Tárgynév:	**Algebraic logic**
Tárgykód:	**BMI-LOTD-325E.02**
Tárgyfelelős neve:	**Máté András Dr.**
Tárgy követelménye:	**gyakorlati jegy (5)**
Tárgy heti óraszáma:	**0/2/0**

Oktatás célja:

To show the algebraic side of logic.

Tantárgy tartalma:

n the course of the development of philosophical logic, there have been

developed a great number of various logical systems, e.g. propositional logic,

classical rst order logic and its variants (like nite-variable fragments of it

or its rank-free version), many versions of modal- and multimodal logic, to

mention just some of the most traditional systems. Starting from the 60-

s of the 20th century, the development of theoretical computer science also

brought about / brought to the light a huge number of further logical systems

(e.g. several versions of dynamic logic of programs, lambda calculus etc.).

After a while, it became apparent that, when checking some logical properties

of these logical systems (from now on \logics", for short), certain patterns

of ideas, concepts, proofs kept being repeated with only slight dierences.

It was time to develop appropriate abstract levels of the subject.

Several schools have been formed (like abstract model theory, the theory of

institutions and others).

Some of these schools beneted from using universal algebraic methods.

The most outstanding of these schools was led by Alfred Tarski. First they

concentrated on the algebraic counterpart of rst order logic, developing this

way the theories of cylindric-, polyadic- and relation algebras. These studies

Tantárgy tartalma:

naturally led to nding the algebraic counterparts of some other logics (e.g.

that of rst order logic with innitary conjunction, modal- and multi modal

logics). The theories of these classes of algebras can, and have been developed

in the way of developing just any class in abstract algebra (like group theory

or ring theory). Indeed, in Henkin-Monk-Tarski [1] the theory of cylindric

algebras has been built up in such a fashion. However, the logical motivation

can also be felt strongly, throughout the monograph.

Some researchers wished to make this feeling more explicit via concretely

describing and investigating the process of \turning logics into algebras"; and

concentrating on a two way connection between the \country" of LOGIC and

that of ALGEBRA.

The ambition here is to nd, via a general method or algorithm:

(1) the specic class(es) of algebras belonging to a given logic (e.g., to propositional

logic, this class is the class of Boolean algebras);

(2) the algebraic counterparts of concrete logical properties.

In this course we will look into this process of algebraization of logic. We

will concentrate more on the semantical aspects than the syntactical ones.

We will show / illustrate how to gain new knowledge in logic via algebraic

methods.

Thematic order of course:

1.   Introductory example: Propositional Logic.

2.   A general concept of logic. Examples.

3.   Further examples for logic.

4-5-6-7.

      Basics of universal algebra. The concept of an algebra, simple examples. Subalgebras, homomorphic images, congruences, direct products. Varieties and quasi-varieties.

8.   Refining our concept of a logic. Logical connectives, compositionality,

Tantárgy tartalma:

Iter property, syntactical substitution property, semantical substitution

property.

9. Working on examples.

10. Parametrized logical systems.

11. The algebraic counterparts of logics. Basic features and examples.

12. Hilbert type inference systems. Algebraic characterization of completeness of a logical system.

Számonkérési és értékelési rendszere:

Oral exam

Kötelező irodalom:

1. L. Henkin, J. D. Monk and A. Tarski: Cylindric Algebras Part I and Part II. North Holland, Amsterdam, 1971 and 1985.

2. H. Andréka, I. Németi and I. Sain: Algebraic Logic. In: D. M. Gabbay and F. Guenther, editors, Handbook of Phylosophical Logic Volume II, Second Edition, pages 133-247. Kluwer Academic Publishers, 2001.