



**FACULTY
OF MATHEMATICS
AND PHYSICS**
Charles University

August 26, 2023

Advisor's report on diploma thesis of Daria Bilan

Daria Bilan worked on the problem of the size of the smallest finite automata distinguishing given two words. This problem is simple to state but for about forty years eludes its resolution. Daria Bilan managed to provide new insights into the problem which are summarized in her thesis.

From the very onset of her work on the problem she proceeded very independently and thoroughly. She found various literature on the problem independently including an erroneous paper claiming resolution of the problem. She identified a gap in the argument in the paper and set on verifying the underlying claim. This led to wealth of experimental results on the claims related to the problem. Eventually she managed to fully disprove the underlying claim thus showing that the approach followed by the erroneous paper is unworkable. The experimental results and observations together with the argument refuting the previously made claims are one part of the thesis.

Another part of the thesis focuses on properties of randomly chosen finite automata for discerning given two words. In that part Bilan presents a series of experimental evidence supporting the conjecture that the automata discerning two words should be of logarithmic size. This hasn't been done before. She focuses on randomly chosen automata, randomly chosen permutation automata and special type of randomly chosen permutation automata suggested by herself. All this provides an intriguing insight into the problem.

In addition to the new results the thesis contains survey of virtually all known results on the problem.

Overall, the thesis is written in excellent and mature manner and it is delightful to read. Daria Bilan has proven herself to be a capable researcher with excellent mathematical skills. (This is in no way in contradiction to the fact that she did not manage to fully resolve

**Computer Science Institute of Charles
University**

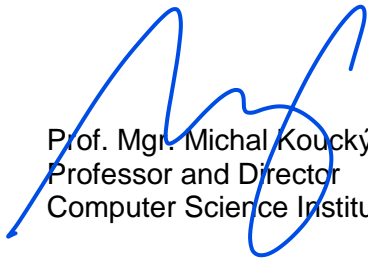
Malostranské nám. 2/25, 118 00 Praha 1
Czech Republic

phone: +420 951554230, fax: +420 257531014
e-mail: sekretariat@iuuk.mff.cuni.cz

the problem as many well-seasoned researchers did not solve the problem before her either.)

Hence, I strongly recommend to accept the presented thesis as a diploma thesis.

Sincerely,

A handwritten signature in blue ink, consisting of stylized, overlapping loops and curves, positioned above the printed name.

Prof. Mgr. Michal Koucký, Ph.D.
Professor and Director
Computer Science Institute of Charles University