REVIEWER'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Pruning for Best-Response Algorithms for Imperfect Information Extensive-Form Games**
Author's name:	**Jan Blahoš**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Computer Graphics and Interaction
Thesis reviewer:	Ing. Matěj Klíma, Ph.D.
Reviewer's department:	Department of Computer Science

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

I evaluate the difficulty of the assignment as challenging as the author must prove his ability to implement an algorithm that computes an exact base response in imperfect-information extensive-form games. Moreover, he must further extend this algorithm and compare the results with those returned by other selected existing algorithms solving the discussed problem.

Satisfaction of assignment	**fulfilled with minor objections**

Four requirements are defined in the assignment:

The author attempts to satisfy requirement *1) to review existing methods of computing the exact best response in imperfect-information extensive-form games by Chapter* 3. However, it is just a basic introduction with only a few solutions to the problem, and it lacks more relevant references.

The requirements *2) to implement the exact best response in imperfect-information extensive-form games based on [3] into OpenSpiel* and *3) extend the implementation to compute an error-bounded approximate variant of best response* were satisfied.

Requirement *4) compare the performance of newly implemented algorithms with full best response and other methods identified in step 1)* was satisfied only briefly without using proper metrics and charts.

Method of conception	**partially applicable**

The author implemented certain algorithms and tested the results on OpenSpiel's Kuhn poker and Leduc poker games. However, the chosen approach and results of the experiments are not documented well in the thesis.

Technical level	**D - satisfactory.**

The introduction chapter lacks a general introduction to the problem discussed in this thesis. In fact, the introduction to the game theory domain is missing in the thesis. Moreover, certain terms used in the thesis should be introduced, like a sequence algorithm, oracle algorithm, stochastic environment, etc.

Definitions in Chapter 2 derived from sources abbreviated as [Bos14], [SL09], and [Sch21] are sometimes missing some important parts (e.g., the concept of the nature player c, the best response is not described clearly, and in Definition 2.2 there should be stated that π_i is a strategy of the player i).

Chapter 3 is called related work but is more of a brief description of existing methods.

In Chapters 4 and 5, the author's original contribution is not clearly distinguished from statements used in other research papers. Chapter 6 is a mixture of a description of the method of the experiments and the results of the experiments. Both activities should be described separately and more comprehensively. For example, there is only one chart used throughout the thesis, denoted Figure 6.1 and it contains a "Convergence to BRS value based on number of samples". I would rather expect bar charts comparing the runtimes of the individual methods and a table with the results of the individual metrics.

Formal and language level, scope of thesis	**F - failed.**

The language and formal level used in the thesis are correct. However, the thesis scope contains only roughly 16 pages of textual content (when not counting blank pages, the title page and acknowledgments, the table of contents, and the bibliography). Since in those 16 pages, there is certain content that is extracted from external sources, and since the thesis lacks further introduction to the field, a more comprehensive description of the presented solution, and a better

presentation of the results, I evaluate the scope of the thesis as not satisfactory.

Selection of sources, citation correctness	E - sufficient.

The thesis contains a list of ten bibliographic sources. Throughout the thesis, the author's own ideas and statements are not correctly distinguished from statements from the literature. For example, in figures 4.1 and 4.2, the author depicts certain algorithms and states that "Very similar pseudocode can be found in [Bos14, Section 4.2],". This clearly misses the exact statement distinguishing the author's original contribution from materials taken from external research papers. Similarly unclear is the source of Lemma 4.1 and the principle (2) in Chapter 4.

The sentence "MCTS is described in more detail in [Cow12] and there are many sources online" leads me to an assumption that the author does not quite understand the purpose of a bachelor thesis, which should be to find, utilize, and mention relevant sources and not to leave this work up to the reader.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

In this thesis, the author attempts to solve a challenging assignment with four essential requirements. Most of them were satisfied but with objections specified in the relevant section of this evaluation. The thesis lacks a clear introduction to the domain, which is an important part of a bachelor's thesis. Throughout the thesis text, it was hard to distinguish the author's original contribution from what was taken from other research papers. Also, the experiments that were conducted are described, but the results presented lack a more comprehensive and understandable presentation.

During the defense, I ask the author to distinguish his contributions from external research clearly. Also, to justify the narrow scope of the thesis.

I evaluate the handed thesis with a classification grade of **E - sufficient.**

Date: **5.6.2024**   Signature: