

Invitation to Combinatorial Reconfiguration*

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1 Introduction

The first international workshop on Combinatorial Reconfiguration (CoRe 2015) will be held on February 18–20, 2015 in Sendai, Japan. This is the first workshop dedicated to the topic of “combinatorial reconfiguration.”

1.1 Reconfiguration problems

Reconfiguration problems arise when we wish to find a step-by-step transformation between two feasible solutions of a combinatorial problem such that all intermediate results are also feasible. For example, given two specified satisfying assignments A and B to a Boolean formula, one might ask whether A can be transformed into B by changing the assignment of one variable at a time such that each intermediate assignment is also satisfying [3]. Thus, a reconfiguration problem asks the “reachability” on the solution space (see Fig. 1), whereas the original problem asks the “existence” of at least one feasible solution.

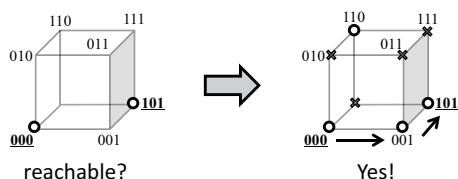


Fig. 1. The reconfiguration problem for SAT asking a “path” between two satisfying assignments 000 and 101.

1.2 Known results

The systematic study of a number of such reconfiguration problems was initiated by Ito et al. [4], and this reconfiguration framework has been applied to many central combinatorial problems in recent years. Some important examples are the reconfiguration problems of *vertex colorings* [1] or *independent sets* [2, 5, 6] in graphs.

Recently, more results on efficient algorithms are being obtained, whereas many of the early results were negative (hardness) results. The application of new complexity paradigms such as parameterized complexity has been fruitful recently [7, 8].

2 Our Results

The following is the main result of this abstract.

Theorem 1. *CoRe 2015 is fun, so worth to attend.*

To prove Theorem 1, we give the following lemma.

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Lemma 1. *Combinatorial reconfiguration is fun.*

Proof. The main challenge for solving reconfiguration problems efficiently is that the number of feasible solutions is usually exponential in the input size, so to obtain efficient search algorithms, one cannot simply enumerate them; smarter search methods are required. Indeed, for most reconfiguration problems, the reachability question is PSPACE-hard in general, although efficiently solvable cases can be identified. \square

In addition, we are planning to have the following two invited lectures, both of which are nice and hot themes in combinatorial reconfiguration.

- Paul Bonsma (Univ. of Twente): “Algorithmic techniques for reconfiguration problems”
- Naomi Nishimura (Univ. of Waterloo): “Parameterized complexity of reconfiguration problems”

3 Conclusion

Combinatorial reconfiguration is still a very young research topic, with many open questions, and lots of potential for growth. So, please join the CoRe 2015 workshop, and let’s start collaborations together! We are really looking forward to seeing you in Sendai.

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