

Logic and Computation, B.S.

The Major in Logic and Computation

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Overview

The Bachelor of Science in Logic and Computation curriculum is flexible in that it permits students to focus on any of a number of areas including (but not limited to):

- computer science,
- artificial intelligence and cognitive science,
- logic and the foundations of mathematics,
- methodology and philosophy of science.

Curriculum

The Logic and Computation major requires 13 courses and a senior thesis. Students in their first and sophomore year, are expected to complete the five courses in Introduction to Formal Systems, which include courses in mathematics, statistics, computer science and philosophy.

Students must then complete the Logic Core which includes 80-310 Formal Logic and 80-311 Undecidability and Incompleteness. These courses provide comprehensive background in logic, computability, and analytic philosophy. In addition students will take two courses in the Computer Science core which introduce students to imperative computation and functional programming.

Four advanced electives are chosen in the area of focus, as described below in the sample curricula, and should support independent research towards fulfilling the senior thesis requirement. In their senior year, **Primary and Additional Majors** in Logic and Computation will engage in original research under the supervision of a faculty advisor in 80-595 Senior Thesis (a workload equivalent of 12 units). Students are responsible for identifying a thesis topic and securing a faculty advisor prior to the start of the semester in which they plan to complete the thesis. Note: Students should work with the Senior Academic Program Manager during their junior year to begin the process of identifying their topic and potential advisors.

All courses, if taken at Carnegie Mellon University, must be taken for a letter grade and passed with a grade of "C" or above. Students may double count any course for the major with another major or minor. No more than two courses transferred from another institution may count towards the major requirements.

Core Courses

Introduction to Formal Systems	51 units
	Units
80-150 Nature of Reason	9
80-211 Logic and Mathematical Inquiry	9
or 80-210 Logic and Proofs	
36-200 Reasoning with Data	9
15-112 Fundamentals of Programming and Computer Science	12
21-127 Concepts of Mathematics	12
Logic Core	18 units
80-310 Formal Logic	9
*Students should complete before their junior year.	
80-311 Undecidability and Incompleteness	9
Computer Science Core	24 units
15-122 Principles of Imperative Computation	12
15-150 Principles of Functional Programming	12

80-595 Senior Thesis

The Senior Thesis is required of all primary and additional majors. This 12 unit thesis will be completed over the course of two semesters, the first and second semesters of a student's senior year. Typically, preliminary research begins in the fall semester of the senior year, and students complete the thesis in the spring.

Advanced Electives

Logic and Computation Electives 36 units

Bearing in mind prerequisites, Logic and Computation majors must complete **four advanced courses** in areas that use logical and computational tools, such as philosophy, computer science, linguistics, mathematical logic, psychology, or statistics. The sequence of courses, mostly at the *300-level and above, must be selected in consultation with the Senior Academic Program Manager.

Sample Curricula

Below are four samples of Logic and Computation curricula (beyond the core courses), each reflecting a different emphasis: Computer Science, Language and Information Technology, Artificial Intelligence and Cognitive Science, Logic and the Foundations of Mathematics, and Methodology.

Sample 1.

A student interested in **Computer Science** might take the following courses:

80-315	Logics for Knowledge and Belief	9
80-413	Category Theory	9
15-312	Foundations of Programming Languages	12
15-317	Constructive Logic	9

Sample 2.

A student interested in **Artificial Intelligence and Cognitive Science** might take the following courses:

80-249	AI, Society, and Humanity	9
80-315	Logics for Knowledge and Belief	9
80-325	Foundations of Causation and Machine Learning	9
80-411	Proof Theory	9
85-412	Cognitive Modeling	9

Note: If you are a Cognitive Science (<https://www.cmu.edu/dietrich/psychology/undergraduate/prospective-students/academics/cognitive-science/>) major (Department of Psychology) this additional major would complement your coursework.

Sample 3.

A student interested in **Logic and the Foundations of Mathematics** might consider the following courses:

80-254	The History of Analytic Philosophy and Its Influence	9
80-312	Mathematical Revolutions	9
80-411	Proof Theory	9
80-413	Category Theory	9

Sample 4.

A student interested in **Methodology** might consider the following courses:

80-220	Philosophy of Science	9
80-221	Philosophy of Social Science	9
36-309	Experimental Design for Behavioral & Social Sciences	9
80-305	Game Theory	9

Additional major in Logic and Computation

The Logic and Computation major is also suitable as an additional major for students within the University. The Philosophy Department does not limit the number of courses that can be counted for other majors and minors around the University. However additional majors must consult with their primary major advisor on which courses may be double counted with their program. In their senior year, the additional major in Logic and Computation will write a thesis under the supervision of a faculty advisor.