

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

Program Department Mathematics

Initiator Gaywalee Yamskulna

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Title of New Program Big Data and Computational Intelligence Sequence

Submission Date Wednesday, January 11, 2023

Email gyamsku@ilstu.edu

Campus Address 4520 Mathematics

Version 1 **ID** 421

Proposed Starting Catalog Year 2024-2025

1. Proposed Action

New Major

New Minor

✓ New Sequence

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

Sequence Major

Data Science

2. Provide Undergraduate Catalog copy for new program.

Major in Data Science, Big Data and Computational Intelligence Sequence

Degree Offered: B.S.

Big Data and Computational Intelligence is a blend of machine learning, deep learning, applied mathematics, statistics, and computational algorithms for modern data analysis. Students in this sequence will learn to think critically about the process of modeling and analyzing large scale data in scientific and practical contexts. The students will be able to gain deep insights from big data using knowledge from statistical inference, computational processes, predictive modeling, and data management strategies. Computational Intelligence plays a major role in the development of solutions based on massive data sets to solve complex problems in various areas in industry. Students in the Big Data and Computational Intelligence sequence will gain extensive preparation to help them become successful data scientists who can solve problems from a wide range of areas in science and technology. A minimum major GPA of 2.00 is required for graduation.

Major Requirements

Minimum required credited hours: 72

- IT 166 Python Programming for Science and Data Analysis (4)
- IT 168 Structured Problem Solving (4)
- IT 179 Introduction to Data Structures (3)
- IT 180 C++ (1)
- IT 279 Algorithms and Data Structures (3)
- IT 348 Introduction to Machine Learning (3)
- MAT 145 Calculus I (4)
- MAT 146 Calculus II (4)
- MAT 147 Calculus III (4)
- MAT 175 Elementary Linear Algebra (4)
- MAT 252 Introduction to Statistics with Applications (3)
- MAT 260 Discrete Mathematics (4)
- MAT 350 Applied Probability Models (4)
- MAT 351 Statistics and Data Analysis (4)
- MAT 355 Generalized Linear Models and Predictive Modeling (4)

Take one of the following:

- POL 309 Data Analysis and Data Visualization in Political Science (3)
- CTK 302 Computer Programming for Creatives (this is the recommended course for this sequence) (3)
- IT 352 Data and Information Visualization (this is the recommended course for this sequence) (3)

Take one of the following:

- PHI 234 Business Ethics (3)
- MKT 236 Business Ethics, Social Responsibility, and Sustainability (3)
- IT 214 Social, Legal, and Ethical Issues in Information Technology (3)

Take 3 courses from the following:

- MAT 337 Advanced Linear Algebra (4)
- MAT 353 Regression and Time Series Analysis (4)
- MAT 354 Nonparametric Statistics (4)
- MAT 356 Statistical Computing (4)
- MAT 362 Linear Optimization (4)
- MAT 363 Graph Theory (4)
- IT 326 Principle of Software Engineering (3)
- IT 328 Introduction to the Theory of Computation (3)

Take one of the following:

- IDS 398a05
- IDS 388

3. Provide a description for the proposed program.

The IDS Data Science major prepares students with the technical knowledge and computational skills to meet current and future problem solving and analysis of large data sets. The IDS Data Science major is an interdisciplinary major with three core areas of curricula including: 1) mathematics and statistics, 2) information technology and computer science, and 3) an applied sequence for contextual application in an area linked to the future career path of the student. The sequences include 1) Big Data and Computational Intelligence, 2) Business Analytics, 3) Population Health, 4) Social Demographic/Public Policy analytics, and 5) Individualized Plan of Study.

The core curriculum will include 32 credit hours of Mathematics courses (20 hours basic and 12 hours advanced courses), 14 credit hours of Information Technology courses, one ethics course, one data visualization course, and one capstone/internship course. The capstone course will be an instructor led course to complete an applied data science project from an external partner. As an alternative to the campus-based capstone project course, students may elect to complete an externally based internship for the equivalent of a 3-credit hour course. The sequence will consist of five to seven additional courses. The proposal provides for five sequences including: 1) Big Data and Computational Intelligence, 2) Business Analytics, 3) Population Health, 4) Social Demographic/Public Policy analytics, and 5) Individualized Plan of Study.

4. Provide a rationale of proposed program.

An increase in employer demand and a large number of relevant job postings indicate strong need for program graduates. In the last 12 months, employers posted a high number of relevant job postings both locally and regionally (i.e., 49,180 and 113,459 job postings, respectively). Between June 2018 and May 2021, employer demand growth for bachelor's-level data science professionals outpaced employer demand growth for all bachelor's-level professionals both locally (i.e., 1.60 percent compared to 0.92 percent), and regionally (i.e., 1.81 percent compared to 0.92 percent). Additionally, local and regional employment is projected to increase faster than average in all top occupations. This indicates a large and growing labor market for program graduates with increasing employment opportunities in the coming years.

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

Upon approval, the major will begin with approximately 50 students and this number of students can be absorbed within the existing departments and courses. As demand grows, faculty will be needed in the core areas of mathematics and information technology. If there is disproportionate distribution of students to the sequences, there may need to be additional faculty resources with future growth. As this is a distinct major, it is anticipated that this will attract new students to Illinois State University who are not currently choosing ISU.

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.*

Four-year Plan of Study for Big Data and Computational Intelligence (120 credit hours)**First Year – Fall Semester (16 credit hours)**

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

First Year - Spring Semester (17 credit hours)

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

Second Year - Fall Semester (16 credit hours)

MAT 147 (BS-SMT) (4)
 MAT 252 (3)
 IT 179 (3)
 General Education (3)
 General Education (3)

Second Year - Spring Semester (15 credit hours)

MAT 175 (4)
 IT 180 (1)
 MAT 350 (4)
 General Education (3)
 General Education (3)

Third Year - Fall Semester (14 credit hours)

MAT 260 (4)
 MAT 351 (4)
 University-wide elective (3) (AMALI)
 IT 254 (3) or IT 225 (3) (Pre-req for IT 261)

Third Year - Spring Semester (13 credit hours)

MAT 355 (4)
 IT 279 (3)
 University-wide elective (3)
 Major Elective course (3-4)

Fourth Year - Fall Semester (13 credit hours)

PHI 234, MKT 236, or IT 214 (3)
 Major Elective course (3-4)
 University-wide elective (3) (IDEAS)
 CTK 302, or IT 352 (3)

Fourth Year - Spring Semester (16 credit hours)

IDS 398.05 or IDS 388 (3)
 IT 348 (3)
 Major Elective course (3-4)
 University-wide elective (3)
 University-wide elective (3)

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 program will require two new courses including a capstone course (IDS 388) and an internship course (IDS 398.05).

8. Anticipated funding needs and source of funds.

This program will need 1.5 administrative personnel staff hired by year 5 of the program. An AP staff member with duties including academic advising and a capstone/internship coordination will be needed in year 1. By year 5 the initial AP will coordinate internship/capstone courses and teach 1 course each semester in the capstone. At this point a .5 advisor will be needed to cover the highly specialized advisement.

In year 1, the program will need 1 MAT tenure track faculty member who specializes in Applied & Pure Mathematics and 1 IT faculty member. In year 2, the program will need 1 BIS and 1 MKT faculty members. By year 5 the total number of new tenure track faculty members will be 11 comprised of:

4 MAT tenure track faculty members who specializes in Applied & Pure Mathematics and Statistics

3 IT

2 BIS

2 MKT

With a projection of 50 students per year, by year 5 with 250 and projected tuition revenue of \$8500 per student, the program will generate \$2,125,000. The personnel costs will be \$1,300,000.

9. No Does this program count for teacher education?

10. Yes Is this an Interdisciplinary Studies program?

List all departments who share in the administration of this program.

- Mathematics
- Accounting
- Anthropology
- Health Sciences
- Marketing
- Politics and Government
- School of Information Technology
- Sociology

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?

Yes Beyond General Education, does the major require more than 66 semester hours?

Rationale for mandating over 66 hours in the major. [Required Hours Policy](#)

As an interdisciplinary program, it is necessary to include depth of knowledge in disciplines along with the breadth of knowledge across disciplines. Required courses for the major along with General Education requirements still puts students below the 120-credit hour mark.

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 (MAT, IAI M1 900-1 College-level Calculus I), MAT 146 (QR, BS-SMT, IAI M1 900-2 College-level Calculus II), MAT 147 (IAI M1 900-3 College-level Calculus III, BS-SMT), MAT 175 (BS-SMT)

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	1/19/2023 11:09:34 AM
Signature	Print	Date

2. Mathematics Department Chair/School Director

<u>Gaywalee Yamskulna (website)</u>	Gaywalee Yamskulna	1/19/2023 11:11:33 AM
Signature	Print	Date

3. School of Information Technology Department Chair

<u>Traci Carte (website)</u>	Traci Carte	1/19/2023 11:13:16 AM
Signature	Print	Date

4. Anthropology Department Chair

<u>Joan Brehm (website)</u>	Joan Brehm	1/19/2023 11:17:13 AM
Signature	Print	Date

Signature

Print

Date

5. Sociology Department Chair*Joan Brehm (website)*

Joan Brehm

1/19/2023 11:17:36 AM

Signature

Print

Date

6. Politics and Government Department Chair*Thomas McClure (website)*

Thomas McClure

1/19/2023 11:49:38 AM

Signature

Print

Date

7. Marketing Department Chair*Horace Melton (website)*

Horace Melton

1/19/2023 12:57:23 PM

Signature

Print

Date

8. Health Sciences Department Chair*David Grieshaber (website)*

David Grieshaber

1/19/2023 1:07:20 PM

Signature

Print

Date

9. Accounting Department Chair*Joseph Johnston (website)*

Joseph Johnston

1/19/2023 1:46:03 PM

Signature

Print

Date

10. Council on General Education Chair*Gregory Ferrence (website)*

Gregory Ferrence

2/9/2023 1:56:41 PM

Signature

Print

Date

11. University Curriculum Committee Chair*Mary Califf (website)*

Mary Califf

3/10/2023 2:59:54 PM

Signature

Print

Date

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