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Fakultät für Mathematik

Berufungsvorträge
„Mathematische Logik mit Berücksichtigung der Grundlagen der Informatik“

Die Berufungsvorträge schließen folgende Punkte mit ein:

Didaktischer Vortrag (25 Minuten)
Fragen/Pause (10 Minuten)
Wissenschaftlicher Vortrag (45 Minuten)
Fragen/Pause (15 Minuten)
Kommissionelles Hearing -
(Dekanatsbesprechungszimmer, 11. Stock)

Montag, 8. Oktober 2018, Hörsaal 11

Prof. Alessandra Palmigiano
(Delft University of Technology)

14:30 Uhr: Didaktischer Vortrag
“Geometry on the phone”

If you went to school in the pre-smartphone era, you surely have fond recollections of many afternoons spent solving geometry exercises on the phone with your classmates. You had drawn your own picture, and could not see the one of your classmate, but somehow ideas got across all the same, even if you drew your picture with a blotchy pen and no ruler, and your classmate had a perfectly sharp pencil and a ruler. You have surely wondered how it was possible that the differences between the two pictures did not matter, and neither did it matter how accurate they were, as long as they were drawn "in the right way". And how could a certain fact that you discovered working on one particular picture of an isosceles triangle possibly hold for all isosceles triangles? In this lecture, these questions from your teenage years will be answered at long last, and the answer has less to do with geometry than with logic.

15:05 Uhr: Wissenschaftlicher Vortrag
“Logical foundations of categorization theory”

Categories are the most fundamental cognitive tools humans use to make sense of the world, and interact with it and with each other. They are key to the use of language, the construction of meaning, knowledge and identity, and the formation of agents' evaluations and decisions. While the literature on categorization is expanding rapidly in fields ranging from computational linguistics to social and management science to machine learning and data analysis, the various approaches to categorization are difficult to integrate and compare, and significant insights do not transfer smoothly, even within a single discipline. These same difficulties are present in the extant mathematical approaches to categorization. The main thrust of my present and future research is the creation of novel and unifying logical foundations of categorization theory that adequately capture the essentials of the emerging perspective on categorization: that categories are dynamic, and that their dynamism both results from and shapes processes of social interaction.
My methodology is grounded in three interconnected techniques in mathematical logic (unified correspondence, multi-type calculi, and updates on algebras) which I have introduced with my students and collaborators. These techniques bring together algebra, duality theory and proof theory in an innovative way, and used together, make it possible to unify the extant mathematical approaches to categorization, explicitly link them with logic, endow them with the formal machinery to account for the dynamic aspects of categorization, and create an overarching formal environment in which to analyze the dynamics of categories in connection with other relevant aspects of agency and social interaction. This line of research engages with a broad range of cross-disciplinary issues, both theoretical (context-dynamics, self-reinforcing processes, dynamic frame analysis, decision-making under uncertainty, collective decision-making) and real-life (bank runs, deliberation in committees), which will ensure that the new foundations of categorization theory are robust and general, while constantly challenging the limits of extant techniques in mathematical logic.

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Dienstag, 9. Oktober 2018, Seminarraum 11

Prof. Ana Sokolova
(Universität Salzburg)

9:00 Uhr: Didaktischer Vortrag

“Undecidability of First-Order Logic”

I will present the famous result of Turing on undecidability of validity (equivalently, satisfiability) of first-order logic (FOL) formulas, Hilbert's Entscheidungsproblem, via a reduction of the halting problem to unsatisfiability of a FOL formula. The method of proof and the results I will present are close to the original sources by Turing and Büchi. We may also briefly discuss connections to undecidability of FOL on the class of finite models, i.e., Trakhtenbrot's theorem.

9:35 Uhr: Wissenschaftlicher Vortrag

“Proper Semirings and Proper Convex Functors”

In this talk, I will present recent results on the semantics of probabilistic transition systems and convexity that enable proving completeness of axioms for trace equivalence of probabilistic transition systems. Our results show that certain semirings and convex functors are "proper". The notion of proper semiring was introduced by Esik and Maletti. They also proved that some important (classes of) semirings -- Noetherian semirings, natural numbers -- are proper. Properness matters as the equivalence problem for weighted automata over a semiring which is proper and finitely and effectively presented is decidable. Recently, Milius generalised the notion of properness from a semiring to a functor. As a consequence, a semiring is proper if and only if its associated "cubic functor" is proper. Moreover, properness of a functor renders soundness and completeness proofs for axiomatisations of equivalent behaviour. However, proving properness is difficult. In a joint work with Harald Woracek, we provide a method for proving properness of functors, and instantiate it to cover both the known cases and several novel ones: (1) properness of the semirings of positive rationals and positive reals, via properness of the corresponding cubic functors; and (2) properness of two functors on (positive) convex algebras. The latter functors are important for axiomatising trace equivalence of probabilistic transition systems. Our proofs rely on results that stretch all the way back to Hilbert and Minkowski.

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Mittwoch, 10. Oktober 2018, Seminarraum 8

Prof. Manuel Bodirsky
(Technische Universität Dresden)

9:00 Uhr: Didaktischer Vortrag
“Amalgamation Classes and Homogeneous Limit Structures”

This lecture is an introduction to Fraïssé theory. We will learn how to construct very symmetric infinite limit structures from classes of finite structures. These classes have to satisfy a strong combinatorial property: the amalgamation property. Many famous mathematical structures can be constructed in this way.

9:35 Uhr: Wissenschaftlicher Vortrag
“Model Theory of Constraint Satisfaction”

The constraint satisfaction problem (CSP) of a structure T is the computational problem of deciding whether a given conjunction of atomic formulas is satisfiable in T. Such problems are abundant in theoretical computer science. A very fruitful research direction is the classification of the computational complexity of the CSP of T depending on the structure T. Such a classification has been achieved in 2017 for the class all finite structures T. For infinite structures T, model theory is an essential tool to understand for which classes of structures T we can hope for complete complexity classifications. The questions that arise have multiple and deep links with many areas of mathematics, for example with Ramsey theory in combinatorics, topological dynamics, finite model theory, and universal algebra.

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Donnerstag, 11. Oktober 2018, Seminarraum 12

Prof. Grigor Sargsyan
(Rutgers University)

9:00 Uhr: Didaktischer Vortrag
“The pumping lemma for regular languages”

The pumping lemma for regular languages is a basic theorem in theoretical computer science concerning the regular languages. It essentially says that in regular languages words that have sufficiently long lengths have a middle part that can be repeated arbitrary many times to form new words.

9:35 Uhr: Wissenschaftlicher Vortrag
“Determinacy and Large Cardinals, an approach to Gödel's Program”

In set theory, Gödel's Program is the program of removing the incompleteness phenomenon by considering hierarchy of theories that have natural models, much like natural numbers have a canonical and minimal model, namely the set of natural numbers. Large Cardinal Axioms are axioms describing powerful properties of infinity that have a dramatic effect on "small" sets, such as sets of reals or even reals themselves. Gödel himself suggested these axioms as the axioms that will complete mathematics. On the other hand, determinacy of two player games of perfect information has emerged as the dominant principle deciding almost all classical questions about sets of reals. And therefore it is not an accident that there is an intimate connection between determinacy and large cardinals. In this talk, I will introduce Gödel's program more precisely, outline the connection between determinacy and large cardinals, and explain the current state of Gödel's program.