



Supervisor's report on the PhD studies and thesis of Tomáš Lávička (Charles University)

My first contact with Tomáš Lávička was when he followed my master courses in Charles University about mathematical fuzzy logic and abstract algebraic logic in the academic year 2013/14. After passing the exams brilliantly, he asked me for a topic for his master thesis. I gave him a research paper that I had recently coauthored and pointed him to a difficult problem that had remained open. I asked him to study the paper and think about the problem. My intention was only to get him interested in the topic (abstract study of disjunction connectives and some related filter-extension properties) and then suggest some easier tasks. However, few weeks after, Lávička came back to me with an intricate idea that he believed would lead to the solution of our open problem. We discussed it in full details and I was soon persuaded not only that he actually had the right idea, but also that it was substantial enough to turn it into the topic of a master thesis. Indeed, he wrote with my help his dissertation and obtained the master title on September 2015 with the qualification of *v ýborně*.

Realizing that he was specially gifted for mathematical research, I took him as a PhD student right after finishing the master. Since then he has been working under my supervision, in the context of two funded projects. He has continued to follow a strict program of study, research and service to the community. On the first aspect, he has fulfilled all the study requirements at the university, leading him to pass the PhD state exams on January 2017, again evaluated as *v ýborně*. Moreover, he has been helping in many extra duties, including his tasks as a teaching assistant in Charles University and in the Czech Technical University, as editor of a proceedings volume, as organizer of two international conferences, and as referee of articles for peer-reviewed journals.

But, most importantly, he has developed an excellent task as a researcher. He has obtained a quite impressive number of results in abstract algebraic logic and written them in several research articles. So far, he has two papers published in peer-reviewed journals (plus another one under revision) and one full paper published in an international conference. At the moment he is working on the preparation of two more papers to be sent soon to journals.

He has prepared his PhD dissertation entitled "An Abstract Study of Completeness in Infinitary Logics" based on the contents of the mentioned papers. He has taken care in reorganizing the results of his research in the form of a reasonably self-contained monograph. He has explained the main motivations of the work, carefully introduced the necessary preliminaries and has built a solid piece of mathematical theory in a clearly written text. The thesis is, in my opinion, an important contribution to the area of abstract algebraic logic. Its main merit is that, by developing the general theory of propositional logics with infinitary rules, it expands the horizons of a field that had been traditionally largely confined to the realm of finitary logics. The investigation starts with a focus on completeness properties by showing how the classical Lindenbaum-Tarski proof can be extended to infinitary logics under certain theory/filter-extension conditions. This yields a new classification of infinitary logics described in the first part of the thesis together with all the necessary separating examples. The second part is devoted to three particular kinds of theories that are ubiquitous

in the study of (non-)classical logics: prime, linear, and maximally consistent sets of formulas, together with their corresponding extension properties and completeness theorems. What they have in common is that such theories cannot be non-trivially decomposed as intersection of other theories and ensure completeness with respect to classes of finitely subdirectly irreducible models. This part of the monograph also contributes to the study of the role of connectives in propositional logics, namely the benefits of well-behaved disjunction, implication, and negation, with a wealth of new results that will arguably become part of the central theoretic corpus of abstract algebraic logic.

My conclusion is that Tomáš Lávička has performed at an excellent level in all the aspects of his PhD studies, has fully reached the skills that will enable him to become an independent researcher, and has produced a thesis that:

- a. meets all the standards required for a doctoral dissertation,
- b. can be recommend for public defense, and
- c. should be graded as «Pass».

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Prague, 14th of September 2018