

# COMPUTER SCIENCE (MS)

The Master of Science in Computer Science provides a broad background in the practical and theoretical foundations of Computer Science appropriate for those interested in research or in advanced career opportunities.

The M.S. in Computer Science offers the following areas of specialization:

- No Concentration (Default)
- Artificial Intelligence
- Cybersecurity
- Computer Systems
- Thesis Track

## Related Programs

### Master's

- Information Technology (MS) (<https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/computer-science/information-technology-ms/>)
- Software Engineering (MS) (<https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/computer-science/software-engineering-ms/>)

## Curriculum

The Master of Science in Computer Science requires a total of 30 credit hours (typically 10 courses). To achieve depth and breadth, Computer Science students must complete the following to obtain the required 30 credits to graduate:

Code	Title	Hours
COMP 417	Social and Ethical Issues in Computing <sup>1</sup>	3
COMP 460	Algorithms & Complexity <sup>1</sup>	3
<b>Track/Major Requirements</b>		<b>12</b>
<i>No Concentration (Default)</i>		
Required Course		
COMP 413	Intermediate Object-Oriented Development	
Select three of the following:		
COMP 410	Operating Systems	
COMP 433	Web Services Programming	
COMP 436	Markup Languages	
COMP 439	Distributed Systems	
COMP 442	Server-Side Software Development	
COMP 443	Computer Networks	
COMP 453	Database Programming	
COMP 464	High-Performance Computing	
COMP 471	Theory of Programming Languages	
COMP 473	Advanced Object Oriented Programming	
COMP 474	Software Engineering	
<i>Artificial Intelligence</i> <sup>2</sup>		
Required Course		
COMP 479	Machine Learning	
Select one of the following:		
COMP 429	Natural Language Processing	

COMP 487	Deep Learning	
COMP 488	Computer Science Topics <sup>3</sup>	
Select two of the following:		
COMP 406	Data Mining	
COMP 429	Natural Language Processing	
COMP 458	Big Data Analytics	
COMP 487	Deep Learning	
COMP 488	Computer Science Topics	
<i>Cybersecurity</i> <sup>2</sup>		
Required Course		
COMP 401	Computer Security	
Select three of the following:		
COMP 431	Cryptography	
COMP 440	Computer Forensics Investigations	
COMP 445	Internet of Things Device and Application Security	
COMP 447	Intrusion Detection and Computer Forensics	
COMP 448	Network Security	
COMP 449	Wireless Networking and Security	
COMP 452	Introduction to Computer Vulnerabilities	
COMP 488	Computer Science Topics <sup>3</sup>	
<i>Computer Systems</i> <sup>2</sup>		
Required Course		
COMP 410	Operating Systems	
Select three of the following:		
COMP 405	Database Administration	
COMP 413	Intermediate Object-Oriented Development	
COMP 439	Distributed Systems	
COMP 443	Computer Networks	
COMP 451	Enterprise Networking	
COMP 462	Advanced Computer Architecture	
COMP 464	High-Performance Computing	
COMP 472	Compiler Construction	
General Elective Courses		12
<b>Total Hours</b>		<b>30</b>

<sup>1</sup> Either required course above can be substituted with another graduate course under the discretion of Graduate Program Director if students had their equivalent in their undergraduate program.

<sup>2</sup> Students may petition the Graduate Program Director to substitute COMP 460 with a fifth course from this list.

<sup>3</sup> COMP 488 counts as an AI restricted elective only if the GPD determines that the course in question is related to Machine Learning. Similarly, COMP 488 counts as a Cybersecurity restricted elective only if the GPD determines that the course is related to Cybersecurity.

## Prerequisite/Preparation Courses

All of these courses must be taken if you do not have a four-year undergraduate degree in a related field, and will not be counted towards the MS degree requirements.

Code	Title	Hours
COMP 400A	Object-Oriented Programming	3
COMP 400B	Data Structures I	3
COMP 400C	Data Structures II	3

COMP 400D	Computing Tools and Techniques	1
COMP 400E	Discrete Structures	3

For students who have taken Computer Science coursework at Loyola: many 400-level courses in the department are cross-listed with 300-level analogues (e.g. COMP 443 Computer Networks and COMP 343 Computer Networks). Students who enter the MS program after taking a Loyola course in this category must choose to take 400-level courses that are not cross-listed with any 300-level courses taken earlier, unless granted specific permission by the Graduate Program Director. Students may not use an introductory course to satisfy a foundation or elective requirement.

Preparatory courses do not count towards the 30 required credit hours of non-preparatory courses.

A student taking any necessary preparation course is considered to be a full-fledged student of the Graduate School. Preparation courses may be taken in the same semester as other graduate courses, provided the prerequisites for the other graduate courses are met. Students are expected, however, to take all necessary preparation courses early in their career.

A student may place out of an introductory course under any of the following conditions:

- The student has appropriate coursework equivalent to the introductory course.
- The student has appropriate and verified professional experience equivalent to the introductory course.
- The student passes a Graduate Competency Assessment (GCA) in the introductory course area.
- This can be waived with discretion of the GPD.

If a student has had a preparatory course waived, departmental assistance will usually be necessary to allow the student to register for any other course having that preparatory course as a prerequisite.

## General Electives

General electives can be any COMP 400 (<https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/computer-science/#coursestext>)-level class, except the preparation courses listed above.

The elective course options are common for all programs, differing only in the total number of credits required. There are numerous options for independent study, including a programming project, research, or a service-oriented project. Students may take up to a maximum of 6 credit hours of COMP 490 Independent Project and/or COMP 499 Internship to fulfill electives.

## Thesis Tracks

MS in Computer Science students may elect to craft a master's thesis. Course work is strongly recommended over the thesis option, especially for those not planning on a research-oriented career. Many students pursuing the thesis option would be considering a PhD program.

Students wishing to do a thesis should discuss this option as early as possible with the Graduate Program Director. These may involve research in purely theoretical computer science (for example, development or analysis of algorithms), the development of a software package, or instrumentation, measurement, and analysis of existing systems (for example, studying network performance). Because of this wide range,

there is no one formal course in research methods. Courses in the electives list contain a significant component of area-specific integrated research methods material. Students interested in writing a thesis are strongly urged to seek advising as early as possible as to which electives will be the most appropriate for the student's proposed area of research.

1. Identify a faculty advisor and select a tentative topic or area of research. The existing program allows you to take up to 6.0 hours of COMP 490 Independent Project. You will typically begin your research program in such a course, though you may also identify an advisor and select a tentative topic as part of a conventional classroom.
2. Secure permission to pursue the thesis option from the Graduate Program Director. The Graduate Program Director, in consultation with you and your chosen advisor, recommends a thesis committee to the Graduate School. The committee will consist of at least three faculty members; normally the committee director will be the advisor.
3. Once required courses are concluded and a thesis committee is approved, you maintain full-time status by enrolling in the zero-credit-hour COMP 605 Master of Science Study or COMP 595 Thesis Supervision.
4. You will then prepare a formal research proposal, in consultation with your advisor. This proposal must be submitted to your committee for review. Any research involving human subjects will require IRB approval or exemption *before* the Graduate School approves your proposal. After this step you are now ready to "conduct research" for the project.
5. Upon completion of your thesis, you will be required to formally defend your research. Schedule this with your committee. Your thesis should be in nearly final form. Typically you should give the committee three weeks to read the final draft of the thesis before the defense date. Once approved by your committee, the GPD will submit the ballot for Graduate School approval and the student will submit their thesis for publication in the university eCommons.

## Suggested Sequence of Courses

This sequence assumes starting in Fall and taking one Internship in the following Summer.

Course	Title	Hours
<b>Year 1</b>		
<b>Fall</b>		
COMP 413	Intermediate Object-Oriented Development	3
COMP 417	Social and Ethical Issues in Computing	3
Elective 1		3
<b>Hours</b>		<b>9</b>
<b>Spring</b>		
COMP 460	Algorithms & Complexity	3
Restricted Elective 1		3
Restricted Elective 2		3
<b>Hours</b>		<b>9</b>
<b>Summer</b>		
COMP 499	Internship	3
<b>Hours</b>		<b>3</b>
<b>Year 2</b>		
<b>Fall</b>		
Restricted Elective 3		3

Elective 2	3
Elective 3	3
<b>Hours</b>	<b>9</b>
<b>Total Hours</b>	<b>30</b>

## STEM Designation

With a national shortage of professionals trained in STEM-related fields, employers are actively pursuing STEM degree holders. Distinguish yourself in technology with a STEM-designated degree.

Loyola's master's degree programs in Computer Science have been granted a STEM designation from the U.S. Department of Homeland Security. The program achieved STEM designation because of its emphasis on teaching students how to solve computer science problems with a suite of quantitative and technological tools.

Under this STEM classification, international students can extend their training in the U.S. by working in their field of study. Students can qualify for a 24-month OPT (Optional Practical Training) Extension, bringing the total OPT time granted to 36 months.

## Responsible Conduct of Research

All PhD students and students in thesis-based Master's degree programs must successfully complete UNIV 370 Responsible Conduct in Research and Scholarship or other approved coursework in responsible conduct of research as part of the degree requirements. It is strongly recommended that students complete this two-day training before beginning the dissertation/thesis stage of the program.

## Graduate & Professional Standards and Regulations

Students in graduate and professional programs can find their Academic Policies in Graduate and Professional Academic Standards and Regulations (<https://catalog.luc.edu/academic-standards-regulations/graduate-professional/>) under their school. Any additional University Policies supersede school policies.

## Learning Outcomes

- Students will gain a broad background in the practical and theoretical foundations of Computer Science.
- Students in a specific concentration will gain mastery in that area, which students who pursue the thesis option will gain deep expertise in their research area.