matfyz

Michael Kompatscher

Department of Algebra

Presentation of new assistant professors

31.03.2023

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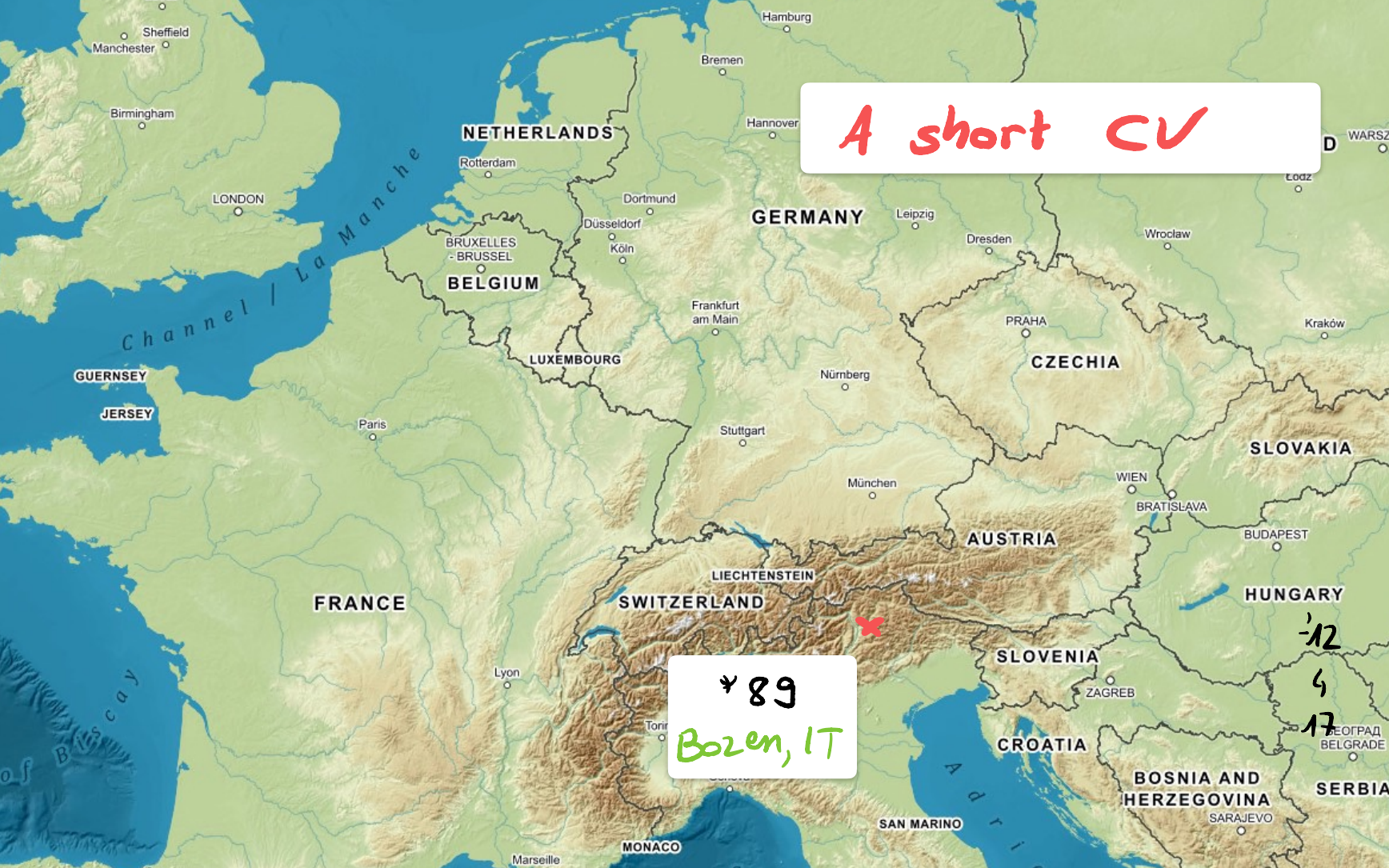
A short CV
*89
Bozen, IT
-12
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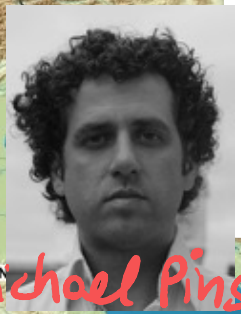
17
Hamburg
Bremen
Hannover
Sheffield
Manchester
Birmingham
NETHERLANDS
Rotterdam
LONDON
Dortmund
Düsseldorf
Köln
GERMANY
Leipzig
Dresden
Wrocław
BRUXELLES - BRUSSEL
BELGIUM
Frankfurt am Main
PRAHA
Kraków
CZECHIA
LUXEMBOURG
Nürnberg
GUERNSEY
JERSEY
Paris
Stuttgart
SLOVAKIA
München
WIEN
BRATISLAVA
AUSTRIA
BUDAPEST
LIECHTENSTEIN
SWITZERLAND
FRANCE
HUNGARY
SLOVENIA
Lyon
ZAGREB
CROATIA
BOSNIA AND HERZEGOVINA
SERBIA
SARAJEVO
SAN MARINO
MONACO
Marseille
Channel / La Manche

A short CV



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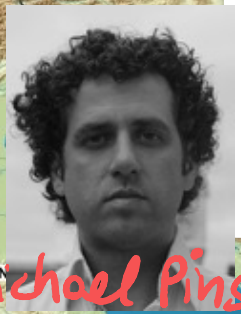

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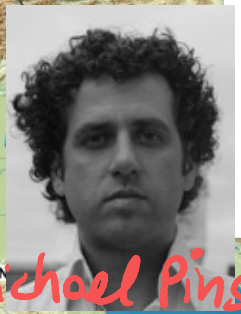

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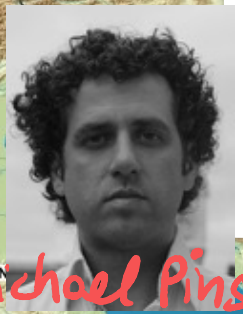

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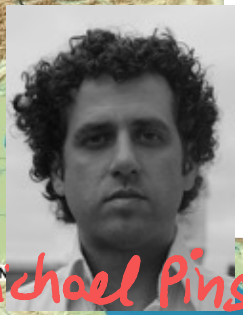

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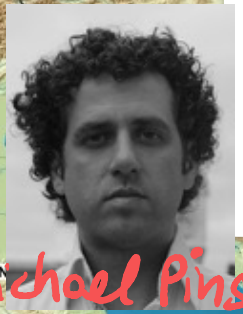

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Where am I now?

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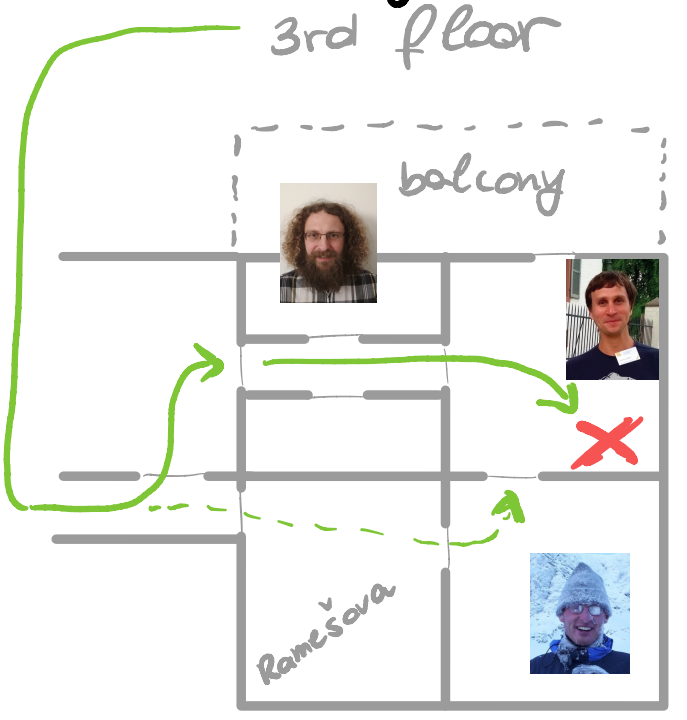

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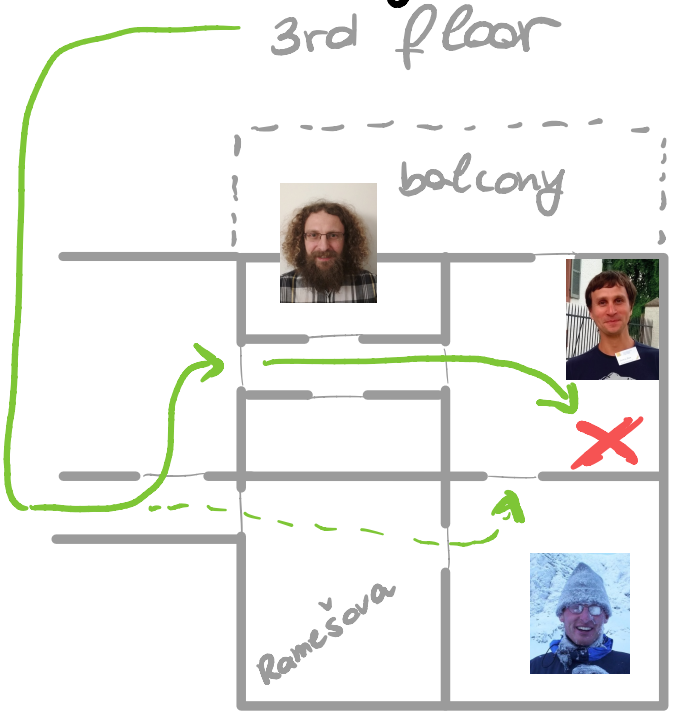
Teaching

- Universal Algebra 1&2
- Algebra 1&2 for CS



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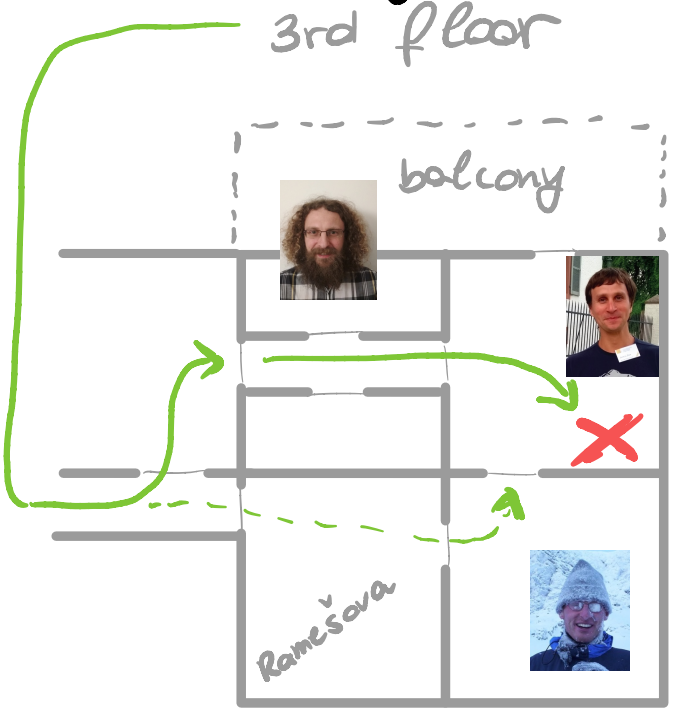
Learning (pomalu)

- Czech for beginners



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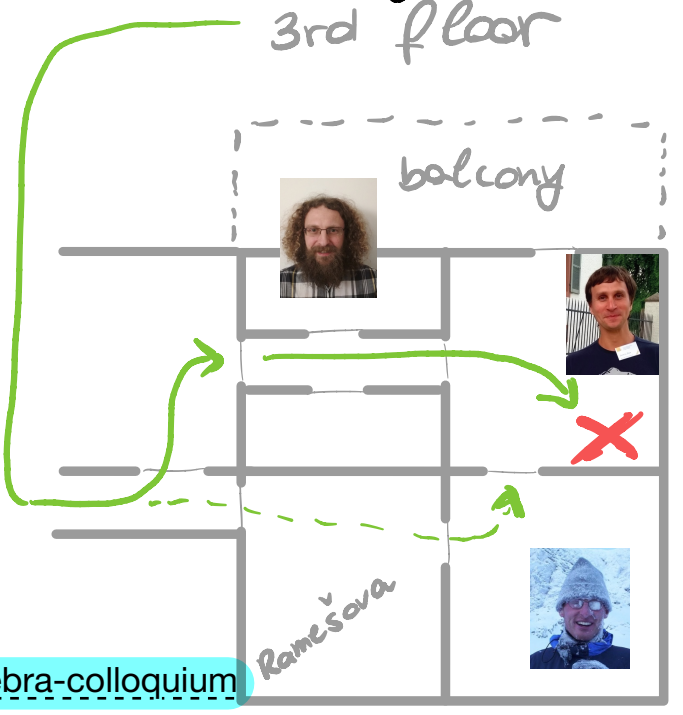
Teaching + Learning

- Algebra Colloquium

https://www.mff.cuni.cz/en/math/ka/events/seminars/algebra-colloquium



Algebra colloquium

It takes place on Tuesdays 15:40 at K1. We start on February 28.

Information

Algebra colloquia are designed for master's and doctoral students, and the faculty. The aim is to offer a platform for researchers to present their own results or current trends in their area of interest in a way that is easy to understand for non-experts.

Colloquia talks will have 45 minutes and will be followed by questions and informal discussions (and cookies :) . Everyone is most welcome to attend, including people from other departments. The colloquium is co-organized by Zuzka and Michael. If you want to give a talk, please, let one of us know.

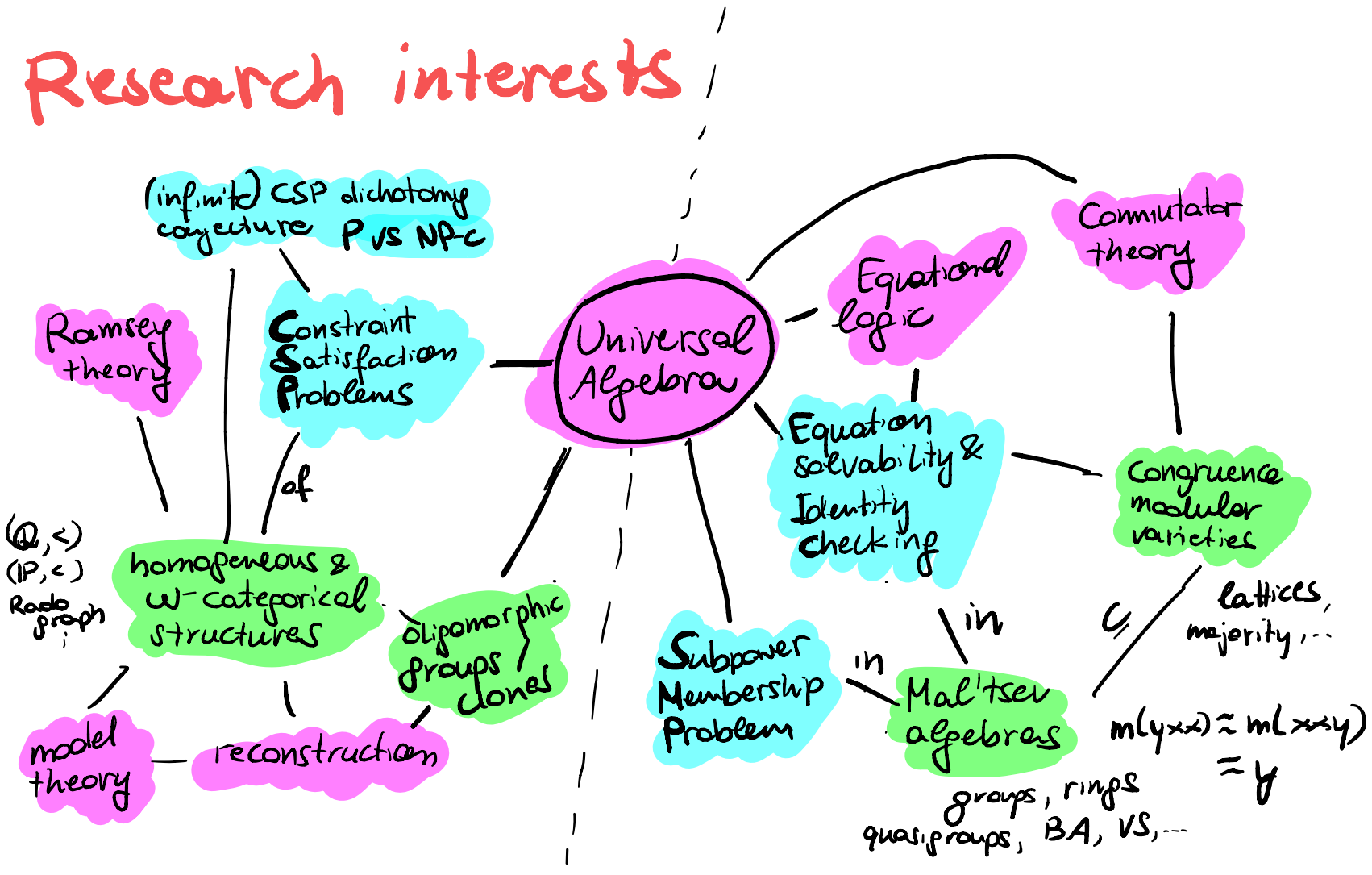
Please note that a colloquium talk should be much more accessible than a usual seminar talk. If we asked you to give a talk, please at least read the brief information given here (of course, their specific local information, e.g. about talk length, doesn't apply :)). If you want, a little longer guide to read is here. We do try to keep our colloquia accessible to students, so feel free to discuss your plans for the talk with us in advance, we're happy to help you gauge the correct level for the talk. But also, please don't be surprised or offended if we ask you to make changes to your abstract after you send it to us.

Spring semester 2023

- 28. 02. Jaroslav Nešetřil: Ramsey Theory, Sparsity and Limits
- 07. 03. Siu Hang Man: The partition function and Ramanujan's congruences
- 14. 03. Manuel Bodirsky (TU Dresden): Valued Constraint Satisfaction Problems and Resilience in Database Theory
- 21. 03. David Cerna (Academy of Sciences): Anti-unification: Recent Results and How is it Used
- 28. 03. Nicolas Daans: Hilbert's 10th Problem and decidability in number theory
- 04. 04. Štěpán Holub: What is it like to code mathematics (in Isabelle/HOL)
- 11. 04. Michal Hrbek (Academy of sciences)
- 18. 04. Stefano Pozza
- 25. 04. Ian Wanless (Monash university, Australia): Quadratic Latin squares and quasigroups

Zuzka Patáková

Research interests



Some facts about $\mathbb{Z}_p = (\{0,1,\dots,p-1\}, +, -, \cdot)$

1) Checking identities in $\mathbb{Z}_p$, e.g.
$x_1 + x_3 - x_1 + 2 + x_2 \approx 1$? is easy [rewrite terms to NF $\sum a_i x_i + c$ $\Rightarrow \in P$]

2) Checking $\bar{b} \in \langle \bar{a}_1, \bar{a}_2, \dots \bar{a}_n \rangle$? is easy [Gauss elimination $\rightarrow \in P$]
for $\bar{b}, \bar{a}_1, \bar{a}_2, \dots \bar{a}_n \in \mathbb{Z}_p^*$

3) Every $R \leq \mathbb{Z}_p^k$ has a short (pp-) definition
$R(x_1 x_2 \dots x_k) \Leftrightarrow \exists y_1 \dots y_m \; R_1(x_1 x_2 y_1) \wedge R_2(y_1 x_2 y_2) \wedge \dots$ $\leq$ poly(k)
with $R_i \leq \mathbb{Z}_p^3$

Can we generalize this to finite Mal'tsev algebras?

$m(yxx) \approx m(xxy) \approx y$

rings, vs, modules, BA, ...	$m(xyz) = x - y + z$
groups	$m(xyz) = xy^{-1}z$
loops	$m(xyz) = (x/y) \cdot z$
minority	$m(xyz) = \min(xyz)$

Some questions about $\underline{A} = (A, f_1 \dots f_n)$.

1) How hard is it to check identities in $\underline{A}$?

$f_2(f_1(x_1, f_1(x_2 x_1))) \approx f_3(a, x_1 x_2)$ [K.'18]

sensitive to encoding of terms; best by circuits

For Mal'tsev algebras $\underline{A}$: conditional results!

super-nilpotent	2-nilpotent	nilpotent of FL K	non-nilpotent
P [AM'10]	P [KKK'18]	$\leq 2^{(\log n)^c}$ [K'22] $\geq 2^{(\log n)^{c-1}}$ [K'21]	coNP-complete [IK'18]

Some questions about $\underline{A} = (A, f_1, \dots, f_n)$

2) SMP($\underline{A}$) How hard is it to check if

$$b \in Sg_{\underline{A}^k}(a_1, a_2, \dots, a_n)?$$

for general $\underline{A}$ ~ SMP($\underline{A}$) EXPTIME
for $\underline{A}$ Mal'tsev ~ SMP($\underline{A}$) $\in$ NP. Is SMP($\underline{A}$) $\in$ P?

3) For which $\underline{A}$ do relations $R \leq A^k$ have short pp-definitions?

$$R(\bar{x}) \Leftrightarrow \exists y_1 \dots y_m \, R_{i_1}(\dots) \wedge R_{i_2}(\dots) \wedge \dots \quad ?$$

for $\underline{A}$ Mal'tsev (or cube terms) ... partial results

coNP, NP

Thanks for your attention!

Any questions?