Department of Algebra
Faculty of Mathematics and Physics, Charles University

Algebraic logic

Besides familiar two-valued classical logic, a wealth of non-classical logical systems with varied motivations exists: intuitionistic logic (constructive reasoning), fuzzy logics (truth comes in degrees), substructural logics (resource-sensitive reasoning), paraconsistent logics (reasoning with contradictory information), and more.

Algebraic logic is a branch of mathematical logic that studies such logical systems through their algebraic semantics: classical logic through Boolean algebras, intuitionistic logic through Heyting algebras, and so on. The metalogical properties of the logical system are then reflected in the algebraic properties of its associated semantics, by means of correspondence results known as bridge theorems. Algebraic logic thus harnesses the methods of universal algebra in the pursuit of logical goals.

The aim of the course is to get acquainted with some of the most important examples of non-classical logics, mainly modal and substructural logics, and to learn how to study them through their algebraic semantics. The core of the course will be an investigation of the characteristic properties of logical connectives (such as the deduction theorem for implication) through their algebraic counterparts.

Summary:

(1) Algebraic semantics and matrix semantics.
(2) The equivalent algebraic semantics of a logic.
(3) Examples: modal and substructural logics.
(4) Implication and the deduction theorem.
(5) Disjunction and the proof by cases property. The disjunction property.
(6) Negation and the inconsistency lemma. Semisimplicity and Glivenko translations.
(7) The Finite Model Property and the Finite Embeddability Property.

Prerequisites:

Familiarity with the very basic notions of universal algebra (such as: homomorphisms, subalgebras, congruences) will be assumed.

Lecturer:	Adam Přenosil (`prenosil@cs.cas.cz`) `https://sites.google.com/view/adamprenosil`
Course format:	1×90 min of teaching a week
Time and place:	Friday 10:40 – 12:10, Sokolovská 49/83, seminar room of the Dept. of Algebra (room KNM, 4th floor). **Lectures start on Oct 2nd.**
Link:	`https://is.cuni.cz/studium/predmety/index.php?do=predmet&kod=NMAL435&skr=2026&fak=11320`