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Viewing: BS-DS : Bachelor of Science in Data Science

Last approved: 11/11/22 12:49 pm

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Changes proposed by: ellisr

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In Workflow

1. CC Interdisciplinary Curriculum Committee Chair
2. Academic Affairs
3. Undergraduate Academic Affairs
4. CC Dean
5. Undergraduate Studies Committee Chair
6. Faculty Council Chair
7. Academic Affairs

Program Status	Active
Requestor	Name Robert Ellis Patty Johnson Winston E-mail ellisr@iit.edu
Origination Date	2025-2-21 2022-11-11
Is this an interdisciplinary program?	Yes
Academic Unit College	Applied Mathematics College of Computing
Contributing Academic Unit(s)	Academic Units Computer Science
Program Title	Bachelor of Science in Data Science
Effective Academic Year	2025 2022 - 2026 2023
Effective Term	Fall 2025
Academic Level	Undergraduate

Approval Path

1. 02/21/25 10:36 pm Xiaofan Li (lix): Approved for CC Interdisciplinary Curriculum Committee Chair

History

1. Jun 14, 2022 by Kiah Ong (kong2)
2. Nov 11, 2022 by Patty Johnson Winston (winston)
3. Nov 11, 2022 by Patty Johnson Winston (winston)
4. Nov 11, 2022 by Patty Johnson Winston (winston)

If all courses in a subject in your department are required, please enter each subject followed by the number ranges in the "Quick Add" field in the pop up box when you click the green plus button below. For example: ARCH 100-499.

What courses will factor the major GPA?

Program Type Degree

Degree Type Bachelor of Science (BS)

CIP Code
30.7001 - Data Science, General.

Program Code BS-DS

Program Attribute

Total Program Credit Hours 120 ~~127~~

Rationale for change in program credit hours.

The university has moved to a minimum of 120 credit hours for BS programs, and we are reducing the number of free elective credits and Data Science Elective credits to have this degree's minimum requirement be in line with the new university policy.

Please provide a summary and rationale for the requested program revision.

Proposed Changes:

(1) Reduce the Data Science Technical Depth credits from 12 credits to 9 credits.

(2) Reduce the free electives from 9 credits to 2-5 credits, subject to 120 minimum degree credits.

(3) Remove HIST 385 from the Ethics and Society requirement.

Overall, this reduces the total minimum number of credits from 127-130 to 120.

Rationale:

(1) Even after the reduction in Data Science Technical Depth credits, this degree remains robust and has more than the typical number of required courses at both lower and upper levels.

(2) The reduction in free electives is mainly to reach the minimum 120 credit hours for the degree.

(3) HIST 385 no longer exists as a course, according to the CIM system. There is no other reason for removing it, and it can be restored were the course to reactivate. 11/11/2022;

PJW:Entered Sample Curriculum, which was missing from Bulletin next. 11/11/2022;

Program Narrative and Justification

Narrative description of how the institution determined the need for the program. For example, describe what need this program will address and how the institution became aware of that need. If the program is replacing a current program(s), identify the current program(s) that is being replaced by the new program(s) and provide details describing the benefits of the new program(s). If the program will be offered in connection with, or in response to, an initiative by a governmental entity, provide details of that initiative.

In the last decade, data science education has been mainly at the graduate level. Many universities have opened data science master's programs or programs of similar names. Illinois Tech also opened MAS in Data Science in 2013 and MAS in AI in 2019 to meet the demands from students. Although these programs have been successful with graduates working in many reputable companies and industries, many universities have now also realized the importance and benefits of data science education at the undergraduate levels. Prominent examples include the UC Berkeley BA in Data Science, Carnegie Mellon University B.S. in Statistics and Machine Learning, and the brand new University of Chicago BA in Data Science.

Narrative description of how the program was designed to meet local market needs, or for an online program, regional or national market needs. For example, indicate if Bureau of Labor Statistics data or State labor data systems information was used, and/or if State, regional, or local workforce agencies were consulted. Include how the course content, program length, academic level, admission requirements, and prerequisites were decided; including information received from potential employers about course content; and information regarding the target students and employers.

Data science has become an increasingly popular profession in industries, businesses, and government organizations across the economy and society, with a high projected job growth rate through 2030 and attractive median salary. Employees trained with the analytical and computational knowledge and skills of data science are highly sought after. As one of the highest-paying professions, data science and related majors are also increasingly popular among students.

Narrative description of any wage analysis the institution may have performed, including any consideration of Bureau of Labor Statistics wage data related to the new program.

"Data Scientist" is the #2 job in the 2021 Glassdoor ranking as of October, 2021; with closely related jobs "Data Engineer" and "Machine Learning Engineer" also making the top 50. The US Bureau of Labor Statistics predicts 31.4% cumulative growth in data science and other mathematical science occupations between 2020-2030, with median salary of \$98,230.

Narrative description of how the program was reviewed or approved by, or developed in conjunction with, one or more of the following: a) business advisory committees; b) program integrity boards; c) public or private oversight or regulatory agencies (not including the state licensing/authorization agency and accrediting agency); and d) businesses that would likely employ graduates of the program. For example, describe the steps taken to develop the program, identify when and with whom discussions were held, provide relevant details of any proposals or correspondence generated, and/or describe any process used to evaluate the program.

The proposal was being put together in the fall of 2021. The details of the proposal were worked out by Lulu Kang(AMAT), Michael Pelsmajer (AMAT), and Robert Ellis (AMAT). After that, the Computer Science Department was looped in to help comment on the proposal.

In particular, a steering committee was formed to help with the program administration.

As of February, 2025, the committee consists of the following members.

Director and Chair of Steering Committee: Robert Ellis (AMAT)

Steering Committee: Michael Pelsmajer (AMAT), Ioan Raicu (CS), Binghui Wang (CS)

The original committee consisted of the following members.

Director and Chair of Steering Committee: Lulu Kang (AMAT)

Steering Committee: Robert Ellis (AMAT), Michael Pelsmajer (AMAT), Ioan Raicu (CS), Binghui Wang (CS), Kai Shu (CS)

Admission Entry Details

What are the enrollment estimates?

Year 1	20	Year 2	40	Year 3	80
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Attach Additional
Program
Justification
Document(s)

Academic Information

Advising

Since quality advising is a key component of good retention, graduation, and career placement, how will students be mentored? What student professional organizations will be formed? How will the department work with the Career Services office to develop industry connections?

The program administrator will work with the Applied Mathematics and Computer Science Departments to find suitable faculty and/or staff to serve as academic advisors to students in the program. Such advisors will need to be familiar with the curriculum the data science domain, and the university policy regarding the undergraduate study. The students are required to regularly get in touch with the academic advisor to report and receive feedback on their study, courses selection, and academic performances.

Connections have been established with the industry through our experience running the Master in Data Science program. We plan to enhance these connections and give students a wide range of options in internship and job opportunities.

Program Resources

Which program resources are necessary to offer this program?

Personnel

Describe the personnel requirements necessary to offer the program. Describe how and when resources will be made available to hire any additional personnel that are required.

Program Director (faculty). Responsible for the overall content of the curriculum and ensuring that needed courses are developed and taught, in conjunction with the steering committee and the Applied Mathematics and Computer Science Departments. Runs regular program assessments. Builds and maintains a network of corporate, non-profit, and government employers of data scientists; for the purposes of (1) Securing Math 4XX internships; (2) Developing case studies and projects for incorporation into data science courses; and (3) Updating curriculum content with the evolving skill sets required of data science practitioners. Assists post-graduation job placement of majors. Assists with fundraising efforts. Appointed by agreement of the Applied Mathematics and Computer Science Department chairs.

Program Coordinator (staff). Tracks majors through graduation and beyond, to maintain an alumni network to support identification of internship and career opportunities for current majors as well as engagement and fundraising. Supports guest speakers and seminars. Processes logistics for data science internships, and supports sharing agreements between faculty and outside organizations for internships, case studies, and data-sharing. Facilitates compliance with IIT regulations and employment law. Forms and coordinates vertically-integrated student data science pods, mixing new and experienced students for mentoring in academic success, conducting team projects, and preparing for careers. (This may be a part-time position initially until the program grows sufficiently.)

Proposed Catalog Entry

Admission

Requirements

The admission requirements of the B.S. in Data Science program are similar to other undergraduate programs of the College of Computing. The administration staff of the program will work in coordination with the Undergraduate Admissions Office on marketing, recruitment and other aspects of the admission process.

Course Requirements

Data Science Requirements		(24-25)
DS 100	Introduction to the Profession	3
DS 151	Introduction to Data Science	3
Select one of the two options:		6-7
DS 251 & DS 351	Mathematical Foundations for Data Science I and Mathematical Foundations for Data Science II	6
MATH 252 & MATH 350	Introduction to Differential Equations and Introduction to Computational Mathematics	7
DS 261	Ethics and Privacy in Data Science	3
DS 451	Data Science Life Cycle	3
or CSP 571	Data Preparation and Analysis	
MATH 474	Probability and Statistics	3
or MATH 476	Statistics	
MATH 484	Regression	3
or CS 484	Introduction to Machine Learning	
Applied Mathematics Requirements		(17)
MATH 151	Calculus I	5
MATH 152	Calculus II	5
MATH 251	Multivariate and Vector Calculus	4
MATH 332	Elementary Linear Algebra	3
Computer Science Requirements		(10-12)
Select one of the following sequences:		4-6
CS 115 & CS 116	Object-Oriented Programming I and Object-Oriented Programming II	4
CS 104 & CS 201	Introduction to Computer Programming for Engineers and Accelerated Introduction to Computer Science	6

CS 331	Data Structures and Algorithms	3
CS 425	Database Organization	3
Communication		(3)
Select one of the following:		3
COM 421	Technical Communication	3
COM 428	Verbal and Visual Communication	3
INTM 301	Communications for the Workplace	3
ITM 300	Communication in the Workplace	3
SCI 522	Public Engagement for Scientists	3
Ethics and Society		(3)
Select one of the following:		3
HIIST 385	Course HIIST 385 Not Found	3
ITMM 485	Legal and Ethical Issues in Information Technology	3
PHIL 374	Ethics in Computer Science	3
PHIL 375	Computer Ethics	3
PHIL 381	Artificial Intelligence, Philosophy and Ethics	3
SOC 362	Technology and Social Change	3
Data Science Technical Depth		(9)
Select four of the following:		12
Select three of the following:		9
CS 422	Data Mining	3
CS 429	Information Retrieval	3
CS 430	Introduction to Algorithms	3
CS 451	Introduction to Parallel and Distributed Computing	3
CS 481	Artificial Intelligence Language Understanding	3
CS 522	Advanced Data Mining	3
CS 577	Deep Learning	3
CS 584	Machine Learning	3
CSP 554	Big Data Technologies	3
MATH 435	Linear Optimization	3
MATH 446	Introduction to Time Series	3
MATH 475	Probability	3

<u>MATH 476</u>	Statistics	3
<u>MATH 535</u>	Optimization I	3
<u>MATH 546</u>	Introduction to Time Series	3
<u>MATH 563</u>	Mathematical Statistics	3
<u>MATH 564</u>	Regression	3
<u>MATH 569</u>	Statistical Learning	3
<u>MATH 574</u>	Bayesian Computational Statistics	3
Data Science Electives		(12)
Select 12 credit hours from the following courses, or any other courses in Data Science Technical Depth:		12
<u>COM 383</u>	Social Networks	3
<u>CS 458</u>	Introduction to Information Security	3
or <u>ECE 443</u>	Introduction to Computer Cyber Security	
<u>CS 480</u>	Introduction to Artificial Intelligence	3
<u>CS 487</u>	Software Engineering I	3
<u>CS 512</u>	Computer Vision	3
<u>CS 520</u>	Data Integration, Warehousing, and Provenance	3
<u>CS 546</u>	Parallel and Distributed Processing	3
<u>CS 553</u>	Cloud Computing	3
<u>CS 554</u>	Data-Intensive Computing	3
<u>CS 578</u>	Interactive and Transparent Machine Learning	3
<u>CS 579</u>	Online Social Network Analysis	3
<u>CS 583</u>	Probabilistic Graphical Models	3
<u>CS 585</u>	Natural Language Processing	3
<u>DS 472</u>	Data Science Practicum	3-6
<u>ECE 308</u>	Signals and Systems	3
<u>ECE 442</u>	Internet of Things and Cyber Physical Systems	3
<u>ECE 447</u>	Artificial Intelligence and Edge Computing	3
<u>ECE 449</u>	Object-Oriented Programming and Machine Learning	3
<u>ECE 481</u>	Image Processing	3
<u>ECE 501</u>	Artificial Intelligence and Edge Computing	3
<u>ECE 510</u>	Internet of Things and Cyber Physical Systems	3

ECE 511	Analysis of Random Signals	3
ECE 520	Information Theory and Applications	3
ECE 521	Quantum Electronics	3
ECE 563	Artificial Intelligence in Smart Grid	3
ECE 565	Computer Vision and Image Processing	3
ECE 566	Machine and Deep Learning	3
ECE 567	Statistical Signal Processing	3
EMGT 363	Creativity, Inventions, and Entrepreneurship for Engineers and Scientists	3
ITMS 418	Coding Security	3
ITMS 448	Cyber Security Technologies	3
ITMS 478	Cyber Security Management	3
MATH 225	Introductory Statistics	3
MATH 380	Introduction to Mathematical Modeling	3
MATH 483	Design and Analysis of Experiments	3
MATH 497	Special Problems	1-20
MATH 527	Machine Learning in Finance: From Theory to Practice	3
MATH 565	Monte Carlo Methods	3
SSCI 325	Intermediate Geographic Information Systems	3
SSCI 480	Introduction to Survey Methodology	3
Science Requirement and Electives		(10)
See Illinois Tech Core Curriculum, Section D		10
Humanities and Social Science Requirements		(21)
See Illinois Tech Core Curriculum, Sections B and C		21
Interprofessional Projects (IPRO)		(6)
See Illinois Tech Core Curriculum, Section E		6
Free Electives		(2-5)
<u>Select two to five credit hours ¹</u>		<u>2-5</u>

Minimum degree credits required: 120

¹Students who complete MATH 252 and MATH 350 instead of DS 251 and DS 351 will need to take 4 credits of free electives. Students who complete CS 104 and CS 201 instead of CS 115 and CS 116 will need to take 3 credits of free electives. Students who complete all of MATH 252, MATH 350, CS 104, and CS 201 instead of DS 251, DS 351, CS 115, and CS 116 will need to take 2 credits of free electives.

Sample
Curriculum/Program
Requirements

		Year 1	
Semester 1	Credit Hours	Semester 2	Credit Hours
<u>DS 100</u>	3	<u>ETHICS AND SOCIETY</u>	3
<u>DS 151</u>	3	<u>MATH 152</u>	5
<u>MATH 151</u>	5	<u>CS 116</u>	2
<u>CS 115</u>	2	<u>SCIENCE ELECTIVE</u>	4
<u>HUMANITIES 200-LEVEL COURSE</u>	3	<u>SOCIAL SCIENCE ELECTIVE</u>	3
<u>Humanities 200-level course</u>	3	<u>Ethics and Society</u>	3
		<u>Science Elective</u>	4
		<u>Social Science Elective</u>	3
	16		17
		Year 2	
Semester 1	Credit Hours	Semester 2	Credit Hours
<u>MATH 251</u>	4	<u>MATH 474</u>	3
<u>MATH 332</u>	3	<u>DS 261</u>	3
<u>CS 331</u>	3	<u>CS 425</u>	3
<u>SCIENCE ELECTIVE</u>	3	<u>SOCIAL SCIENCE ELECTIVE (300+)</u>	3
<u>HUMANITIES OR SOCIAL SCIENCE ELECTIVE</u>	3	<u>SCIENCE ELECTIVE</u>	3
<u>Science Elective</u>	3	<u>Social Science Elective (300+)</u>	3
<u>Humanities or Social Science Elective</u>	3	<u>Science Elective</u>	3
	16		15
		Year 3	
Semester 1	Credit Hours	Semester 2	Credit Hours
<u>DS 251</u>	3	<u>DS 351</u>	3
<u>CS 484</u>	3	<u>COMMUNICATION</u>	3
<u>DS ELECTIVE</u>	3	<u>DS TECH DEPTH</u>	3
<u>FREE ELECTIVE</u>	3	<u>DS TECH DEPTH</u>	3
<u>HUMANITIES ELECTIVE (300+)</u>	3	<u>DS ELECTIVE</u>	3
<u>DS Elective</u>	3	<u>Communication</u>	3
<u>Humanities Elective (300+)</u>	3	<u>DS Tech Depth</u>	3
<u>Free Elective</u>	3	<u>DS Elective</u>	3
	15	<u>Free Elective</u>	3
			15
		Year 4	
Semester 1	Credit Hours	Semester 2	Credit Hours
<u>DS 451</u>	3	<u>DS 472</u>	3
<u>FREE ELECTIVE</u>	3	<u>FREE ELECTIVE</u>	3
<u>DS TECH DEPTH</u>	3	<u>DS TECH DEPTH</u>	3
<u>I PRO</u>	3	<u>I PRO</u>	3

<u>SOCIAL SCIENCE ELECTIVE (300+)</u>	<u>3</u>	<u>HUMANITIES ELECTIVE (300+)</u>	<u>3</u>
<u>DS ELECTIVE</u>	<u>3</u>	<u>DS Tech Depth</u>	<u>3</u>
<u>DS Tech Depth</u>	<u>3</u>	<u>I PRO</u>	<u>3</u>
<u>I PRO</u>	<u>3</u>	<u>Humanities Elective (300+)</u>	<u>3</u>
<u>Social Science Elective (300+)</u>	<u>3</u>		
<u>DS Elective</u>	<u>3</u>		
	15		12

Total Credit Hours: 121

Specialization
Requirements

Program Outcomes and Assessment Process

What are your learning objectives in this program? Please list each learning objective in the boxes below:

Note: These should be the same as described in your assessment plan at the bottom of this form.

Assess data collection, modeling, analysis, visualization, and explanation needs in the context of a client's needs

Appropriately collect, clean, evaluate, and prepare data for exploration, modeling, and analysis

Design, implement, and evaluate relevant computational systems to address data science needs

Choose and implement key statistical analysis methods and appropriate models for a given data analysis problem

Effectively derive and communicate useful insights from data, including through storytelling and visualization

Communicate effectively in a variety of professional contexts

Function effectively as a member or leader of a team engaged in activities appropriate to the discipline

Identify, analyze, and mitigate ethical, privacy, and data and algorithmic bias issues in practical data science contexts

Upload your
assessment plan
here:

Undergraduate Program Requirements

What courses will factor the major GPA?

Undergraduate Degree Requirements

Minimum credit hours 120 ~~127~~

Specialization required?

No

Minor required?

No

Proposed General Curriculum

List Major Course Requirements

Data Science Requirements		(24-25)
DS 100	Introduction to the Profession	3
DS 151	Introduction to Data Science	3
Select one of the two options:		6 or 7
DS 251 & DS 351	Mathematical Foundations for Data Science I and Mathematical Foundations for Data Science II	6
MATH 252 & MATH 350	Introduction to Differential Equations and Introduction to Computational Mathematics	7
DS 261	Ethics and Privacy in Data Science	3
DS 451	Data Science Life Cycle	3
or CSP 571	Data Preparation and Analysis	
MATH 474	Probability and Statistics	3
or MATH 476	Statistics	
MATH 484	Regression	3
or CS 484	Introduction to Machine Learning	

List Mathematics Requirements	
Applied Mathematics Requirements	(17)
<u>MATH 151</u> Calculus I	5
<u>MATH 152</u> Calculus II	5
<u>MATH 251</u> Multivariate and Vector Calculus	4
<u>MATH 332</u> Elementary Linear Algebra	3
List Science Requirements	
Science Requirement and Electives	(10)
See Illinois Tech Core Curriculum, Section D	10
List Computer Science Requirements	
Computer Science Requirements	(10-12)
Select one of the following sequences:	4-6
<u>CS 115</u> Object-Oriented Programming I & <u>CS 116</u> and Object-Oriented Programming II	4
<u>CS 104</u> Introduction to Computer Programming for Engineers & <u>CS 201</u> and Accelerated Introduction to Computer Science	6
<u>CS 331</u> Data Structures and Algorithms	3
<u>CS 425</u> Database Organization	3
List Humanities and Social Sciences Requirements	
Humanities and Social Science Requirements	(21)
See Illinois Tech Core Curriculum, Sections B and C	21
List Interprofessional Project (IPRO) Requirements	
Interprofessional Projects (IPRO)	(6)
See Illinois Tech Core Curriculum, Section E	6
Communication	(3)

List Technical Elective Course Options		
Select one of the following:		3
COM 421	Technical Communication	3
COM 428	Verbal and Visual Communication	3
INTM 301	Communications for the Workplace	3
ITM 300	Communication in the Workplace	3
SCI 522	Public Engagement for Scientists	3
Ethics and Society		(3)
Select one of the following:		3
HIST 385	Course HIST 385 Not Found	3
ITMM 485	Legal and Ethical Issues in Information Technology	3
PHIL 374	Ethics in Computer Science	3
PHIL 375	Computer Ethics	3
PHIL 381	Artificial Intelligence, Philosophy and Ethics	3
SOC 362	Technology and Social Change	3
Data Science Technical Depth		(9)
Select four of the following:		12
<u>Select three of the following:</u>		<u>9</u>
CS 422	Data Mining	3
CS 429	Information Retrieval	3
CS 430	Introduction to Algorithms	3
CS 451	Introduction to Parallel and Distributed Computing	3
CS 481	Artificial Intelligence Language Understanding	3
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MATH 475	Probability	3
MATH 476	Statistics	3