

Speaker: Ionuț Țuțu (joint work with Go Hashimoto and Daniel Găină)

Title: Forcing, Transition Algebras, and Calculi

Abstract: We bring forward a logical system of transition algebras that enhances many-sorted first-order logic using features from dynamic logics. The sentences we consider include compositions, unions, and transitive closures of transition relations, which are treated similarly to the actions used in dynamic logics in order to define necessity and possibility operators. This leads to a higher degree of expressivity than that of many-sorted first-order logic. For example, one can finitely axiomatize both the finiteness and the reachability of models, neither of which are ordinarily possible in many-sorted first-order logic. We introduce syntactic entailment and study basic properties such as compactness and completeness, showing that the latter does not hold when standard finitary proof rules are used. Consequently, we define proof rules having both finite and countably infinite premises, and we provide conditions under which completeness can be proved. To that end, we generalize the forcing method introduced in model theory by Robinson from a single signature to a category of signatures, and we apply it to obtain a completeness result for signatures that are at most countable.

Relevant paper: Go Hashimoto, Daniel Găină and Ionuț Țuțu, *Forcing, Transition Algebras, and Calculi*, In Proceedings of 51st EATCS International Colloquium on Automata, Languages and Programming (ICALP 2024), Tallinn, Estonia, 8-13 July 2024, <https://arxiv.org/abs/2404.16111>