Data Science Program Graduate Handbook

Loyola University Chicago

February 21, 2024

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Chapter 1

Introduction

Welcome to the graduate program in Data Science at Loyola University Chicago. The following pages contain information regarding the M.S. and B.S./M.S. programs and the program's faculty. Information is also included with regards to general graduate assistant duties as well as a variety of professional information. Please pay close attention to meeting all graduate school and program requirements in a timely manner. Failure to comply with the degree milestones and requirement sequence can delay or prevent progress to degree. In regard to this manual, our objective was to be as comprehensive and accurate as possible. However, the Loyola Graduate School Office formally administers the requirements of the graduate program. Information obtained from the Graduate School is the official degree documentation.

Data Science Graduate Program
Loyola University Chicago

Chapter 2

Directory

Graduate School Office

- **Dr. Emily Barman**, Dean
- **Dr. Susan Grossman**, Associate Dean of Academics
- **Ms. Heather Sevener**, Assistant Dean for Student Services
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The Lake Shore Campus Graduate School Office is located in room 440 of the Granada Center on Sheridan Road. The telephone number is: 773-508-3396 (or, from a campus phone: 8-3396).

Data Science - Graduate Program

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Chapter 3

The M.S. Program

3.1 General M.S. Program Information

3.1.1 About the M.S. Program

The Data Science M.S. is a multi-disciplinary program that integrates coursework in mathematics, computer science, and statistics to organize, analyze, visualize, and extract useful information from data. The goal of the program is to enhance students' skills to apply these tools in their own areas of interest.

The M.S. program includes two tracks:

1. **Thesis Track**: Students engage in an original research project which includes experimental design and development, analysis and interpretation of results, as well as scientific writing and presentation. With the M.S. Thesis degree, graduates of this program are primed for continuing graduate programs or for advanced research positions in the private, federal, and public sectors. The last semester of this track is fully dedicated to research. This track is typically completed in 4 semesters.

2. **Non-thesis Track**: Students gain real-world experience in a capstone project. The breadth of course-work prepares students specifically for positions in industry. With the M.S. Non-thesis degree, graduates of this program can pursue employment in many organizations, including for-profit, non-profit, education, and federal agencies. This track is typically completed in 3 semesters.

3.1.2 Degree Requirements

Students pursuing the M.S. in data Science must complete 30 credit hours. The Thesis Track and Non-thesis Track include a set of core courses (19 credit hours) that will provide students with a broad foundation of fundamental concepts in addition to an introduction to current tools and techniques in the field. Each track also will have a set of track-specific courses (11 credit hours).

Required Classes - M.S.

Core Data Science Courses Required in Both Tracks (19 credits)

- **Computer Science Requirements (6 credits)**
  - COMP 453 Database Programming (3 credits)
  - COMP 458 Big Data Analytics (3 credits)
- **Statistics Requirements (6 credits)**
  - STAT 408 Applied Regression Analysis (3 credits)
  - STAT 410 Categorical Data Analysis (3 credits)
- **Data Science Core (7 credits)**
  - DSCI 401 Introduction to Data Science (3 credits)
  - COMP 479 Machine Learning or STAT 438 Introduction to Predictive Analytics (3 credits)

Track-specific Courses (11 credits)

- **Thesis Track**
  - DSCI 494 Data Science Research Design (2 credits)
  - DSCI 499 Data Science Research (8 credits)
  - DSCI 595 Thesis Supervision (1 credit)
- **Non-thesis Track**
  - COMP 4XX Elective (3 credits)
  - STAT 4XX Elective (3 credits)
  - COMP 4XX / STAT 4XX Elective (3 credits)
  - DSCI 470 - Data Science Consulting (Capstone) (2 credits)

3.1.3 Elective Courses

The Non-thesis Track requires three Data Science Electives with at least one in the Computer Science Department and one in the Math and Statistics Department. The selection of Data Science Electives can vary each year; courses that can be counted as Data Science Electives are evaluated periodically. The most up-to-date listing can be found in this document. The list includes electives that are offered on a regular basis and special topics electives that may vary in content as well as in frequency

when they are being offered. 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 GPD if they plan to take a secondary elective.

As of Fall 2023, the following electives are approved:

Primary COMP electives	**Primary STAT electives**
COMP 406 Data Mining COMP 429 Natural Language Processing COMP 484 Artificial Intelligence COMP 487 Deep Learning COMP 488 Topics in computer vision COMP 488 Topics in Computer Science (if the topic is closely relevant to data science)	STAT 411 Survival Analysis STAT 421 or COMP 421 Math Modeling & Simulation STAT 451 Applied Nonparametric Methods STAT 488 Multivariate Statistics STAT 488 Bayesian Statistics STAT 444 Longitudinal Data Analysis and Mixed Modeling Other STAT 488 classes
Secondary COMP electives	**Secondary STAT electives**
COMP 436 Markup Languages COMP 441 Human-Computer Interface Design COMP 460 Algorithms and Complexity COMP 405 Database Administration COMP 412 Free/Open-Source Computing COMP 413 Inter. Object-Oriented Development COMP 418 Combinatorial Mathematics COMP 424 Client-Side Web Design COMP 474 Software Engineering COMP 422 Software Development for Wireless/Mobile Devices COMP 417 Social, Legal, and Ethical Issues in Comp. COMP 490 Independent Project COMP 499 Internship COMP 477 IT Project Management	STAT 403 SAS programming STAT 407 Design of experiments STAT 404 Mathematical Statistics STAT 405 Mathematical Statistics STAT 498 Independent Study in Statistics

3.1.4 Course Registration

Students can register for courses through LOCUS (locus.luc.edu) for most courses. Students cannot enroll in those courses marked as "Department Consent Required."

Such courses include Data Science Research Design (DSCI 494), Thesis Supervision (DSCI 595), and Data Science Consulting (DSCI 470). To enroll in these courses, please email the GPD for assistance. To enroll in Data Science Research, the Research Director and number of credit hours should be specified. For Data Science Electives requiring departmental consent, please email the GPD.

3.1.5 Prerequisite Course Requirements

Prerequisite course requirements can be found on the Computer Science, and Mathematics and Statistics departmental webpages and/or through communication with the instructor. Departmental websites are as follows:

- Computer Science: luc.edu/cs
- Mathematics and Statistics: luc.edu/math

Core Data Science course prerequisites are as follows:

Course	**Prerequisite**
COMP 453 Database Programming	COMP 271 Data Structures I
COMP 458 Big Data Analytics	COMP 405 Database Administration or COMP 453 Database Programming. COMP 406 Data Mining or COMP 479 Machine Learning or STAT 338 Predictive Analytics or STAT 408 Applied Regression Analysis
STAT 408 Applied Regression Analysis	Some background in basic statistical methods or biostatistics
STAT 410 Categorical Data Analysis	Some background in basic statistical methods or biostatistics
DSCI 401 Introduction to Data Science	None
COMP 479 Machine Learning	COMP 271 Data Structures I. MATH 131 Applied Calculus I or MATH 161 Calculus I. One or more of the following: STAT 103 Fundamentals of Statistics, STAT 203 Statistics, ISSCM 241 Business Statistics, PSYC 304 Statistics.
STAT 438 Introduction to Predictive Analytics	None

For students who have not fulfilled prerequisite coursework upon acceptance into the M.S. Data Science program, prerequisite coursework is required. These

prerequisite courses can be fulfilled at Loyola or at another institution, e.g., Community Colleges. Loyola course numbers for these prerequisites are provided in the previous table. If prerequisite courses were taken at institutions other than LUC, the corresponding course equivalents can be determined online at lucweb.luc.edu/courseEq. Some prerequisites may be satisfied through online courses; however, this requires written approval of the GPD. It is the student's responsibility to inform the GPD of prerequisite coursework completed after admission to the program.

3.1.6 Switching Tracks

Since the recommended class schedules under the two tracks are different starting with the first semester, it is not possible to switch tracks.

3.1.7 Funding Opportunities

Continuing students will be regularly notified via email (msdatascience@luc.edu) and the Sakai CS/DS site of available funding opportunities, e.g., research assistantships with tuition reimbursement, hourly opportunities, and fellowships. Details will be specified in these email/Sakai announcement (as requirements may vary depending upon the type of funding).

Research funding for the preparation of a dissertation, thesis, or major research paper, in the amount of $500, is available from the Graduate School by completing this online form. Allowable expenses include supplies, software, printing costs, and travel.

The Graduate School also provides funding to present at conferences. Students can apply for up to $750 for conference travel (per academic year) and related expenses annually. To be considered for funding, students must apply through GSPS (gsps.luc.edu) before the conference. Additional application instructions, including application deadlines, are available here.

3.1.8 Advising

M.S. students will be advised by the Data Science Graduate Program Director.

3.1.9 Online Classes

While the majority of the courses in the program are in person (face to face classes that may include some online interactions), a few classes may be fully online. Graduate students on an F-1 visa are required to maintain a full course load of 9 credit hours, of which 6 must be in person (a maximum of one 3-credit class can be online in a given semester).

3.2 M.S. Thesis Track

The M.S. Thesis degree must indicate advanced research work and an appropriate written document (Thesis). A Research Director and a Thesis Committee are selected to supervise the directed study. In addition to the Core Data Science courses (19 credits), this track requires the successful completion of 11 research-related credits (see Degree Requirements in 3.1.2). The program currently accepts students under this track for the Fall semester start.

3.2.1 Courses and Credit Hours

A total of 30 credit hours are required, with research credit counted in the 30-hour total (see Thesis Track-specific courses in 3.1.2). Graduate students are expected to maintain an overall grade point average (GPA) of no less than 3.0 (B). Those failing to meet this standard may be dismissed from the program. No more than two courses for which a student receives a final grade of C+ (2.33) or C (2.00), and no course for which a student receives a final grade of less than a C (2.00), may be applied toward the fulfillment of the M.S. degree requirements. Such grades, however, will be used in the calculation of a student's overall grade point average. No student will graduate with less than a B average (3.0). All courses must be at the graduate level (400-level or above).

3.2.2 Sample Schedule for Thesis Track

The following is a class schedule guide for M.S. Thesis Track students in the Data Science program assuming a Fall semester start. It is the student's responsibility to complete these requirements to the standards defined in this handbook and by Loyola's Graduate School. This is best accomplished through diligence and regular consultation with the student's Research Director and/or the Graduate Program Director. It is strongly advised to refer to course planning resources and LOCUS to determine when required and elective courses are offered. Importantly, students should enroll in Thesis Supervision (DSCI 595) during the semester in which they intend to defend their thesis.

	Fall	Spring
Year 1	DSCI 401 Introduction to Data Science (4) STAT 408 Applied Regression Analysis (3) DSCI 494 Data Science Research Design (2) *Total Credit Hours: 9*	STAT 410 Categorical Data Analysis (3) DSCI 499 Data Science Research (3) COMP 458 Big Data Analytics (3) *Total Credit Hours: 9*
Year 2	STAT 438 Into to Predictive Analytics or COMP 479 Machine Learning (3) DSCI 499 Data Science Research (3) COMP 453 Database Programming (3) *Total Credit Hours: 9*	DSCI 499 Data Science Research (2) DSCI 595 Thesis Supervision (1) *Total Credit Hours: 3*

3.2.3 Research Director

Research and thesis are supervised by a Research Director selected by the student in coordination with the GPD before research is begun. The Research Director must be a tenure-track or tenured Data Science-affiliated faculty member. A listing of Data Science-affiliated faculty can be found on the Data Science website (luc.edu/datascience/people/faculty/). Any concerns over the Research Director selection can be mediated with the help of the Graduate Program Director. A suitable Research Director should be identified before acceptance to the program. The deadline for selecting a Research Director is prior to the beginning of the second semester.

3.2.4 Thesis Committee

Once the student has selected a Research Director, a Thesis Committee is formed. Members of the Thesis Committee will be determined by the Research Director and the student. This committee must consist of at least 3 members with the majority of the committee comprised of Data Science-affiliated faculty members. Loyola faculty who are not Data Science-affiliated faculty but are members of the Faculty of the Graduate School may serve on a student's committee as a voting member. Faculty outside of the Loyola community and industry professionals are eligible to serve on a student's committee as readers (non-voting). Note that Loyola's Graduate School requires a minimum of two voting members on a Thesis Committee. The student must complete and submit the "Thesis Committee Recommendation Form" no later than January 15 of Year 1 through GSPS (gsps.luc.edu).

3.2.5 Responsible Conduct of Research

Students in this track are required to complete the Responsible Conduct of Research course (https://www.luc.edu/ors/RCRHome.shtml) before engaging in research tasks. If applicable, IRB approval or exemption should be obtained (https://www.luc.edu/irb/) before the Graduate School approves the thesis proposal.

3.2.6 Thesis Proposal

Thesis proposals will be developed under the guidance of the student's Research Director and according to the requirements of the Graduate School (luc.edu/gradschool/academics_policies.shtml). A thesis proposal should include a statement of the purpose of the proposed research, a review of the related literature, and an overview of the project's research methodology and procedures. The student must submit the "Thesis Approval Form" and their proposal through GSPS (gsps.luc.edu) by January 31 of Year 1. Copies of the thesis proposal are distributed electronically via the GSPS system to the Thesis Committee members who will be prompted to approve the proposal or suggest modifications.

3.2.7 Graduation Application

The Graduate School reviews applications for graduation (conferral of degree) three times a year, during the Fall, Spring, and Summer semesters. Graduate applications are completed on LOCUS (locus.luc.edu). Below are the application deadlines for degree conferral that correspond to each term:

Review Term	Deadline	Degree Conferral
Fall	August 1	December
Spring	December 1	May
Summer	February 1	August

For more information on graduation applications, refer to the Graduate School website (luc.edu/gradschool/graduation/mastersthesis/).

3.2.8 Thesis and Oral Defense

The thesis research is successfully concluded by mutual agreement between the student and their Research Director. The student summarizes their work in a written thesis and must defend the project and results before the Thesis Committee. The written thesis must conform to the format dictated by the Graduate School (luc.edu/gradschool/formatting.shtml). The thesis must be submitted for a format check by the Graduate School through the Graduate School's ProQuest ETD website (etdadmin.com/luc) on or before the following deadlines:

- **Fall** (conferral in December), October 1
- **Spring** (conferral in May), March 1
- **Summer** (conferral in August), June 1

After the student has submitted their thesis for format check, the student will be notified of any corrections via their LUC email account. Please allow a few days for a response. Format check can occur before or after the defense.

The student must submit copies of the thesis to the Thesis Committee at least two weeks before the scheduled defense. Note that the distribution of the thesis text and the defense can be scheduled after the deadline for format check but must be completed before the deadlines for conferral listed below. The student is responsible for bringing to their defense one copy of the "Approval Ballot for Text and Oral Defense Form," which can be found online. The majority of the student's voting members of the Thesis Committee must be physically present at the defense. All members of the Thesis Committee must be in attendance, if not physically present then remotely with video and audio capabilities. All voting members are required to sign the ballot before the deadline for conferral. The committee may award "Distinction" to designate outstanding work on both the text and oral defense; this designation is made only on rare occasions of truly exceptional work. Votes of "Distinction" must be unanimous. This designation will appear on the student's transcript. Once all members of the Thesis Committee have signed the ballot, the Research Director is responsible for submitting the form to the Graduate Program Director for approval. The Graduate Program Director will upload the signed and approved form to GSPS.

Members of the Thesis Committee may request edits and/or additions to the student's thesis text before or on the day of the defense. As such, committee members may postpone signing the ballot until these changes are made and approved by the committee member or full Thesis Committee. This may delay conferral of the degree. It is thus strongly urged that students schedule their defense with ample time for making revisions. The deadlines for conferral stipulated by the Graduate School are as follows:

Degree Conferral	Completed Thesis Deadline
December	November 1
May	April 1
August	July 1

3.2.9 Submission of Completed Thesis

The following material must be submitted by the student after the thesis defense and prior to the deadlines for conferral (above):

- One electronic copy of the **completed and correctly formatted thesis manuscript**.
- The **Final Approval Sheet**, formatted as described in the thesis formatting guide, signed by the Research Director (in PDF form, uploaded as supplemental item in ETD account).
- One **extra title page**, formatted as described in the thesis formatting guide (in PDF form, uploaded as supplemental item in ETD account).
- One **extra abstract**, formatted as described in the thesis formatting guide (in PDF form, uploaded as supplemental item in ETD account).

For more information on this final submission process, please refer to the Graduate School website (luc.edu/gradschool/process.shtml).

3.2.10 Sample Timeline for Thesis-related Activity

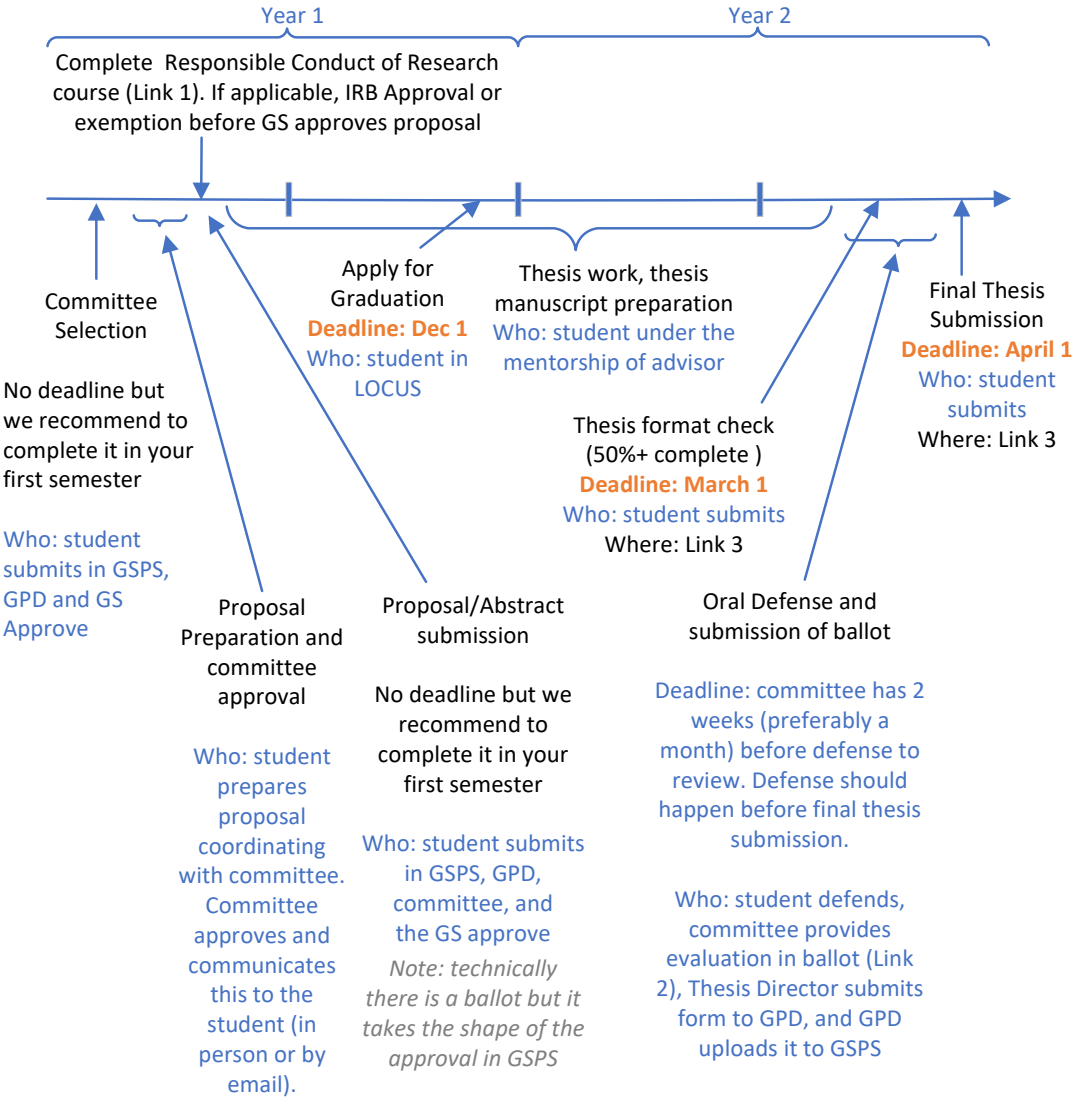
The following is a timeline guide for M.S. Thesis Track students in the Data Science program assuming a Fall semester start. It is the student's responsibility to complete these requirements to the standards defined in this handbook and by Loyola's Graduate School. This is best accomplished through diligence and regular consultation with the student's Research Director and/or the Graduate Program Director.

3.2.11 Participation in Commencement

Loyola University Chicago holds commencement ceremonies in May only. A student is eligible to participate in Loyola University Chicago's May commencement celebration if the student (1) has successfully defended and submitted their materials to the Graduate School or (2) has submitted their thesis for format check by the deadline for August conferral and has scheduled their defense prior to July 1. December graduates are invited to participate in the May commencement of the following calendar year.

3.2.12 Time Limit

Generally, 2 years of full-time work is sufficient to complete an M.S. degree. However, the time limit for completion of the M.S. program, as specified by the Graduate School, is 5 years. This is computed from the date of commencement of the first course applied to the degree. More information on the Graduate School policy on M.S. degree time limit can be found in 6.2.



Link 1: https://www.luc.edu/ors/RCRHome.shtml
Link 2: https://www.luc.edu/media/lucedu/gradschool/pdfs/T%20&%20D%20defense%20ballot--DB.pdf
Link 3: https://www.luc.edu/gradschool/formatting.shtml (follow link to ProQuest)

Page with Graduate School forms: https://www.luc.edu/gradschool/servicesandresources_forms.shtml

Figure 3.1: Sample Timeline for Thesis-related Milestones

3.2.13 Capstone

The culmination of the education for students on the thesis track will be their thesis defense (DSCI 595), which will be presented at the end of Year 2.

3.3 M.S. Non-Thesis Track

This is a course-based M.S. degree. In addition to the Core Data Science courses (19 credits), this track requires the successful completion of 3 electives (9 credits) and a 2-credit capstone class (see Degree Requirements in 3.1.2). The program currently accepts students under this track to start in the Fall and Spring semesters.

3.3.1 Courses and Credit Hours

A total of 30 credit hours are required. Graduate students are expected to maintain an overall grade point average (GPA) of not less than 3.0 (B). No more than two courses for which a student receives a final grade of C+ (2.33) or C (2.00), and no course for which a student receives a final grade of less than a C (2.00), may be applied toward the fulfillment of the M.S. degree requirements. Such grades, however, will be used in the calculation of a student's overall grade point average. No student can graduate with less than a B average (3.0). All courses should be at the graduate level (400-level or above). In consultation with the GPA, the capstone class (DSCI 470 - Data Science Consulting) can be replaced by a 2-credit internship, independent study, or other approved project. In these cases, the internship or independent study must include some aspect of data science work.

3.3.2 Sample Schedule for Non-thesis Track

The following is a class schedule guide for M.S. Non-thesis Track students in the Data Science Program assuming a Fall semester start. It is the student's responsibility to complete these requirements to the standard defined in this handbook and by Loyola Graduate School. This is best accomplished through diligence and regular consultation with the Graduate Program Director and/or Program Director. It is strongly advised to refer to course planning resources and LOCUS to determine when required and elective courses are offered. Observe that while the sample schedule shows a case where the non-thesis track can be completed in 3 semesters, students who start in the Spring semester usually complete the program in 4 semesters due to class availability constraints.

	Fall	Spring
Year 1	DSCI 401 Introduction to Data Science (4) STAT 408 Applied Regression Analysis (3) COMP 453 Database Programming (3) *Total Credit Hours: 10*	STAT 410 Categorical Data Analysis (3) COMP 458 Big Data Analytics (3) COMP 4XX / STAT 4XX (3) <see note> *Total Credit Hours: 9*
Year 2	STAT 438 Into to Predictive Analytics or COMP 479 Machine Learning (3) COMP 4XX / STAT 4XX (3) <see note> COMP4XX / STAT4XX (3) <see note> DSCI 470 Data Science Consulting (2) *Total Credit Hours: 11*	
Note: Three of the elective credits must be in a COMP class and three in a STAT class.		

3.3.3 Graduation Application

The Graduate School reviews applications for graduation (conferral of degree) three times a year, during the Fall, Spring, and Summer semesters. Graduate applications are completed on LOCUS (locus.luc.edu). Below are the application deadlines for degree conferral that correspond to each term:

Review Term	Deadline	Degree Conferral
Fall	August 1	December
Spring	December 1	May
Summer	February 1	August

For more information on graduation applications, refer to the Graduate School website (luc.edu/gradschool/graduation/mastersnothesis).

3.3.4 Participation in Commencement

Loyola University Chicago holds commencement ceremonies in May only. Students are eligible to participate in the May commencement if they have no more than 6 credit hours remaining and will complete the remaining coursework during that same summer term. December graduates are invited to participate in the May commencement of the following calendar year.

3.3.5 Time Limit

Generally, 2 years of full-time work is sufficient to complete an M.S. degree. However, the time limit for completion of the M.S. program, as specified by the Graduate School, is 5 years. This is computed from the date of commencement of the first course applied to the degree. More information on the Graduate School policy on M.S. degree time limit can be found in 6.2.

3.3.6 Capstone

Most students on the non-thesis track should complete their capstone experience by completing a project in the data science consulting course (i.e. DSCI470). However, students can also opt to replace the data science consulting course with an internship, independent study, or other project as long as the student receives prior approval from the Data Science program director or graduate program director.

3.4 B.S./M.S. 5-Year Program (4+1)

3.4.1 About the B.S./M.S. Program

Loyola's Data Science Program includes a B.S./M.S. program with both a B.S. and a M.S. in Data Science. This program permits up to 3 classes or 9 credit hours of undergraduate coursework to be taken at the graduate level and count towards both the 120 credit hours required for the B.S. degree and 30 credit hours required for the M.S. degree. Thus, students can complete both a B.S. and M.S. in as little as 5 years, in contrast to 6 years required for completing each individually. The B.S./M.S. program offers a Thesis and Non-thesis Track. Both the thesis and non-thesis track require thirty (30) graduate credit hours to complete. These credit hours will be completed in Year 4 of the B.S. program and the additional (+1) year of the B.S./M.S. program.

3.4.2 Applying to the B.S./M.S. Program

Applicants must be a declared B.S. Data Science major and be in junior standing (based upon credit hours earned) at the time of applying. Applications are accepted each spring semester through Loyola's online system (gpem.luc.edu). Only applications submitted through this system by the deadline, March 15, will be considered by the admissions committee. In addition to being in Junior standing, candidates for admission must meet the following criteria:

- Minimum cumulative GPA of at least 3.3 for all coursework at Loyola, and
- Minimum 3.5 GPA in at least 5 courses of the Data Science major, 3 of which must be at the 300-level.

Application materials include:

- Official college transcript(s),
- Two letters of recommendation from Loyola faculty,
- A current resume/curriculum vitae, and
- A brief (500 word) statement of purpose.

For those students applying for the Thesis Track, **one of the letters of recommendation must be from their intended Research Director**. Applications are rigorously reviewed by the Data Science Program admissions committee. Meeting the credit hour and GPA requirements does not guarantee admission.

3.4.3 Courses, Credit Hours, and Grade Requirements

Once admitted to the B.S./M.S. program, a student can take up to 3 classes or 9 credit hours of undergraduate coursework at the graduate level (400-level) and count these courses towards both degrees. It is important to note that all B.S. requirements must be fulfilled before the M.S. degree can be conferred. Upon admission to the 4+1 program, students are expected to maintain an average of not less than B (3.0 out of 4.0). No more than two courses for which a student receives a final grade of C+ (2.33) or C (2.00), and no course for which a student receives a final grade of less than a C (2.00), may be applied toward the fulfillment of the M.S. degree requirements. Such grades, however, will be used in the calculation of a student's overall grade point average. In addition, students who earn multiple grades of C are subject to review by the Graduate School and possible withdrawal from the program. No student will graduate with less than a 3.0 average for all graduate courses taken in this program. All the courses taken to fulfill the M.S. program requirements must be at the graduate level (400-level or above). In addition to the courses required to fulfill the undergraduate B.S. Data Science degree and the university's Core Curriculum requirements, all students in the 4+1 program need to satisfy the following class requirements.

Required Classes for the M.S. component of the B.S./M.S. Program

Core Data Science Courses Required in Both Tracks (16 credits)

- DSCI 401 Introduction to Data Science (4 credits)
- STAT 410 Categorical Data Analysis (3 credits)
- COMP 453 Database Programming (3 credits)
- COMP 458 Big Data Analytics (3 credits)
- STAT 438 Predictive Analytics or COMP 479 Machine Learning (3 credits)

Track-specific Courses (14 credits)

- Thesis Track
  - DSCI 494 Data Science Research Design (2 credits)
  - DSCI 499 Research (8 credits)
  - DSCI 595 Thesis (1 credit)
  - STAT 4XX Elective (3 credits). See list of approved electives in 3.1.3.
- Non-thesis track
  - DSCI470 Data Science Consulting (Capstone) (2 credits) (This course can be replaced by an internship, independent study, or other approved project).
  - The remaining twelve (12) credits must be chosen from 400 level STAT, COMP, or DSCI courses. If no DSCI electives are taken, at least six (6) credits must be chosen from STAT electives and at least three (3) credits from COMP electives. DSCI electives could count as STAT or COMP electives. See list of approved electives in 3.1.3.

Note, if one of the Core M.S. Data Science courses is completed at the 300-level prior to beginning the B.S./M.S. program, it must be substituted with an elective from the same subject. For instance, if Categorical Data Analysis is taken at the 300-level (STAT 410), then one of the electives in statistics must be taken at the 400-level.

B.S./M.S. students on the Thesis Track must enroll for and complete Data Science Research Design (DSCI 494) during the fall semester following admission. They are responsible for completing the Committee Form, submitting their proposal by

the M.S. stated deadlines, and satisfying the responsible conduct of research requirements as described in 3.2.

3.4.4 Double Dipping Policy

No more than nine (9) credit hours can be used to fulfill both the B.S. and M.S. Data Science degree requirements. All courses that are being used to fulfill both degrees must be taken at the graduate level (i.e. 400-level). The selected 400-level courses would all substitute in the B.S. degree for the 300-levels courses in the same subject.

The nine (9) credits that can be double dipped are the following:

- STAT 438 - Predictive Analytics or COMP479 - Machine Learning (3 credits) [Fulfills the B.S. requirement for STAT338 or COMP379]
- STAT 410 - Categorical Data Analysis (3 credits) [Fulfills the B.S. requirement for STAT310]
- COMP 458 - Big Data Analytics (3 credits) [Fulfills the B.S. requirement for COMP 358]

In exceptional circumstances, after coordination with the Program Director or Graduate Program Director, other courses may be allowed to be double dipped instead of the listed ones.

3.4.5 Sample Schedules

The following is a class schedule guide for B.S/M.S. students in the Data Science Program assuming a Fall semester start. It is the student's responsibility to complete these requirements to the standard defined in this handbook and by Loyola Graduate School. This is best accomplished through diligence and regular consultation with the Program Director and/or Graduate Program Director. It is strongly advised to refer to course planning resources and LOCUS to determine when required and elective courses are offered. Courses used for dual credit for the B.S. and M.S. degrees are in bold.

Non-thesis Track

	Fall	**Spring**
Year 1	DSCI 101 Fundamentals of Data Science in R (3) MATH 161 Calculus I (4) *Total Credit Hours: 7*	MATH 162 Calculus II (4) COMP 141 Introduction to Computing Tools and Techniques (3) *Total Credit Hours: 7*
Year 2	MATH 212 Linear Algebra (3) MATH 215 Object Oriented Math Programming (3) *Total Credit Hours: 6*	COMP 231 Data Structures Algorithms for Informatics (3) STAT 203 Introduction to Probability and Statistics (3) *Total Credit Hours: 6*
Year 3	STAT 308 Applied Linear Regression Analysis (3) COMP 353 Database Programming (3) *Total Credit Hours: 6*	COMP 3XX (elective) (3) STAT 3XX (elective) (3) COMP 317 Social, Legal, and Ethical Issues in Computing (3) *Total Credit Hours: 9*
Year 4	**STAT 438 Predictive Analytics or COMP 479 Machine Learning (3)** COMP 3XX elective (3) STAT 3XX elective (3) *Total Credit Hours: 9*	**COMP458 Big Data Analytics (3)** **STAT410 Categorical Data Analysis (3)** STAT 370 Data Science Consulting (3) *Total Credit Hours: 9*
Year 5	DSCI 401 Introduction to Data Science (4) DSCI 470 Data Science Consulting (2) COMP 4XX elective (3) [substitutes COMP 453 as COMP 353 was taken in Y3] STAT 4XX elective (3) *Total Credit Hours: 12*	COMP 4XX elective (3) STAT 4XX elective (3) STAT 4XX / COMP 4XX elective (3) *Total Credit Hours: 9*

Thesis Track

	Fall	Spring
Year 1	DSCI 101 Fundamentals of Data Science in R (3) MATH 161 Calculus I (4) Total Credit Hours: 7	MATH 162 Calculus II (4) COMP 141 Introduction to Computing Tools and Techniques (3) Total Credit Hours: 7
Year 2	MATH 212 Linear Algebra (3) MATH 215 Object Oriented Math Programming (3) Total Credit Hours: 6	COMP 231 Data Structures Algorithms for Informatics (3) STAT 203 Introduction to Probability and Statistics (3) Total Credit Hours: 6
Year 3	STAT 308 Applied Linear Regression Analysis (3) COMP 353 Database Programming (3) Total Credit Hours: 6	COMP 3XX elective (3) STAT 3XX elective (3) COMP 317 Social, Legal, and Ethical Issues in Computing (3) Total Credit Hours: 9
Year 4	**STAT 438 Predictive Analytics or COMP 479 Machine Learning (3)** COMP 3XX elective (3) STAT 3XX elective (3) Total Credit Hours: 9	**COMP 458 Big Data Analytics (3)** **STAT 410 Categorical Data Analysis (3)** STAT 370 Data Science Consulting (3) Total Credit Hours: 9
Year 5	DSCI 401 Introduction to Data Science (4) COMP 4XX elective (3) [substitutes COMP 453 as COMP 353 was taken in Y3] DSCI 494 Data Science Research Design (2) STAT 4XX elective (3) Total Credit Hours: 12	DSCI 499 Data Science Research (8) DSCI 595 Data Science Thesis (1) Total Credit Hours: 9

3.4.6 Graduation Applications

Students in the B.S./M.S. program will apply for graduation twice, once for their undergraduate degree and once for their graduate degree. Conferral of the B.S. degree will occur after all undergraduate major, College of Arts and Sciences, and university requirements are satisfied. Students apply for graduation through LO-

CUS (locus.luc.edu). Below are the application deadlines that correspond to each conferral term:

- Fall (conferral in December), March 1
- Spring (conferral in May), October 1
- Summer (conferral in August), October 1

For more information about applying for B.S. graduation, see luc.edu/cas/academic advising/applyforgraduation. For details regarding M.S. graduation application, please refer to the prior sections for Thesis Track and Non-thesis Track.

3.4.7 Advising

Students that are in their B.S. years will be advised by the Data Science Program Director and then will be advised by the Data Science Graduate Program Director in their M.S. year.

3.4.8 Capstone

See the guidelines for the thesis and non-thesis tracks in 3.2.13 and 3.3.6, respectively.

Chapter 4

Graduate Faculty in Data Science

Data Science is an interdisciplinary field and our faculty are from the Computer Science and Mathematics and Statistics departments. A full list of Data Science-affiliated faculty can be found on the program's website: https://www.luc.edu/datascience/people/faculty/.

Chapter 5

General Duties of the Research/Teaching Assistants

This section pertains to students who receive an assistantship from the Data Science Program for research or teaching service. Students serving as research/teaching assistants will be notified of their assignments prior to the start of the semester. The student is responsible for reaching out to the research advisor or instructor of record to discuss responsibilities before the start of classes. Research/Teaching assistants are expected to devote about 19.5 hours/week to the assigned tasks. Acceptance of a research/teaching assistantship indicates agreement to fulfill all of the assigned responsibilities.

5.1 Graduate School Perspective of Teaching Assistants

The Graduate School expectations of duties can be found at: luc.edu/gradschool/FundingGrad.Education.shtml. The rationale for supporting research/teaching assistants is centered on the role the experience plays in their professional and educational development. Students holding assistantships devote their time to a combined program of study and research/instructional activities. The stipend received by research/teaching assistants is in recognition of their service to the university.

5.2 Graduate Assistant Evaluation

Each research/teaching assistant will be evaluated in writing at the conclusion of each semester. In the case of a research assistant, the evaluation should be completed by the research advisor and should be based on the performance in the assigned research tasks. In the case of a teaching assistant, the evaluation should be completed by the instructor of record and should be based on the observation

of the teaching assistant in action.

5.3 Termination and Resignation

Assistants are required to keep a minimum 3.0 GPA (each semester as well as cumulatively), make progress toward their degree, and perform assistantship duties in an acceptable manner. Maintaining academic standing, per Graduate School or departmental academic requirements, is mandatory and failure to do so will result in the termination of an assistantship. Should an assistant's performance be deemed unacceptable by any of the departments (Computer Science, Mathematics and Statistics), the Graduate Program Director will inform the student in writing that his/her performance is unsatisfactory. The letter will include information about the deficiencies and a remediation plan of action. Additionally, the letter will include a date for re-evaluation. If the student fails to improve his or her performance, the assistantship will be withdrawn. In very specific instances, such as violations of university policies, academic dishonesty, or violations of ethical or professional code of conduct, the assistant may have his or her duties suspended immediately and a departmental recommendation of termination to the Graduate School is in order. Termination appeals, just as all other grievances, should first be made at the departmental level before moving to the Graduate School. The stipend will be stopped at the date of the termination. Departments depend on the services of graduate assistants for the period of appointment. If the assistant must resign their position during the course of the academic year, the assistant must follow the following steps:

1. Discuss the intent to resign with the Graduate Program Director well in advance of the actual resignation so that the program can make appropriate plans to replace the assistant.

2. Submit a formal letter explaining the reason(s) for and date of the resignation. A copy of this letter should be sent to the Graduate School.

3. Return of any keys and research/instructional material to the corresponding department.

The assistant's stipend will be ended upon receipt of the letter of resignation. Graduate Assistants who do not wish to be considered for future Graduate Assistantship Awards should inform the Graduate Program Director of their intentions prior to resigning.

Chapter 6

General Academic Information

The general information below is from the Graduate School's policies and regulations that govern all graduate programs.

6.1 Course Approval

New students should discuss the courses to be taken with the Graduate Program Director for approval. Continuing students are equally recommended to consult with their Research Director (Thesis Track), the Graduate Program Director, and/or Program Director for class planning.

6.2 Time Limits, Extensions and Leave of Absence

An applicant entering an M.S. degree program has 5 years from beginning of coursework applicable towards degree. If the student does not complete the degree requirements within the specified time limit, the student must request a time extension from the Dean of the Graduate School. The student should formally apply to the Graduate Dean after consulting with the Graduate Program Director. This should be done prior to the time limit. Such an extension may be granted for sufficient reason. If and when the extension is approved, an official letter signed by the Dean of the Graduate School is sent to the student. The student's record is annotated with the new expiration date.

When it becomes necessary for a student to interrupt, temporarily, his or her work toward a degree, the student should formally apply to the Graduate School for a leave of absence. For sufficient reason a leave of absence will be granted by the Graduate School, the net effect of which will be to "stop the clock" during the leave of absence. This possibility applies only before completion of all formal coursework except remaining research.

6.3 Transfer Credit

Students seeking advanced standing shall be examined on her or his major subject during the first semester of residence. Unless the Program Director or Graduate Program Director recommends such transferred credit by the end of the transfer student's first semester at Loyola, no transferred credit will be allowed. Students should expect to provide the Graduate Program Director with a copy of their transcript and copies of the syllabus for the courses they are seeking to transfer. All courses must have been taken at the graduate level.

To be considered for acceptance as part of the Loyola degree requirement, courses taken elsewhere must have been equivalent to our graduate level courses. If the transferred course is equivalent to one of Loyola's special-topics courses, this special-topics course must have been offered within the last 10 years. All transferred courses must have been awarded grades equivalent to a B (3.0) or higher. Up to two lecture-based courses (6.0 hours) are allowed to transfer for M.S. degrees only if the grade earned was of a B (3.0) or higher, per course. This rule applies to both the M.S. Thesis Track and M.S. Non-thesis Track.

6.4 Financial Aid

Graduate students who are U.S. citizens or permanent residents of the U.S. may apply to the University for the National Direct Student Loans and College Work-Study assistance through the Financial Aid office. Students also may wish to borrow under the Federally Insured or Guaranteed Student Loan Programs. Application and information regarding these two loan programs are available from banks and other lending institutions.

6.5 Graduate Academic Calendar and Key Dates

For the graduate student, it is essential to view the Graduate School's Academic Calendar with Key Dates and Deadlines: luc.edu/gradschool/key_dates.shtml.

6.6 Tuition and Fees

For a list of current course fees, mandatory fees, and other fees, view the Graduate Arts and Sciences Tuition and Fees webpage: luc.edu/bursar/tuitionfees/.

Chapter 7

Miscellaneous Information

7.1 Data Science Seminar

The Data Science program organizes a seminar series inviting experts in various aspects of data science. The calendar and presentation details are available at luc.edu/datascience/events/datascienceseminar/.

7.2 Data Science Student Club

This club aims to foster a passion for data science and help to connect with other students with similar interests. Additional information about the club can be found at luc.campuslabs.com/engage/organization/dsc.

7.3 Center for Data Science and Consulting

Loyola's Center for Data Science and Consulting is dedicated to helping students and faculty harness the power of their data to achieve their research goals. The Center specializes in providing data science training and assistance for researchers in all aspects of data science including data collection, data wrangling, data analysis, machine learning, statistical modeling, visualization, and database management. Additional information about the center can be found at luc.edu/cdsc/.

7.4 Campus Resources

Campus Map: The Lake Shore Campus can be found online at: luc.edu/media/luc edu/pdfs-campusmaps/lsc.pdf.

Bookstore The University Bookstore, managed by Follett and located on the first floor of the Granada Center, supplies books to graduate students at a discount.

Cudahy Library The Cudahy Library on the Lake Shore Campus is the main library of Loyola University Chicago, and houses the university's fine arts, humanities, science, and social sciences collection. View more information: libraries.luc.edu/cudahy.

Entertainment and Recreation In the neighborhood are movie theaters which offer varied entertainment at reasonable to cheap prices. The Student Activities Board hosts weekly movies on campus for free. The city provides every type of museum conceivable, most of which are located downtown and can be reached by public transportation. The Loyola student ID provides students with free admission to the world-famous Art Institute Chicago. The Halas Sports Center is equipped with a pool, gym, weight room, exercise room and handball/racquetball court for student use with payment of a fee. The Student Activities Board sponsors special events throughout the year. Women's and Men's basketball games with the Loyola Ramblers team take place at the Gentile Center and there are a limited number of free student tickets for each game. Chicago provides the campus with the Loyola Beach Area which is located four blocks north of the campus.

Food Besides numerous restaurants and fast-food chains, there are moderately priced meals available at the Damen Student Center and in the Simpson Living and Learning Center. There are also several grocery stores in the area.

Health There is a Wellness Center on campus that handles minor health problems. It is located at the Granada Center, 6439 N. Sheridan, suite #310 (luc.edu/wellness/). For more serious problems, the Ascension Saint Francis Hospital is two miles away on Ridge Avenue in Evanston. Health insurance, which is required, is available through The Graduate School, but the student pays the entire cost. Health insurance also may be purchased through an independent provider. More information is available at luc.edu/bursar/insurance.shtml. Mental health resources also are available through the wellness center (luc.edu/wellness/mentalhealth/).

Housing Some graduate housing is available on campus (luc.edu/reslife/prospective/graduatestudents/). Private housing, one bedroom and studios, furnished or unfurnished can be found in the neighborhood.

Parking A campus parking sticker and/or card can be purchased in the LSC Parking Office, located in the Main Parking Structure. They allow admittance to the parking garage adjacent to Flanner Hall. More information can be found online at luc.edu/parking.

Transportation The CTA, now augmented by the RTA, provides good public transportation for the metropolitan area. The Red Line elevated train stops at the Sheridan Road corner of the Lake Shore Campus. The stop is called Loyola. The Red Line runs north to Howard Street where one may transfer to other lines to reach Evanston, Wilmette, and Skokie. The Red Line also runs south to the Loop and beyond with connections to other lines going west. Three different bus routes pass the Lake Shore Campus. For more information, including directions to destinations, call the CTA at 312-836-7000. Graduate students enrolled in 8 or more credit hours are eligible for a CTA U-Pass. For more details see: luc.edu/upass.

Amtrak runs out of Union Station downtown. O'Hare Airport is available via the Blue Line, Continental Trailways bus from the Holiday Inn in Evanston, and Nortran buses (call RTA for schedules). Amtrak and Metra trains also connect Chicago to many suburbs and neighboring states. Other transportation options from Chicago include MegaBus. Within the city, taxis, Lift, and Uber are all reliable sources.

Chapter 8

Forms and Websites

There is a significant amount of paper forms, online form-filling, and record-keeping encountered during the earning of a M.S. or B.S/M.S. degree. It is recommended that you save all Loyola communications regarding degree progress and fulfilling of requirements. The following list includes forms and guidelines available at LOCUS (locus.luc.edu), the Graduate Student Progress System (GSPS, gsps.luc.edu), the Graduate School (luc.edu/gradschool/servicesandresources_forms.shtml), and other relevant Loyola sites.

General M.S. Forms and Websites

- Acceptance of a Graduate Assistantship Award:
  https://gsps.luc.edu/Secure/Admin/Students/Awards.aspx
- Extension of Time Limit for Completion:
  https://gsps.luc.edu/Secure/Admin/Students/Extension.aspx
- Recommendation for Transfer of Credit:
  https://gsps.luc.edu/Secure/Admin/Students/CreditTransfer.aspx
- Leave of Absence Form:
  https://gsps.luc.edu/Secure/Admin/Students/LeaveOfAbsence.aspx
- Application for Graduation:
  https://locus.luc.edu/
  Guide: https://www.luc.edu/cas/academicadvising/applyforgraduation/

M.S. Thesis Track Forms and Websites

- Thesis Committee Recommendation Form:
  https://gsps.luc.edu/Secure/Admin/Students/ThesisDissertationCommittee.aspx

- Thesis Proposal Approval Form:
  https://gsps.luc.edu/Secure/Admin/Students/ThesisDissertationProposal.aspx
- Responsible Conduct of Research course:
  https://www.luc.edu/ors/RCRHome.shtml
- Ballot for Text and Oral Defense Form:
  https://www.luc.edu/media/lucedu/gradschool/pdfs/T%20&%20D%20defense%20ballot--DB.pdf
- Thesis Format Check/Thesis Final Submission:
  https://www.luc.edu/gradschool/formatting.shtml (follow link to ProQuest)

M.S. Non-thesis Forms and Websites

- Finding An Internship:
  https://www.luc.edu/career/internships_find.shtml
- COMP 490: Independent Project:
  https://academics.cs.luc.edu/courses/comp490.html
- STAT 498: Independent Study in Statistics:
  https://www.luc.edu/math/academics/courses/stat499/
- COMP 499: Internship:
  https://academics.cs.luc.edu/courses/comp499.html

B.S./M.S. Forms and Websites

- See the links under the M.S. Thesis and M.S Non-Thesis groups