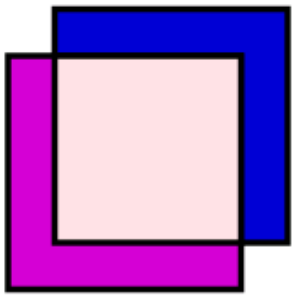
10 YEARS OF DIMATIA



PROGRAMME

DIMATIA Week

April 23 – April 27, 2007

All scientific programmes take place in the university building, Malostranské nám. 25

Monday, April 23 – Day of guests

room S1, 4th floor, 10:35 – 12:20

David Wood

PLANAR DECOMPOSITIONS AND THE CROSSING NUMBER OF GRAPHS WITH AN EXCLUDED MINOR

Mark Siggers

THE FIBRE CONSTRUCTION

room S8, 1st floor, 13:15 – 15:40

Dirk Schlatter

THE EVOLUTION OF POSET DIMENSION

Michael Newman

QUANTUM CHROMATIC NUMBER OF GRAPHS

Attila Pór

TBA

Tuesday, April 24 – 66th Mathematical Colloquium

room S3, 3rd floor, 14:00

John Friedlander *(Toronto)*

INTRODUCTION TO SIEVE METHODS

Wednesday, April 25 – Day of professors

room S5, 2nd floor, 10:35 – 12:20

Martin Klazar

POLYNOMIAL AND QUASIPOLYNOMIAL COUNTING

Václav Koubek

ENDOMORPHISM MONOIDS OF FINITE GRAPHS

Jean Sébastian Sereni

$L(2,1)$ LABELLING OF GRAPHS

Refectory hall, 1st floor, 14:00 – 18:00

Jan Kratochvíl

DISTANCE CONSTRAINED GRAPHS LABELINGS

Martin Loebl

JONES POLYNOMIAL, Q COUNTING AND QUANTUM COMPUTING

Jaroslav Nešetřil

MANY FACETS OF DUALITIES

Aleš Pultr

ABSENCE OF DUALITIES IN HYPER GRAPHS

Pavel Valtr

PATH WITH NO SMALL ANGLES

Thursday, April 26 – A special lecture

room S5, 2nd floor, 15:45

Avi Widgerson *(Institute for Advance Study Princeton)*

EXPANDER GRAPHS CONSTRUCTIONS AND APPLICATIONS

Friday, April 27 – Saturday, April 28 – DIMATIA fest

DIMATIA Fest

April 26, April 27, 2007

All scientific programmes take place in the university building, Malostranské nám. 25

Friday, April 27

Refectory hall, 1st floor

10:30 Opening

11:00 **67th Mathematical Colloquium**
Avi Widgerson *(Institute for Advanced Study, Princeton)*
THE POWER AND WEAKNESS OF RANDOMNESS IN COMPUTATION

12:30 Lunch (Profesní dům restaurant floor -1)

Lecture hall S5, 2nd floor

14:00 ***John Friedlander*** *(Toronto)*
INTRODUCTION TO SIEVE METHODS

15:00 Coffee break

15:30 **68th Mathematical Colloquium**
Vojtěch Rödl *(Emory)*
ON THE REGULARITY LEMMA FOR HYPERGRAPHS AND ITS APPLICATIONS

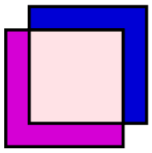
Saturday, April 28

Small conference room, 1st floor

9:30 information of sites – DIMATIA business meeting

12:00 Lunch

14:00 Business and closing meeting



DIMATIA Week

Day of guests

Monday, April 23

room S1 (4th floor), 10:35 – 12:20

David Wood: PLANAR DECOMPOSITIONS AND THE CROSSING NUMBER OF GRAPHS WITH AN EXCLUDED MINOR

Drawings of graphs with few crossings are important in discrete geometry and information visualisation for example. The ”crossing number” of a graph $\mathbf{G}$ is the minimum number of crossings in a drawing of $\mathbf{G}$ in the plane. The first part of this talk will give a broad introduction to the crossing number that should be accessible to a wide audience. A graph $\mathbf{H}$ is a ”minor” of $\mathbf{G}$ if $\mathbf{H}$ can be obtained from a subgraph of $\mathbf{G}$ by contracting edges. Say $\mathbf{G}$ is a graph that excludes some fixed graph as a minor. The second part of this talk will outline methods for the construction of drawings of $\mathbf{G}$ with few crossings. Most generally, we sketch a proof that every bounded degree n-vertex graph that excludes a fixed graph as a minor has $O(n)$ crossing number. The main combinatorial tool used, so-called ”planar decompositions”, generalise tree decompositions, and are of independent interest.

This is joint work with Jan Arne Telle.

Mark Siggers: THE FIBRE CONSTRUCTION

Hell and Nešetřil showed that H-coloring is NP-complete if H contains an odd cycle, and is polynomial time solvable otherwise. Using techniques of Universal Algebra, Bulatov, Jeavons, and Krokhin conjectured similar dichotomy for CSPs. We present a new construction that reproves many of the results of Bulatov et.al., and thus give the dichotomy conjecture a combinatorial setting. We also look at consequences the construction has on restricted versions of the CSP dichotomy.

DIMATIA Week

Day of guests

Monday, April 23

room S8 (1st floor), 13:15 – 15:40

Dirk Schlatter: THE EVOLUTION OF POSET DIMENSION

Kleitman and Rothschild showed that w.h.p. a uniform random poset on n vertices is of a particular shape. Erdős, Kierstead, and Trotter proved that w.h.p. the dimension of such a poset (the minimum number of linear extensions whose intersection contains it) is about $n/4$. We will generalize this result and discuss the dimension of a uniform random poset with n vertices and dn^2 comparable pairs, for a constant $0 < d < 1/2$.

Michael Newman: QUANTUM CHROMATIC NUMBER OF GRAPHS

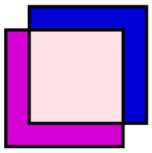
We develop a graph parameter inspired by quantum information theory, which can be seen as a natural generalization of the ordinary chromatic number.

Alice and Bob are each given a vertex of a graph, and must independently answer a colour, subject to the condition that if the vertices are the same then the colours must be equal and if the vertices are adjacent the colours must be distinct. It is not hard to see that if Alice and Bob are allowed no shared resources, then this is equivalent to a proper colouring of the graph. If they are allowed to share so-called quantum entanglement, they can sometimes do better: the minimum number of colours required in this broader setting is the quantum chromatic number of the graph.

Mathematically, this can be described in terms of orthogonal subspaces, and is thus naturally related to (complex) orthogonal embeddings of graphs. Many nice properties of the chromatic number carry over to the quantum version, and we consider some related parameters and bounds as well.

Please note that knowledge of quantum physics is neither presumed nor required!

This is joint work with Cameron, Montanaro, Severini and Winte.



DIMATIA Week

Day of professors

Wednesday, April 25

room S5 (2nd floor), 10:35 – 12:20

Martin Klazar: POLYNOMIAL AND QUASIPOLYNOMIAL COUNTING

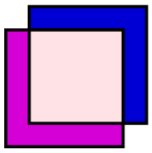
In the talk I will discuss classes of enumerative problems enjoying the property that every problem in the class has counting function f(n) which is a polynomial (or a quasipolynomial) for large n. Examples of this phenomenon include (but are not restricted to) counting lattice points in polytopes, counting elements of sumsets in abelian semigroups, or counting graphs avoiding forbidden patterns as subgraphs. Some of the presented results are joint work with V. Jelínek.

Václav Koubek: ENDOMORPHISM MONOIDS OF FINITE GRAPHS

All endomorphisms of a given graphs form a transformation monoid w.r.t. a composition. It is well known that for any finite monoid $\mathbf{M}$ there exists a finite graph $\mathbf{G}$ such that endomorphism monoid of $\mathbf{G}$ is isomorphic to $\mathbf{M}$ but on the other side almost all finite graphs are rigid (i.e. their endomorphism monoids are singeltons). This motivates the following notions: for a finite monoid $\mathbf{M}$ let $\gamma(\mathbf{M})$ be the least cardinal α such that there exists a graph $\mathbf{G}$ on a set of cardinality α with endomorphism monoid isomorphic to $\mathbf{M}$ and let $\nu_M(n)$ be the number of distinct graphs on an n-element set such that their endomorphism monoids are isomorphic to $\mathbf{M}$. I will present several partial results by V. Rödl and me describing a behaviour of $\gamma(\mathbf{M})$ and ν_M for a finite monoid $\mathbf{M}$.

Jean Sébastian Sereni: $L(2,1)$ LABELLING OF GRAPHS

An $L(2,1)$-labelling of a graph is an assignment of integers (called colours) to its vertices so that adjacent vertices get colours differing by 2 and vertices at distance 2 get colours differing by 1. In 1992, Griggs and Yeh conjectured that every graph of maximum degree D admits an $L(2,1)$-labelling using at most D^2+1 colours. We shall sketch a proof that this conjecture is true if D is large enough. This is joint work with Frdric Havet and Bruce Reed.



DIMATIA Week

Day of professors

Wednesday, April 25

Refectory hall (1st floor), 14:00 – 18:00

Jan Kratochvíl: DISTANCE CONSTRAINED GRAPHS LABELINGS

Motivated by a very practical problem of Frequency Assignment, the distance constrained graph labelings provide a graph invariant which turns out to be quite interesting also from the theoretical point of view. For instance, this problem belongs to the very few problems known to be solvable in polynomial time for trees but NP-complete already for tree-width two graphs (series-parallel graphs). We will survey recent results and open problems in this area, including the connection to locally constrained graph homomorphisms.

Martin Loebl: JONES POLYNOMIAL, Q COUNTING AND QUANTUM COMPUTING

We present some relations of studies of Jones polynomial of knots with enumeration and with quantum computing.

Jaroslav Nešetřil: MANY FACETS OF DUALITIES

We shall define and explain the notion of (homomorphism) duality and show various context in which the notion appears. Particularly, we show various constructions of dual objects.

Aleš Pultr: (ABSENCE OF) DUALITIES IN HYPERGRAPHS

It is known (and will be discussed in the lecture by J. Nešetřil) that in categories of relational systems, and in special categories of similar nature, one has (abundant) instances of non-trivial dualities

$$\mathcal{A} \not\to X \qquad \text{iff} \qquad X \to \mathcal{B}$$

($\mathcal{A}$ and $\mathcal{B}$ are finite sets of objects, $\not\to$ indicates that there is no morphism starting in an $A \in \mathcal{A}$, and $\to$ indicates that there is a morphism into some $B \in \mathcal{B}$). In categories of hypergraphs with natural choices of morphisms, however, non-trivial dualities are lacking, and this also holds for the somewhat weaker dualities of the type

$$\mathcal{A} \not\hookrightarrow X \quad \text{iff} \quad X \to \mathcal{B} \quad (\text{or iff} \quad X \twoheadrightarrow \mathcal{B})$$

concerning, on the left hand side, forbidden subobjects instead of the non-existence of maps.

Some special features of the category of complexes will be mentioned, too.

Pavel Valtr: PATH WITH NO SMALL ANGLES

We show that given a finite set of points in the plane, it is possible to connect them to a (possibly self-intersecting) polygonal path so that every angle on the polygonal path is at least $\pi/9$. Joint work with I. Bárány and A. Pór.