

I. IDENTIFICATION DATA

Thesis title:	Reversibility of Non-Deterministic Actions
Author's name:	Jakub MED
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Computer Science
Thesis reviewer:	Michael MORAK
Reviewer's department:	AICS, Univeristy of Klagenfurt, Austria

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>How demanding was the assigned project?</i>	
Investigating how reversibility in planning applies to non-deterministic planning settings like FOND planning is certainly interesting. While the extension of the relevant notions is not too difficult, getting the details right is indeed a challenging and worthwhile task.	

Fulfilment of assignment	fulfilled
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
The thesis fulfills the goals that were set up-front in an adequate way. The relevant definitions of reversibility for FOND planning were formalized in two intuitive ways based on planning in the FOND setting, and the interrelationships between these notions were investigated. One area that is missing from this work is a complexity-theoretic investigation. However, this can be a rather complex topic and a narrow reading of the goals of the project would not necessarily encompass such an investigation. Methods for computing reversibility were proposed, implemented and tested. I therefore consider the thesis to have fulfilled its goals.	

Methodology	correct
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
Relevant proof techniques were employed to obtain the formal results in the thesis. The practical results were obtained by an implementation and experiments on well-known domains of planning problems.	

Technical level	A - excellent.
<i>Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?</i>	
The thesis nicely explains the relevant theoretical constructs, the statements obtained and proven, as well as what was implemented and tested in practice. Relevant proof techniques are employed correctly and proofs of the corresponding theorems to the ones proposed by Faber, Morak, and Chrupa, for the non-deterministic planning setting are argued convincingly.	

Formal and language level, scope of thesis	B - very good.
<i>Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?</i>	
The thesis convincingly explains why the newly introduced notions are interesting, and how the investigation within the thesis was carried out. The thesis is adequately structured and I could follow it easily and the obtained results are well-presented. However, I would have liked to see a clearer separation between already existing notions of reversibility and the new notions introduced in the thesis. It would have been nice to clearly define and explain the already existing notions and then explain how they can be extended to the non-deterministic setting considered in this thesis. Also, the thesis is very light on examples. It would have been nice to give some simple examples to illustrate the newly defined notions. The level of English used in the thesis is generally good, with some minor issues (see below for a partial list). These, however, should be easily fixable with a final pass of proofreading.	

Selection of sources, citation correctness

A - excellent.

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

Relevant earlier work is cited adequately and referred to in the relevant places of the thesis. In Section 2, it could have been made somewhat clearer what the exact separation between existing and novel work is in the thesis, since this section simultaneously provides an overview of existing work on reversibility in the deterministic setting and introduces new notions in the non-deterministic setting (see also "Formal and Language Level" above). In general, I think that this is more an issue with the thesis' structure, since it is still clear what notions already exist and which ones are newly introduced.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

Overall, I think this is a nice thesis that introduces novel formal notions as well as a practical implementation and evaluation. This illustrates the student's ability both in the formal and practical settings.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

In this thesis, the author extends various notions of reversibility of actions proposed for the deterministic STRIPS planning setting to the world of non-deterministic planning. This is done methodically and the same notions that exist in the deterministic world are shown to hold (in an adequately adapted way) in the non-deterministic world as well. Algorithms to compute this are proposed, implemented, and tested on relevant benchmark instances.

I found that the thesis is generally nicely readable. It is also well-structured, although the structure does not make it clear which sections contain established results, and which sections contain new ones. In fact, several sections provide a mix, where established results are cited or recapitulated first, and then extended to the non-deterministic case. Still, it is never unclear which results already existed and which ones are new.

I also thought, while reading the thesis, that some examples would have made it more accessible. Maybe such examples can still be added for the final version.

Questions to the student:

- A) Do you already have some complexity results regarding the decidability of reversibility in the non-deterministic setting? What would it take to establish such results? Can you give any "trivial" upper bounds?
- B) What potential uses do you see for the Decision Scheme described in Section 3.5?

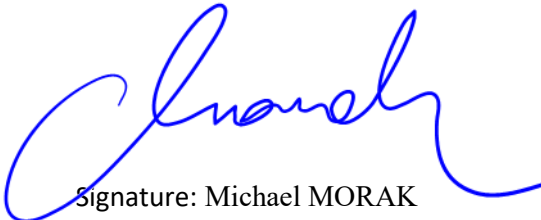
Minor comments:

- There are some grammatical issues present throughout the thesis, e.g. referring to named statements without a capital letter (it should be "Theorem 3.6", not "theorem 3.6"; also "Algorithm 2", or "Section

2”), or using articles where there should be none, like in “the action reversibility” when it should be just “action reversibility” without the article, or minor typos like “An experiments were performed” or “A [...] action are present”, or “fort” instead of “for”. I think this can be easily rectified with an additional pass of proof-reading.

- The captions in the list of figures should be capitalized

The grade that I recommend for the thesis is **A - excellent**.



Date: **16.6.2023**

Signature: Michael MORAK