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Report for doctoral thesis of Mgr. Václav Vlček “Classes of Boolean Formulae with Effectively Solvable SAT”

New scientific results Chapters 1 and 2 review the literature, while Chapters 3 and 4 contain new results. The main result of Chapter 3 is Theorem 32. It shows the NP-completeness of deciding non-membership in the SLUR-class. A second, minor result is Theorem 35.

Chapter 4 introduces the novel hierarchies $SLUR(i)$ and $SLUR^*(i)$, together with basic inclusion properties.

Importance of results Theorem 32 is the main result of the thesis. It answers a question open since SLUR was introduced in 1995, and can be considered a fundamental result for the area of the complexity of propositional satisfiability.

The second main contribution is the introduction of the hierarchies $SLUR(i)$ and $SLUR^*(i)$. These ideas have already motivated novel research directions, and I consider them fundamental contributions to the field of propositional complexity in the sense of starting a new branch (while the concrete definitions and results are likely to be superseded by further developments).

I consider the other results as minor.

Potential applications There are possible direct applications of the hierarchies in SAT solving, although it might be that the algorithmic concepts do not fit well in the (existing) frameworks. Extensions of these hierarchies, as they have been meanwhile introduced and studied, have (potential) applications in the area of Knowledge Representation.

Form of the submitted thesis The introduction is very short. Historical information is incomplete, and misleading at places. The discussion of the developments in References [21,22] is rather shallow. The proof of Theorem 32 is too technical, and explanations and general insights are missing.

Technically the work is correct and carefully written. The language is appropriate.

General evaluation I would have wished the thesis would have had, say, 30 pages more. But the thesis definitely shows the ability of the author for creative (and correct) scientific work. A fundamental result (coNP-completeness of SLUR) has been found, and a fundamental new approach (SLUR hierarchies) has been introduced. With hindsight, the results can be generalised and proofs simplified, but this does not diminish the substantial additions to the scientific field. I recommend to accept the thesis.

Yours sincerely


Oliver Kullmann