Logic Seminar (MSc) Summer 2023 **Prof. Dr. Martin Otto**

Selected Topics in Model Theory

The seminar pre-supposes some interest in the classical model theory of first-order logic, but is also explores specific directions towards non-classical themes and connections, e.g. with combinatorical issues and the model theory of finite structures. Devoted to a bunch of selected separate topics, the seminar should allow participants to choose and prepare a topic following individual preferences. The following is a preliminary collection of suggested themes.

- the Keisler–Shelah theorem on isomorphic ultrapowers (involving some infinitary set-theoretic combinatorics, otherwise 'pure' classical model theory)
- expressive completeness of positive existential FO for homomorphism preservation: Rossman's approach to the classical as well as the finite model theory version
- expressive completeness of existential FO for preservation under extensions: a restricted finite model theory variant due to Atserias–Dawar–Grohe (pure finite model theory)
- pebble games with counting in the study of the Sherali–Adams hierarchy for integer linear programming, based on papers by Atserias–Maneva and Grohe–Otto (finite model theory and combinatorics)
- Lindström theorems for interesting fragments of FO, based on papers by (among others) van Benthem, ten Cate and Väänänen (classical model theory for logics other than FO)

References

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[3] J. van Benthem, B. ten Cate, J. Väänänen. Lindström Theorems for Fragments of First-Order Logic. *Logical Methods in Computer Science*, vol. 5(3:3), 2009.

[4] P. Dittmann. Ultraproducts as a tool for first-order inexpressibility in the finite and infinite. Preprint, arXiv:1310.3137, 2013.

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[8] S. Shelah. Every two elementarily equivalent models have isomorphic ultrapowers *Israel J. Math.*, vol. 10, pp. 224–233, 1971.