Titles and Abstracts

Tsinghua Logic Colloquium

May 17 2015 - on Logic, Modality and Proofs

09:00-09:50 **Hiroakira Ono** (Japan Advanced Institute of Science and Technology)
Finite model property, cut elimination and analytic cut

Kripke completeness and finite model property are basic semantical notions, while cut elimination, analytic cut property and subformula property are basic syntactic notions in proof theory of sequent systems. The aim of my talk is to show a unified approach to these notions, focusing on modal logics. My talk is mainly based on the idea of M. Takano. After giving a quick introduction to proof theory of sequent systems, we will show how these properties can be proved by a simple semantical method. In particular, we will discuss cut elimination for GS4 and analytic cut property of GS5 in details. They are sequent systems for S4 and S5, respectively, introduced by Ohnishi-Matsumoto (1957).

References

* M. Takano, Subformula property as a substitute for cut-elimination in modal propositional logics, Mathematica Japonica 37 (1992), pp.1192-1145.
* M. Takano, A modified subformula property for the modal logics K5 and K5D, Bulletin of the Section of Logic 30/2 (2001), pp.115-122.

10:10-11:00 **Ren-June Wang** (National Chung Cheng University)
Proof realization on modal logics

In this paper a complete proper subclass of Hilbert-style S4 proofs, named non-circular, will be determined. This study originates from an investigation into the formal connection between S4, as Logic of Provability and Logic of Knowledge, and Artemov's innovative Logic of Proofs, LP, which later developed into Logic of Justification. The main result concerning the formal connection is the realization theorem, which states that S4 theorems are precisely the formulas which can be converted to LP theorems with proper justificational objects substituting for modal knowledge operators. We extend this result by showing that on the proof level, non-circular proofs are exactly the class of S4 proofs which can be realized to LP proofs. In turn, this study provides an alternative algorithm to achieve the realization theorem, and, a logical system, called $\mathsf{S4}_{\triangle}$, is introduced, which, under an adequate interpretation, is worth studying for its own sake.

11:00-11:50 **Zhe Lin** (Sun Yat-sen University)
On the complexity of Lambek calculus extended with classical propositional logic

We analyze the complexity of the decision problem of BFNL (boolean nonas-sociative Lambek calculus). Our main results are that BFNL is PSPACE-complete. PSPACE-hardness of BFNL is obtained by a polynomial reduction from the modal logic K which is PSPACE-complete to BFNL. That BFNL is in PSPACE is shown by a polynomial reduction from BFNL to the bi-tense logic $\mathsf{K}.t_{1,2}$. We show that the bi-tense logic $\mathsf{K}.t_{1,2}$ is in PSACE by a polynomial reduction from it to the minimal tense logic $\mathsf{K}.t$ which is PSPACE-complete. The ternary frame semantics for BFNL is essentially used in our proof. Moreover this result also yields the PSPACE-completeness of DFNL.

14:00-14:50 **Jeremy Seligman** (The University of Auckland)
Boolean network games

Communication can be regarded as a game in which agents choose repeatedly between signals that are transmitted to other agents, with possibility varying objectives. A very simple example of this is the model of negotiation proposed and studied experimentally by Kearns, Suri and Montfort (2006). In this, agents get to choose repeatedly between "colours" with the objective of eventually being a different colour to each of their neighbours. We propose a framework for modelling communication in this way and draw some technical comparisons with existing work in computer science on iterated Boolean games (Gutierrez, Harrenstein, and Wooldridge, 2014).

∗ Joint work with Declan Thompson (Auckland)

14:50-15:40 **Qing Jia** (Chinese Academy of Social Sciences)
Ought to do and ought to be

In deontic logic, the operator "obligation" could be added before some event(s) or some action(s). That is why there are so many theories or logical systems analyzing what an agent ought to do and what it ought to be that the agent does respectively. In this paper, we will go further, and present a theory to explain why there exist such distinction by STIT theory which uses BST (branching space-times) as a foundation. Event could be formalized as a transition. Action could be formalized as a transition plus agency. Based on this connection and two STIT-style definitions for ought to do and ought to be respectively, we will present a simple theory for the connections between ought to do and ought to be and some applications of this theory in logic and philosophy.

16:00-16:50 **Yanjing Wang** (Peking University)
Beyond knowing that: non-standard epistemic logics

Standard epistemic logic focuses on propositional knowledge (in terms of "knowing that phi"). However, various forms of knowledge expressions are used in everyday life, which suggests non-standard but interesting new epistemic modalities. In this talk, I survey our recent line of work on modal logics based on "knowing whether", "knowing what", "knowing how", and "knowing why" operators. These new logics are not normal due to the lack of standard modal axioms and rules thus requiring new techniques to axiomatize. The focus is on the recent developments on logics of "knowing how" and "knowing why" which are closely related to dynamic logic and justification logic respectively.

16:50-17:40 **Junhua Yu** (Tsinghua University)
A tableau system for the "instantiable neighborhood modal logic"

In neighborhood semantics of modal logic, formula $\Box\psi$ says that the current state has a neighborhood (set of states) in which ψ holds everywhere. In van Benthem's "instantiable" neighborhood semantics, instead of $\Box\psi$, we have formulas like $\Box(\phi_1, ..., \phi_n; \psi)$ which means the current state has a neighborhood in which ψ holds everywhere and each of ϕ's holds somewhere. As expressive power strictly increases, a complete axiomatization is not trivial. After giving a tableau system, we show the equivalence between "axiomatically provable", "valid", and "has a closed tableau", thereby establish the completeness of an axiomatization for the "instantiable" semantics.

∗ This is a joint work with Johan van Benthem and Nick Bezhanishvili.