New Proposal

Date Submitted: 04/21/23 3:07 pm

Viewing: : Data Science Minor

Last edit: 03/21/24 12:01 pm

Changes proposed by: David Unger

In Workflow

1. **U Program Review**
2. **1583 Head**
3. **1434 Head**
4. **1992 Head**
5. **1257 Head**
6. **KP Committee Chair**
7. **LP Committee Chair**
8. **KP Dean**
9. **LP Dean**
10. **KV Dean**
11. **University Librarian**
12. **COTE Programs**
13. **Provost**
14. **Senate EPC**
15. Senate
16. U Senate Conf
17. Board of Trustees
18. IBHE
19. HLC
20. DMI

Approval Path

1. 04/24/23 2:02 pm Deb Forgacs (dforgacs): Approved for U Program Review
2. 04/24/23 2:13 pm Bo Li (libo): Approved for 1583 Head
3. 04/24/23 3:14 pm Margaret Fleck (mfleck): Approved for 1434 Head
4. 04/24/23 4:44 pm Melissa Newell

(menewell): Approved for 1992 Head
5. 04/28/23 11:04 am Lee DeVille (rdeville): Approved for 1257 Head
6. 09/22/23 9:23 am Ashley Hallock (ahallock): Approved for KP Committee Chair
7. 10/12/23 11:41 am Lisa Bievenue (bievenue): Approved for LP Committee Chair
8. 10/12/23 11:42 am Michael Stoller (stoller4): Approved for KP Dean
9. 02/20/24 5:04 pm Catherine Blake (clblake): Approved for LP Dean
10. 02/28/24 2:08 pm Stephen Downie (sdownie): Approved for KV Dean
11. 03/05/24 11:05 am Claire Stewart (clairest): Approved for University Librarian
12. 03/05/24 5:30 pm Suzanne Lee (suzannel): Approved for COTE Programs

13. 03/07/24 1:32 pm Brooke Newell (bsnewell): Approved for Provost

Proposal Type

Proposal Type:
Minor (ex. European Union Studies)

Administration Details

Official Program Name	Data Science Minor
Diploma Title	Minor in Data Science
Sponsor College	Liberal Arts & Sciences
Sponsor Department	Statistics
Sponsor Name	Feng Liang
Sponsor Email	liangf@illinois.edu
College Contact	Stephen R. Downie
College Contact Email	sdownie@illinois.edu
College Budget Officer	Michael Wellens, Assistant Dean of Finance and Resource Planning
College Budget Officer Email	wellens@illinois.edu

List the role for rollbacks (which role will edit the proposal on questions from EPC, e.g., Dept Head or Initiator) and/or any additional stakeholders. Purpose: List here who will do the editing work if proposal needs rolled back. And any other stakeholders.

David Unger, Director of Undergraduate Programs, dunger@illinois.edu
Bo Li, Department Chair, libo@illinois.edu

Does this program have inter-departmental administration?

Yes

Interdisciplinary Colleges and Departments (list other colleges/departments which are involved other than the sponsor chose above)

Please describe the oversight/governance for this program, e.g., traditional departmental/college governance. Inclusion of/roles of elected faculty committees? Inclusion of/roles of any advisory committees.

The curriculum and experience of the Minor in Data Science is interdisciplinary. The units involved in the collaboration and continued oversight of the Minor in Data Science are as follows:
- Department of Statistics (sponsoring unit)
- Department of Computer Science
- Department of Mathematics
- School of Information Sciences

The Department of Statistics submits this proposal for the Minor in Data Science and will be the primary administrator of the Minor – a role which includes:
- Providing infrastructure and advising services to support the Minor and students,
- Submitting revision proposals as needed, and
- Maintaining, publicizing, and updating the list of qualified courses as needed.

The inspiration for the core set of required courses and advanced electives is taken from the framework of the X+DS majors. Thus, the four units who each contribute to the core of the X+DS majors (listed above) will provide continued oversight of the Minor and its curriculum. The respective executive officers of these units (e.g., dean, head, chair) will each appoint a member to a steering committee which will be responsible for continued development of the Minor. Most notably, this steering committee will guide the evolution of the Minor's curriculum and evaluate the merits of potential new courses for inclusion.

College	Grainger College of Engineering
Department	Computer Science
Is there an additional department involved in governance?	Yes
College	Information Science, School of
Department	Information Sciences
Is there an additional department involved in governance?	Yes
College	Liberal Arts & Sciences
Department	Mathematics
Is there an additional department involved in governance?	No

Proposal Title

Effective Catalog Term	Fall 2024

Proposal Title (either Establish/Revise/Eliminate the Degree Name in Program Name in the College of XXXX, i.e., Establish the Bachelor of Science in Entomology in the College of Liberals Art and Sciences, include the Graduate College for Grad Programs)

Establish the Undergraduate Minor in Data Science in the College of Liberal Arts & Sciences

Does this proposal have any related proposals that will also be revised during the next 6 weeks? Consider Majors, Minors, Concentrations & Joint Programs in your department. Please know that this information is used administratively to move related proposals through workflow efficiently. Example: If you are revising the BS proposal and one related concentration within the next 6 weeks, "This BS proposal (key 567) is related to the Concentration A proposal (key 145)."

Program Justification

Provide a brief justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

In Spring 2017, in response to an Investment for Growth Proposal from the Department of Statistics, Interim Provost John Wilkin called on the College of Liberal Arts & Sciences, the Grainger College of Engineering, the Gies College of Business, and the School of Information Sciences to develop a collaborative approach to undergraduate data science at UIUC. The deans of those colleges formed a task force (herein the “Data Science Education Task Force” or DSETF) to explore opportunities and make proposals for undergraduate data science education at UIUC. At the core of their work was the vision that every Illinois undergraduate should have the opportunity to have a meaningful exposure to data science. In February of 2019, the four deans agreed to support a shared framework for X + Data Science majors, based on recommendations from the DSETF. In addition to the X + Data Science majors, the DSETF also believes that a Minor in Data Science would contribute to this mission and make data science more accessible at UIUC. A Minor in Data Science would be a valuable addition to any major on campus and will empower students from a wide array of disciplines to understand how statistics, computation, and business intelligence work together. The Minor in Data Science prepares students with knowledge and computational tools to actively engage in data science projects and can help prepare students to further their education in graduate school, and to use data science in their field of interest.

Please include how the proposed minor requires some depth in the subject, but not as extensive as the major.

There is not a major titled as nor exclusively dedicated to the discipline of Data Science on our campus. However, the campus has spearheaded an initiative to create collaborative majors Data Science, named X+DS Majors. The Minor in Data Science provides students with a comprehensive overview of data science that includes a strong foundation in the basics as well as more advanced skills such as modeling and machine learning. The Minor is not as extensive as the majors because it does not include the "X" discipline found in the collaborative X+DS majors; the Minor requires fewer courses to complete; and the Minor does not include the research or capstone experience found in the X+DS majors. Students in the X + Data Science majors cannot earn the Minor in Data Science.

The proposed minor will provide introductory and intermediate depth into the exploration of data science. The Majors within the X+DS framework require eight core courses from the DS pillar units of CS, IS, Math, and Stat, along with a variety of courses from the X discipline to round out the curriculum. The DS Minor will require only three of those eight core courses from the X+DS Majors and three additional supporting courses available from both the X and DS units.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does this new program/proposed change result in the replacement of another program?

No

Does the program include other courses/subjects outside of the sponsoring department impacted by the creation/revision of this program?

Yes

Courses outside of the sponsoring department/interdisciplinary departments

- ATMS 207 - Weather and Climate Data Sci
- CS 307 - Model & Learning in Data Sci
- CS 225 - Data Structures
- CS 277 - Algo & Data Stru for Data Sci
- CS 416 - Data Visualization
- CS 441 - Applied Machine Learning
- GGIS 407 - CyberGIS & Geospatial Data Sci
- IS 417 - Data Science in the Humanities
- IS 445 - Data Visualization
- IS 467 - Ethics & Policy for Data Scien
- IS 477 - Data Mgmt, Curation, & Reprodu

LING 406 - Intro to Computational Ling
IS 357 - Intro to Data Storytelling
MATH 467 - Math For Machine Learning
STAT 107 - Data Science Discovery

Please attach any letters of support/acknowledgement for any Instructional Resources consider faculty, students, and/or other impacted units as appropriate.

DS_minor_proposal_letters_of_support_all_042423.pdf

Program Regulation and Assessment

Plan to Assess and Improve Student Learning

Illinois Administrative Code: 1050.30(b)(1)(D) Provision is made for guidance and counseling of students, evaluations of student performance, continuous monitoring of progress of students toward their degree objectives and appropriate academic record keeping.

List the program's student learning outcomes. Each outcome should identify what students are expected to know and/or be able to do upon completing this program.

The student learning outcomes are intertwined with the framework for the Minor in Data Science. Through the curriculum of the Minor, students will be able to:
- understand, explain, and utilize basic data science techniques,
- cultivate their data science skills in a domain specific field through interdisciplinary courses, and
- develop and apply ethical practices in their data analysis.

Describe how, when, and where these learning outcomes will be assessed.

Describe here:

The methods for program assessment for the Minor in Data Science will be similar to those utilized for the Department of Statistics major programs. These include:
- a satisfaction survey to students within the Minor program,
- evaluating code samples from students, and
- reviewing analysis samples from students.

Identify faculty expectations for students' achievement of each of the stated student learning outcomes. What score, rating, or level of expertise will signify that students have met each outcome? Provide rating rubrics as necessary.

The faculty expectations for students' achievement within the Minor in Data Science will be similar to those utilized for the Department of Statistics major programs. Unlike our Major programs, the Minor allows students a wider array of supporting courses, including interdisciplinary choices maintained by other departments which do not include our Statistics faculty.

Explain the process that will be implemented to ensure that assessment results are used to improve student learning.

The Undergraduate Program Committee in the Department of Statistics will be tasked with compiling an annual report on the student learning outcomes of the Minor in Data Science. This report will be crafted to include feedback from the DS Minor Steering Committee. This information will be available to the department faculty and DS Minor Steering Committee for the purpose of helping to evolve the Minor.

Program Description and Requirements
Attach Documents

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PublicAdminRules2017.pdf). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

An undergraduate minor should consist of at least 16 - and no more than 21 hours - of course work, with at least 6 hours of 300- or 400- level courses. Except for clearly remedial offerings, prerequisite courses within the sponsoring unit count towards the total; prerequisite courses outside the sponsoring unit do not count toward this total. The unit sponsoring the minor and that unit's college may set educationally necessary prerequisites for eligibility for the minor within these constraints. Does this proposal meet these criteria?

Yes

Attach Program of Study-related information such as sample sequences (for undergraduate programs) or college-level forms.

Catalog Page Text - Overview Tab

Description of program for the catalog page. This is not official content, it is used to help build the new catalog page for the program. Can be edited in the catalog by the college or department.

The Minor in Data Science, an interdisciplinary collaboration administered by the Department of Statistics, is designed to provide students with an understanding of data science, including statistical analysis and inference, computation, and business intelligence. A Minor in Data Science will assist students with their major field of study to better prepare them for a career in their chosen field. It will also prepare students for graduate studies in a multitude of areas where data science plays an important role. Interested students should submit the Minor Declaration Form available from the Provost's website. Advising for undergraduates interested in the Minor in Data Science is available in the Department of Statistics.

All University of Illinois undergraduate students are eligible to earn the Minor in Data Science, except for those enrolled in a BS degree program for an X+DS major. While there are no strict prerequisites to enter the Minor, basic familiarity with computers is expected.

To complete the Minor, students must complete three core courses plus three supporting courses which cover sufficient data science content from an approved list of courses offered from a range of disciplines. The three core courses are STAT 107, STAT 207, and CS 307. Note that students must complete one calculus course (e.g., MATH 234, MATH 220) and one linear algebra course (e.g., MATH 227, MATH 257) prior to taking CS 307.

To satisfy the completion of three supporting courses in data science, students must choose two courses from the Domain Specific Data Science group and one course from the Data Ethics group. Some courses in the two supporting groups may have prerequisites aside from the three core courses of the Minor. The lists of Supporting Courses that satisfy the Minor in Data Science are dynamic as new classes are added each year. As data science curricula across the University develop, other courses approved by the steering committee for the Minor in Data Science will be added.

Completion of the Minor in Data Science requires at least six hours of advanced (300 or 400 level) course credit distinct from credit earned for any major or another minor.

Statement for Programs of Study Catalog

Course List

Code	Title	Hours
STAT/CS/IS 107	Data Science Discovery	4
STAT 207	Data Science Exploration	4
CS 307	Modeling and Learning in Data Science	4
Note that students must complete one calculus course (e.g., MATH 234, MATH 220) and one linear algebra course (e.g., MATH 227, MATH 257) prior to taking CS 307.		
Choose 2 courses in Domain Specific Data Science		6-8
ATMS 207	Weather and Climate Data Science	
CS 225	Data Structures	
CS 277	Algorithms and Data Structures for Data Science	

Code	Title	Hours
Students may use credit from CS 225 or CS 277, but not both.		
CS 416	Data Visualization	
CS 441	Applied Machine Learning	
GGIS 407	Foundations of CyberGIS & Geospatial Data Science	
IS 357	Introduction to Data Storytelling	
IS 417	Data Science in the Humanities	
IS 445	Data Visualization	
LING 406	Introduction to Computational Linguistics	
MATH 467	Mathematics for Machine Learning	
STAT 432	Basics of Statistical Learning	
STAT 440	Statistical Data Management	
STAT 447	Data Science Programming Methods	
STAT 480	Big Data Analytics	
Choose 1 course in Data Ethics		3
IS 467	Ethics and Policy for Data Science	
IS 477	Data Management, Curation & Reproducibility	
Total Minimum Hours Required		21

Program Features

Academic Level Undergraduate

Is this minor?
An interdisciplinary study focusing on a single theme

Is This a Teacher Certification Program?
No

Will specialized accreditation be sought for this program?

No

Other than certification via the students' degree audits, is there any additional planned mechanism to award/honor successful completion of the minor?
No

Delivery Method

This program is available:
On Campus - Students are required to be on campus, they may take some online courses.

Enrollment

Will the department limit enrollment to the minor?
No

Describe how the department will monitor the admission to/enrollment in the minor.

The Department of Statistics will use the current University process of having students submit the Provost's "Intent to Declare a Minor" form. All UIUC undergraduate students will be given an opportunity to enroll after completing the form, with the exception of those pursuing a BS degree in an X+DS major. Although this Minor is a interdisciplinary collaboration, students will be advised by the staff within the Department of Statistics.

Are there any prerequisites for the proposed minor?

Yes

List the prerequisites including course titles and number of credit hours for each prerequisite course, and whether or not these prerequisites count in the total hours required for the minor.

There are no prerequisites for the DS Minor. However, prior to taking one of the core minor courses, CS 307, students must complete a first semester calculus course (e.g., MATH 220, MATH 234) and a linear algebra course (e.g., MATH 227, MATH 257).

Number of Students in Program (estimate)

Year One Estimate	50	5th Year Estimate (or when fully implemented)	300

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Additional Budget Information

The Minor in Data Science is comprised of courses from the Data Science core of the X+DS Majors and is expected to be a small fraction of all Data Science students (<10%). We anticipate no additional impact on faculty resources beyond the demand created by the X+DS Majors.

Attach File(s)

Financial Resources

How does the unit intend to financially support this proposal?

We do not anticipate additional financial resources will be necessary.

Will the unit need to seek campus or other external resources?

No

Attach letters of support

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

This proposal utilizes the existing courses and does not include significant topics that the University Library does not currently support. Current resources are sufficient to meet the needs of the program according to Sarah Park, subject specialist for the Mathematics Library.

EP Documentation

EP Control Number	EP.24.092
Attach Rollback/Approval Notices	
This proposal requires HLC inquiry	No

DMI Documentation

Attach Final Approval Notices	
Banner/Codebook Name	
Program Code:	

Minor Code	Conc Code	Degree Code	Major Code

Senate Approval Date	
Senate Conference Approval Date	
BOT Approval Date	
IBHE Approval Date	
HLC Approval Date	
DOE Approval Date	
Effective Date:	

Attached Document Justification for this request

Program Reviewer Comments

Key: 1192

Letters of Support

ATMS - Atmospheric Sciences

From: Trapp, Robert <jtrapp@illinois.edu>
Sent: Thursday, May 5, 2022 7:33 AM
Subject: Re: [DS Minor] Request to include ATMS courses in the Data Science Minor

Dear David,

On behalf of the Department of Atmospheric Sciences, I grant you permission to include ATMS 207 in the curriculum for the DS Minor and Certificate.

Thanks!
Jeff

ILLINOIS

DEPARTMENT OF COMPUTER SCIENCE
Thomas M. Siebel Center for Computer Science
201 N. Goodwin Ave.
Urbana, IL 61801-2302 USA

NANCY M. AMATO
Abel Bliss Professor and Head
2248 Siebel Center
namato@illinois.edu

April 22, 2023

To Whom It May Concern,

I am writing to indicate the strong support of the Department of Computer Science for the proposal to create a Minor in Data Science.

This Minor is formally sponsored by the Department of Statistics in the College of Liberal Arts & Sciences and is a collaboration between the four units (Computer Science, the iSchool, Mathematics and Statistics) that have developed and provide the data science core for the X+DS degree programs.

Computer Science is excited to continue our collaboration with Statistics, Mathematics and the iSchool and will provide support to the Minor in Data Science in the following ways:

1. Computer Science agrees to be a collaborator in the continued evolution of the Data Science Minor. Specifically, we will appoint a member to serve on a steering committee which will be responsible for evaluating the merits of potential new courses for inclusion to the Minor.

2. Computer Science supports including the following to satisfy requirements of this Minor:
    - STAT/CS/IS 107: Data Science Discovery (4 hours)
    - CS 225: Data Structures (4 hours)
    - CS 277: Algorithms and Data Structures for Data Science (4 hours)
    - CS 307: Modeling and Learning in Data Science (4 hours)
    - CS 416: Data Visualization (3 hours)
    - CS 441: Applied Machine Learning (3 hours)

In summary, Computer Science is excited to continue our collaboration with Statistics, Mathematics and the iSchool to provide more students on campus the opportunity to develop data science skills by supporting the Minor in Data Science.

Sincerely,

Nancy M. Amato
Abel Bliss Professor and Head
Department of Computer Science

GGIS - Geography & Geographic Information Science

From: Cidell, Julie L <jcidell@illinois.edu>
Sent: Wednesday, February 22, 2023 5:12 PM
Subject: Re: [DS Minor] Request for letter of support

Hello David,

Yes, I agree that GGIS 407 can be included in the Minor in Data Science.

Sincerely,
Julie Cidell
Acting Department Head, Geography & Geographic Information Science

IS - Information Sciences

From: Underwood, William E <tunder@illinois.edu>
Sent: Friday, February 24, 2023 9:17 AM
Subject: Re: [DS Minor] Request for letter of support; collaborative minor

Hi David —

Sorry to be slow; it's been an unusually busy week.

Personally I'm very impressed by the plan of this minor. I'm not only willing to support it, but enthusiastic about the plan for a steering committee, which seems forward-thinking and inclusive.

However, let me check with my Dean and Executive Associate Dean before providing an official letter of support. I don't want to overstep. My initial reaction, though, is certainly positive.

Yours,

Ted

Ted Underwood
Professor of Information Sciences and English
Associate Dean of Academic Affairs, School of Information Sciences

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From: Underwood, William E <tunder@illinois.edu>
Sent: Tuesday, February 28, 2023 2:19 PM
Subject: Re: [DS Minor] Request for letter of support; collaborative minor

Hi David —

After checking with other members of our administrative team, I feel comfortable saying that the iSchool can support this proposed minor.

Ted

Ted Underwood
Professor of Information Sciences and English
Associate Dean of Academic Affairs, School of Information Sciences

LING - Linguistics

From: Lasersohn, Peter Nathan <lasersoh@illinois.edu>
Sent: Thursday, May 5, 2022 3:23 PM
Subject: RE: [DS Minor] Request to include LING courses in the Data Science Minor

Yes, the Department of Linguistics would be happy to have LING 406 count as an elective for the Data Science minor.
Peter Lasersohn
Prof. of Linguistics

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

College of Liberal Arts & Sciences
Department of Mathematics
273 Altgeld Hall, MC-382
1409 W. Green St.
Urbana, IL 61801 USA

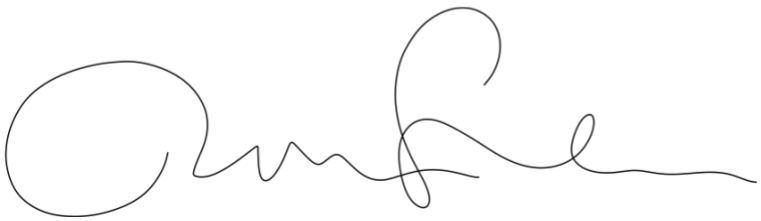
April 17, 2023

To whom it may concern:

The Department of Mathematics endorses the proposal for the Minor in Data Science, sponsored by the Department of Statistics in the College of Liberal Arts & Sciences. In particular, our unit will provide support to the Minor in Data Science in the following ways.

1) Our department will allow inclusion of the following courses to satisfy requirements of this Minor.
    a. MATH 467: Mathematics for Machine Learning (4 hours)
2) Our department agrees to be a collaborator in the continued evolution of this Minor. Specifically, our Head will appoint a member of our Department to serve on a steering committee which will be responsible for evaluating the merits of potential new courses for inclusion to the Minor.
3) Our department also acknowledges that at least one of the courses required for the Minor list a first course in Calculus (MATH 220 or 221 or 231) and a course in Linear Algebra (MATH 227 or 257) as prerequisites. We are currently in the practice of running MATH 220, 231, and 257 every semester, MATH 221 every fall, and MATH 227 every Spring, and expect that we will continue to do so.

Sincerely,



Vera Hur

Professor and Chair