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Preface

Special Issue Dedicated to Ivo G. Rosenberg

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This second volume dedicated to the memory of the late Professor Ivo G. Rosenberg (1934-2018) comprises five contributions that cover further research interests of Ivo that include topics in universal algebra, graph theory, order theory and theoretical physics.

The first, *Profinite congruences and unary algebras* is by Jorge Almeida and Ondřej Klíma. The authors investigate congruences on profinite algebras

that determine profinite quotients. This is generally a rather difficult problem. In a previous paper, the authors made the conjecture that fully invariant closed congruences on a relatively free profinite algebra are always profinite. In this paper they show that their conjecture is false for unary algebras and that closed congruences on relatively free profinite semigroups are not necessarily profinite. Furthermore, they establish an adjunction between profinite unary algebras and profinite monoids. Finally, they show that the Polish representation of the free profinite unary algebra is faithful.

The second, *Siblings of countable cographs* is by Genă Hahn, Maurice Pouzet and Robert Woodrow. In 2000 Stéphan Thomassé made the conjecture that every countable relation has 1, $\aleph_0$ or $2^{\aleph_0}$ non isomorphic siblings. The authors partially answer this conjecture by proving that every countable cograph has either 1 or infinitely many siblings. However, a counterexample for trees was claimed in 2008 in the Oxford PhD thesis of Tateno. A paper by Abdi, Laflamme, Tateno and Woodrow disproving conjectures of Thomasse, Bonato and Tardif and Tyomkyn based on Tateno's work appeared on arXiv in 2022. This does not take away the interest in the cases where the conjecture are true.

The third, *Prime and critical digraphs*, is by Mayssam Barhoumi, Jamel Dammak and Hamza Si Kaddour. In 1997 P. Ille proved the following result: Let $G = (V, E)$ be a prime digraph, with $|V| \geq 11$. Then for every $x \in V$, there are $y \neq z \in V \setminus \{x\}$ such that $G - \{y, z\}$ is a prime digraph and he asked whether this result holds if $|V| \leq 10$. The authors answer this question by showing that Ille's result remains valid for a prime digraph $G = (V, E)$ with $|V| \geq 9$ and confirm that the value 9 is optimal, i.e. that Ille's result for $|V| = 8$ is false. In addition, the authors give a further characterization for the $\{a\}$-critical digraphs, which corresponds to the characterization of I. Boudabbous (resp. I. Boudabbous, J. Dammak, M. Yaich) for the Tournaments (resp. Symmetric digraphs).

The fourth, *Description of the digraphs* $\{-1\}$*-hypomorphic to a reducible digraph*, is by Mouna Achour, Youssef Boudabbous and Abderrahim Boussaïri.The authors describe the digraphs that are $\{-1\}$-hypomorphic to G, where G is a reducible digraph with more than four vertices. Their description is based on a Gallai's decomposition (1967). From this, the authors conclude two results: 1) every reducible digraph with more than 4 vertices $\{-1\}$-is reconstructible and 2) every digraph G having more than two vertices such that the frame of G is a complete or an empty digraph is $\{-1\}$-reconstructible. This improves older results by P. Kelly (1957) and F. Harary and E. Palmer (1967).

The last contribution, *Remarks on antichains in the causality order of space-time*, is by Stephan Foldes, where the author investigates partial orders which are defined on the set of points of spacetime and which are invariant under Lorentz transformations. He shows that the causality order is gradable and that the level sets under different gradings are exactly the anti-chain cutsets. Moreover, he shows that the causality orders corresponding to different light speed parameters are essentially the only partial orders that are invariant under Lorentz transformations and some other more obvious affine transformations of space-time. Finally, he provides some characterizations that enable him to obtain an alternative proof for the Alexandrov-Zeeman theorem.

The editors would like to express their sincere thanks to the authors and reviewers of this second volume in memory of Ivo Rosenberg. We had the great pleasure of knowing Ivo as a close friend. We also had the privilege of collaborating with him, sharing blissful moments in research. He was a most knowledgeable researcher who never hesitated to share his immense mathematical culture with us. Professor Ivo Rosenberg was a wonderful human being. May his soul rest in peace.

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