Supervisor's statement of a final thesis

Czech Technical University in Prague   **Faculty of Information Technology**

Student:	Mykyta Viazovskyi
Supervisor:	RNDr. Michal Čertický, Ph.D.
Thesis title:	MCTS library for unit movement planning in real-time strategy game StarCraft
Branch of the study:	Web and Software Engineering

Date: 6. 6. 2017

Evaluation criterion:	*The evaluation scale: 1 to 5.*
1. Difficulty and other comments on the assignment	*1 = extremely challenging assignment,* ***2 = rather difficult assignment,*** *3 = assignment of average difficulty,* *4 = easier, but still sufficient assignment,* *5 = insufficient assignment*

Criteria description:
Characterize this final thesis in detail and its relationships to previous or current projects. Comment what is difficult about this thesis (in case of a more difficult thesis, you may overlook some shortcomings that you would not in case of an easy assignment, and on the contrary, with an easy assignment those shortcomings should be evaluated more strictly.)

Comments:
The assignment is considered quite difficult for bachelor thesis. The student needed to understand and implement the MCTS algorithm and its application in complex domain of real-time strategy games, as was proposed in recent PhD-level research publications. On top of that, the student needed to package the solution in a form of easily reusable library and make sure it's compatible with current StarCraft AI frameworks or bots. This assignment requires both good algorithmic thinking and non-trivial software engineering knowledge.

Evaluation criterion:	*The evaluation scale: 1 to 4.*
2. Fulfilment of the assignment	***1 = assignment fulfilled,*** *2 = assignment fulfilled with minor objections,* *3 = assignment fulfilled with major objections,* *4 = assignment not fulfilled*

Criteria description:
Assess whether the thesis meets the assignment statement. In Comments indicate parts of the assignment that have not been fulfilled, completely or partially, or extensions of the thesis beyond the original assignment. If the assignment was not completely fulfilled, try to assess the importance, impact, and possibly also the reason of the insufficiencies.

Comments:
Assignment was fulfilled without any objections. In fact, the work by Mr. Viazovskyi exceeded the assignment, since he managed to propose and implement another solution, in addition to MCTS (solution based on Negamax algorithm), and compare those two. He demonstrated good programming skills, the ability to work efficiently with literature and to solve problems by himself.

Evaluation criterion:	*The evaluation scale: 1 to 4.*
3. Size of the main written part	***1 = meets the criteria,*** *2 = meets the criteria with minor objections,* *3 = meets the criteria with major objections,* *4 = does not meet the criteria*

Criteria description:
Evaluate the adequacy of the extent of the final thesis, considering its content and the size of the written part, i.e. that all parts of the thesis are rich on information and the text does not contain unnecessary parts.

Comments:
The written part contains all the crucial information and meets the criteria. I haven't found anything irrelevant in the text. In fact, I feel that more detailed explanations could be added at a few places to make it easier to understand for readers lacking any domain knowledge. However, I consider the written part of the thesis sufficient.

Evaluation criterion:	*The evaluation scale: 0 to 100 points (grade A to F).*
4. Factual and logical level of the thesis	*100 (A)*

Criteria description:
Assess whether the thesis is correct as to the facts or if there are factual errors and inaccuracies. Evaluate further the logical structure of the thesis, links among the chapters, and the comprehensibility of the text for a reader.

Comments:
I have not noticed any factual errors or inaccuracies. The logical structure follows my recommendations, so I cannot object to that.

Evaluation criterion:	*The evaluation scale: 0 to 100 points (grade A to F).*
5. Formal level of the thesis	*90 (A)*

Criteria description:
Assess the correctness of formalisms used in the thesis, the typographical and linguistic aspect s, see Dean's Directive No. 14/2015, Article 3.

Comments:

The thesis is written in English language. Grammar and writing style is satisfactory and the text is easy to read. I was only able to notice occasional punctuation errors or imperfect use of apostrophes. There is nothing major to criticize in this respect.

Evaluation criterion:	*The evaluation scale: 0 to 100 points (grade A to F).*
6. Bibliography	*75 (C)*

Criteria description:
Evaluate the student's activity in acquisition and use of studying materials in his thesis. Characterize the choice of the sources. Discuss whether the student used all relevant sources, or whether he tried to solve problems that were already solved. Verify that all elements taken from other sources are properly differentiated from his own results and contributions. Comment if there was a possible violation of the citation ethics and if the bibliographical references are complete and in compliance with citation standards.

Comments:

Thesis references 20 external sources, including the most important publications in the field. I noticed that at least one bibliography entry is not referenced in the text. Also, the style of bibliographic entries is not perfect in some cases. Bibliography also contains three references to Wikipedia. Despite a few formal imperfections in the bibliography, the student was able to effectively find the right sources of relevant information and actually use them not only in the text, but also during implementation.

Evaluation criterion:	*The evaluation scale: 0 to 100 points (grade A to F).*
7. Evaluation of results, publication outputs and awards	*100 (A)*

Criteria description:
Comment on the achieved level of major results of the thesis and indicate whether the main results of the thesis extend published state-of-the-art results and/or bring completely new findings. Assess the quality and functionality of hardware or software solutions. Alternatively, evaluate whether the software or source code that was not created by the student himself was used in accordance with the license terms and copyright. Comment on possible publication output or awards related to the thesis.

Comments:

Presented work extends the state of the art in the field of RTS AI in two ways:

1. Thesis proposes and demonstrates a novel solution of the squad control problem, using Negamax algorithm. This approach has not been tried yet.

2. More importantly, author developed and released an open-source software library that can be easily used to solve this problem in practice, using both MCTS and Negamax. I am fairly confident that this library will be widely used by the research community.

Evaluation criterion:	*No evaluation scale.*
8. Applicability of the results	

Criteria description:
Indicate the potential of using the results of the thesis in practice.

Comments:

As I mentioned above, the software library can (and will) be used extensively in practice by researchers and programmers working on Real-Time Strategy AI. It addresses the challenge that's currently very relevant in the field and has a potential to save future users a lot of work.

Evaluation criterion:	*The evaluation scale: 1 to 5.*
9. Activity and self-reliance of the student	*9a:* *1 = excellent activity,* ***2 = very good activity,*** *3 = average activity,* *4 = weaker, but still sufficient activity,* *5 = insufficient activity* *9b:* ***1 = excellent self-reliance,*** *2 = very good self-reliance,* *3 = average self-reliance,* *4 = weaker, but still sufficient self-reliance,* *5 = insufficient self-reliance.*

Criteria description:
Review student's activity while working on this final thesis, student's punctuality when meeting the deadlines and consulting continuously and also, student's preparedness for these consultations. Furthermore, review student's independency.

Comments:

Student is extraordinarily independent. He was able to solve non-trivial technical problems without intervention and to gather and apply theoretical knowledge on his own.

Evaluation criterion:	*The evaluation scale: 0 to 100 points (grade A to F).*
10. The overall evaluation	*95 (A)*

Criteria description:
Summarize the parts of the thesis that had major impact on your evaluation. The overall evaluation **does not** have to be the arithmetic mean or any other formula with the values from the previous evaluation criteria 1 to 9.

Comments:

The student was able to achieve all the goals of this considerably difficult achievement. In some cases, he decided to take the harder path and do quite a lot of extra research and work in order to improve the final result. He worked independently and efficiently. I do not have any objections to resulting software or his work process. The quality of the written part is good, despite a few insignificant imperfections. I recommend assigning a grade A.

Signature of the supervisor: