## **B.S. in Data Science**

Data science is the study and practice of extracting information and structure from data that can then be used for reasoning and adding value to the solution of a problem. It has growing applications in health and medicine, finance, marketing, economics, genomics, social networks, cyber-security, journalism, and other fields where data is collected. It spans academic fields in computer science and mathematics such as machine learning and statistical inference, probability, linear algebra, computer programming, software engineering, high performance computing, and cloud computing. The B.S. in Data Science program has two options, Computing (in the Ying Wu College of Computing) and Statistics (in the Department of Mathematical Sciences in the College of Science and Liberal Arts).

## **B.S. in Data Science (Computing Option)**

(120 credits)

CS 100         Roadmap to Computing         3           MATH 111         Calculus I         4           MATH 111         Calculus I         4           PHYS 111         Physics I Lab <sup>1</sup> 1           ENGL 101         English Composition: Introduction to Academic Writing         3           FYS SEM         First-Year Student Seminar         3           Term Credits         1         3           CS 113         Introduction to Computer Science         3           MATH 112         Calculus I         4           PHYS 121         Physics II <sup>1</sup> 3           PHYS 121         Physics II <sup>1</sup> 3           Robit 102         English Composition: Introduction to Writing for Research         3           Second Year         1         1           Term Credits         4         4           Second Year         3         3	First Year		
MATH 1111     Calculus I     4       PHYS 111A     Physics I Lab <sup>1</sup> 3       PHYS 111A     Physics I Lab <sup>1</sup> 1       ENGL 101     English Composition: Introduction to Academic Writing     3       FYS SEM     First-Year Student Seminar     0       Term Credits     14     14       Znd Semester     3       CS 113     Introduction to Computer Science     3       MATH 112     Calculus I     4       PHYS 121A     Physics II <sup>1</sup> 3       PHYS 121A     Physics II <sup>1</sup> 3       PHYS 121A     Physics II Lab <sup>1</sup> 3       ENGL 102     English Composition: Introduction to Writing for Research     3       Second Year     14     14       Second Year     14     14       Second Year     14     14       Second Year     3     3       History and Humanities GER 200 level (http://catalog.nijt.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science.gen/ 1     3       Social Sciences GER (http://catalog.nijt.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science.gen/ 1     3       Social Sciences GER (http://catalog.nijt.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science.gen/ 1     3       Social Sciences GER (http://catalog.nijt.edu/und	1st Semester		Credits
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PHYS 111A     Physics I Lab <sup>1</sup> 1       ENGL 101     English Composition: Introduction to Academic Writing     3       FYS SEM     First-Year Student Seminar     0       Term Credits     14       2nd Semester     3       CS 113     Introduction to Computer Science     3       MATH 12     Calculus II     4       PHYS 121     Physics II <sup>1</sup> 4       PHYS 121     Physics II Lab <sup>1</sup> 4       Second Year     7     7       Term Credits     14       Second Year     1     14       Ist Semester     14       Staff All     Introduction to Computer Science II     3       MATH 327     Introduction to Computer Science II     3       MATH 337     Linear Algebra     3       Istory and Humanitles GER 200 level (http://ctatalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/science-II     3       Social Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/science-II     3       Social Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/science-II     3       Social Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/science-II     3       Social Sciences GER (http://catalog.njit.	PHYS 111	Physics I <sup>1</sup>	3
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FYS SEM         First-Year Student Seminar         000000000000000000000000000000000000	ENGL 101	•	3
Term Credits     14       2nd Semester     33       CS 113     Introduction to Computer Science     33       MATH 112     Calculus II     4       PHYS 121     Physics II 1a     1       ENGL 102     English Composition: Introduction to Writing for Research     33       Term Credits     34       Second Year     14       Second Year     14       Second Year     14       Second Year     33       Term Credits     34       MATH 24     Introduction to Computer Science II     37       MATH 337     Linear Algebra     33       History and Humanities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science-ger/     33       Term Credits     35     350       CS 241     Foundations of Computer Science I     33       Social Science GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science Ger/     33       Zh Semester     35     350       CS 241     Foundations of Computer Science I     33       Si 350     Computing & Effective Com     33       MATH 341     Statistical Methods II     34       YWCC 207     Computing & Effective Com     34       Data Science Electiv	FYS SEM		0
CS 113     Introduction to Computer Science     3       MATH 112     Calculus II     4       PHYS 121     Physics II <sup>1</sup> 3       PHYS 121     Physics II Lab <sup>1</sup> 3       ENGL 102     English Composition: Introduction to Writing for Research     3       Term Credits       Science II       Science II       Science II       MATH 37       Linear Algebra       Science II       Science SCER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Science SCER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Science SCER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Science SCER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/       Science SCER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/		Term Credits	14
MATH 112     Calculus II     4       PHYS 121     Physics II 1a     1       PHYS 121A     Physics II Lab     1       ENGL 102     English Composition: Introduction to Writing for Research     3       Second Year     1       Stemester     1       CS 114     Introduction to Computer Science II     3       MATH 244     Introduction to Probability Theory     3       MATH 337     Linear Algebra     3       History and Humanities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/social-science-ger/)     3       Social Science SGER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/     3       Social Science SGER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-educati	2nd Semester		
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Term Credits     14       Second Year     151       151 Semester     23       CS 114     Introduction to Computer Science II     23       MATH 244     Introduction to Probability Theory     23       MATH 337     Linear Algebra     23       History and Humanities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-200-level/)     23       Social Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science-ger/)     3       Term Credits     15       2nd Semester     15       CS 241     Foundations of Computer Science I     3       CS 240     Programming Language Concepts     3       Social Science Elective I     3     3       VWCC 207     Computing & Effective Com     3       YWCC 207     Computing & Effective Com     3       Third Year     16     3       Third Year     16     3       Statistical Methods II     3     3       VWCC 207     Computing & Effective Com     3       Third Year     3     3       1st Semester     3     3       St 288     Intensive Programming in Linux     3       St 331     Database System Design & Mgmt     3 </td <td>PHYS 121A</td> <td></td> <td>1</td>	PHYS 121A		1
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MATH 337       Linear Algebra       3         History and Humanities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-200-level/)       3         Social Sciences GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ social-science-ger/)       3         Term Credits       15         2nd Semester       5         CS 241       Foundations of Computer Science I       3         CS 280       Programming Language Concepts       3         IS 350       Computers, Society and Ethics       3         MATH 341       Statistical Methods II       3         YWCC 207       Computing & Effective Com       3         Data Science Elective 1       3       3         Third Year       3       3         1st Semester       3       3         CS 288       Intensive Programming in Linux       3         CS 301       Introduction to Data Science       3         S 331       Database System Design & Mgmt       3	MATH 244	Introduction to Probability Theory	
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social-science-ger/)         Term Credits         15           2nd Semester         15           CS 241         Foundations of Computer Science I         3           CS 280         Programming Language Concepts         3           IS 350         Computers, Society and Ethics         3           MATH 341         Statistical Methods II         3           YWC 207         Computing & Effective Com         1           Data Science Elective 1         3         3           Term Credits         16         16           Third Year         15         3           S288         Intensive Programming in Linux         3           CS 301         Introduction to Data Science         3           CS 331         Database System Design & Mgmt         3	•		3
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CS 241Foundations of Computer Science I3CS 280Programming Language Concepts3IS 350Computers, Society and Ethics3MATH 341Statistical Methods II3YWCC 207Computing & Effective Com1Data Science Elective 13Term CreditsThird Year15 SemesterCS 288Intensive Programming in Linux3CS 301Introduction to Data Science3CS 331Database System Design & Mgmt3		Term Credits	15
CS 280Programming Language Concepts3IS 350Computers, Society and Ethics3MATH 341Statistical Methods II3YWCC 207Computing & Effective Com1Data Science Elective3Term CreditsThird YearIs SemesterCS 288Intensive Programming in Linux3CS 301Introduction to Data Science3CS 331Database System Design & Mgmt3	2nd Semester		
IS 350Computers, Society and Ethics33MATH 341Statistical Methods II33YWCC 207Computing & Effective Com1Data Science Elective 133Term CreditsTerm Credits16Third Year1st SemesterCS 288Intensive Programming in Linux33CS 301Introduction to Data Science33CS 331Database System Design & Mgmt33	CS 241	Foundations of Computer Science I	3
MATH 341Statistical Methods II3YWCC 207Computing & Effective Com1Data Science Elective I3Term CreditsThird Year1st SemesterCS 288Intensive Programming in Linux3CS 301Introduction to Data Science3CS 331Database System Design & Mgmt3	CS 280	Programming Language Concepts	3
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Data Science Elective 1     3       Term Credits     16       Third Year     16       1st Semester     1       CS 288     Intensive Programming in Linux     3       CS 301     Introduction to Data Science     3       CS 331     Database System Design & Mgmt     3	MATH 341	Statistical Methods II	3
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CS 288Intensive Programming in Linux3CS 301Introduction to Data Science3CS 331Database System Design & Mgmt3	Third Year		
CS 301Introduction to Data Science3CS 331Database System Design & Mgmt3	1st Semester		
CS 331 Database System Design & Mgmt 3	CS 288	Intensive Programming in Linux	3
CS 331 Database System Design & Mgmt 3	CS 301	Introduction to Data Science	3
CS 370 Introduction to Artificial Intelligence 3	CS 331	Database System Design & Mgmt	3
	CS 370	Introduction to Artificial Intelligence	3

or COM 313 2nd Semester CS 435	or Technical Writing	
	Term Credits	15
		10
00 100	Advanced Data Structures and Algorithm Design	3
Data Science Elective		3
CS 482	Data Mining	3
CS 375	Introduction to Machine Learning	3
	s GER 300+ level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-	3
YWCC 307	Professional Dev in Computing	1
	Term Credits	16
Fourth Year		
1st Semester		
CS 450	Data Visualization	3
CS 444	Big Data Systems	3
CS 492	Data Science Capstone I	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elective		3
	Term Credits	15
2nd Semester		10
	Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/	3
	uirements/hss-capstone/)	0
Free Elective 1 <sup>2</sup>		3
CS 493	Data Science Capstone II	3
MATH 344	Regression Analysis	3
Data Science Elective		3
	Term Credits	15
	Total Credits	120
Code	Title	Credits
Data Science (Compu	ting Option) Electives	
YWCC 310	Co-op Work Experience I	3
CS 332	Principles of Operating Systems	3
CS 350	Intro to Computer Systems	3
CS 351	Introduction to Cybersecurity	3
CS 356	Introduction to Computer Networks	3
CS 357	Fundamentals of Network Security	3
CS 370	Introduction to Artificial Intelligence	3
CS 375	Introduction to Machine Learning	3
CS 444	Big Data Systems	3
CS 408	Cryptography and Internet Security	3
CS 485	Selected Topics In CS	3
	Business Research Methods	3
	Artificial Intelligence for Business Decisions	3
	Marketing Analytics	3
MGMT 416		3
MGMT 416 MRKT 378	Marketing Research	
MGMT 416 MRKT 378 MRKT 430	Marketing Research Multivariate Distributions	
MGMT 416 MRKT 378 MRKT 430 MATH 345	Multivariate Distributions	3
MGMT 416 MRKT 378 MRKT 430 MATH 345 MATH 388	Multivariate Distributions Introduction to Chaos Theory	3
MGMT 416 MRKT 378 MRKT 430 MATH 345 MATH 388 MATH 391	Multivariate Distributions Introduction to Chaos Theory Numerical Linear Algebra	3 3 3
MGMT 316 MGMT 416 MRKT 378 MRKT 430 MATH 345 MATH 388 MATH 391 MATH 430 MATH 447	Multivariate Distributions Introduction to Chaos Theory	3 3 3 3 3 3 3

MATH 461	Introduction to Statistical Computing with SAS and R	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

## B.S. in Data Science (Statistics Option)

(120 credits)

First Year		
1st Semester		Credits
CS 100	Roadmap to Computing	:
MATH 111	Calculus I	4
PHYS 111	Physics I <sup>1</sup>	:
PHYS 111A	Physics I Lab <sup>1</sup>	
ENGL 101	English Composition: Introduction to Academic Writing	;
FYS SEM	First-Year Student Seminar	(
	Term Credits	14
2nd Semester		
CS 113	Introduction to Computer Science	;
MATH 112	Calculus II	4
PHYS 121	Physics II <sup>1</sup>	:
PHYS 121A	Physics II Lab <sup>1</sup>	
ENGL 102	English Composition: Introduction to Writing for Research	
	Term Credits	14
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	
MATH 244	Introduction to Probability Theory	
MATH 337	Linear Algebra	
History and Huma requirements/ger-	anities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education- 200-level/)	÷
Social Sciences C social-science-ge	GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ r/)	;
	Term Credits	1:
2nd Semester		
CS 241	Foundations of Computer Science I	
CS 280	Programming Language Concepts	;
MATH 213	Calculus III B	4
MATH 341	Statistical Methods II	;
History and Huma requirements/ger-	anities GER 300+ level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education- ·300-level/)	:
	Term Credits	10
Third Year		
1st Semester		
	Applied Numerical Mathada	

MATH 340	Applied Numerical Methods	3
MATH 344	Regression Analysis	3
MATH 391	Numerical Linear Algebra	3
CS 288	Intensive Programming in Linux	3

CS 301	Introduction to Data Science	3
	Term Credits	15
2nd Semester		
MATH 345	Multivariate Distributions	3
MATH 447	Applied Time Series Analysis	3
MATH 478	Stat Methods in Data Sci	3
Data Science Elec	tive 1	3
History and Huma requirements/ger-	nities GER 300+ level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education- 800-level/)	3
	Term Credits	15
Fourth Year		
1st Semester		
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
MATH 462	Statistics and Statistical Learning (Capstone I)	3
CS 450	Data Visualization	3
Data Science Elec	tive 2	3
	Term Credits	15
2nd Semester		
MATH 463	Statistics and Statistical Learning (Capstone II)	3
Math Upper Level	Elective (300+ level)	3
Data Science Elec	tive 3	3
Humanities and S	cial Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/	3
-	requirements/hss-capstone/)	
Free Elective <sup>2</sup>		4
	Term Credits	16
	Total Credits	120
Code	Title	Credits
Data Science (Sta	istics Option) Electives	
YWCC 310	Co-op Work Experience I	
00.004		3
CS 331	Database System Design & Mgmt	3
CS 331 CS 332	Database System Design & Mgmt Principles of Operating Systems	
		3
CS 332	Principles of Operating Systems	3 3 3
CS 332 CS 350	Principles of Operating Systems Intro to Computer Systems	3 3
CS 332 CS 350 CS 351	Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity	3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356	Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks	3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357	Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security	3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370	Principles of Operating Systems         Intro to Computer Systems         Introduction to Cybersecurity         Introduction to Computer Networks         Fundamentals of Network Security         Introduction to Artificial Intelligence	3 3 3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370 CS 375	Principles of Operating Systems         Intro to Computer Systems         Introduction to Cybersecurity         Introduction to Computer Networks         Fundamentals of Network Security         Introduction to Artificial Intelligence         Introduction to Machine Learning	3 3 3 3 3 3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370 CS 375 CS 444	Principles of Operating Systems         Intro to Computer Systems         Introduction to Cybersecurity         Introduction to Computer Networks         Fundamentals of Network Security         Introduction to Artificial Intelligence         Introduction to Machine Learning         Big Data Systems	3 3 3 3 3 3 3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370 CS 375 CS 444 CS 408	Principles of Operating SystemsIntro to Computer SystemsIntroduction to CybersecurityIntroduction to Computer NetworksFundamentals of Network SecurityIntroduction to Artificial IntelligenceIntroduction to Machine LearningBig Data SystemsCryptography and Internet Security	3 3 3 3 3 3 3 3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370 CS 375 CS 444 CS 408 CS 435	Principles of Operating SystemsIntro to Computer SystemsIntroduction to CybersecurityIntroduction to Computer NetworksFundamentals of Network SecurityIntroduction to Artificial IntelligenceIntroduction to Machine LearningBig Data SystemsCryptography and Internet SecurityAdvanced Data Structures and Algorithm Design	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
CS 332 CS 350 CS 351 CS 356 CS 357 CS 370 CS 375 CS 444 CS 408 CS 435 CS 482	Principles of Operating SystemsIntro to Computer SystemsIntroduction to CybersecurityIntroduction to Computer NetworksFundamentals of Network SecurityIntroduction to Artificial IntelligenceIntroduction to Machine LearningBig Data SystemsCryptography and Internet SecurityAdvanced Data Structures and Algorithm DesignData Mining	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
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IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

Students considering switching to Computer Science or Mathematical Sciences should take PHYS 111/111A and 121/121A. Do not take PHYS 102/102A

<sup>2</sup> Free electives should be chosen in consultation with the advisor. Some restrictions apply.