



FACULTY  
OF MATHEMATICS  
AND PHYSICS  
Charles University

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**Advisor's report on doctoral thesis of Jakub Pekárek**

The doctoral thesis of Jakub Pekárek consists of two major parts. The first part concerns 3-colorability of triangle-free graphs and presents three results:

- An exact characterization of 3-colorability of triangle-free graphs drawn on the torus, obtained using a computer-assisted argument (joint work with myself, published in *Journal of Combinatorial Theory, Series B*).
- A practical flow-based algorithm for 3-precoloring extension in planar triangle-free graphs with two precolored faces and only a few faces of length other than four, a special case important in the theory of 3-colorability of triangle-free graphs on surfaces (joint work with myself, published in *European Journal of Combinatorics*).
- A practical algorithm to find a 3-coloring of a triangle-free graph drawn on the torus based on a combination and extension of the previous two results (joint work with myself, unpublished).

The second part concerns independent sets and coloring of graphs that do not contain as an induced subgraph a union of many induced odd cycles, a class of graphs motivated by geometric considerations. The following results are given:

- Approximation algorithms for the independence number, based in part on showing that the class is polynomially  $\chi$ -bounded (joint work with myself, published in *Journal of Graph Theory*).
- Partial results towards characterization of geometric intersection graphs whose complements have the described property (independent work of Jakub Pekárek, unpublished).

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Jakub significantly contributed to all the joint papers on which the thesis is based; e.g., he worked out the details of the computer-assisted argument for proving the characterization of 3-colorability of triangle-free graphs drawn on the torus, and entirely contributed the results on  $\chi$ -boundedness of graphs with bounded induced odd cycle packing number. During his studies, he also independently worked with other students and researchers at Computer Science Institute as well as with several researchers abroad (Jean-Sébastien Sereni, Marthe Bonamy, ...), resulting in a number of papers in various areas of combinatorics and graph theory.

Hence, I strongly support accepting the presented thesis as a doctoral thesis and recommend awarding him the doctoral degree.

Sincerely,

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