Supervisor's report on the bachelor's thesis
by Vlastimil Hudeček
entitled "Programming quantum computers"

Vlastimil Hudeček's work encompasses a broad overview of the tools for using currently available quantum computers, and the detailed description and applications of two major algorithms (VQE and QAOA) that are regarded as the most promising algorithms for the noisy intermediate scale hybrid quantum-classical computing. His work also extended over actual implementations of these algorithms using the Qiskit library.

The thesis follows a clear and simple structure, elaborated with great attention paid even to little details. After a brief introduction, the two essential optimization algorithms, QAOA and VQE are introduced theoretically. The presentation are comprehensive and scientifically correct, complemented by appealing illustrations. Important applications of both algorithms are introduced, and several algorithmic approaces are described in detail. Next, after a review of quantum programming tools, the earlier described numerical techniques are compared based on their performance using quantum programming code ran on simulated quantum hardware. Somewhat more details on the analysis of the computation results might have had been appropriate, however, since the thesis is already considerably long, I believe that it is better that these sections are kept brief and are essentially limited to demonstrate that the codes have been developed and yield correct results. The developed codes are not part of the thesis, but a link is given to a public git repository where they are are available open source.

As the supervisor, I can add that Vlastimil has displayed a deep interest and own initiative while working on his thesis. He compiled the extensive bibliography independently, researching relevant literature and mapping out not only those on the properties of these algorithms but also many applications of these algorithms. My impression is the actual thesis contains just a part of the knowledge that he sought for in these works.

In summary, I can only report positively on this work.

Evaluation: A, excellent.

Prague, 5 January 2023

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