Conference Proceedings

Ninth Annual Conference of the Iranian Association for Logic

Tehran, 19-20 January 2022

Ninth Annual Conference of the Iranian Association for Logic
"Executive Schedule"

Wednesday, 19 January

Morning Panel (Sessions Manager: Zia Movahhed)
10:00 - Opening (Speech by the IAL president)
10:15 - Description of the IAL election program and candidacy
10:30 - **Mehdi Azimi (Invited):** The concept of logic in Avicenna
11:30 - Short Break
12:00 - **Hassan Hamtaii:** Zalta à la Clark
12:30 - **Fateme Sadat Nabavi:** Preferential structures in deontic logic and nonmonotonic logic
13:00 - Long Break

Evening Panel (Sessions Manager: Saeed Salehi)
15:00 - **Mohammad Golshani:** Extensions of the Keisler-Shelah isomorphism theorem
15:30 - **Karim Khanaki:** New results in "pure" model theory
16:00 - **Seyyed Ahmad Mirsanei:** Non-standard completeness of first-order MTL's extension using the single-chain method
16:30 - **Melvin Fitting (Invited):** Why can't quantifier domains be empty?

Thursday, 20 January

Morning Panel (Sessions Manager: Morteza Moniri)
10:30 - **Shohreh Tabatabaei Seifi:** Translation of DRT discourse language into Z descriptive language
11:00 - **Nazanin Roshandel Tavana:** Complexity in computable analysis
11:30 - **Sara Negri (Invited):** Modal embeddings revisited proof-theoretically
12:30 - Long Break

Evening Panel (Sessions Manager: Mohammad Ardeshir)
14:30 - Presenting a report on the activities of the IAL in 2021
15:00 - **Amir Reza Shiralinasab:** Language of a Topos as a quotient of category of spans
15:30 - **Mark van Atten (Invited):** Intuitionistic induction
16:30 - Free discussion session with IAL board members

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The concept of logic in Avicenna

Mehdi Azimi (Invited Speaker)
Tehran University, Tehran, Iran

Abstract
This Speech is in Persian.

Presentation Time
Wednesday, 19 January 2022
10:30 (Tehran Time Zone)
07:00 (GMT)

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Zalta à la Clark

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Abstract

In order to affirm that the round square is round, Meinongians of the two-copula school (hereafter dicolpulists), should commit themselves to non-ordinary modes of predication (e.g. the encoding mode), as well as non-ordinary objects (the round square), and these are beside their commitment to ordinary objects and ordinary mode of predication (i.e. the exemplifying mode). Such an extra metaphysical burden, has been overwhelming enough to encourage many, even some Meinongians, to reduce encoding formulas to ordinary ones.

Here I list a family of such reductivist approaches in which encoding an ordinary property by an abstract object, reduces to exemplifying a non-ordinary property by an abstract object. Further members of the very family, have encoding an ordinary property by an abstract object reduced to exemplifying a special (two place) relation, by a pair of an abstract object and an ordinary property.

Reformulating these proposals into a unique form, I will show how they all lead to the Clark paradox, grounded in conjoining two otherwise innocent principles: unrestricted property abstraction and unrestricted object characterization.

Of all the ways out to cope with the paradox, those proposed by Meinongians are either to restrict the first principle, thus banning the possibility to abstract those properties and relations necessary for reduction to work, or to embrace dicopulism /multicopulism in one way or the other, which in turn contrasts the very idea of reduction. Non-Meinongian reductivists, on the other hand, simply miss the emergence of the paradox, in pain of inconsistency. This, I conclude, corroborate the idea that the encoding mode of predication, at least in its mature conception by Zalta, is not grounded in the ordinary exemplificational predication.

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Wednesday, 19 January 2022
12:00 (Tehran Time Zone)
08:30 (GMT)

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Preferential structures in deontic logic and nonmonotonic logic

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Abstract

Preferential semantics are firstly, applied by Hansson, in Deontic logic literature, for defining conditional obligation, His aim was preventing the Contrary-to-Duty paradox.

They are like the possible-worlds semantics except checking the truth, in preferred worlds instead of whole possible worlds. O(A/B) (If A, then B is obligatory) is true in a Hanssonian Deontic Logic, If A is true in all preferred B-worlds.

In nonmonotonic logic literature, Craus and his coordinators applied preferential semantics as a special case of cumulative models. Pursuing Gabby's suggestion as studying nonmonotonic logics according to the positive axioms satisfied by their consequence relations, instead of describing them by negative property of nonmonotonicity, they examined a lot of candidated axioms and classified them in cumulative models as a unified framework. They introduced 5 class of logics, in this way. The first class, contained only the axioms suggested by Gabbay and the last was classical logic. Three others were systems between these two systems. They introduced a class of semantical models for each of them and showed the related soundness and completeness. The most important system among them was P, whose semantics was preferential models, which are very similar to Deontic preferential models.

After that, a lot of other semantical models introduced by some other researchers, which lead exactly in system P. The nonmonotonic consequence relation is showed by |~ (snake). A|~B is read as "if A, normally B". In a preferential model, A|~B is true iff in all minimal A-worlds, B is also true. In other words, B is true in the most normal A-worlds.

In this presentation, we introduce preferential semantics in both contexts, in short. Then we show by some examples, they are not capable to formalize some reasonings in both contexts.

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Extensions of the Keisler-Shelah isomorphism theorem

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Abstract
Ultraproducts arise naturally in model theory and many other areas of mathematics. Ultraproduct is a way to connect the notions of elementary equivalence and isomorphism. The Keisler-Shelah isomorphism theorem is one of the key results in this direction which states that under some conditions, two structures are elementary equivalent if and only if they have isomorphic ultrapowers.

We show some limitations on the size of the structures are needed, and indeed we show that Keisler's theorem is equivalent to the continuum hypothesis (CH). We do this by showing that if the continuum fails, then there are two dense linear orders without end points of size at most continuum (one of them can be taken to be (Q, <)) which have no isomorphic ultrapowers with respect to any ultrafilter on the natural numbers.

We also discuss some generalizations of Keisler-Shelah theorem in the absence of the continuum hypothesis. This is done by connecting the Keisler theorem to the cardinal invariant Cov(meagre). In particular we show that if the continuum has cofinality $\aleph_1$ and if Cov(meagre) is the continuum, then Keisler's theorem holds for models of size at most $\aleph_1$, which is optimal by our counterexample. Note that in the presence of CH, this becomes Keisler's theorem. The proof is done by a forcing argument!

We also discuss when the elementary equivalence between two ultraproducts leads to an isomorphism, and prove some consistency result in the absence of the continuum hypothesis. To do this, we first define the notion of an ultrapower problem which is essentially a sequence (M_{1n}, M_{2n}: $n<\omega$) of models in a fixed countable language, each model of size at most $\aleph_1$ with some extra properties. We find generic extensions in which CH fails and for any non-principal ultrafilter D on ω if the ultraproducts $\Pi_D M_{1n}$ and $\Pi_D M_{2n}$ are elementary equivalent, then they are isomorphic.

If time permits, we also discuss some further results in this directs, connecting our results to the Ax-Kochen isomorphism theorem.

The talk is based on joint work with Shelah.

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New results in “pure” model theory

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Abstract
Pure model theory is the core of the model theory, and its development is essential to new applications. In this paper, we generalize some results in pure model theory from stable, and NIP theories to arbitrary theories. We give new results on Morley sequences and generically stable types to arbitrary theories. We also generalize some results on Keisler’s measures to arbitrary theories.

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Non-standard completeness of first-order MTL's extension using single-chain method

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Abstract
One of the main problems in t-norm fuzzy logic's meta-theorems is that despite the strong completeness of BL's extensions such as Łukasiewicz (Ł), Gödel (G) and Product (Π) logics (i.e., Multi-valued, Gödel and Product standard algebras on [0,1] interval) in the propositional approach, in the first-order approach, given their standard chains and corresponding algebras, they aren't complete and strongly complete. One solution to this problem is that the first-order approaches of different fuzzy logics are complete and even strongly complete with respect to non-standard single chains. But despite the success of this method in proving the strong completeness of many fuzzy logics such as TM, NM, BL, SBL, Ł and their first-order extensions, G and its first-order extensions, Π and its first-order extensions, the n-contraction logics SBLn, and Every finite valued extension of BL (such as finite valued Łukasiewicz (Łn) and finite valued Gödel (Gn)), there are three open problems:
(1) Are MTL, IMTL, PMTL, WNM and their first-order extensions, (strongly) complete w.r.t. a single chain?;
(2) Although SMTL and SBL are strongly chain complete, Are SMTL∀ and SBL∀ also strongly completeness w.r.t. a single chain?; and
(3) does chain completeness entail strong chain completeness or not?
Answering these open problems and proving the completeness or incompleteness of these logics is the main purpose of this study, which will be achieved by some algebraic and meta-logical strategies.

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Why can't quantifier domains be empty?

Melvin Fitting (Invited Speaker)
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Abstract

The most ubiquitous formal logic, classical logic, is complete with respect to a semantics that disallows the empty domain, while at the same time everybody seems to have no difficulties dealing with an empty domain in practice. This is a curious problem: why do we almost universally assume that something exists as a matter of logic?

In the 1950's and 1960's, the empty domain was an issue of some (relatively minor) interest and axiomatizations were given for first-order logic allowing the empty domain. Vacuous quantifiers turned out to be an issue here, and two different, but quite natural intuitions for them exist when the empty domain is involved. Axiom systems appropriate for each of the intuitions were given. In the early 1970's, almost exactly 50 years ago, I published a tableau proof procedure for first-order logic allowing the empty domain. With tableaus, the differences between the two intuitions just mentioned directly and naturally motivate the rules for two tableau versions allowing the empty domain.

Quite recently I returned to this apparently minor backwater of logic, and found there was more to be said. The two intuitions for the behavior of vacuous quantification actually lead to two different behaviors for interpolation, something that today is considered one of the fundamental features that a logic might have. Very simply, one version has interpolation, the other does not.

I suggest that finally we have a pretty good reason for ruling out the empty domain for first-order logic. Cases whose behavior our intuitions differ on, with both being reasonable, lead to different results on matters of importance.

Finally I note that classical logic is not at all unique here. Similar issues arise for intuitionistic logic, relevance logics, modal logics, and so on. None of these have been formally considered. It might be interesting to see what happens.

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A translation of DRT discourse language to Z specification language

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Abstract

Several different formal languages have been used to represent the semantics of natural language sentences. We proposed another formalism to do so which is quite famous in the domain of programming language specification named Z schema language. We show that there is a neat translation from Discourse Representation Theory (DRT) to Z schemas. DRT or Discourse Representation Theory is a famous formal framework for Natural Language Semantics. Its main objective is to solve the problem of continuation in representation of a piece of discourse. In this representation, there is no explicit use of quantification symbols; instead, there are boxes which have two slots. The first slot is for introducing new discourse referents or variables and the second one is for the relations of those variables. The boxes can be inside each other and their position toward each other implicitly determine which variables are accessible from what boxes. The accessibility rules are designed somehow that the proper variables are always accessible for the later referential expressions. There is an elegant formal translation from DRT to First Order Logic. In the current paper, we put forward a formal translation from DRT to Z specification Language. Our translation shows that Z specification Language can be used in the domain of Natural Language Semantics.

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Complexity in Computable Analysis

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Abstract

Mathematical problems are expressed with the help of multi-valued functions $f :\subseteq X \rightrightarrows Y$ which are just relations $f :\subseteq X \times Y$. One can consider

$$\mathrm{dom}(f) = \{x \in X : f(x) \neq \emptyset\}$$

as the set of admissible instances x of the problem f and the corresponding set of function values $f(x) \subseteq Y$ as the set of possible results. In the case of single-valued f, we identify f(x) with the corresponding singleton. An example of mathematical problem is zero finding. Many problems in mathematics can be expressed in terms of solutions of equations of type $f(x) = 0$ with a continuous $f: X \to \mathbb{Q}$. A represented space (X, δ) is a set X together with a surjective partial function $\delta :\subseteq \mathbb{N}\mathbb{N} \to X$. A partial multi-function on $f :\subseteq X \rightrightarrows Y$ represented spaces is called problem. Define

$$f \sqsubseteq g : \Leftrightarrow \mathrm{dom}(g) \subseteq \mathrm{dom}(f), \forall x \in \mathrm{dom}(g)\ f(x) \subseteq g(x).$$

In this situation, we say f solves g. A problem f is called computable(continuous) if it has a computable (continuous) realizer. For two problems f and g and pairing functions <.,. >

1. $f \leq W\ g : \Leftrightarrow$ there are computable functions $H, K \subseteq \mathbb{N}\mathbb{N} \rightrightarrows \mathbb{N}\mathbb{N}$ such that for all $G \vdash g$, $H < id, GK > \vdash f$.
2. $f \leq sW\ g : \Leftrightarrow$ there are computable functions $H, K :\subseteq \mathbb{N}\mathbb{N} \rightrightarrows \mathbb{N}\mathbb{N}$ such that for all $G \vdash g$, $HGK \vdash f$.

The $\leq W$ and $\leq sW$ are pre-orders and we denote the corresponding equivalences by $\equiv W$ and $\equiv sW$. The equivalence classes induced by $\equiv W$ and $\equiv sW$ are called (strong)Weihrauch degrees. Many notions related to complexity can be defined here

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Modal embeddings revisited proof-theoretically

Sara Negri (Invited Speaker)
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Abstract
Motivated by the idea that intuitionism expresses a modal notion of provability, G odel de_ned in 1933 a translation of intuitionistic logic Int into the modal logic S4. He stated without proof the soundness of the translation and only conjectured its faithfulness. It took some years before McKinsey and Tarski proved the conjecture indirectly using algebraic semantics and completeness of S4 with respect to closure algebras and of intuitionistic logic with respect to Heyting algebras.
The result was later extended in various directions, most notably to embedding results for intermediate logics in modal logics between S4 and S5 by Dummett and Lemmon, and to the embeddings of Int into the provability logics GL and Grz of Godel-Lob and of Grzegorczyk. Unlike the proofs of soundness, the syntactical proofs of faithfulness of these embeddings are not entirely straightforward, as witnessed in section 9.2 of [3] for the relatively simple case of the embedding of Int into S4.
Our _rst step to establishing such faithfulness results consists in the formulation of a cut-free sequent system for the logic that is the target of the embedding. Secondly, we obtain a modular treatment by the use of labelled sequent calculi: di_erent logics are speci_ed by rules that are una_ected by the translations We thus get at the same time calculi with good structural and analytic properties and uniform syntactical proofs of embedding results [1, 2].
We shall detail the method for the embedding of intermediate logics into their modal companions and sketch the modi_cations needed to extend the result to the case of in_nitary logics [4].

References
[1] Dyckho, R. and S. Negri. Proof analysis in intermediate propositional logics. Archive for Mathematical Logic, vol. 51, pp. 71{92, 2012.
[2] Dyckho, R. and S. Negri. A cut-free sequent system for Grzegorczyk logic with an application to the Godel-McKinsey-Tarski embedding. Journal of Logic and Computation, vol. 26, pp. 169{187, 2016.
[3] Troelstra, A. and H. Schwichtenberg. Basic Proof Theory. 2nd ed, Cambridge, 2000.
[4] Tesi, M. and S. Negri. In_nitary modal logic and the G odel-McKinsey-Tarski embedding. Submitted.

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11:30 (Tehran Time Zone)
08:00 (GMT)

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Language of a topos as a quotient of category of spans

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Abstract
The category of spans and its quotients are used widely in categorical structures. It has more morphisms than the base category. This property can be used to construct new categories with various features. For a topos, we use its span category to introduce a new description of its internal language. We obtain a category which is cartesian closed and contains all variables and terms. Also, all of logical connectives are defined as morphisms of this category.

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Thursday, 20 January 2022
15:00 (Tehran Time Zone)
11:30 (GMT)

Intuitionistic induction

Mark van Atten (Invited Speaker)
Husserl Archive (CNRS/ENS), Paris, France

Abstract
In the intuitionistic tradition after Brouwer, one finds two different answers to the question what the evidence of the principle of induction consists in. In this talk, both will be presented in their historical context, and compared with a reconstruction of Brouwer's view. Finally, Brouwer's view thus reconstructed will be juxtaposed with Weyl's.

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