Δ_7-workshop on logic

23 September 2017

Schedule

All talks are held in Z201, Mechanical Engineering Building, Beijing Jiaotong University.

Time	Speakers	Titles
9:00–9:50	Mou Bo	Advanced metatheory in second-order logic
9:50–10:40	Yan Zhang	有穷深度的传递逻辑的可有穷公理化问题
10:40–11:00	Coffee Break	
11:00–11:50	Yongqi Sun	Finding Ramsey numbers with computational methods
12:00–14:00	Lunch Time	
14:00–14:50	Zhilin Wu	Decision procedures for separation logic with inductive definitions
14:50–15:40	Aleksander Ivanov	Soficity and hyperlinearity for metric groups
15:40–16:00	Tea Break	
16:00–16:50	Liang Yu	Analysis aspects of Ω operators

Advanced Metatheory in Second-order Logic

Mou Bo

Lanzhou University

There are two motives to talk about this topic: one from subsystems of second-order arithmetic, another from structuralism in philosophy of mathematics. In part 1, I will talk about the use of the set-theoretic hierarchy to provide the semantics of second-order languages. The plausibility of this depends on certain reflection principles, and we enter the realm of so-called "small large cardinals". In part 2, I will talk about the analogues of the Lowenheim-Skolem theorems, entering the domain of "large large cardinals". In part 3, I will show some views about the modal-structuralism in philosophy of mathematics.

有穷深度的传递逻辑的可有穷公理化问题

张炎

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这个报告讨论有穷深度的传递逻辑的可有穷公理化问题。我们证明有穷深度且有穷宽度的传递逻辑都是可有穷公理化的，但当宽度不受限制时，只有深度小于3的传递逻辑是都可有穷公理化的。

Finding Ramsey Numbers with Computational Methods

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Ramsey theory is often regarded as the study of how order emerges from randomness. The subject first concerned mathematical logic, but over the years it found its way into several areas of mathematics, computing, finance and other fields. In this

presentation, we will show how to study Ramsey numbers using computational methods. We describe concrete results on how to improve the lower bounds on multicolor Ramsey numbers for even cycles using factorizations and Latin squares. We determine the exact value of $R_4(C_4)$ by a large computation in which some techniques, such as relabeling the label of vertices and dynamic forecasting were used to enhance the efficiency for processing edge colorings. Finally, we introduce **nauty**, a soft- ware tool by McKay, which is used to detect whether two graphs are isomorphic.

Decision procedures for separation logic with inductive definitions

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Separation logic is an extension of first-order logic, proposed by Peter O' Hearn and John C. Reynolds around 2000, to verify programs manipulating dynamic memories (aka heaps). Since its introduction, separation logic has become a very popular approach for the analysis and verification of heap-manipulating programs, and many tools have been developed. Most of all these tools are based on the extension of separation logic with inductive definitions (SLID), since inductive definitions can represent abstractly and finitely dynamic data structures of unbounded size. A notable such tool is the INFER tool, which has been bought by Facebook and is now actively used in its development process. Because the decision problems of SLID are undecidable in general, many tools based on SLID only provide heuristics or incomplete decision procedures. Nevertheless, complete decision procedures are desirable to increase the precision and usability of these tools. Our ambition is to provide in the near future complete decision procedures for SLID, where both the shape properties and data constraints of dynamic data structures can be specified. In this talk, I will report our recent progress in this direction, in particular, the results published in CONCUR 2017 and CADE 2017 respectively.

Soficity and hyperlinearity for metric groups

Aleksander Ivanov

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Let us consider the class $\mathcal{G}$ of all continuous structures which are metric groups (G, d) with bi-invariant metrics $d \leq 1$. Let $\mathcal{G}_{sof} \subset \mathcal{G}$ be the subclass of all closed metric subgroups of metric ultraproducts of finite symmetric groups with Hamming metrics. We call metric groups from $\mathcal{G}_{sof}$ *sofic metric groups*. The class $\mathcal{G}_{w.sof}$ of weakly sofic continuous metric groups, consists of continuous metric groups (G, d) which embed into metric ultraproducts of finite metric groups with invariant metrics bounded by 1. In a similar way we define the classes $\mathcal{G}_{l.sof}$ and $\mathcal{G}_{hyplin}$ of continuous metric groups which are linear sofic and hyperlinear as metric groups.

We study relationship among the classes of the collection

$$\{\mathcal{G}, \mathcal{G}_{sof}, \mathcal{G}_{w.sof}, \mathcal{G}_{hyplin}, \mathcal{G}_{l.sof}\}.$$

All of them are axiomatizable in continuous logic. We show that the class $\mathcal{G}_{w.sof} \setminus (\mathcal{G}_{sof} \cup \mathcal{G}_{hyplin} \cup \mathcal{G}_{l.sof})$ is not empty. This together with recent results of Nikolov, Schneider and Thom substantially clarifies the situation.

We connect these questions with the topic of metric transformations of metric spaces (initiated by I.J.Schoenberg and W.A.Wilson in the 1930s).

I am going to present some concrete examples which are principal in our approach.

Analysis aspects of Ω operators

Liang Yu

National University of Singapore and Nanjing University

We prove that Ω operator is an almost everywhere differentiable, comeagerly non-differentiable, and nowhere monotone continuous function. We also investigate other analysis properties of Ω operators. This is joint work with Heidelberg logic team and its related people.