

Supervisor's report of the doctoral thesis of Mgr. Michal Opler
Structural and Algorithmic Properties of Permutation Classes

A natural algorithmic problem in combinatorics is to determine whether a given structure (a 'pattern') is contained in a given larger substructure. In the context of permutations, this is known as the Permutation Pattern Matching problem, or PPM. The computational complexity of PPM, with its many variants and ramifications, is the central topic of Michal's thesis.

When Michal started his Ph.D. studies, some five years ago, the knowledge of the complexity of PPM was mostly restricted to a handful of disconnected results. Nowadays, we not only have many more results, but more importantly, we have a coherent, unified understanding of the features that distinguish tractable forms of PPM from hard ones. Specifically, we now understand how algorithmic complexity of PPM relates to various permutation width parameters, how it connects with first-order and second-order definability in logic, or how it is affected by structural properties, such as griddability. Much of the credit for this massive advance of the state of the art in this area is due to the work of Michal and his collaborators, presented in this thesis.

Throughout his Ph.D. studies, Michal has demonstrated not only great problem-solving skills, but also an impressive capacity for generalization and theory-building. His Ph.D. thesis, despite its impressive amount of scientific content, represents only a part of his research achievements to date, which span the fields of combinatorics, graph theory and discrete geometry. As Michal's Ph.D. supervisor, I can testify that his work required no supervising at all, as Michal has demonstrated repeatedly his capacity of fully independent research work, including the ability to identify important new research directions, discover the connections of his work to other areas of research, and establish fruitful collaborations.

I have no doubt whatsoever that Michal's work easily meets, and in fact surpasses, the standards expected from a Ph.D. graduate at our faculty. I therefore recommend to accept the submitted Ph.D. thesis and to award Michal the Ph.D. degree.

Prague, 29. 9. 2022

Doc. RNDr. Vít Jelínek, Ph.D.