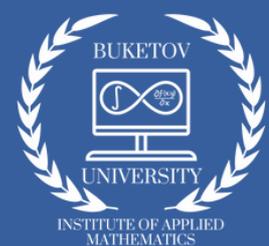# AP09260237 «The cosemantic classes and their classes of models»

RELEVANCE

Research in the field of model theory is one of the most relevant areas of modern mathematics. Using the capabilities of the first-order predicate calculus language, Model Theory studies the general patterns of models of arbitrary signatures.

On the other hand, many classical results of universal algebra direct connect with the model-theoretic description. For example, the description of such classes of models as varieties and quasivarieties depends on the types of axioms of the first-order language. As part of the research of this project, 7 specific mathematical problems were presented, as well as their combinations and their consequences. Solving these problems is definitely useful both from the point of view of Model Theory and from the point of view of universal algebra.
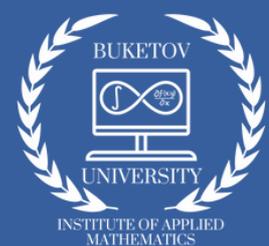
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PROJECT GOAL

The purpose of the project is to study the syntactic and semantic properties of model-theoretic questions concerning classes of Jonsson spectra concerning the cosemanticness relation.

EXPECTED AND ACCOMPLISHED RESULTS

1. A sufficient and necessary condition of class simplicity is obtained for a simple fragment of a theoretical set from a fixed JSp(K).
2. A description of the connection between the class of algebraically closed and existentially closed models for the cosemanticness class of a fixed JSp(K) is obtained.
3. A description of the JSB property for models of fragments of theoretical sets with respect to a fixed JSp(K) is obtained.
4. A description of the properties of an existentially closed models class for universal fragments of theoretical sets with respect to a fixed JSp(K) is obtained.
5. A description of the properties of countable and uncountable categoricity of fragments of theoretical sets for convex existentially simple cosemanticness classes from a fixed JSp(K) is obtained.
6. The invariant properties of the rheostat principle are described for small models of convex existentially simple perfect fragments of theoretical sets with respect to a fixed JSp(K).
7. A model-theoretic description of the algebraic properties of the lattice of existential formulas $En([Fr(X)])$ for a fixed JSp(K), where X is a theoretical set, is obtained.
8. A description of the properties of the algebra of classes of hereditary fixed JSp(K) is obtained.

EXPECTED AND ACCOMPLISHED RESULTS

The concept of the Jonsson spectrum of a class of models and all the results obtained related to this concept are new and form the following list within the framework of results 1)-8): some sufficient condition for the model completeness of the center of the Jonsson theory is found, which is relevant to the problem of λ-comparison of two existentially closed models; the criterion of uncountable categoricity for the class of the Robinson spectrum on the criterion of uncountable categoricity of the omega-categorical universal center of the class of the hereditary Jonsson theory in an inessential extension is obtained; criteria of Jonsson non-working (JNF) and Jonsson Lascar-Poizat non-working (JNFLP) are obtained; in the class of J-simple theories, a Jonsson version of the Kim-Pillay theorem is obtained for the class of the Jonsson spectrum of an arbitrary signature model.

A sufficient condition for the existential closure of an algebraically closed Jonsson variety is obtained; the Jonssonness and perfectness of the theories of differentially perfect and differentially closed fields are shown of a fixed characteristic and a sufficient condition is formulated for the theory of differential fields in the context of the property of being a Jonsson; the characterization of the Jonsson spectra of PM-theories of S-acts over a group with respect to cosemanticness is obtained using some invariants; the equivalence of atomic and simple models obtained using some closure operator given on definable subsets of the semantic model of some fixed cosemanticness class of the perfect Jonsson spectrum of a class of existentially closed models of some complete inductive theory is proved; the conditions are obtained under which the forcing companion of the Jonsson AP-theory retains its properties when expanding the theories under consideration by adding new predicate and constant symbols to the language; the theorem of the existence of a holographic structure in the class of models of the perfect Jonsson theory complete for $\forall\exists$-sentences is proved; the connection between the perfectness of the cosemanticness class from a fixed JSp(K) and the properties of the lattice En([D]); sufficient and necessary conditionns for the countable categoricity of the #-companion of the cosemanticness class of a fixed JSp(K) are obtained.

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THE NAMES OF THE MEMBERS OF THE RESEARCH GROUP WITH THEIR IDENTIFIERS (SCOPUS AUTHOR ID, RESEARCHER ID, ORCID, IF AVAILABLE, AND LINKS TO THE RELEVANT PROFILES

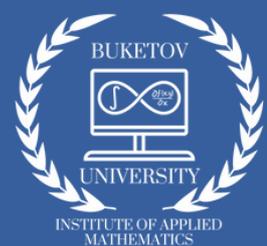|	
1.	**Yeshkeyev Aibat Rafhatuly** - Head of the topic, Doctor of Physical and Mathematical Sciences, Professor (Scopus Author ID: 35786898900, Researcher ID: U-6268-2018, ORCID: 0000-0003-0149-6143);
2.	**Ulbrikht Olga Ivanovna** - leading researcher, PhD (Scopus Author ID: 57193349139, Researcher ID: U-6228-2018, ORCID: 0000-0002-3340-2140);
3.	**Kassymetova Maira Tekhnikovna** - leading researcher, PhD (Scopus Author ID: 57204895696, Researcher ID: AAF-9387-2020, ORCID: 0000-0002-4659-0689);
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5.	**Mussina Nazerke Muhtaramkyzy** - research associate (Researcher ID: FMW-5992-2022);
6.	**Omarova Makhabat Toleuovna** - research associate (Researcher ID: DJT-5349-2022);
7.	**Issayeva Aigul Koishibaevna** - research associate (Researcher ID: CWS-5067-2022);
8.	**Popova Nadezhda Viktorovna** - research associate (Researcher ID: AAY-8746-2020);
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10.	**Yarullina Alina Rashidovna** - junior research assistant, doctoral student of the NPJSC "Karaganda Buketov University", specialty 8D05409201-Mathematics (Researcher ID: GGC-7878-2022).

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