
Sandor Fekete (Braunschweig)	: Online searching with turn cost
Jinfeng Feng (Aachen)	: Hamiltonian problem on almost distance-hereditary graphs
Monika Ficon (Bielefeld)	: A classification of half-tubes
Bernd Fiedler (Leipzig)	: Investigation of algebraic curvature tensors by means of tools of Algebraic Combinatorics
Sabine Giese (Berlin)	: Decomposition of Divisible Designs
Harald Gropp (Heidelberg)	: Configurations and matroids
Christian Grothaus (Bielefeld)	: On the Constructive Enumeration of Fusenes and Benzenoids with Perfect Matchings
Martin Grüttmüller (Rostock)	: Pairwise Balanced Designs whose Block Size Set Contains Seven and Thirteen
Harri Haanpää (Helsinki)	: Minimum Sum and Difference Covers of Small Abelian Groups
Heiko Harborth (Braunschweig)	: Number of ones in general binary Pascal triangles
Nils Hebbinghaus (Kiel)	: Discrepancy of linear Hyperplanes in $\mathbb{F}_q^r$
Olof Heden (Stockholm)	: The super dual of perfect codes
Laura Heinrich-Litan (Braunschweig)	: Computing geometric medians

Guildo Helden (Aachen)	: Maximal planar graphs with minimum degree four
Stephan Hell (Berlin)	: On Tverberg–type theorems
Premysl Holub (Plzen)	: Forbidden subgraphs and the hamiltonian index of graphs
David Ilsen (Kaiserslautern)	: Translinear Networks: Constructive Combinatorics for Analog Microelectronics
Leif K. Jørgensen (Aalborg)	: Rank of regular $(0, 1)$ matrices and an application to graphs
Claudia Justus (Bielefeld)	: Numbers of faces in disordered patches
Thomas Kalinowski (Rostock)	: Multileaf collimator field segmentation with interleaf collision constraint
Petteri Kaski (Helsinki)	: One-Factorizations of Regular Graphs of Order 12
Jacob Katriel (Haifa)	: Weights of spin and permutational-symmetry adapted states for arbitrary elementary spins
Arnfried Kemnitz (Braunschweig)	: Circular Total Colorings of Graphs
Simon King (Darmstadt)	: A Topological Approach to Polytopal and Shellable Triangulations of S^3
Matthias Köppe (Magdeburg)	: Integer Programming with group relaxations
Anja Kohl (Freiberg)	: Distance list coloring
Axel Kohnert (Bayreuth)	: On the Numbers of Graphical Partitions
Stefan Krause (Braunschweig)	: Blocking shortest paths by deleting minimal edge sets
Matthias Kriesell (Hannover)	: Disjoint A-Paths in Digraphs
Daniela Kühn (Berlin)	: Extremal connectivity for topological cliques
Sascha Kurz (Bayreuth)	: A bijection between the d-dimensional simplices with all distances in $\{1, 2\}$ and the partitions of $d + 1$
Martin Kutz (Berlin)	: Angels With Broken Wings
Marina Kyureghyan (Bielefeld)	: Monotonicity Checking in the Linear Model
Dr. Carsten Lange (Berlin)	: On generalised Kneser colouring theorems
Uwe Leck (Rostock)	: Self-orthogonal graph decompositions
Mark de Longueville (Berlin)	: Towards constructive consensus-$\frac{1}{k}$-division
Frank Lutz (Berlin)	: Graph Colorings and Sphere Bundles
Massimiliano Marangio (Salzgitter)	: Chromatische Zahlen von Distanzgraphen
Rafael Mechtel (Berlin)	: The Simplex-Algorithm in Dimension Three
Morten Hegner Nielsen (Odense)	: Finding complementary cycles in locally semicomplete and quasi-transitive digraphs
Walter Oberschelp (Aachen)	: Convolution Techniques for demographic Population Numbers
Patric Östergård (Helsinki)	: Resolving the Existence of Full-Rank Tilings of Binary Hamming Spaces
Deryk Osthus (Berlin)	: Large planar subgraphs and spanning triangulations
Andreas Paffenholz (Berlin)	: New Polytopes derived from Products
Andrè Poenitz (Mittweida)	: A unified approach to the computation of graph invariants
Anja Pruchnewski (Ilmenau)	: Finding total dominating sets in a graph using continuous multivariable polynomial formulations
Jörn Quistorff (Berlin)	: New upper bounds on Enomoto-Katona's coding type problem

Ingo Schiermeyer (Freiberg)	: Ore's Theorem: Counting the number of missing edges
Martin Sonntag (Freiberg)	: Domination hypergraphs of digraphs
Ulrich Tamm (Chemnitz)	: The Berlekamp–Massey Algorithm and Combinatorics
Anusch Taraz (Berlin)	: Canonical colourings with many colours
Peter Tittmann (Mittweida)	: Chromatic Polynomials and Clique Partition Polynomials
Dries van Dyck (Ghent)	: Algorithms for filtering Yutsis graphs
Preben Dahl Vestergaard (Aalborg)	: Packing paths into a graph
Thomas Voigt (Berlin)	: Edge Expansion of Abstract Cubical Complexes
Annegret Wagler (Berlin)	: The Normal Graph Conjecture and Circulant Graphs
Arnold Waßmer (Berlin)	: A quantified version of the Borsuk-Ulam Theorem
Rob Waters (Nottingham)	: Consecutive choosability
Soeren Werth (Kiel)	: Multi-color Discrepancy of Rectangles
Arne Winterhof (Linz)	: Cyclotomic $\mathcal{R}$-Orthomorphisms of Finite Fields
Wadim Zudilin (Köln)	: On a combinatorial problem of Asmus Schmidt

Weitere Teilnehmer

Patrick Baier (Berlin) Lilya Budaghyan (Magdeburg) Peter Bundschuh (Köln) Elias Dahlhaus (Frankfurt a.M.) Veerle Fack (Ghent) Stefan Felsner (Berlin) Hans-Dietrich Gronau (Rostock) Yubao Guo (Aachen) Egbert Harzheim (Köln) Franz Hering (Dortmund) Doreen Hertel (Magdeburg) Christoph Josten (Frankfurt) Mohammed Anamul Kabir (Kharkov) Thomas Kölmel (Bad Mergentheim) Wolfgang Mader (Hannover) Milton Mohanta (Kharkov) Matthias Peinhardt (Berlin) J. M. S. Simões-Pereira (Coimbra) Alexander Pott (Magdeburg) Astrid Reifegerste (Hannover) Sarah Renkl (Berlin) Stefan Schirra (Magdeburg) Bianca Spille (Magdeburg) Michael Stiebitz (Ilmenau) Christian Thürmann (Braunschweig) Robert Weismantel (Magdeburg) Günter M. Ziegler (Berlin)

Freitag, 14.11.2003 — Zeit: 9:30 — G03-315

Supermodular functions and connectivity of graphs

ANDRÁS FRANK (Budapest)

Network flows were the first general framework to handle connectivity problems such as minimum cost paths or maximum flows. Matroids formed a model to understand the greedy algorithm for minimum cost trees. Matroid intersection and, more generally, submodular flows helped solving much more complex problems on connectivity such as finding a minimum cost subdigraph that is rooted k-edge- or k-node-connected. In the last 15 years another branch of results concerning supermodular functions and connectivity problems have been found. In this talk I make an attempt to survey these developments.

Freitag, 14.11.2003 — Zeit: 10:45 — G03-315

Some geometric applications of abelian groups

DIETER JUNGNICKEL (Augsburg)

Let Π be a finite projective plane admitting a large abelian collineation group. It is well-known that this situation may be studied by algebraic means (via a representation by suitable types of difference sets), namely using group rings and algebraic number theory and leading to rather strong non-existence results. What is less well-known is the fact that the abelian group (and sometimes its group ring) can also be used in a much more geometric way, which will be the topic of this lecture. In one direction, abelian collineation groups may be applied for the construction of interesting geometric objects such as unitals, arcs and (hyper-)ovals, (Baer) subplanes and projective triangles. On the other hand, this approach makes it sometimes possible to provide simple geometric proofs for non-trivial structural restrictions on the given collineation group, avoiding algebraic machinery.

Samstag, 15.11.2003 — Zeit: 9:00 — G03-315

Extremal random graph theory

ANGELIKA STEGER (Zürich)

Extremal graph theory is a well-established branch of graph theory. Its main concern is the question of how many edges a graph with certain forbidded substructres can have and what properties such an extremal graph might have. As an example consider the class of H-free graphs, that is, the class of all graphs which do not contain a copy of H as a weak subgraph. Here a result of Erdös and Stone (1946) implies that the maximum number of edges of the extremal graph is basically determined by the chromatic number of the graph H. The situation changes, if we consider not deterministic graphs but random graphs. Here the equivalent question is: given a random graph $G(n, p)$ with edge probability p, what is the largest H-free subgraph of this graph. In the talk we survey the state of the art of this problem.

Samstag, 15.11.2003 — Zeit: 15:00 — G03-315

Crossing number, pair-crossing number, and expansion

JIŘÍ MATOUŠEK (Prag)

The crossing number of a graph G is the minimum number of edge crossings in a drawing of G in the plane (the edges are drawn by arbitrary arcs, not only straight segments). We discuss techniques for bounding the crossing number above and below, mainly due to Leighton and his co-workers. In particular, we explain interesting connections between the crossing number and the edge expansion of a graph. We also present results from a joint work with Petr Kolman, concerning a tantalizing problem due to Pach and Toth on the relation of the crossing number to the pair-crossing number, that is, the minimum number of pairs of edges that have to cross in a drawing of the considered graph. Few other fascinating questions will be mentioned as well.

Freitag, 14.11.2003 — Zeit: 13:00

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1 — Sektion I — G03-315 — 13:00

Learning winning strategies in terminal games

THOMAS BÖHME (Ilmenau)

Let $m_1, m_2, \ldots$ be a sequence of plays of a terminal game. We say that a player p applies a deterministic 1-learning rule in this sequence if p's strategy in the $(i+1)^{st}$ play is determined by the i^{th} play. It will be shown that a deterministic 1-learning rule suffices to detect a winning strategy. Furthermore, it will be analyzed under which conditions the application of this learning by more than one player leads to a common winning strategy. The results presented in this talk are partly joint work with F. Göring (Chemnitz), Zs. Tuza (Budapest) and H. Unger (Rostock).

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2 — Sektion II — G03-223 — 13:00

Distance list coloring

ANJA KOHL (Freiberg)

Let G be a simple graph and for all $v \in V$ let $L(v)$ be a set of colors assigned to v. $L(v)$ is called the list of v and the set of all lists is called the list assignment $\mathcal{L}$. A $k-$assignment is a list assignment where all lists have the same cardinality k that is $|L(v)| = k$ for all $v \in V$.
Define $\chi_l^{d,s}(G)$ to be the smallest integer k such that for every $k-$assignment we can choose a color $c(v) \in L(v)$ for every vertex in such a way that

1. $|c(v) - c(w)| \geq d$, if $d(v, w) = 1$ and
2. $|c(v) - c(w)| \geq s$, if $d(v, w) = 2$.

We present first results on $\chi_l^{d,s}(G)$. Mainly we determine bounds for $\chi_l^{d,s}(G),\ s = 0, 1$ for special classes of graphs, e.g. paths, stars and cycles.

This is a joint work with Margit Voigt, Zsolt Tuza and Jens Schreyer.

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3 — Sektion III — G03-106 — 13:00

Decomposition of Divisible Designs

SABINE GIESE (Berlin)

Many different kinds of designs are already known. In this talk we deal with divisible t-designs. These are incidence structures whose point sets are divided into point classes all of equal size, the block sets consist of transversal k-sets of points with the property that any transversal t-set of points is incident with a constant number λ_t of blocks. These designs are closely connected to constant weight codes.

It is possible that a divisible design has more inner structure in addition to the partition of the point set. We define a *decomposition* of a divisible design D, its *inner designs* and an *outer divisible design of* D. We give an example of a decomposable divisible design with an outer design whose inner designs are mutually isomorphic. This divisible design admits a so called dual translation group as an automorphism group.

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4 — Sektion IV — G02-109 — 13:00

Cycles in expanding graphs and digraphs

STEPHAN BRANDT (Ilmenau)

Roughly speaking, expansion of a graph means that large vertex sets must have large neighbourhoods, the cardinality depending on the cardinality of the set. Among the many different expansion concepts we use one that is particularly suitable to measure large expansion. We show that a quadratic expansion function is sufficient to imply a hamiltonian cycle while we needed an exponential function to imply hamiltonicity in digraphs. In both cases probably a suitable linear function is sufficient. Moreover we show that linear expansion implies cycles of linear lengths, as well as a 2-factor in undirected graphs and a cycle factor in digraphs, respectively. For a fairly general class of digraphs we prove a tight expansion bound for hamiltonicity. With the use of our results for undirected graphs we can establish some graph theoretical properties of so-called Ramanujan graphs.

This is joint work with Hajo Broersma, Reinhard Diestel, Matthias Kriesell (undirected case) and Jørgen Bang-Jensen (directed case).

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5 — Sektion V — G02-111 — 13:00

Online searching with turn cost

SANDOR FEKETE (Braunschweig)

We consider the problem of searching for an object on a line at an unknown distance OPT from the original position of the searcher, in the presence of a cost of d for each time the searcher changes direction. This is a generalization of the well-studied linear-search problem. We describe a strategy that is guaranteed to find the object at a cost of at most $9 \cdot \mathrm{OPT} + 2d$, which has the optimal competitive ratio 9 plus the minimum additive term. Our argument for upper and lower bound uses an infinite linear program, which we solve by experimental solution of an infinite series of approximating finite linear programs, guessing the limits, and solving the resulting recurrences. We feel that this technique is interesting in its own right and should help solve other searching problems. In particular, we consider the *star search* or *cow-path problem* with turn cost, where the hidden object is placed on one of m rays emanating from the original position of the searcher. For this problem we give a tight bound of $\left(1 + 2\frac{m^m}{(m-1)^{m-1}}\right) \mathrm{OPT} + m\left(\left(\frac{m}{m-1}\right)^{m-1} - 1\right) d$. Our results also establish the notion of a competitive ratio with an additive term.

This is joint work with Erik Demaine (MIT) and Shmuel Gal (Haifa).

Freitag, 14.11.2003 — Zeit: 13:30

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6 — Sektion I — G03-315 — 13:30

Q-ary Ulam-Renyi game with constrained lies

CHRISTIAN DEPPE (Bielefeld)

The Ulam-Renyi game is a classical model for the problem of determining the minimum number of queries to find an unknown number in a finite set when up to a finite number e of the answers may be lies. In the variant, we consider here, questions with q many possible answers are allowed, q fixed and known beforehand, and lies are constrained as follows: Let $\mathcal{Q} = \{0, 1, \ldots, q-1\}$ be the set of possible answers to a q-ary question. For each $k \in \mathcal{Q}$ when the sincere answer to the question is k, the responder can choose a mendacious answer only from a set $L(k) \subseteq \mathcal{Q} \setminus \{k\}$. For each $k \in \mathcal{Q}$, the set $L(k)$ is fixed before the game starts and known to the questioner. The classical q-ary Ulam-Renyi game, in which the responder is completely free in choosing the lies, in our setting would correspond to the particular case $L(k) = \mathcal{Q} \setminus \{k\}$, for each $k \in \mathcal{Q}$. The setting we propose here, is suggested by the counterpart of the Ulam-Renyi game in the theory of error-correting codes. Here lies are provoked by the noise affecting a channel carring the answers. The aim is to try to exploit the additional knowledge (possibly) available about the effect of the noise (the sets $L(k)'s$ containing the types of errors/lies) in order to produce the most efficient strategies. We essentially solve the problem under some symmetry-hypothesis on the sets $L(k)$. We assume that there is a constant $d \leq q-1$ such that $|L(k)| = d$ for each k, and the number of indices j such that $k \in L(j)$ is equal to d. We provide a lower bound on the number of questions needed to solve the problem and prove that in infinitely many cases thi sbound is attained by (optimal) searching strategies. Moreeover we prove that, in the remaining cases, at most one question more than the lower bound is always sufficient to successfully find the unknown number. Our results are constructive and searching strategies are actually provided. All our strategies also enjoy the property that, among all the possible adaptive strategies, tehy use the minimum amount of adaptiveness during the search process.

This is joint work with Ferdinando Cicalese.

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7 — Sektion II — G03-223 — 13:30

Circular Total Colorings of Graphs

ARNFRIED KEMNITZ (Braunschweig)

A (k, d)-total coloring ($k, d \in \mathbb{N}$, $k \geq 2d$) of a graph G is an assignment c of colors $\{0, 1, \ldots, k-1\}$ to the vertices and edges of G such that $d \leq |c(x_i) - c(x_j)| \leq k - d$ whenever x_i and x_j are two adjacent edges, two adjacent vertices or an edge incident to a vertex. The circular total chromatic number $\chi''_c(G)$ is defined by $\chi''_c(G) = \inf\{k/d : G$ has a (k, d)-total coloring$\}$. It holds $\chi''(G) - 1 < \chi''_c(G) \leq \chi''(G)$ with equality for all type-1 graphs where $\chi''(G)$ is the total chromatic number of G. We determine infinite classes of graphs G such that $\chi''_c(G) < \chi''(G)$ and we list all graphs of order at most 7 with this property.

8 — Sektion III — G03-106 — 13:30

The super dual of perfect codes

OLOF HEDEN (Stockholm)

The super dual of perfect 1-error correcting binary codes will be defined. We show how the super dual may be used to construct new perfect codes, get an error correcting algorithm for non linear perfect codes, to classify and enumerate *some* classes of perfect codes and to solve *some* problems concerning perfect codes.

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9 — Sektion IV — G02-109 — 13:30

Hamiltonian problem on almost distance-hereditary graphs

JINFENG FENG (Aachen)

Let $G = (V, E)$ be a connected graph. The distance between two vertices x and y in G, denoted by $d_G(x, y)$, is the length of a shortest path between x and y. For a vertex subset $S \subseteq V$ we denote $G[S]$ the subgraph of G induced by S. A graph G is called almost distance-hereditary if each connected induced subgraph F of G has the property that $d_F(u, v) \leq d_G(u, v) + 1$ for every pair of vertices u and v in F. We will confirm that every 2-connected, claw-free and almost distance-hereditary graph has a Hamiltonian cycle.

This is joint work with Yubao Guo.

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10 — Sektion V — G02-111 — 13:30

The Steiner Ratio

DIETMAR CIESLIK (Greifswald)

We consider Steiner's Problem in $\mathcal{L}_p^3$, which is a three-dimensional space equiped with p-norm. Steiner's Problem is the Problem of shortest connectivity", that means, given a finite set N of points in the plane, search for a network interconnecting these points with minimal length. This shortest network must be a tree and is called a Steiner Minimal Tree (SMT). It may contain vertices different from the points which are to be connected. Such points are called Steiner points.
If we do not allow Steiner points, that means, we only connect certain pairs of the given points, we get a tree which is called a Minimum Spanning Tree (MST) for N.
Steiner's Problem is very hard as well in combinatorial as in computational sense, but on the other hand, the determination of an MST is simple. Consequently, we are interested in the greatest lower bound for the ratio between the lengths of these both trees:

$$m(3,p) := \inf \left\{ \frac{L(\text{SMT for } N)}{L(\text{MST for } N)} : N \subseteq \mathcal{L}_p^3 \text{ is a finite set} \right\},$$

which is called the Steiner ratio (of $\mathcal{L}_p^3$).
We look for estimates for $m(3, p)$, depending on the parameter p, and determine general upper bounds for the Steiner ratio of $\mathcal{L}_p^3$.

Freitag, 14.11.2003 — Zeit: 14:00

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11 — Sektion I — G03-315 — 14:00

Towards constructive consensus-$\frac{1}{k}$-division

MARK DE LONGUEVILLE (Berlin)

It is a theorem of Noga Alon that for all n and k there exists a solution to the problem of dividing a peace of cake into k pieces so that according to individual measures of n people all pieces have the same size. To obtain an arbitrary good approximate solution there exists a convincing algorithm for the case $k = 2$, which relies on the - for topological combinatorialists well known - Tucker lemma. We will discuss the case for general k.

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12 — Sektion II — G03-223 — 14:00

Consecutive choosability

ROB WATERS (Nottingham)

List colouring is a generalisation of ordinary graph colouring, in which the colour of each vertex must be chosen from a list of colours assigned to that vertex. We consider variations of the list colouring problem in which the lists are required to be sets of consecutive integers.

13 — Sektion III — G03-106 — 14:00

Classifying (partial) ovoids in generalized quadrangles using maximum clique algorithms

MIROSLAVA CAJKOVA (Ghent)

An ovoid of a (finite) generalized quadrangle $S = (P, B, I)$ of order (s, t) is a set O of points of S such that each line of S is incident with a unique point of O. An ovoid of S corresponds to a maximum coclique of size $st + 1$ in the so-called point graph G_S of S (or equivalently, a maximum clique in its complement $\overline{G_S}$). If no coclique of the required size exists, then the maximum coclique is said to be a maximal partial ovoid in S. We use standard maximum clique algorithms and add pruning strategies based on specific properties of the point graph in order to classify (partial) ovoids of some classical generalized quadrangles.

This is joint work with Veerle Fack.

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14 — Sektion IV — G02-109 — 14:00

Ore's Theorem: Counting the number of missing edges

INGO SCHIERMEYER (Freiberg)

In 1960 Ore proved the following theorem: Let G be a graph of order n. If $d(u) + d(v) \geq n$ for every pair of nonadjacent vertices u and v, then G is hamiltonian. In this note we strengthen Ore's theorem as follows: We determine the maximum number of pairs of nonadjacent vertices that can have degree sum less than n (i.e. violate Ore's condition) but still imply that the graph is hamiltonian. Some other sufficient conditions for hamiltonian graphs are strengthened as well.

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15 — Sektion V — G02-111 — 14:00

Monotonicity Checking in the Linear Model

MARINA KYUREGHYAN (Bielefeld)

Monotonicity checking problem: is given a finite poset and an unknown real-valued function on it find out whether this function is monotone, that is, whether $f(x) \leq f(y)$ for any $x < y$ in P. The queries are comparisons of linear combinations of the values of the function.
We get a general lower bound on the complexity of monotonicity checking using the geometric structure of the monotone polyhedron of the poset, which is the polyhedron of all monotone functions on the P. Using it we get the lower bound $1.167n$ on the complexity of simultaneous determination of the minimum and the maximum in a sequence of n real numbers.

Freitag, 14.11.2003 — Zeit: 14:30

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16 — Sektion I — G03-315 — 14:30

On the Numbers of Graphical Partitions

AXEL KOHNERT (Bayreuth)

A graphical partition is a weakly decreasing sequence of positive integers, which is also a vertex degree sequence of a simple graph. The sum over this partition is called the weight. We denote by $g(n)$ the number of graphical partitions of weight n and by $p(n)$ the number of all partitions (may be not a vertex degree sequence) of weight n. An open question is whether $lim_{n\to\infty}\frac{g(n)}{p(n)} = 0$. There are several criteria which says whether a partition is graphical or not. We give a new one, which allows us to derive a recursion formula which helps us to compute $g(n)$ and also the above quotient for values up to $n > 900$.

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17 — Sektion II — G03-223 — 14:30

Chromatische Zahlen von Distanzgraphen

MASSIMILIANO MARANGIO (Salzgitter)

Ein Distanzgraph $G(S, D)$ mit $S \subseteq \mathbb{R}^n$ und $D \subseteq \mathbb{R}^+$ ist ein Graph mit Knotenmenge S und Kanten zwischen allen Knoten u und v, für die der euklidische Abstand $\|u - v\|_2 \in D$ ist.
Im Vortrag werden Ergebnisse über die chromatische Zahl $\chi(G)$, die kantenchromatische Zahl $\chi'(G)$ und die totalchromatische Zahl $\chi''(G)$ von Distanzgraphen $G = G(S, D)$ zusammengefasst.

18 — Sektion III — G03-106 — 14:30

Weights of spin and permutational-symmetry adapted states for arbitrary elementary spins

JACOB KATRIEL (Haifa)

For N identical particles with elementary spin $\frac{1}{2}$ each total spin state corresponds to a unique irreducible representation (irrep) of the symmetric group S_N. This one-to-one correspondence ceases to hold for higher elementary spins, where states with a given total spin can belong to different irreps of S_N, and any particular irrep can appear more than once. This problem is equivalent to the decomposition of the N-fold direct product of an irrep of $su(2)$ with itself into a sum of subspaces, each one of which spans an irrep of $su(2)$ as well as of S_N. A generating function for the multiplicities ("weights") of these subspaces was given by Stanley [Studies in Appl. Math., **50** 259 (1971)], but the present aim is to obtain explicit expressions, with a view to applications in statistical mechanics. A complementary approach is explored, allowing the elementary spins to be arbitrary but maintaining a fixed number of particles. Explicit expressions are presented for few-particle systems, suggesting the principal features of the general pattern.

19 — Sektion IV — G02-109 — 14:30

Forbidden subgraphs and the hamiltonian index of graphs

PREMYSL HOLUB (Plzen)

We say that $L^k(G) = L(L^{k-1}(G))$ is the k-th iteration of the line graph of G. The hamiltonian index of a graph G is the smallest number k for which $L^k(G)$ is hamiltonian. Bedrossian characterized forbidden induced pairs of subgraphs for hamiltonian graphs. The generalization in terms of the hamiltonian index of Bedrossian's result is presented. Similar results for essentially 2-edge connected graphs can be shown too. Simple examples show that these results are sharp.

20 — Sektion V — G02-111 — 14:30

The Normal Graph Conjecture and Circulant Graphs

ANNEGRET WAGLER (Berlin)

Normal graphs are defined in terms of cross-intersecting set families: a graph is normal if it admits a clique cover $\mathcal{Q}$ and a stable set cover $\mathcal{S}$ s.t. $Q \cap S \neq \emptyset$ for all $Q \in \mathcal{Q}$ and $S \in \mathcal{S}$. Normal graphs can be considered as closure of perfect graphs, e.g. by means of co-normal products (Körner 1973), graph entropy (Cziszár et al. 1990), and forbidden subgraphs as follows: Perfect graphs have been recently characterized as those graphs without odd holes and odd antiholes as induced subgraphs (Strong Perfect Graph Theorem, Chudnovsky et al. 2002). De Simone and Körner observed that C_5, C_7, and $\overline{C}_7$ are minimal not normal and conjectured, as generalization of the Strong Perfect Graph Theorem, that every C_5, C_7, $\overline{C}_7$-free graph is normal (Normal Graph Conjecture, de Simone and Körner 1999). We discuss this conjecture for a special class of graphs, the circulant graphs, and provide some partial results.

Freitag, 14.11.2003 — Zeit: 15:00

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21 — Sektion I — G03-315 — 15:00

Angels With Broken Wings

MARTIN KUTZ (Berlin)

We play a game with a chess king on an infinite checker board. The king moves according to the usual chess rules and we want to trap him by destroying squares of the board. Can you encircle the king, or is he able to run on forever?
Berlekamp showed that you can trap him. But the problem gets amazingly difficult if you increase the power of the king. Conway defined a k-*angel* to be a king who can "fly" in one move to any untouched square at distance at most k from his current position, while his opponent—*the devil*—still destroys one square per move. The problem whether angels of some power k can be caught, remains unsolved for at least two decades now.
After revisiting some well-known, yet rather counterintuitive facts about possible escape strategies, we introduce a slight variant of the problem which turns out asymptotically equivalent. Under these refined conditions we are able to obtain very slight improvements upon Berlekamp's result, trying to emphasize a new aspect of this "everlasting game."

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22 — Sektion II — G03-223 — 15:00

Configurations and matroids

HARALD GROPP (Heidelberg)

A configuration (v_r, b_k) is a finite incidence structure of v points and b lines such that each point lies on r lines, each line contains k points and two different points are connected by at most one line. Hence a configuration is a linear uniform regular hypergraph. However, configurations were already defined in 1876.
The drawing of configurations should be discussed in the framework of hypergraph drawing. The geometrical background of configurations emphasizes the drawing of hyperedges as straight line segments instead of ellipse-like curves if possible. The realization of configurations should be discussed in the framework of matroid realization.
Configurations were "born" in a geometric and algebraic context in the 19^{th} century. Now after more than 100 years later research on configurations should again focus on the (geometric) drawing and the (algebraic) realization problem.

23 — Sektion III — G03-106 — 15:00

On perfect 2-codes in the odd graphs

CHRISTIAN BEY (Magdeburg)

The Odd graph $O(k)$ has as its vertex set all $(k-1)$-element subsets of $\{1,\ldots,2k-1\}$, with two vertices adjacent if and only if their intersection is empty. A perfect e-code in $O(k)$ is a subset $\mathcal{C}$ of the vertex set such that every vertex of $O(k)$ is at distance at most e from exactly one vertex in $\mathcal{C}$. Only two perfect codes in the odd graphs are known: the Fano plane in $O(4)$ and the Witt design $S(4,5,11)$ in $O(6)$, both are 1-perfect. We will present some work towards a proof of the nonexistence of perfect 2-codes in $O(k)$.

24 — Sektion IV — G02-109 — 15:00

Domination hypergraphs of digraphs

MARTIN SONNTAG (Freiberg)

Let $D=(V,A)$ be a digraph. A set $e\subseteq V$ *dominates* D iff every vertex $v\in V\setminus e$ has a predecessor in e. We generalize the well-known concept of the *domination graph* in the following way: $\mathcal{DH}(D)=(V,\mathcal{E})$ is the *domination hypergraph* of the digraph D iff

$$\mathcal{E}=\{e\mid e\subseteq V\ \wedge\ e \text{ is a minimal dominating set of } D\}.$$

Basic properties of domination hypergraphs of some classes of digraphs, e.g. certain trees, oriented cycles and tournaments, are investigated. Moreover, we discuss the relationship between domination hypergraphs and competition hypergraphs of tournaments.

25 — Sektion V — G02-111 — 15:00

A unified approach to the computation of graph invariants

ANDRÈ POENITZ (Mittweida)

In this talk, a framework for the description of graph related computational problems like the computation of graph invariants is introduced.

The framework is easily adapted to “uncommon” graph invariants that are not as well known as e.g. the chromatic number, yet arise regularly from practical applications.

The framework allows direct translation into algorithms implementing certain general techniques like full enumeration, reduction and splitting. It therefore relieves the user from implementing recurring structures and algorithms resulting in very short implementation times.

Moreover, as the same description is used for all “algorithmic backends”, it is easy to construct combined algorithms taking advantage of all available approaches.

Freitag, 14.11.2003 — Zeit: 16:00

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26 — Sektion I — G03-315 — 16:00

Blocking sets, minihypers and optimal linear codes

MICHAEL BRAUN (Bayreuth)

A linear $(n, k, d; q)$-code is a k-dimensional subspace of an n-dimensional vector space over the finite field $GF(q)$ with q elements and minimum distance d. The aim is to construct codes with high minimum distance d for given n, k and q. In my talk I introduce a method to construct $(n, k, d; q)$-codes with prescribed parameters n, k, d and q by constructing equivalent structures, the so-called minihypers which are selections of 1-subspaces of $GF(q)^k$. To obtain such selections we solve a diophantine system of equations. As results we present some new codes with higher minimum distances than the so far known codes.

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27 — Sektion II — G03-223 — 16:00

Chromatic Polynomials and Clique Partition Polynomials

PETER TITTMANN (Mittweida)

Let $G = (V, E)$ be a finite undirected graph. The *clique partition polynomial* $C(G, x)$ is the ordinary generating function for the number of partitions of G with blocks forming cliques in G with respect to the number of blocks. This polynomial is closely related to the chromatic polynomial of G. Let G^1 and G^2 be subgraphs of G such that $G^1 \cup G^2 = G$ and $G^1 \cap G^2 = (U, \emptyset)$. We show that $C(G, x)$ satisfies a splitting formulae with respect to the separating vertex set U. Using the splitting formulae, we can show that the clique partition polynomial of graphs of bounded treewidth can be computed in polynomial time. As an application, we define a new class of graphs for which the chromatic polynomial can be obtained efficiently.

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28 — Sektion III — G03-106 — 16:00

Convolution Techniques for demographic Population Numbers

WALTER OBERSCHELP (Aachen)

The linear recursion

$$\mathrm{F}_n{}^{(k,m)} = \mathrm{F}_{n-1}{}^{k,m} + \mathrm{F}_{n-k}{}^{k,m} - \mathrm{F}_{n-m}{}^{k,m}$$

is the basis of demographic considerations à la Fibonacci for populations, which start uniform fertility at time k and finish fertility at time m, whereas by a simple difference operation mortality can be taken care of. While in the case $m = \infty$ (eternal fertility) the asymptotic behavior of $\mathrm{F}_n{}^{(k,\infty)}$ can be analyzed via generating functions of Binet-Euler-Type in a transparent manner (Dilcher 1993), finite values of m give rise to complications (Oberschelp 2003, in preparation). We propose an alternate calculation, which starts with the numbers ${F_n}^{(k,\infty)}$ and use convolution arguments. We prove a Shift-Theorem, which gives a representation via alternating sums. Asymptotic estimates can be found by partial fraction techniques with special emphasis on multiple roots.

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29 — Sektion IV — G02-109 — 16:00

Finding total dominating sets in a graph using continuous multivariable polynomial formulations

ANJA PRUCHNEWSKI (Ilmenau)

For a finite undirected graph G on n vertices three continuous formulations of the minimum total dominating set problem are considered. Each case involves the minimization of an n-variable polynomial f_i ($i = 1, 2, 3$) over the n-dimensional unit cube C_n that yields the total domination number $\gamma_T(G)$ of G. Given any solution $p \in C_n$ we propose a polynomial-time algorithm for finding minimal total dominating sets with cardinality less than or equal to $f_i(p)$ ($i = 1, 2, 3$).

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30 — Sektion V — G02-111 — 16:00

Multi-color Discrepancy of Rectangles

SOEREN WERTH (Kiel)

The multi-color discrepancy problem is to color a finite hypergraph $\mathcal{H} = (V, \mathcal{E})$ with $c \in \mathbb{N}$ colors so that each hyperedge contains approximately the same number of vertices in each color. The discrepancy of $\mathcal{H}$ in c colors is defined by

$$\text{disc}(\mathcal{H}, c) := \min_{\chi: V \to [c]} \max_{i \in [c], E \in \mathcal{E}} \left| |\chi^{-1}(i) \cap E| - \frac{|E|}{c} \right| .$$

In this talk we give upper and lower bounds for the multi-color discrepancy of rectangles, that is, the hypergraph $\mathcal{H}_N = ([N] \times [N], \mathcal{E})$ for $N \in \mathbb{N}$, where $\mathcal{E} := \{[x_1, y_1] \times [x_2, y_2] \,|x_i, y_i \in [N], x_i \leq y_i, i \in [2]\}$.
We show:
The multi-color discrepancy for rectangles in $c \in \mathbb{N}$ colors is disc$(\mathcal{H}_N, c) = \Theta(\log c)$.

This is joint work with Benjamin Doerr, Nils Hebbinghaus

Freitag, 14.11.2003 — Zeit: 16:30

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31 — Sektion I — G03-315 — 16:30

Discrepancy of linear Hyperplanes in $\mathbb{F}_q^r$

NILS HEBBINGHAUS (Kiel)

We want to determine the c-color discrepancy of the hypergraph $\mathcal{H}_V$ of linear hyperplanes in a finite vector space V. For every finite vectorspace V we can find integers q and r with $V = \mathbb{F}_q^r$, the r-dimensional vector space over $\mathbb{F}_q$. Let $\mathcal{H}_V = (V, \mathcal{E}_{V,1})$ be the hypergraph where $\mathcal{E}_{V,1}$ is the set of all linear hyperplanes of V, i.e., the subspaces of codimension one. Let $n := |V| = q^r$.
We investigate the VC-dimension of $\mathcal{H}_V$ to determine an upper bound $O\left(\sqrt{\frac{n}{c}}\right)$ for the discrepancy $\mathrm{disc}(\mathcal{H}_V, c)$. Our main result is, that this bound is asymptotically tight, i.e. $\mathrm{disc}(\mathcal{H}_V, c) = \Theta\left(\sqrt{\frac{n}{c}}\right)$.
The method for the lower bound proof might be interesting in itself. Often lower bounds for the discrepancy function are proved via the L^2-discrepancy. Here we use the positive discrepancy $\mathrm{disc}^+(.)$, which is the discrepancy function without the absolute value, to determine a lower bound for $\mathrm{disc}(\mathcal{H}_V, c)$. With Fourier Analysis on $\mathbb{F}_q^r$, we show $\mathrm{disc}^+(\mathcal{H}_V) = \Omega(\sqrt{\frac{n}{c}})$ proving a lower bound. We show also an extension to subspaces with higher codimension than one.

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32 — Sektion II — G03-223 — 16:30

Large planar subgraphs and spanning triangulations

DERYK OSTHUS (Berlin)

We study the following extremal question: given a function $m = m(n)$, how large does the minimum degree of a graph G of order n have to be in order to guarantee a planar subgraph with at least $m(n)$ edges? In particular, we prove that every graph of sufficiently large order n and minimum degree at least $2n/3$ contains a triangulation as a spanning subgraph (joint work with Daniela Kühn). This is best possible: for all integers n there are graphs of order n and minimum degree $\lceil 2n/3 \rceil - 1$ without a spanning triangulation. For other values of $m(n)$ we also obtain essentially best possible results. I will also discuss some open problems.
This is joint work with Daniela Kühn and Anusch Taraz.

33 — Sektion III — G03-106 — 16:30

Notion of Numerical Isomerism for Graphs

THOMAS BIER (Kuala Lumpur)

In this contribution we discuss the characterization of graphs on v vertices by various systems of numbers, for example by counting all the s-subsets $S \subset V$ which have μ_2 edges in S, μ_1 edges crossing from S to $V \backslash S$ and μ_0 edges in $V \backslash S$. The resulting system of numbers $K(\mu_0, \mu_1, \mu_2; s)$ can often be used to distinguished non isomorphic graphs, but There exist examples of pairs (and even triples) of graphs which have all their numbers $K(\mu_0, \mu_1, \mu_2; s)$ equal but yet they are not isomorphic. Such pairs of (non isomorphic) graphs will be called numerically K- isomeric graphs. We have come to know that there can be infinitely many such pairs of graphs, for example regular graphs, e.g. for any even order $v = 10$ cubic graphs or else, for each integer $v = 10$ certain kinds of non regular graphs of order v. We have also found pairs of numerically K-isomeric trees.
We can further investigate pairs of graphs where the extension behavior of any vertex subset $S \subset V$ to another subset T with $S \subset T \subset V$ is taken into account. This will be called numerically $W-$isomeric graphs. It can be seen easily that W-isomeric graphs are also K-isomeric, and it is proved that for cubic ($3-$regular) graphs the converse statement also holds, that is K-isomeric cubic graphs are also W-isomeric. For general regular graphs such statements are not true, e.g. for quartic ($4-$regular) graphs there exist pairs of graphs which are K-isomeric but not $W-$isomeric.
After a general introduction to the topic in this paper we feature on construction methods for non regular pairs of $K-$isomeric graphs. These methods can be described as random edge methods, either deleting or adding edges to given pairs of regular graphs, or by adding on certain extra edges plus single new vertices to given regular graphs. In each case one obtains a pair of graphs that is K-isomeric, and sometimes also $W-$isomeric. Random edge methods have the advantage that can be used starting from any fixed regular graph, and by using particular constructions we can obtain larger regular graphs from smaller ones. For example using random edge methods it can be shown that for each even integer $v = 12$ there exists a pair of non isomorphic connected cubic graphs of order v which are $K-$ isomeric.

34 — Sektion IV — G02-109 — 16:30

Packing paths into a graph

PREBEN DAHL VESTERGAARD (Aalborg)

We investigate *equipackable graphs*, i.e. graphs for which every maximal edge-disjoint packing of the graph with paths of a fixed length k is a maximum. This is partly prompted by the study of well-covered graphs, those in which every maximal independent set of vertices is also a maximum. Here we consider graphs in which every maximal set of subgraphs with a different property P is also a maximum such set. In general, this would permit a greedy algorithm to find the desired set.

This is joint work with B.L. Hartnell (Bert.Hartnell@smu.ca), Saint Mary's Univ.,Halifax, Canada

35 — Sektion V — G02-111 — 16:30

A quantified version of the Borsuk-Ulam Theorem

ARNOLD WASSMER (Berlin)

The Borsuk-Ulam theorem is an elementary theorem in algebraic topology. It states that certain maps between spheres cannot be continuous. L. Dubins and G. Schwarz quantified "how discontinuous" these maps are. I will present a shorter proof of their theorem with more geometric arguments

Freitag, 14.11.2003 — Zeit: 17:00

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36 — Sektion I — G03-315 — 17:00

Minimum Sum and Difference Covers of Small Abelian Groups

HARRI HAANPÄÄ (Helsinki)

A subset S of an Abelian group G is a sum cover of G, if every element of G may be expressed as a sum $s+t$ where $s,t \in S$. In a strict sum cover, we additionally require $s \neq t$, and in a difference cover we consider $s-t$ instead.
We present a backtrack search method with isomorph rejection for computing the minimum sum cover, strict sum cover, and difference cover of a given finite Abelian group. The search method is an orderly algorithm.
We obtain the minimum sum covers, strict sum covers, and difference covers for Abelian groups of order up to 80, 90, and 127, respectively.

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37 — Sektion II — G03-223 — 17:00

Graph Colorings and Sphere Bundles

FRANK LUTZ (Berlin)

In the topological approach to graph coloring problems, initiated by Lovász, lower bounds on the chromatic number $\chi(G)$ of a graph G are obtained by associating certain simplicial or cell complexes to G and then exploiting topologica invariants of the resulting spaces.
Recently, Babson and Kozlov proved Lovász' conjecture that if for a graph H the cell complex $\mathrm{Hom}(C_{2r+1}, H)$, introduced by Lovász, is k-connected for some $r \geq 1$, then $\chi(H) \geq k+4$. In this talk, we will show that, in fact, $\mathrm{Hom}(C_5, K_{n+2}$ is an $(n-1)$-sphere bundle over the n-sphere. Moreover, we will characterize the graphs G for which $\mathrm{Hom}(G, K_n)$ are manifolds, and, in this way, obtain a new and rich class of *graph coloring manifolds*.

Thi is joint work with Péter Csorba and Stefan Felsner.

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38 — Sektion III — G03-106 — 17:00

Investigation of algebraic curvature tensors by means of tools of Algebraic Combinatorics

BERND FIEDLER (Leipzig)

We show that the space of algebraic covariant derivative curvature tensors $\mathfrak{R}'$ is generated by Young symmetrized product tensors $T \otimes \hat{T}$ or $\hat{T} \otimes T$, where T and $\hat{T}$ are covariant tensors of order 2

and 3 whose symmetry classes are irreducible and characterized by the following pairs of partitions: $\{(2), (3)\}$, $\{(2), (2\,1)\}$ or $\{(1^2), (2\,1)\}$. Each of the partitions (2), (3) and (1^2) describes exactly one symmetry class, whereas the partition $(2\,1)$ characterizes an infinite set $\mathfrak{S}$ of irreducible symmetry classes. These set $\mathfrak{S}$ contains exactly one symmetry class $S_0 \in \mathfrak{S}$ whose elements $\hat{T} \in S_0$ can not play the role of generators of tensors $\mathfrak{R}'$. The tensors $\hat{T}$ of all other symmetry classes from $\mathfrak{S} \setminus \{S_0\}$ can be used as generators for tensors $\mathfrak{R}'$.
Foundation of our investigations is a theorem of S. A. Fulling, R. C. King, B. G. Wybourne and C. J. Cummins about a Young symmetrizer that generates the symmetry class of algebraic covariant derivative curvature tensors. Furthermore we apply ideals and idempotents in group rings $\mathbb{C}[\mathcal{S}_r]$, the Littlewood-Richardson rule and discrete Fourier transforms for symmetric groups $\mathcal{S}_r$. For certain symbolic calculations we used the Mathematica packages Ricci and PERMS.

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39 — Sektion IV — G02-109 — 17:00

Decomposing tournaments into strong spanning subdigraphs

JØRGEN BANG-JENSEN (Odense)

The so-called Kelly conjecture states that every regular tournament on $2k+1$ vertices has a decomposition into k-arc-disjoint hamiltonian cycles. We conjecture that every k-arc-strong tournament contains k arc-disjoint spanning strong subdigraphs. We have proved several results which support the conjecture:

- If $D = (V, A)$ is a 2-arc-strong semicomplete digraph then it contains 2 arc-disjoint spanning strong subdigraphs except for one digraph on 4 vertices.
- Every tournament (in fact every semicomplete digraph) which has a non-trivial cut (both sides of size at least 2) with precisely k arcs in one direction can be decomposed into k arc-disjoint strong spanning subdigraphs.
- Every k-arc-strong tournament with minimum in- and out-degree at least $37k$ contains k arc-disjoint spanning subdigraphs $H_1, H_2, \ldots, H_k$ such that each H_i is strongly connected.

The last result implies that if T is a $74k$-arc-strong tournament with specified not necessarily distinct vertices $u_1, u_2, \ldots, u_k, v_1, v_2, \ldots, v_k$ then T contains $2k$ arc-disjoint branchings $F^-_{u_1}, F^-_{u_2}, \ldots, F^-_{u_k}, F^+_{v_1}, F^+_{v_2}, \ldots, F^+_{v_k}$ where $F^-_{u_i}$ is an in-branching rooted at the vertex u_i and $F^+_{v_i}$ is an out-branching rooted at the vertex v_i, $i = 1, 2, \ldots, k$. This solves a conjecture of Bang-Jensen and Gutin.
In the talk we will also discuss related problems and conjectures.

This is joint work with Anders Yeo, Royal Holloway, University of London

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40 — Sektion V — G02-111 — 17:00

Directed paths of diagonals within polygons

JENS-P. BODE (Braunschweig)

Given n and t lengths $1 \leq l_1 < l_2 < \ldots < l_t \leq n-1$ of oriented diagonals within an n-gon, it is a problem of Brian Alspach to find a directed path within an n-gon using each length exactly once (and no vertex twice). In other words it is the problem to find a permutation of a given subset of $\{1, 2, \ldots, n-1\}$ such that no set of consecutive elements in this permutation has a sum $\equiv 0 \pmod{n}$. It is conjectured that such paths exist if (and only if) $l_1 + l_2 + \ldots + l_t \not\equiv 0 \pmod{n}$. We prove this conjecture for $t = n-1$ and $t = n-2$.

This is joint work with Heiko Harborth.

Freitag, 14.11.2003 — Zeit: 17:30

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41 — Sektion I — G03-315 — 17:30

Pairwise Balanced Designs whose Block Size Set Contains Seven and Thirteen

MARTIN GRÜTTMÜLLER (Rostock)

In this talk, we investigate the PBD-closure of sets K with $\{7, 13\} \subseteq K \subseteq \{7, 13, 19, 25, 31, 37, 43\}$. In particular, we show that $v \equiv 1 (\mathrm{mod}\ 6), v \geq 109819$ implies $v \in B(\{7, 13\})$. Furthermore, we show some elements to be not essential in a Wilson bases for the PBD-closed set $\{v : v \equiv 1 \pmod 6, v \geq 7\}$.

This is joint work with Julian Abel, Malcolm Greig and Sven Hartmann.

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42 — Sektion II — G03-223 — 17:30

On generalised Kneser colouring theorems

DR. CARSTEN LANGE (Berlin)

25 years ago, Lovász proved Kneser's conjecture using the Borsuk–Ulam theorem. In the subsequent years this result has been generalised by Dol'nikov, Alon-Frankl-Lovász, Kříž, Sarkaria, and finally by Ziegler. We shall discuss topological lower bounds for r-uniform hypergraphs and give a new proof of Ziegler's result using "Sarkaria's inequality".

43 — Sektion III — G03-106 — 17:30

On log-arithmetic, Fermat and the powers of 3 (mod 2^k)

NICO F. BENSCHOP (Geldrop)

The group of units mod p^k (prime $p > 2$) is known to be cyclic for $k \geq 1$, for k=1 corresponding to Fermat's Small Theorem: $n^{p-1} \equiv 1$ mod p (n coprime to p). If $p = 2$ and $k > 2$ the 2^{k-1} units (odd residues) require two generators, such as 3 and -1 mod 2^k, since 3 is semi-primitive root of 1 mod 2^k. So each residue $n \equiv \pm 3^i 2^j$ mod 2^k with unique non-negative $i < 2^{k-2}$, $j \leq k$. For engineering purposes this yields efficient log-arithmetic with dual base 2 and 3.

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44 — Sektion IV — G02-109 — 17:30

Disjoint A-Paths in Digraphs

MATTHIAS KRIESELL (Hannover)

Let $k \geq 0$ be an integer and let A be an independent set of vertices of a finite digraph G. Generalizing an old result of GALLAI, we prove a necessary and sufficient separator condition to G for the existence of a set of k disjoint paths each of which connects two distinct vertices in A.

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45 — Sektion V — G02-111 — 17:30

Algorithms for filtering Yutsis graphs

DRIES VAN DYCK (Ghent)

Yutsis graphs are cubic graphs that can be partitioned into two trees of equal size and appear in the quantum theory of angular momenta. In this paper we address the decision problem of determining whether a given (bridgeless) cubic graph is a Yutsis graph. We present an exhaustive backtracking algorithm, which becomes expensive for larger graphs but always gives an exact solution, as well as a Monte Carlo local search algorithm, which is faster for larger graphs but has a small chance of not recognizing a Yutsis graph. Results for both algorithms are discussed, with emphasis on the local search based approximation algorithm.

This is joint work with Veerle Fack.

Samstag, 15.11.2003 — Zeit: 10:15

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46 — Sektion I — G03-315 — 10:15

Number of ones in general binary Pascal triangles

HEIKO HARBORTH (Braunschweig)

Is every natural number n realizable as the number of ones in the top portion of rows of a binary general Pascal triangle, that is, where the left and the right diagonals of ones are substituted by any lists of zeros and ones? Moreover, what is the minimum number of rows so that n is realizable? In this context the maximum number of ones is determined being possible in the first k rows of a general binary Pascal triangle.

This is joint work with Glenn Hurlbert, Arizona State University, Tempe, AZ.

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47 — Sektion II — G03-223 — 10:15

Self-orthogonal graph decompositions

UWE LECK (Rostock)

Given a simple graph H, a self-orthogonal decomposition of $2H$ is a collection of subgraphs of H such that every edge of H occurs in exactly two of the subgraphs and any two of the subgraphs have exactly one common edge. We discuss the case when all the subgraphs are isomorphic to some graph G. If for given G there is an appropriate H, then our goal is to find one with as few vertices as possible. Special attention is paid to the cases that G is a path or a matching.

48 — Sektion III — G03-106 — 10:15

Cyclotomic $\mathcal{R}$-Orthomorphisms of Finite Fields

ARNE WINTERHOF (Linz)

A polynomial $f(X)$ over a finite field is an orthomorphism if both $f(X)$ and $f(X) - X$ are permutation polynomials. (Orthomorphisms are pertinent to the problem of constructing orthogonal Latin squares.) We consider a special class of orthomorphisms. Let $\mathcal{R}$ be a nonempty set of positive integers. Then $f(X)$ is called an *$\mathcal{R}$-orthomorphism* if $f^{(r)}(X)$ is an orthomorphism for all $r \in \mathcal{R}$, where $f^{(r)}(X)$ is the rth iterated composition of $f(X)$ with itself. We prove the existence of some special (cyclotomic) $\mathcal{R}$-orthomorphisms, if q is sufficiently large with respect to n and the cardinality of $\mathcal{R}$. These results are not only interesting in their own right, but also in view of the bounds for character sums appearing in the analysis of pseudorandom number generators and for applications to combinatorial design theory.

This is a joint work with Harald Niederreiter from National University of Singapore.

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49 — Sektion IV — G02-109 — 10:15

Extremal connectivity for topological cliques

DANIELA KÜHN (Berlin)

Let $d(s)$ be the smallest number such that every graph of average degree $> d(s)$ contains a subdivision of K_s. So far, the best known asymptotic bounds for $d(s)$ are

$$(1 + o(1))\frac{9s^2}{64} \leq d(s) \leq (1 + o(1))\frac{s^2}{2}.$$

As observed by Łuczak, the lower bound is obtained by considering bipartite random graphs. Since with high probability the connectivity of these random graphs is about the same as their average degree, a connectivity of $(1 + o(1))9s^2/64$ is necessary to guarantee a subdivided K_s. We prove that for bipartite graphs this gives the correct asymptotics. Moreover, we slightly improve the constant in the upper bound of Komlós and Szemerédi for $d(s)$. Our proof is based on Szemerédi's Regularity Lemma. In particular, it relies on a 'random' version of this lemma which will hopefully also be useful in other situations (a similar version was proved independently of us by Gerke, Kohayakawa, Steger and Rödl).

This is joint work with Deryk Osthus

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50 — Sektion V — G02-111 — 10:15

Edge Expansion of Abstract Cubical Complexes

THOMAS VOIGT (Berlin)

A popular technique for random generation of objects of a combinatorial class is to design a Random Walk whose states are objects of this class. The mixing time of the corresponding Markov Chain is often bounded using Condunctance, which is closely related to the edge expansion of the underlying graph.

In this paper we show that graphs of neighbourly cubical complexes – cubical complexes in which every pair of vertices spans a (unique) cube – have good expansion properties, using a technique based on multicommodity flows. By checking that graphs of stable set polytopes are graphs of neighbourly cubical complexes we give a new proof that graphs of stable set polytopes have edge expansion 1.

Samstag, 15.11.2003 — Zeit: 10:45

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51 — Sektion I — G03-315 — 10:45

Finding complementary cycles in locally semicomplete and quasi-transitive digraphs

MORTEN HEGNER NIELSEN (Odense)

We consider the problem of determining whether a given digraph D has complementary cycles, i.e. two disjoint cycles that cover all vertices of D. Being a generalization of the Hamilton cycle problem, this is $\mathcal{NP}$-complete for general digraphs. For some classes of digraphs, however, the problem can be solved (and a pair of complementary cycles found if it exists) in polynomial time. We consider two (different) extensions of the class of tournaments, namely the *locally semicomplete digraphs* and the *quasi-transitive digraphs*, and give a brief outline of polynomial algorithms for the above problem on these two classes of digraphs.

This is joint work with Jørgen Bang-Jensen.

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52 — Sektion II — G03-223 — 10:45

Computing geometric medians

LAURA HEINRICH-LITAN (Braunschweig)

We present an efficient approach to compute Tukey medians. In particular we consider the Tukey median of a convex polygon C, which is the point p for which the minimum area cut off from C by any halfplane containing p is maximized. This point is known in classical geometry as the center of area of a convex polygon. Although its properties were studied already long ago, it is quite nontrivial to really determine this point. We describe a simple randomized linear-time algorithm for computing the Tukey median of a convex polygon.

This is joint work with Peter Brass and Pat Morin.

53 — Sektion III — G03-106 — 10:45

Maximal planar graphs with minimum degree four

GUILDO HELDEN (Aachen)

We present some results on maximal planar graphs with minimum degree four, denoted by $MPG4$ graphs. We describe an algorithm which transforms a $MPG4$ graph in a $MPG5$ graph, and we give the time complexity. Furthermore, we describe some attributes of $MPG4$ graphs

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54 — Sektion IV — G02-109 — 10:45

Disjoint A-Paths in Digraphs

MATTHIAS KRIESELL (Hannover)

Let $k \geq 0$ be an integer and let A be an independent set of vertices of a finite digraph G. Generalizing an old result of GALLAI, we prove a necessary and sufficient separator condition to G for the existence of a set of k disjoint paths each of which connects two distinct vertices in A.

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55 — Sektion V — G02-111 — 10:45

Canonical colourings with many colours

ANUSCH TARAZ (Berlin)

Canonical colouring theorems assert that any colouring of a discrete object will produce a local structure that is coloured in a very regular (i.e. canonical) way. We discuss conditions that force this local structure to be rich in colours.
The objects of interests are graphs and hypergraphs, as well as arithmetic progressions on the natural numbers. For example a typical question is: Does any colouring of the natural numbers which uses an unbounded number of coulours yield a 3-term arithmetic progression with 3 different colours?

Samstag, 15.11.2003 — Zeit: 11:15

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56 — Sektion I — G03-315 — 11:15

A bijection between the d-dimensional simplices with all distances in $\{1, 2\}$ and the partitions of $d + 1$

SASCHA KURZ (Bayreuth)

We give a construction for the d-dimensional simplices with all distances in $\{1, 2\}$ from the set of partitions of $d + 1$.

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57 — Sektion II — G03-223 — 11:15

Translinear Networks: Constructive Combinatorics for Analog Microelectronics

DAVID ILSEN (Kaiserslautern)

Translinear networks form a very special class of electrical networks which are nonlinear and thus do not fit into classical network theory, but which, when implemented in integrated circuits, provide many technical advantages. The core topologies of translinear networks are encoded in so-called translinear graphs which are defined as 2-connected digraphs that have in every cycle as many forward arcs as backward arcs.
The special structure of translinear networks and the strong constraints on their elements let this class of networks appear so narrow, in spite of its flexibility, that it seems possible to compile a complete library of prototypes for translinear networks which can serve as a design tool for engineers. This talk presents the combinatorial problems that arise in the task of building such a library, including the cataloging of translinear graphs.

58 — Sektion III — G03-106 — 11:15

Resolving the Existence of Full-Rank Tilings of Binary Hamming Spaces

PATRIC ÖSTERGÅRD (Helsinki)

A tiling of $\mathbb{F}_2^n$ is a pair (V, A) of subsets of $\mathbb{F}_2^n$ such that every element of $\mathbb{F}_2^n$ can be written in exactly one way as a sum $v + a$ with $v \in V$ and $a \in A$. If the all-zero word belongs to both V and A and the rank of both sets of vectors is n, then we say that we have a full-rank tiling. It is known that full-rank tilings of $\mathbb{F}_2^n$ exist for all $n \geq 10$ and do not exist for $n \leq 8$. The case $n = 9$ is here resolved utilizing an exhaustive computer search based on a classification of linear codes and an algorithm for the exact cover problem. There exists no full-rank tiling of $\mathbb{F}_2^9$.

59 — Sektion IV — G02-109 — 11:15

Applications of structure enumeration in fullerene chemistry

GUNNAR BRINKMANN (Bielefeld)

In this talk I will sketch the application of structure enumeration methods to the theory of stability and formation of fulllerenes. Fullerenes are spherical carbon molecules that correspond to plane cubic graphs with all faces of size 5 or 6. I will present some results and open problems corresponding to and sometimes motivated by the computer approaches. The talk can be regarded as an introductory talk to Claudia Justus' talk where one of the problems will be discussed.

This is joint work with Claudia Justus and Patrick W. Fowler

60 — Sektion V — G02-111 — 11:15

The Simplex-Algorithm in Dimension Three

RAFAEL MECHTEL (Berlin)

We investigate the worst-case behavior of the simplex algorithm on linear programs with 3 variables, that is, on 3-dimensional simple polytopes. Among the pivot rules that we consider, the "random edge" rule yields the best asymptotic behavior as well as the most complicated analysis. All other rules turn out to be much easier to study, but also produce worse results: Most of them show essentially worst-possible behavior; this includes both Kalai's "random-facet" rule, which is known to be subexponential without dimension restriction, as well as Zadeh's deterministic history-dependent rule, for which no non-polynomial instances in general dimensions have been found so far.

This is a joint work with Volker Kaibel, Micha Sharir, and Günter M. Ziegler.

Samstag, 15.11.2003 — Zeit: 11:45

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61 — Sektion I — G03-315 — 11:45

New upper bounds on Enomoto-Katona's coding type problem

JÖRN QUISTORFF (Berlin)

At the Kolloquium über Kombinatorik 2002, G.O.H. KATONA spoke about the following problem: Let $n, k \in \mathbf{N}$ with $2k \leq n$ and X be an n-set. Consider the space

$$\mathcal{R} := \left\{ \{A, B\} \subseteq \binom{X}{k} \mid A \cap B = \emptyset \right\}$$

equipped with $d^{\mathcal{R}}(\{A,B\},\{S,T\}) := \min\{|A \setminus S| + |B \setminus T|, |A \setminus T| + |B \setminus S|\}$. Given $d \in \mathbf{N}$ with $d \leq 2k$, the coding type problem is the determination of the maximum cardinality of a subset $\mathcal{C} \subseteq \mathcal{R}$ with $d^{\mathcal{R}}(\{A,B\},\{S,T\}) \geq d$ for all distinct $\{A,B\},\{S,T\} \in \mathcal{C}$.
Here new upper bounds on this problem are given. Some are modifications of a well-known bound, some are based on ideas from classical coding theory in the Hamming space. New records are archieved if n is small relative to k.

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62 — Sektion II — G03-223 — 11:45

Multileaf collimator field segmentation with interleaf collision constraint

THOMAS KALINOWSKI (Rostock)

Intensity modulated radiation therapy (IMRT) is an important method in the treatment of cancer. A modern way to realize intensity modulated radiation fields is the usage of a multileaf collimator. Here the modulation is achieved by superimposing homogeneous fields of different shapes. This corresponds to a representation of a given nonnegative integer matrix as a positive linear combination of certain $(0,1)$-matrices, so called shape matrices. Two important criteria for the quality of the corresponding treatment plan are the total irradiation time and the number of shape matrices. We present an algorithm for this decomposition that is optimal with respect to the irradiation time taking into account some machine–dependent constraints. In addition, we propose a heuristic for reduction of the number of shape matrices.

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63 — Sektion III — G03-106 — 11:45

Rank of regular $(0,1)$ matrices and an application to graphs

LEIF K. JØRGENSEN (Aalborg)

We consider matrices A such that

- every entry of A is either 0 or 1
- A is an $n \times n$ matrix, for some n
- A has exactly k 1's in each column and exactly k 1's in each row, for some k.

For a given number r, let B_r be the set of all values of $\frac{k}{n}$ for which there exist a matrix with the above properties and with rank r. We prove that the set B_r is finite for every r.
The motivation for investigating this problem is applications to directed (strongly) regular graphs for which 0 is an eigenvalue of very high multiplicity.

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64 — Sektion IV — G02-109 — 11:45

Numbers of faces in disordered patches

CLAUDIA JUSTUS (Bielefeld)

Regular patches are 2-connected plane graphs with all interior faces of the same size k, all interior vertices of the same degree m, and all boundary vertices of degree at most m. It is already known that the number of faces of such a patch is uniquely determined by its boundary structure, that is the cyclic sequence of vertex degrees in the boundary. We consider disordered patches, i.e. patches that may contain so-called defective faces with size $k' \neq k$. Patches with a limited number of defective faces are of special chemical interest for the case $k = 6$, $m = 3$ and $k' = 5$, since transformations between fullerenes can be represented by a pair of such patches with the same boundary. For patches that contain at least two defective faces, one can find examples with the same boundary and different number of faces. The last open question was whether the boundary structure of a patch with exactly one defective face uniquely determines its number of faces. We show that this is the case if the size of the defective face is a not a multiple of k. So in particular, the fullerene case is completely solved.

This is joint work with Gunnar Brinkmann

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65 — Sektion V — G02-111 — 11:45

Integer Programming with group relaxations

MATTHIAS KÖPPE (Magdeburg)

Group relaxations of Integer Linear Programs were introduced by Ralph Gomory in 1969. They are obtained by relaxing the non-negativity constraint on the variables of a simplex basis B, keeping only the integrality constraints. One obtains an optimization problem in the abelian group Z^n/BZ^n. A related polyhedron, the Corner Polyhedron, encodes the integrality constraints in the vicinity of the basic solution corresponding to B.
It was proposed to study the facets of the Corner Polyhedron, in order to employ them in a cutting-plane procedure. Despite a renewed interest in this approach in the last years, this line of research has not yielded a practical algorithm for solving integer programs.
We propose a different approach, where we study the irreducible solutions to the group problem. They form a superset of the vertices of the Corner Polyhedron. We use sets of irreducible solutions to iteratively build extended reformulations of the integer program. We present computational results for some instances from the benchmark library MIPLIB.

This is joint work with Robert Weismantel (Magdeburg), Quentin Louveaux (CORE, Belgium) and Laurence Wolsey (CORE).

Samstag, 15.11.2003 — Zeit: 13:45

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66 — Sektion I — G03-315 — 13:45

From Toothpaste Tubes to Abstract Tubes

KLAUS DOHMEN (Mittweida)

This talk describes the framework for establishing improved inclusion-exclusion identities and Bonferroni inequalities, which are provably at least as sharp as their classical counterparts while involving fewer terms. The connection with convex geometries (dual antimatroids) is particularly emphasized, and examples are given from graph theory, reliability theory and geometry

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67 — Sektion II — G03-223 — 13:45

Blocking shortest paths by deleting minimal edge sets

STEFAN KRAUSE (Braunschweig)

Given a simple and undirected graph we consider the problem of disconnecting all shortest paths of certain pairs of vertices by deleting a minimum cost edge set. This problem is related to set cover and minimum cut. We present complexity results for some special cases as well as approaches to approximation.

68 — Sektion III — G03-106 — 13:45

One-Factorizations of Regular Graphs of Order 12

PETTERI KASKI (Helsinki)

We discuss algorithms for classifying one-factorizations of regular graphs. The smallest open case is currently graphs of order 12; with the present algorithms we have succeeded in classifying one-factorizations of r-regular graphs of order 12 for $r \leq 6$ and $r = 10, 11$. For small degrees we employ two different approaches based on a correspondence between one-factorizations and certain error-correcting codes. For $r = 11$, we have one-factorizations of the complete graph K_{12}. These have earlier been classified, but here we view these as certain triple systems on 23 points and utilize an approach developed for classifying Steiner triple systems. We also present some properties of the classified one-factorizations.

(This is joint work with Patric Östergård.)

69 — Sektion IV — G02-109 — 13:45

A classification of half-tubes

MONIKA FICON (Bielefeld)

A *half-tube* is an infinite, 3-regular, 2-connected plane graph with 6 pentagonal faces and all other faces hexagons. Half-tubes are studied due to their relation to *nanotubes*, which are molecules of pure carbon, which are especially promising with respect to future applications. A *cap boundary* in a *half-tube* is a cycle, so that all six pentagons are in its interior. The *boundary sequence* of a cap boundary is the cyclic sequence of 2s and 3s, obtained by writing 3, resp. 2 for every vertex which is adjacent to another vertex lying in the interior or the exterior face of the boundary.
We will show, that every half-tube has a cap boundary with sequence $(2,3)^k(3,2)^m$ for a unique pair (k,m), $k, m \geq 0$, $k+m > 0$.

This is joint work with Gunnar Brinkmann.

70 — Sektion V — G02-111 — 13:45

A Topological Approach to Polytopal and Shellable Triangulations of S^3

SIMON KING (Darmstadt)

Let T be a triangulation of S^3 with n tetrahedra, and let $\Gamma \subset S^3$ be the embedded dual graph of T, which is a spatial 4–valent graph with n vertices. Any ambient isotopy invariant of $\Gamma \subset S^3$ gives rise to an oriented isomorphism invariant of the simplicial complex T. The first example of such an invariant is $p(T)$, called "polytopality", that is defined as "bridge number" of Γ. We prove $p(T) \leq 3n$ if T or its dual is shellable and $p(T) = n$ if T is polytopal. However, in general, there is no subexponential upper bound for $p(T)$ in n. Without geometric hypothesis on T, we show $n \leq p(T) < 2^{200n^2}$. This is based on a study of the complexity of the Rubinstein-Thompson algorithm for the recognition of S^3, using results from Integer Programming.
We show that any triangulation T of S^3 can be transformed into a *polytopal* triangulation by $O(p(T)^2)$ local subdivisions. So roughly speaking, $p(T)$ (a topological notion!) is small if and only if T is close to being polytopal (a geometrical notion!). These results have further applications in knot theory.

Samstag, 15.11.2003 — Zeit: 14:15

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71 — Sektion I — G03-315 — 14:15

On a combinatorial problem of Asmus Schmidt

WADIM ZUDILIN (Köln)

For any integer $r \geq 2$, define a sequence of numbers $\{c_k^{(r)}\}_{k=0,1,\dots}$, independent of the parameter n, by

$$\sum_{k=0}^{n} \binom{n}{k}^r \binom{n+k}{k}^r = \sum_{k=0}^{n} \binom{n}{k} \binom{n+k}{k} c_k^{(r)}.$$

We prove that all numbers $c_k^{(r)}$ are integers.

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72 — Sektion II — G03-223 — 14:15

Faber-Krahn Type Inequalities for Trees

TÜRKER BIYIKOGLU (Wien)

73 — Sektion III — G03-106 — 14:15

The Berlekamp–Massey Algorithm and Combinatorics

ULRICH TAMM (Chemnitz)

In Coding Theory, Hankel matrices play an important role in decoding of BCH codes, especially in the Berlekamp – Massey algorithm. Their connection to orthogonal polynomials often yields useful applications in Combinatorics: Hankel determinants enumerate certain families of weighted paths, Catalan – like numbers often are sequences important in combinatorial enumeration, and, as a recent application, orthogonal polynomials turned out to be an important tool in the proof of the alternating sign matrix conjecture.

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74 — Sektion IV — G02-109 — 14:15

On Tverberg–type theorems

STEPHAN HELL (Berlin)

In 1966, Helge Tverberg proved a theorem on partitioning $(d+1)(q-1)+1$ points in $\mathbb{R}^d$ into subsets $P_1, P_2, \ldots, P_q$ such that: $\bigcap_{i=1}^{q} \mathrm{conv}(P_i) \neq \emptyset$. Later a topological version of this theorem came up which is proven for q being a prime power, but not for general q. This topological version, the Topological Tverberg Theorem, gives the existence of a Tverberg partition. Gerard Sierksma conjectured a lower bound for the number of Tverberg partitions; this is open as well, even in the affine case. There are numerous related problems, e. g. drawing complete graphs, and generalizations. We'll give an overview of proofs and methods for them.

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75 — Sektion V — G02-111 — 14:15

New Polytopes derived from Products

ANDREAS PAFFENHOLZ (Berlin)

Recently J. Bokowski presented a new family of self-dual 3-spheres based on a construction of G. Gevay. This family contains in particular the hypersimplex and the 24-cell.
In my talk I will show that this family of spheres is a very special case of the "E-construction". This method was invented by D. Eppstein, G. Kuperberg and G. M. Ziegler for the construction of 2-simple and 2-simplicial 4-polytopes and subsequently extended to arbitrary polytopes and, more general, to lattices by G. M. Ziegler and myself.
We will see how this family of spheres can be derived from products $C_m \times C_n$ of two polygons C_m and C_n with m resp. n vertices. We prove that for $\frac{1}{n}+\frac{1}{m} \leq \frac{1}{2}$ we can realise these spheres as polytopes, while in general polytopality is not known. In particular we will see that we get a very flexible method to find new polytopal realisations of the hypersimplex and the 24-cell.

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