About the Logic and Reasoning Institute
The Logic and Reasoning minor is an initiative of JMU’s Logic and Reasoning Institute (LRI), which sponsors and encourages logic-related coursework in departments across the university. The LRI promotes interdisciplinary research in logic, its application and its pedagogy, and emphasizes the philosophical foundations of logic and reasoning in and across disciplines.

Faculty
The minor in Logic and Reasoning fosters interdisciplinary cooperation among scholars in participating departments. The faculty members involved in the minor are:

Thomas Adajian, Department of Philosophy and Religion
Elizabeth Brown, Department of Mathematics and Statistics
Sharon Cote, Department of English (Linguistics)
Kethera Fogler, Department of Graduate Psychology
Christopher Fox, Department of Computer Science
Jeffrey Goodman, Department of Philosophy and Religion
Ralph Grove, Department of Computer Science
Brant Jones, Department of Mathematics and Statistics
William Knorpp, Department of Philosophy and Religion
Tracy Lupher, Department of Philosophy and Religion
Ramon Mata-Toledo, Department of Computer Science
Edwin O’Shea, Department of Mathematics and Statistics
Christopher Runyon, Department of Philosophy and Religion
Jim Sochaki, Department of Mathematics and Statistics
Nathan Sprague, Department of Computer Science
Laura Taalman, Department of Mathematics and Statistics
Logic and Reasoning Minor

The Logic and Reasoning Minor brings together several disciplines — philosophy, mathematics, computer science — that take logic as part of their subject matter, as well as part of their method. The minor emphasizes the core logical elements that are common across disciplines and shows how to apply these common logical concepts and tools in different domains. Graduate schools and employers seek candidates with above-average training in logic and reasoning. This minor supplies such training.

Requirements

The requirement for a minor in Logic and Reasoning is 18 to 19 credits with 12 to 13 credit hours from a set of core courses and 6 credit hours from electives.

Courses

Required Courses: Credit Hours

PHIL 250 Introduction to Symbolic Logic ........................................ 3 credits
Propositional and predicate logic are the building blocks of logic. This class focuses on them and provides a foundation for further study of logic.

PHIL 310 Intermediate Symbolic Logic ........................................... 3 credits
This course is an examination of logics beyond first-order predicate logic, selected properties of formal systems and philosophical issues in the foundations of logic. Topics may include the completeness of propositional and predicate logic, the nature of the consequence relation, higher order logic, the Löwenheim-Skolem theorem and/or the Gödel incompleteness theorems.

Choose either i or ii:

i. MATH 235 Calculus I ........................................... 4 credits
Differential and integral calculus of functions of one variable.

and

MATH 245 Discrete Mathematics ........................................... 3 credits
Logic, set theory, relations and functions, mathematical induction and equivalent forms, recurrence relations, and counting techniques.

ii. MATH/CS 227. Discrete Mathematics I .................................... 3 credits
Discrete mathematics is the mathematics of computing. Besides introducing logic and proofs, these courses cover counting and probability, functions and relations, and sets.

MATH/CS 228. Discrete Mathematics II .................................... 3 credits
A continuation of Math/CS 227.

Elective Courses: Choose at least two of the following:

CS 442. Logic in Computer Science ........................................ 3 credits
Logic can be used to verify programs. Programs can automate logic proofs. These and other connections between logic and computing are explored in this course.

CS 444. Artificial Intelligence ........................................ 3 credits (prerequisite CS 240)
This course surveys the history, goals, social impact, philosophical implications and techniques used to try to make computers intelligent. Logic has played a central role in this field since its inception.

MATH 424. Statistical Decision Theory .................................... 3 credits (prerequisite MATH 318)
This course surveys the development and use of probability and statistics for strategic decision making with applications. Topics include decision flow diagrams, analysis of risk and risk aversion, utility theory, Bayesian statistical methods, the economics of sampling, sensitivity analysis and collective decision making.

PHIL 315. Logic and Legal Reasoning .................................... 3 credits
This course examines legal writings of different kinds, all of which involve reasoning. Symbolic logic is an invaluable tool for the analysis of legal reasoning.

PHIL 320. Inductive Logic ........................................ 3 credits
This course surveys some of the tools and philosophical issues central to inductive logic. Topics may include the philosophical justification of induction, the probability calculus, philosophical theories of probability, issues in the foundations of statistical inference and expected utility theory.

PHIL 395. Philosophy and Scientific Inquiry .................................... 3 credits (prerequisite PHIL 101 or instructor permission)
This course surveys a number of arguments about the nature of science including the role of deductive logic in explanation and laws of nature as well as the nature of induction and confirmation.

PHIL 396. Philosophy of Physics ........................................ 3 credits (prerequisite PHIL 101)
This course examines arguments about the nature of space and time, special relativity, general relativity, quantum theory, classical mechanics, thermodynamics and/or cosmology. The role of paraconsistent logics in the analysis of time and motion examined as well as quantum logic.

PHIL 397. Philosophy of Space and Time .................................... 3 credits
This course surveys debates about the nature of space and time. Topics may include Zeno’s paradoxes, time travel, relationism vs. substantivalism, classical accounts of space and time, and relativistic spacetime. The role of paraconsistent logics in the analysis of time and motion is examined.

PHIL 398. Philosophy of Quantum Theory .................................... 3 credits
Quantum theory describes atoms and particles and is one of the most empirically successful physical theories. However, quantum theory seems to have revolutionary conceptual implications for metaphysics, epistemology and quantum logic. Some have argued that quantum physics shows that the laws of logic can be revised.

Total ........................................ 18–19 credits