DATA SCIENCE (BS/MS)

The Accelerated Bachelor's Master's program in Data Science allows undergraduate students to receive their Master's Degree in a total of five years. Students apply in their junior year and must complete all requirements for the undergraduate and graduate Data Science Programs. They are able to finish the program in only one additional year by double counting 9 credits in their senior year towards both their Undergraduate Degree and their Master's Degree.

CURRICULUM

B.S./M.S. Requirements

Code	Title	Hours
Required B.S. Courses		
Math Requirements		
MATH 161	Calculus I	4
MATH 162	Calculus II	4
MATH 212	Linear Algebra	3
Statistics Requirements		
STAT 203	Introduction to Probability & Statistics	3
STAT 308	Applied Regression Analysis	3
STAT 410	Categorical Data Analysis [1]	3
Any STAT 300-level Course		6
Computer Science Requirements		
COMP 141	Introduction to Computing Tools and Techniques	3
COMP 215 / MATH 215	Object Oriented Programming with Mathematics	3
COMP 231	Data Structures & Algorithms for Informatics	3
COMP 353	Database Programming	3
Any COMP 300-level course		6
Data Science Core		
DSCI 101	Fundamentals of Modern Data Science with R	3
COMP 479	Machine Learning [1]	3
or STAT 438	Introduction to Predictive Analytics	
COMP 317	Social, Legal, and Ethical Issues in Computing	3
COMP 458	Big Data Analytics [1]	3
STAT 370	Data Science Consulting	3
Required M.S. Courses		
M.S. Non-Thesis Requirements		
COMP 453	Database Programming	3
COMP 458	Big Data Analytics [1]	3
COMP 479	Machine Learning [1]	3
or STAT 438	Introduction to Predictive Analytics	
DSCI 401	Introduction to Data Science	4
DSCI 470	Data Science Consulting	2
STAT 410	Categorical Data Analysis [1]	3
Any STAT 400-level Course		6
Any COMP 400-level Class		3
Any STAT or COMP 400-level Course		3
M.S. Thesis Track Requirements		
COMP 453	Database Programming	3
COMP 458	Big Data Analytics [1]	3
COMP 479	Machine Learning [1]	3
or STAT 438	Introduction to Predictive Analytics	
DSCI 401	Introduction to Data Science	4
DSCI 494	Data Science Research Design	2
DSCI 499	Data Science Research	8
DSCI 595	Thesis Supervision	1
STAT 410	Categorical Data Analysis [1]	3
Any STAT 400-level Course		3

[1] This course counts toward requirements for both the B.S. and M.S.

Electives

The list of electives is divided into primary and secondary electives. Primary electives are recommended classes to all data science students. Secondary electives are courses that may be a good fit for students with a specific area of emphasis. Students need to coordinate with the Graduate Program Director if they plan to take a secondary elective.

Code	Title	Hours
Primary COMP Electives		
COMP 406	Data Mining	3
COMP 429	Natural Language Processing	3
COMP 484	Artificial Intelligence	3
COMP 487	Deep Learning	3
COMP 488	Computer Science Topics (If the topic is relevant to data science. Example: Topics in Computer Vision)	1-4
Primary STAT electives		
STAT 411	Applied Survival Analysis	3
STAT 421	Math Modeling & Simulation	3
or COMP 421	Math Models & Simulation	
STAT 451	Applied Nonparametric Methods	3
STAT 444	Longitudinal Data Analysis and Mixed Modeling	3
STAT 488	Topics in Statistics (If the topic is relevant to data science. Examples: Multivariate Statistics, Bayesian Statistics)	1-3
Secondary COMP electives		
COMP 436	Markup Languages	3
COMP 441	Human-Computer Interaction	3
COMP 460	Algorithms & Complexity	3
COMP 405	Database Administration	3
COMP 412	Open Source Computing	3
COMP 413	Intermediate Object-Oriented Development	3
COMP 418	Combinatorial Mathematics	3
COMP 424	Client-Side Web Design	3
COMP 474	Software Engineering	3
COMP 422	Software Development for Wireless and Mobile Devices	3
COMP 417	Social and Ethical Issues in Computing	3
COMP 490	Independent Project	1-6
COMP 499	Internship	1-6
COMP 477	IT Project Management	3
Secondary STAT electives		
STAT 403	SAS Program & Applied Statistics	3
STAT 407	Statistical Design	3
STAT 404	Probability & Statistics I	3

Course	Title	Hours
STAT 405	Probability & Statistics II	3
STAT 498	Independent Study Statistics	1-6

Suggested Sequence of Courses
Non-Thesis Track Suggested Schedule of Courses
The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection.

Course	Title	Hours
Year 1		
Fall		
DSCI 101	Fundamentals of Modern Data Science with R	3
MATH 161	Calculus I	4
	Hours	**7**
Spring		
MATH 162	Calculus II	4
COMP 141	Introduction to Computing Tools and Techniques	3
	Hours	**7**
Year 2		
Fall		
MATH 212	Linear Algebra	3
MATH 215	Object-Oriented Programming with Mathematics	3
	Hours	**6**
Spring		
COMP 231	Data Structures & Algorithms for Informatics	3
STAT 203	Introduction to Probability & Statistics	3
	Hours	**6**
Year 3		
Fall		
STAT 308	Applied Regression Analysis	3
COMP 353	Database Programming	3
	Hours	**6**
Spring		
COMP 300-Level Course		3
STAT 300-Level Course		3
COMP 317	Social, Legal, and Ethical Issues in Computing	3
	Hours	**9**
Year 4		
Fall		
COMP 479 or STAT 438	Machine Learning or Introduction to Predictive Analytics	3
STAT 300-Level Course		3
COMP 300-Level Course		3
	Hours	**9**
Spring		
COMP 458	Big Data Analytics	3
STAT 410	Categorical Data Analysis	3
STAT 370	Data Science Consulting	3
	Hours	**9**
Year 5		
Fall		
DSCI 401	Introduction to Data Science	4
DSCI 470	Data Science Consulting	2
STAT 400-Level Course		3
COMP 400-level Course	Substitutes COMP 453 as COMP 353 was taken in Y3	3
	Hours	**12**
Spring		
STAT 400-Level Course		3
COMP 400-Level Course		3
STAT or COMP 400-Level Course		3
	Hours	**9**
	Total Hours	**80**

Thesis Track Suggested Schedule of Courses
The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection.

Course	Title	Hours
Year 1		
Fall		
DSCI 101	Fundamentals of Modern Data Science with R	3
MATH 161	Calculus I	4
	Hours	**7**
Spring		
MATH 162	Calculus II	4
COMP 141	Introduction to Computing Tools and Techniques	3
	Hours	**7**
Year 2		
Fall		
MATH 212	Linear Algebra	3
MATH 215	Object-Oriented Programming with Mathematics	3
	Hours	**6**
Spring		
COMP 231	Data Structures & Algorithms for Informatics	3
STAT 203	Introduction to Probability & Statistics	3
	Hours	**6**
Year 3		
Fall		
STAT 308	Applied Regression Analysis	3
COMP 353	Database Programming	3
	Hours	**6**

Spring

COMP 300-Level Course		3
STAT 300-Level Course		3
COMP 317	Social, Legal, and Ethical Issues in Computing	3
	Hours	**9**

Year 4

Fall

COMP 479 or STAT 438	Machine Learning or Introduction to Predictive Analytics	3
STAT 300-Level Course		3
COMP 300-Level Course		3
	Hours	**9**

Spring

COMP 458	Big Data Analytics	3
STAT 410	Categorical Data Analysis	3
STAT 370	Data Science Consulting	3
	Hours	**9**

Year 5

Fall

DSCI 401	Introduction to Data Science	4
DSCI 494	Data Science Research Design	2
STAT 400-Level Course		3
COMP 400-Level Course Substitutes COMP 453 as COMP 353 was taken in Y3		3
	Hours	**12**

Spring

DSCI 499	Data Science Research	8
DSCI 595	Thesis Supervision	1
	Hours	**9**
	Total Hours	**80**

Guidelines for Accelerated Bachelor's/ Master's Programs

Terms

- Accelerated Bachelor's/Master's programs: In this type of program, students share limited credits between their undergraduate and graduate degrees to facilitate completion of both degrees.
- Shared credits: Graduate level credit hours taken during the undergraduate program and then applied towards graduate program requirements will be referred to as shared credits.

Admission Requirements

Accelerated Bachelor's/Master's programs are designed to enhance opportunities for advanced training for Loyola's undergraduates. Admission to these programs must be competitive and will depend upon a positive review of credentials by the program's admissions committee. Accordingly, the admission requirements for these programs may be higher than those required if the master's degree were pursued entirely after the receipt of a bachelor's degree. That is, programs may choose to have more stringent admissions requirements in addition to those minimal requirements below.

Requirements:

- Declared appropriate undergraduate major,
- By the time students begin taking graduate courses as an undergraduate, the student has completed approximately 90 credit hours, or the credit hours required in a program that is accredited by a specialty organization,[1]
- A minimum cumulative GPA for coursework at Loyola that is at or above the program-specific requirements, a minimum major GPA that is at or above the program-specific requirements, and/or appropriate designated coursework for evaluation of student readiness in their discipline.[2]

Students not eligible for the Accelerated Bachelor's/Master's program (e.g., students who have not declared the appropriate undergraduate major) may apply to the master's program through the regular admissions process. Students enrolled in an Accelerated Bachelor's/Master's program who choose not to continue to the master's degree program upon completion of the bachelor's degree will face no consequences.[3]

Ideally, a student will apply for admission (or confirm interest in proceeding towards the graduate degree in opt-out programs) as they approach 90 credit hours. Programs are encouraged to begin advising students early in their major so that they are aware of the program and, if interested, can complete their bachelor's degree requirements in a way that facilitates completion of the program. Once admitted as an undergraduate, Program Directors should ensure that students are enrolled using the plan code associated with the Accelerated Bachelor's/ Master's program. Using the plan code associated with the Accelerated Bachelor's/Master's program will ensure that students may be easily identified as they move through the program. Students will not officially matriculate into the master's degree program and be labeled as a graduate student by the university, with accompanying changes to tuition and Financial Aid (see below), until the undergraduate degree has been awarded. Once admitted to the graduate program, students must meet the academic standing requirements of their graduate program as they complete the program curriculum.

[1] Programs that have specialized accreditation will adhere to the admissions criteria provided by, or approved by, their specialized accreditors.

[2] The program will identify appropriate indicators of student readiness for graduate coursework (e.g., high-level performance in 300 level courses). Recognizing differences between how majors are designed, we do not specify a blanket requirement.

[3] If students choose not to enroll in the Accelerated Bachelor's/Master's program, they still must complete all of the standard requirements associated with the undergraduate degree (e.g., a capstone).

For more information on Admissions requirements, visit here (https:// gpem.luc.edu/portal/admission/?tab=home).

Curriculum

Level and progression of courses. The Accelerated Bachelor's/Master's programs are designed to be competitive and attractive to our most capable students. Students admitted to Accelerated Bachelor's/ Master's programs should be capable of meeting graduate level learning outcomes. Following guidance from the Higher Learning Commission, only courses taken at the 400 level or higher (including 300/400 level courses taken at the 400 level) will count toward the graduate program.[1,2] Up to 50% of the total graduate level credit hours, required in the graduate program, may come from 300/400 level courses where the student is enrolled in the 400 level of the course. Further, at least 50% of the credit hours for the graduate program must come from courses

that are designed for and restricted to graduate students who have been admitted to a graduate program at Loyola (e.g., enrolled in plan code that indicates the Accelerated Bachelor's/Master's program, typically ending with the letter "D").[3]

In general, graduate level coursework should not be taken prior to admission into the Accelerated Bachelor's/Master's program. Exceptions may be granted for professional programs where curriculum for the Accelerated Bachelor's/Master's program is designed to begin earlier. On the recommendation of the program's Graduate Director, students may take one of their graduate level courses before they are admitted to the Accelerated Bachelors/Master's program if they have advanced abilities in their discipline and course offerings warrant such an exception.[4] Undergraduate degree requirements outside of the major are in no way impacted by admission to an Accelerated Bachelor's/Master's program.[5]

Shared credits. Undergraduate courses (i.e., courses offered at the 300 level or below) cannot be counted as shared credits nor count towards the master's degree. Up to 50% of the total graduate level credit hours, required in the graduate program, may be counted in meeting both the undergraduate and graduate degree requirements. Of those shared credits, students in an Accelerated Bachelor's/Master's program should begin their graduate program with the standard introductory course(s) for the program whenever possible. So that students may progress through the Accelerated Bachelor's/Master's program in a timely manner, undergraduate programs are encouraged to design their curriculum such that a student can complete some required graduate credit hours while completing the undergraduate degree. For instance, some of the graduate curriculum should also satisfy electives for the undergraduate major.

The program's Graduate Director will designate credit hours to be shared through the advising form and master's degree conferral review process. Shared credit hours will not be marked on the undergraduate record as having a special status in the undergraduate program. They will be included in the student's undergraduate earned hours and GPA. Graduate credit hours taken during the undergraduate program will not be included in the graduate GPA calculation.

[1] If students wish to transfer credits from another university to Loyola University Chicago, the program's Graduate director will review the relevant syllabus(es) to determine whether it meets the criteria for a 400 level course or higher.

[2] Programs with specialized accreditation requirements that allow programs to offer graduate curriculum to undergraduate students will conform to those specialized accreditation requirements.

[3] In rare cases, the Graduate Director may authorize enrollment in a 400-level course for a highly qualified and highly motivated undergraduate, ensuring that the undergraduate's exceptional participation in the graduate class will not diminish in any way the experience of the graduate students regularly enrolled.

[4] For example, if a particular course is only offered once every 2-3 years, and a student has demonstrated the necessary ability to be successful, the Graduate Director may allow a student to take a graduate level course to be shared prior to the student being formally admitted to the graduate program. See, also, footnote 3.

[5] Students should not, for example, attempt to negotiate themselves out of a writing intensive requirement on the basis of admission to a graduate program.

Graduation

Degrees are awarded sequentially. All details of undergraduate commencement are handled in the ordinary way as for all students in the School/College/Institute. Once in the graduate program, students abide by the graduation deadlines set forth by the graduate program. Students in these programs must be continuously enrolled from undergraduate to graduate degree program unless given explicit permission by their program for a gap year or approved leave of absence.

LEARNING OUTCOMES

1. The ability to manage large data sets in preparation for data science analysis.
2. A working knowledge of statistical techniques and computer algorithms, and the ability to apply these methods to a wide array of real-world problems.
3. The ability to perform a data science analysis from beginning to end while adhering to the principles of reproducible and ethical research.
4. The ability to program in both the R and Python programming languages.
5. Complete a project demonstrating competence in the field of data science.
   1. Non-thesis track: Students will be required to complete areal-world data science project prior to graduating from this program, either through our consulting course, an internship, an independent study, or other appropriate project
   2. Thesis track: Students will be required to undertake a research project culminating in a thesis