Department of Mathematics

Honours Project Proposal

Supervisor's info :

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This project is suitable for: Individual only

Title : Coinductive Methods in Formal Language Theory

Subject Classification : [6. Mathematical Logic and Theory of Computation]

Using the following list, indicate the most appropriate classification for your project in the brackets above:

1. Algebra & Number Theory
2. Analysis
3. Approximation & Wavelets
4. Combinatorics & Graph Theory
5. Differential Equations & Numerical Analysis
6. Logic & Theory of Computation
7. Mathematical Physics
8. Operations Research
9. Probability & Statistics
10. Topology & Geometry
11. Miscellaneous

Description of the scope of the project: The purpose of this project is to reformulate (parts) of the classical theory of formula languages in terms of coinductive proof methods. As a motivation we consider the work by Antimirov who gave a coinductive proof method to decide language containment among regular expressions. We have already sketched how to extend Antimirov's method to the problem of deciding language containment among context-free grammars and regular expressions (a problem known to be decidable). It is important to formally verify that these claims are correct. This will be the main task of the project. Another interesting direction is to consider the problem of language containment among context-free grammars (a problem known to be undecidable in general). Our hope is that a coinductive proof method may lead to the discovery of decidable subclasses.

Level of difficulty:

[ ] Less Difficult [X] Moderately difficult [ ] Difficult

The supervisor's perspective of the level of difficulty in this project may not be the same as the students.

Student should clarify with the supervisor, if in doubt.

Expectations: The candidate should give an overview of the literature and state of the art in the field; furthermore, the proof-idea of the supervizors to decide the containment of context-free grammars in regular expressions should be formalized and completely worked out.

Prerequisites: Knowledge about formal languages, either from a lecture or from the book given in the references.

Relevant MA4000 modules / co-requisites: No MA4000 module required.

References:

Valentin M. Antimirov: Partial Derivatives of Regular Expressions and Finite Automaton Constructions. Theoretical Computer Science 155(2):291–319 (1996)

John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation. Addison-Wesley, 2001.