Supervisor’s Review of the Bachelor’s Thesis

Dominika Burešová:

Algebraic and State-Space Properties of Quantum Logics

I have known Dominika Burešová over 2 years. I have found her a student with a mathematical talent. Our cooperation resulted in 3 joint papers. In mathematics, she is a hard working and determined researcher. I believe she may find her career connected with theoretical or applied mathematics.

The thesis concerns topical problems of the theory of quantum logics. It is based on four research papers, three published and one submitted for publication. Let us briefly review the contents of the thesis.

The first chapter studies the generation by subsets in a lattice quantum logic (i.e. in orthomodular lattices). This generation can be quite complicated (recall the classical result on generating infinite substructures of projection logics by 3 vectors). After finding a link of the generation with the state space properties, the author exhibits, as a main result and as an application of a new method, the analogue of this classical result for set-representable lattice logics.

The second chapter investigates the logics that allow for a kind of symmetric difference. After investigating the compatibility relation (disproving a natural conjecture) and finding the extension result for $\mathbb{Z}_2$-states, the author proves a rather instructive result of quantum theories - she proves the independence of the state space and compatibility in this model.

The next chapter introduces the symmetric difference (a type of a XOR operation) in the Abbott algebras situating thus the math-logic structure closer to the quantum theories. She shows that such algebras can be viewed as the sym-dif-closed lattice logics, and she studies further notions of theoretic physics like compatibility, states, etc.

In the last chapter the author exclusively studies set-representable logics. She shows, motivated by Boolean algebras, that every set-representable logic allows for a point-distinguishing representation with all two-valued states Dirac.
The thesis is exceptional as regards the quality of the results. It is a valuable contribution to the modern theory of quantum logics (the 'almost Boolean' line). The style is professional. My evaluation is A (excellent) and in case the committee can suggest a thesis for a special award, this thesis is a good candidate.

Prague, June 1, 2023

Prof. RNDr. Pavel Pták, DrSc.