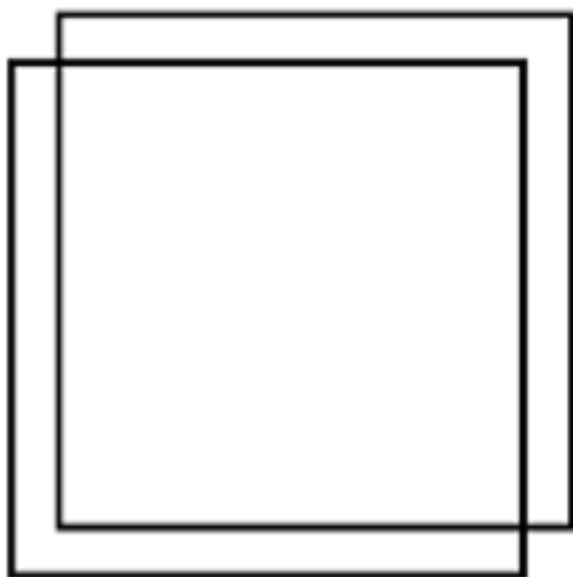A celebration of ITI's long life and successes

ITI fest 2018

3.–4. 12. 2018

Villa Lanna
V Sadech 1
Praha 6, Bubeneč

Faculty of Mathematics and Physics (MFF)
Computer Science Institute of Charles University (IUUK)
Charles University

Monday 3. 12.

10:00 *Jaroslav Nešetřil*

Some of my favourite problems from ITI time

11:00 *Pavel Pudlák*

Linear tree codes

12:00

Lunch

14:00 *Daniel Kráľ*

Cycles of length three and four in tournaments

15:00 *Jiří Šíma*

CE-ITI and Institute of Computer Science, CAS

15:30

Coffee break

16:00 *Petr Savický*

Propagation complete CNF encodings

16:30 *Tomáš Kaiser*

Graph colouring and topology

TBA

Dinner

Tuesday 4. 12.

10:00   *Antonín Kučera*
TBA

11:00   *Zdeněk Ryjáček*
Pilsner branch of ITI, 2000 – 2018

12:00
Lunch

14:00   *Petr Hliněný*
TBA

14:45   *Neil Thapen*
Approximate counting and NP search

15:30
Coffee break

16:00   *Zdeněk Dvořák*
Coloring of graphs with bounded clique number

16:45   *Pavel Valtr*
TBA

Abstracts

Pavel Pudlák (Institute of Mathematics, CAS)
Linear tree codes

We will explain the concept of tree codes and define linear tree codes. The problem of constructing explicit tree-codes (with good parameters) is still open. We will show a reduction of this problem to a construction of suitable matrices over finite fields.

Daniel Kráľ (Masaryk University, University of Warwick)
Cycles of length three and four in tournaments

Linial and Morgenstern conjectured that, among all tournaments with a given density d of cycles of length three, the density of cycles of length four is minimized by a random blow-up of a transitive tournament with all but one parts of equal sizes (similarly to the extremal examples appearing in the famous problem on the minimum density of triangles in a graph with a given edge density). We prove the conjecture of Linial and Morgenstern for d>=1/36 using methods from spectral graph theory. We also demonstrate that the structure of extremal examples is more complex than expected and give its full description for d>=1/16.

This talk is based on joint work with Timothy Chan, Andrzej Grzesik and Jonathan Noel.

Petr Savický (Institute of Computer Science, CAS)
Propagation complete CNF encodings

A propagation complete CNF encoding (PC encoding) is a CNF formula representing a boolean function using existentially quantified auxiliary variables such that the following property is satisfied. If the formula with a given partial assignment implies a literal, then the literal or a contradiction can be derived from the formula by unit propagation. This model was suggested in the area of SAT solving as one of the possible ways how to include a general constraint into an instance for a SAT solver. We compare the expressive power of PC encodings with some other types of representation of boolean functions and present a relatively exact bound on the size of PC encoding of the function at-most-one.

Tomáš Kaiser (University of West Bohemia)
Graph colouring and topology

We review some of the applications of topological methods that yield lower bounds to the chromatic number of graphs. These include the theorem of Lovász on the chromatic number of Kneser graphs, and later results on Schrijver graphs and generalised Mycielski graphs. A unifying geometric view of these results is provided by the concept of projective quadrangulation which we recall next. Extending Youngs' result on quadrangulations of the projective plane, we show that the chromatic number of (suitably defined) nonbipartite quadrangulations of the projective space P^n is at least $n+2$. This implies all the lower bounds mentioned above. We will discuss the result that every Schrijver graph contains a quadrangulation of the projective space of the `right' dimension as

a spanning subgraph, as well as the question whether these subgraphs are edge-critical.

The talk is based on a long-term collaboration with Matěj Stehlík (Université Grenoble Alpes), supported in part by CE-ITI.

Zdeněk Ryjáček (University of West Bohemia)
Pilsner branch of ITI, 2000 - 2018

The first part of the talk will summarize major activities and achievements at the ITI branch in Pilsen. Then I will discuss some of the results and problems from ITI time in which I was involved and which I like, mainly on closures for cycle properties of graphs, and in relation to the recent development around the conjectures by Matthews-Sumner and by Thomassen on hamiltonicity of 4-connected claw-free graphs/line graphs.

Neil Thapen (Institute of Mathematics, CAS)
Approximate counting and NP search

We study a new class of NP search problems, those provably total in Jerabek's theory APC_2 which formalizes approximate counting. In particular, this class includes the weak pigeonhole and Ramsey problems. We show that it does not contain the problem CPLS. This answers an open question in bounded arithmetic and represents some progress in the programme of separating bounded arithmetic theories by low-complexity sentences. Joint work with Leszek Kolodziejczyk.

Zdeněk Dvořák (Computer Science Institute, Charles U)
Coloring of graphs with bounded clique number

We discuss several recent results on chromatic properties of graphs avoiding large cliques, including maximum chromatic number of such graphs of bounded tree-width and (lack of) relationship between the fractional chromatic number and the Hall number (smallest independence ratio over subgraphs).