

New Undergraduate Program (Majors, Minors, Sequences) Proposal
Illinois State University - University Curriculum Committee

Program Department Mathematics

Initiator Pei Geng

Phone 438-7268

Initiator Department Mathematics

Coauthor(s) Maochao Xu (mxu2@ilstu.edu), Papa Sissokho (psissok@ilstu.edu), Gaywalee Yamkulna (gyamsku@ilstu.edu), Xing Fang (xfang13@ilstu.edu), Pruthikrai Mahatanankoon (pmahata@ilstu.edu), Katherine Aplington-Roberge (kaaplir@ilstu.edu)

Submission Date Thursday, January 27, 2022

Email pgeng@ilstu.edu

Campus Address Stevenson Hall 309 D

Title of New Program Data Science and Computational Mathematics Sequence

Version 5 **ID** 324

Proposed Starting Catalog Year 2022-2023

1. Proposed Action

New Major

New Minor

✓ New Sequence

More than 50% of courses in this program are Distance Education

Sequence Major

Data Science and Computational Mathematics

2. Provide *Undergraduate Catalog* copy for new program.

Contact Dr. George Seelinger, Department chair, for more information.

Mathematics Department

Campus Box 4520

Normal, IL 61790-4520

mathchair@ilstu.edu

Copy for the main Department of Mathematics page: <https://illinoisstate.edu/catalog/undergraduate/mathematics>

This sequence is designed to equip students with a solid mathematics and statistics background as well as advanced computer programming skills required for modern data analysis. Students in this sequence follow a common track for the first two years before deciding a concentration in either Data Science or Computational Mathematics. A minimum Mathematics GPA of 2.00 required for graduation.

Data Science Concentration

The Data Science concentration will provide students comprehensive training in mathematical thinking, statistical modeling and computational programming. Students will take courses from mathematics, statistics and information technology areas. During mathematical and statistical preparation, students will learn to think critically about the process of understanding data and analyze data through the full cycle of the investigative process in scientific and practical contexts. During the computational preparation, students will gain solid skills on data structure, computational processes, and data management strategies.

This concentration is designed to equip students with a solid mathematics and statistics background as well as advanced computer programming skills required for modern data analysis. Students majoring in Data Science will learn to think critically about the process of understanding data, and analyze data through the full cycle of the investigative process in scientific and practical contexts. The students in this major will be able to gain deep insights from data in context, using knowledge of statistical inference, computational processes, and data management strategies.

Computational Mathematics Concentration

The Computational Mathematics concentration is a blend of foundational mathematics, applied mathematics, and computer science. It is suited for students interested in pursuing careers in technical fields that require excellent analytical and computational skills. This sequence is also suitable for students who wish to pursue advanced degrees in Applied or Computational mathematics for careers in academia or industry.

Students concentrating in Computational Mathematics will gain extensive preparation in applied and computational mathematics. It is suited for students interested in pursuing careers in technical fields that require excellent analytical and computational skills. This concentration is also suitable for students who wish to pursue advanced degrees in Applied or Computational mathematics for careers in academia or industry.

Copy for the Course Requirements page for the Data Science and Computational Mathematics Sequence

Degree Offered: B.S.

Major Requirements

Minimum required credit hours: 55 (min. of 45 credit hours of Mathematics courses)

- IT 166
- IT 168
- IT 179
- IT 180
- IT 279
- MAT 145
- MAT 146
- MAT 147
- MAT 175
- MAT 252
- MAT 260
- MAT 350

Complete the Data Science or the Computational Mathematics concentration

Data Science Concentration (min. of 17 additional credit hours)

- MAT 351
- MAT 355

Take a minimum of 3 courses (9 credit hours) from the following

- IT 244
- IT 348
- IT 352
- MAT 353
- MAT 354
- MAT 356
- MAT 443
- MAT 450
- MAT 453
- MAT 455
- MAT 456
- MAT 458

Computational Mathematics Concentration (min. of 13 additional credit hours)

- MAT 363

Take at least 3 courses from the following with a minimum of 2 courses from Group 1

Group 1

- IT 244

- IT 328
- MAT 236
- MAT 247
- MAT 268
- MAT 337
- MAT 340
- MAT 361
- MAT 362

Group 2

- MAT 351
- MAT 355
- MAT 443
- MAT 455

Note: Only seniors with good standing will be allowed to take a graduate-level course (courses numbered 400 or higher), provided the Graduate School gives approval. IT courses are not counted towards the min. of 45 credit hours required in Mathematics courses.

3. Provide a description for the proposed program.

This sequence is designed to equip students with a solid mathematics and statistics background as well as advanced computer programming skills required for modern data analysis. Students in this sequence follow a common track for the first two years before deciding a concentration in either Data Science or Computational Mathematics.

The Data Science concentration will provide students comprehensive training in mathematical thinking, statistical modeling and computational programming. Students will take courses from mathematics, statistics and information technology areas. During mathematical and statistical preparation, students will learn to think critically about the process of understanding data, and analyze data through the full cycle of the investigative process in scientific and practical contexts. During the computational preparation, students will gain solid skills on data structure, computational processes, and data management strategies.

Students concentrating in Computational Mathematics will gain extensive preparation in applied and computational mathematics. It is suited for students interested in pursuing careers in technical fields that require excellent analytical and computational skills. This concentration is also suitable for students who wish to pursue advanced degrees in Applied or Computational mathematics for careers in academia or industry.

4. Provide a rationale of proposed program.

In the modern age of Big Data and Artificial Intelligence, massive and complex data have become common in many industrial fields. It is of great importance to provide students not only data analytic skills but also knowledge of data structure and management strategies. Compared to existing programs, such as applied statistics and applied mathematics, this new sequence particularly focuses on programming and computational skills. It is required to take certain core information technology courses in this sequence, while in the existing programs, these courses are elective. This new sequence will greatly enhance the students data analytic skills and data base knowledge. It is expected that the new sequence will attract many students and prepare them to be competitive in the job market or in graduate programs.

5. Describe the expected effects of the proposed program on existing campus programs (if applicable).

This new sequence will add flexibility for students in statistics and mathematics in choosing their careers. The students in this new sequence can also switch back to statistics or mathematics after two years which can potentially increase the enrollment for the Mathematics Department.

6. Provide a sample four-year plan of study that fulfills the following requirements: 120 hours, 42 senior college hours (200 and 300 level courses), and 39 General Education Program hours or 36 hours with exemption. If the program is a BS program, show the BS-SMT degree requirement. If the program is from CAS, show Foreign Language Requirement (LAN 111/LAN 112). Confirm General Education requirement exemptions on the General Education page of the current Academic Catalog. *4-year plans are not required for minor program proposals.*

Sample Plan of Study

First Year Fall Semester (17 credit hours)

MAT 145 Calculus I (General Education) (4)
ENG 101 or COM 110 (3)
General Education (3)
General Education (3)
IT 168 (4)

First Year Spring Semester (17 credit hours)

MAT 146 Calculus II (General Education) (4)
ENG 101 or COM 110 (3)
General Education (3)
IT 166 (4)
General Education (3)

Second Year Fall Semester (16 credit hours)

MAT 147 Calculus III (B.S.-SMT) (4)
MAT 252 (3)
IT 179 (3)
General Education (3)
General Education (3)

Second Year Spring Semester (18 credit hours)

MAT 175 (4)
MAT 260 (4)
MAT 350 (4)
General Education (3)
General Education (3)

Third Year Fall Semester (15 credit hours)

MAT 363 (4) for Computational Math or (Concentration elective or University-wide elective) (4) for Data Science
MAT 351 (4) – for Data Science Concentration
IT 180 (1)
University wide elective (3)
LAN 112 (3) – College Arts Sciences Language Requirement

Third Year Spring Semester (13 credit hours)

MAT 355 (4) – for Data Science or (Concentration elective or University-wide elective) (4) Computational Math
University wide elective (3)
IT 279 (3)
University wide elective (3)

Fourth Year Fall Semester (14-15 credit hours)

University wide elective (4)
Concentration elective (3)
Concentration elective or university wide elective (4)
University wide elective (3-4)

Fourth Year Spring Semester (13-14 credit hours)

Concentration elective (3-4)
Concentration elective (4)
University wide elective (3)
Concentration elective or university wide elective (3)

General Education Program Requirements

ENG 101
COM 110
Natural Science (2 courses)
Mathematics (MAT 145)
US Traditions (1 course)
ICL (1 course)
Fine Arts (1 course)
Humanities (1 course)
Language in Humanities (1 course)
Quantitative Reasoning (MAT 146)
Science, Math, Tech (exempt)
Social Sciences (1 course)

B.S. – SMT Graduation Requirement – MAT 147
CAS Foreign Lang – LAN 112

7. Describe the expected curricular changes required, including new courses. If proposals for new courses have also been submitted, please reference those related proposals here:

This new sequence does not require any curricular changes or new courses.

8. Anticipated funding needs and source of funds.

Two new faculty will be hired for this program. Please see the support document for details.

9. No Does this program count for teacher education?

10. No Is this an Interdisciplinary Studies program?

11. The following questions must be answered.

Yes Have you confirmed that Milner Library has sufficient resources for the proposed program?

No Are more than 120 hours required to complete a degree with this major?

No Beyond General Education, does the major require more than 66 semester hours?

Yes Does this sequence (if in a major) require more than 55 semester hours of courses in the major department/school?

No Does this program stipulate specific general education courses offered in the major department/school as a part of the major requirements only if such courses serve as prerequisites for other courses required by the major?

Yes Does this program stipulate specific course requirements (majors/sequences only) that also satisfy general education and/or IAI requirements?

Please specify those courses below.

MAT 145, and MAT 146

No Is the proposed program intended to be longer than four years (as indicated by the plan of study)?

Yes Have letter(s) of concurrence from affected departments/schools been obtained?
A departments/school is affected if it has a program with significant overlap or if it teaches a required or elective course in the program.

12. Routing and action summary for New Program:**1. Mathematics Department Curriculum Committee Chair**

<u>David Barker (website)</u>	David Barker	10/21/2021 12:03:48 PM
Signature	Print	Date

2. Mathematics Department Chair/School Director

<u>George Seelinger (website)</u>	George Seelinger	10/21/2021 12:13:04 PM
Signature	Print	Date

3. College of Arts & Science College Curriculum Committee Chair

<u>Todd Stewart (website)</u>	Todd Stewart	11/5/2021 2:03:53 PM
Signature	Print	Date

4. College of Arts & Science College Dean

<u>Rocio Rivadeneyra (website)</u>	Rocio Rivadeneyra	11/8/2021 10:22:23 AM
Signature	Print	Date

5. University Curriculum Committee Chair

<u>Mary Califf (website)</u>	Mary Califf	1/31/2022 1:06:20 PM
Signature	Print	Date

All new programs (majors, minors, sequences) are routed by the U.C.C. to the Academic Senate

Comments

Comments from Version 1 from David Barker (Department Curriculum Committee Chair):

Dear Dr. Geng,

The Mathematics Curriculum Committee thanks you, and your coauthors, for your diligent and thoughtful work in developing this proposal for the Data Science and Computational Mathematics Sequence. The Committee appreciates your vision for meeting the future needs of our students and Department and the committee is supportive of your work. The committee has the following suggestions for your proposal:

- 1) Multiple times during the proposal you provide lists of courses (required and optional). We suggest ordering them by Department and number instead of intertwining them. (e.g., IT 166, IT 168, IT 179, IT 279, MAT 145, MAT 146, MAT 147, ...)
- 2) We suggest adding MAT 236 & MAT 268 as optional courses in Group 1 of the Computational Mathematics Concentration.
- 3) We suggest removing MAT 450 and MAT 455 from the optional courses.
- 4) There was considerable discussion in our committee concerning MAT 355 and MAT 356. A complication in this deliberation was the 120-hour limit, which would make it problematic to simply add a course to the requirements. In the end, our conclusion was to have your group consider adding MAT 356 as a requirement in place of MAT 252.

One of the difficulties in any proposal is deciding which courses should be required, especially given the course limitations of a sequence that heavily involves two departments. The Curriculum Committee voiced its high-respect and confidence in all involved in this curriculum process and ask for continued communication as we work out these final decisions. Please feel free to reach out to the Curriculum Committee, especially Dr. Cheng, as you continue your deliberations. In addition, I have a few editorial suggestions that I will scan and forward to you in the next few days. Thanks again for all your hard work.

David Barker
Mathematics Curriculum Committee

Comments from Version 2 from Todd Stewart (College Curriculum Committee Chair):

Hi. We voted that this proposal should be revised and resubmitted. So, I'm hitting the reject button to allow changes (I use the Revise button when much more modest editorial changes are all that is needed). Our overall sense is that this is going to be a very good and worthwhile program to have at ISU. But some details need to be smoothed out. Issues identified by the subcommittee are:

- The Programs of Study have listed in Spring of year 2 'IT 180 or 226' but neither is listed as a requirement. One is a prereq for later classes, so they are de facto required and should be listed as such.
- For the Computational Mathematics Sequence, it lists options in 2 groups, but it says 2 classes are required in Group 1, but no requirement to choose one in Group 2 is listed, so why are there 2 groups?
- It says a "Minimum of 45 hours in MAT required" for the major, but taking the required courses does not add to 45 hours in MAT. For both sequences, there are 27 hours required in MAT. For the Data Science sequence, there are 8 additional hours of MAT required (making 35 required in MAT), then the students choose at least 3 classes from some lists, IF all three are MAT, that is an additional 9, making only 44 hours, less than the minimum 45, and they would not be able to take any of the IT classes on the list. For the Computational Mathematics sequence, there are an additional 4 MAT hours (making 41) required and they need to choose 9 – 10 hours from the lists, and if all were MAT, that would only be 41-42 MAT hours.
- Also, MAT 354 is listed as 3 – 4 hours, but it is only a 3 hour course.

If you have questions about these, please contact Chris Hamaker (chamake@ilstu.edu). He looked at this proposal in detail.

Thanks, Todd Stewart, Chair, CAS CC

Comments from Version 3 from Todd Stewart (College Curriculum Committee Chair):

Hi. We voted to approve this proposal pending some updates. So, while I'm hitting the revise button now to allow changes in the system, I am empowered to approve a suitably updated proposal without seeking another vote. The issues we identified are:

- (1) In the catalog copy, we think that "Three or more courses from Group 1 or both groups including at least two courses from Group 1:" should be replaced with something like: At least three courses from Group 1 and 2, with at least two from Group 1.
- (2) As per the new rules, the program needs to include MAT 144. Please list this as a requirement in the catalog copy, count as part of required hours, and recalculate hours if necessary.
- (3) To the very end of the included plan of study, please add:

Note: Students who place into a lower math course than MAY 145 will need to make adjustments to the sample plan of study.

That's the text CHE used in their proposal to handle the issue of MAT 144.

Thanks, Todd Stewart, Chair, CAS CC

Comments from Version 4 from Ian Gawron (University Curriculum Committee Chair):

After UCC review, this proposal is being sent back on revision to address sample plan of study concerns.

If you have any questions/concerns, please reach out to Amy Hurd (arhurd@ilstu.edu), Mary Elaine Califf (mecalif@ilstu.edu), and/or curriculumforms@ilstu.edu.