DOCTOR OF PHILOSOPHY (DATA SCIENCE)

College of Science

Data Science is a multidisciplinary approach that studies data as a vehicle of information throughout its natural cycle of production, storage, retrieval, processing and purification, analysis, and presentation including visualization, in relation to the scientific questions connected to it. It has emerged as a new field in line with the unprecedented increase in our ability to gather digital information from many different physical, social, economic, technical, and such other kinds of real-world systems.

The **program aims to produce PhD graduates equipped with a good scientific mindset, with adequate technical skills, and a professional perspective of expanding the science of data, with data as carriers of information.** Pursuant to the program's Learning Objectives, a student must be able to

1. Analyze the nature of data throughout its life cycle including the mechanism behind data generation and storage (domain knowledge base);

2. Apply multi-disciplinary theories and methods with their underlying philosophies for data analysis resulting from various phenomena and processes (data science application to domain);

3. Generate new data science theories, data models, architecture, and/or algorithms that can adapt to the evolving nature of data throughout its life cycle including generation, information representation, storage, and/or extraction (generation of new knowledge);

4. Apply data science solutions to real-world problems in collaboration with and/or among academic, industrial and public governmental institutions (collaboration in the application of data science); and

5. Practice ethical and lawful guidelines and policies related to the application of data science processes, methods and techniques, especially in the Philippine context (ethical practice).

Program Tracks

There are three program track options for the PhD Data Science graduate program:

Option 1: Straight PhD. This is a track for those admitted to the program with a BS degree. A total of 58-60 units are required including dissertation units.

Option 2: Regular PhD. This is a track for those admitted to the program with a master's degree. A total of 37 units are required including dissertation units.

Option 3: PhD by Research. This is a track for those admitted with a master's degree, with research experience beyond the master's or equivalent degree, and with at least three (3) published papers in data science and related fields, at least one of which as lead/primary-authored publication. A total of 26 units are required inclusive of the dissertation units.

Option 1 is only for those with a bachelor's degree in the sciences and engineering, or in other fields relevant or data science. Under this program track, students are required to take graduate courses in mathematical, computational, and statistical methods. These courses, together with DS 301 (Foundations of Data Science), serve as foundational courses so students acquire the necessary minimum competencies to do advanced studies in data science. Compared to Option 2, this program track has more units required for elective courses. These additional units for electives allow the students to appreciate the many applications of data science and further their areas of interest (domain).

Option 2 is intended for students with a master's degree. Students applying for the program are expected to already have the necessary competencies to do advance studies in data science as well as the necessary background and skills in the practice of data science particularly in their domain expertise. Thus, relative to Option 1, this program track has fewer electives and does not require the foundational courses in mathematical, computational, and statistical methods. Applicants with master's degree without the appropriate level of mathematical, computational and statistical background may either opt to take Option 1 or enroll in non-degree course/s to attain the required level of competencies, as stipulated in Section 4.

Option 3 is for those with a graduate degree and are proven capable of doing independent research in data science or related disciplines. The student is required to have a research plan prior to enrollment into the program. Under this program track, the student is not required to take any elective course; instead, they shall be enrolled in laboratory and seminar courses to focus their work on research studies and/or publication requirements.

Admission into the Program

Admissions to the Program in the College of Science is handled by the Office of the Associate Dean for Mentoring, Academic Progress, and Advancement (OADMAPA). More information can be found here. Admission may be done during the first or second semester.

All applicants must have appropriate undergraduate level knowledge (or equivalent experience/expertise/background) in:

- intermediate differential calculus (e.g., Math 22, or its equivalent);
- college statistics / statistical data analysis (e.g., Stat 101, or its equivalent); and
- computational skills or good experience with at least one programming language (e.g., Computer Science 11, Appl. Phys. 155, or their equivalent).

Option 1: Straight PhD

1. An undergraduate degree in science (BS), engineering (BEngg), or a related discipline;
2. GWA of 2.0 or better in the undergraduate program (when translated to UP Grading System);
3. Favorable recommendation letter(s) from at least two (2) former professors;
4. Approved proposed program of study endorsed by the program adviser.
5. Passing a placement examination and interview administered by the implementing unit;
6. Passing an English proficiency test per university policy for applicants whose medium of instruction in the previous degree program is not English;
7. Health certificate and other additional and special admission requirements imposed by the Graduate Committee of the implementing institution, duly approved by the Program Committee;

Option 2: Regular PhD

1. Master's degree in science or engineering with at least 24 units of graduate courses from a recognized institution of higher learning. Additional requirements will be imposed for those with a professional master's degree. Specifically, they may be required to take relevant graduate courses. And for those coming from a non-thesis or non-research track master's degree, they must show proof of competence to do graduate-level research;
2. Favorable recommendation letter(s) from at least two (2) former professors;
3. Approved proposed program of study endorsed by the program adviser.
4. Passing a placement examination and interview administered by the implementing unit;

5. Passing an English proficiency test per university policy for an applicant whose medium of instruction in the previous degree program is not English;
6. Health certificate and other additional and special admission requirements imposed by the Graduate Committee of the implementing institution, duly approved by the Program Council;

Option 3: PhD by Research

a. Master's degree in science or engineering with at least 24 units of graduate courses from a recognized institution of higher learning. Additional requirements will be imposed for those with professional master's degree and/or may be required to take relevant credit courses;
b. At least three (3) publications in a highly-reputable publishing medium included in a list approved by the Data Science Graduate Committee, at least one (1) of which the applicant must be the lead/primary author and published in the last five years;
c. Presentation of capsule proposal for dissertation research and endorsement by at least two (2) faculty members from the members of Data Science Graduate Committee.
d. Approved proposed program of study endorsed by the program adviser.
e. Passing a placement examination and interview administered by the implementing unit;
f. Passing an English proficiency test per university policy for an applicant whose medium of instruction in the previous degree program is not English;
g. Health certificate and other additional and special admission requirements imposed by the Graduate Committee of the implementing institution, duly approved by the Program Council;

Program Requirements

The following are the minimum requirements for graduation. The implementing unit may impose more stringent requirements upon approval by the Graduate Committee.

Option 1: Straight PhD

1. Completion of coursework according to the approved Program of Study;
2. Passing the Qualifying Exam after finishing the first 12-14 units of core courses.
3. Passing the Candidacy Exam;
4. Passing the oral presentation of the Dissertation Proposal;
5. Submission of a progress report approved by the thesis adviser and reader at the end of each semester while enrolled in DS 400;
6. Presentation of a Colloquium every two years of dissertation;
7. Passing an oral presentation of the Dissertation;

8. Acceptance of **at least one (1) paper** related to the dissertation work in a highly reputable refereed journal or conference proceeding (e.g., SCIe indexed journal, SCOPUS listed) whitelisted by the Data Science Committee in which the candidate is the primary author; and
9. Submission of dissertation manuscript satisfying the requirement by both the standard university rules and of the implementing unit;

Option 2: Regular PhD

1. Completion of coursework according to the approved Program of Study;
2. *As may be additionally required*: Passing the Qualifying Exam after finishing the additional courses may be imposed.
3. Passing the Candidacy Exam;
4. Passing the oral presentation of the Dissertation Proposal;
5. Submission of a progress report approved by the thesis adviser and reader at the end of each semester while enrolled in DS 400;
6. Presentation of a Colloquium every two years of dissertation;
7. Passing an oral presentation of the Dissertation;
8. Acceptance of **at least one (1) paper** related to the dissertation work in a highly reputable refereed journal or conference proceeding (e.g. SCIe indexed journal, SCOPUS listed) whitelisted by the Data Science Committee in which the candidate is the primary author; and
9. Submission of dissertation manuscript satisfying the requirement by both the standard university rules and of the implementing unit;

Option 3: PhD by Research

1. Completion of coursework according to the approved Program of Study;
2. *As may be additionally required*: Passing the Qualifying Exam after finishing the additional courses imposed.
3. *Presentation in a colloquium under each DS 396;*
4. Passing the Candidacy Exam;
5. Passing the oral presentation of the Dissertation Proposal;
6. Submission of a progress report approved by the thesis adviser and reader at the end of each semester while enrolled in DS 400;
7. *Oral presentation in an international or national scientific conference;*
8. Acceptance of **at least two (2) papers** related to the dissertation work in a highly reputable refereed journal or conference (e.g., SCIe indexed journal, SCOPUS listed) whitelisted by the Data Science Committee in which the candidate is the primary author; and
9. Submission of dissertation manuscript satisfying the requirement by both the standard university rules and of the implementing unit;

Pickup Degree (Option 1 only). Depending on the program of study, the student will be awarded an appropriate pickup master's degree if the student has completed all the

core courses and elective courses in the first two years of the proposed program of study for Option 1 (i.e., for a total of at least 33-35 credited units), and in addition, must have either passed the Qualifying Examination or submitted a data science project (in lieu of not successfully passing the Qualifying Examination and so not able to continue further with the PhD program). Depending on the program of study and/or taken courses, students may earn the following pickup degree, provided that the requirements for the pickup degree are met.

- Professional Master in Data Science (Analytics)
- Master of Engineering in Industrial Engineering (Analytics Systems Engineering Specialization)
- An appropriate non-thesis master's degree as identified by the degree offering unit and endorsed by the Data Science Committee

The implementing unit that is also the degree-offering unit for the master's program shall be responsible for ensuring that the requirements for the intermediate master's degree are met. The degree-offering unit is also the one to endorse the conferment of the master's degree consistent with university rules and existing guidelines for such master's program.