

# MAJOR IN COMPUTER SCIENCE, COMPUTER SCIENCE CONCENTRATION

The Computer Science#general concentration is a broad program that prepares students for any introductory position in the computer science field and many other fields, including business, natural sciences, health, research, engineering, defense and more.

This concentration offers students options to customize their knowledge and skill set on top of core computer science concepts, allowing them to tailor their education to their passions. Students can focus on a specific research area (<https://compsci.colostate.edu/research/>) in their 400-level coursework or take a breadth focus – a little bit of everything – for a broader perspective. Students can also complete a second major or minor, producing a highly interdisciplinary degree.

This concentration allows students to build on multiple different skill sets from across the other concentrations. The knowledge, skill set and focus students create within this concentration varies depending on the courses taken.

## Learning Outcomes

Upon completing this program, students will be able to:

- Leverage teamwork to develop innovative, logical approaches to solving complex real-world problems.
- Analyze and improve processes and outcomes.
- Communicate technical skills verbally and in writing.
- Confidently pursue graduate studies or professional employment in computer science.

## Potential Occupations

This broad concentration is easily applicable to numerous industries and careers. Based on the courses chosen, potential occupations may be listed below, in other concentrations and as cross-disciplinary careers.

Potential occupations include: software engineer, mobile app developer, data scientist, big data engineer, machine learning engineer, virtual and augmented reality developer, cybersecurity analyst, bioinformatics engineer, computational chemist, mixed-reality artist, data journalist and many more.

## Requirements Effective Fall 2022

**A minimum grade of C (2.000) is required in CO 150 and in all CS, DSCI, MATH, STAT and departmental Technology Focus Elective courses which are required for graduation.**

### Freshman

		AUCC	Credits
CO 150	College Composition (GT-CO2)	1A	3
MATH 156 or 160 <sup>1</sup>	Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)	1B	4
Select one group from the following: <sup>2</sup>			4-9
Group A			
CS 150A or 150B	Culture and Coding: Java (GT-AH3) Culture and Coding: Python (GT-AH3)	3B	
CS 162 or 164	CS1–Introduction to Java Programming CS1–Computational Thinking with Java		
Group B			
Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities</a> )		3B	
CS 152	Python for STEM		
CS 162 or 164	CS1–Introduction to Java Programming CS1–Computational Thinking with Java		
Group C			
Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities</a> )		3B	
CS 163	CS1–No Prior Programming Experience		
CS 201/PHIL 201	Ethical Computing Systems (GT-AH3)	3B	3
Select at least two courses totaling a minimum of 7 credits from the following (one course must be or include the sequenced laboratory):			7
AA 100 & AA 101	Introduction to Astronomy (GT-SC2)	3A	
ANTH 120 & ANTH 121	Human Origins and Variation (GT-SC2)	3A	

BZ 110 & BZ 111	Principles of Animal Biology (GT-SC2)	3A	
BZ 120	Principles of Plant Biology (GT-SC1)	3A	
CHEM 107 & CHEM 108	Fundamentals of Chemistry (GT-SC2)	3A	
CHEM 111 & CHEM 112	General Chemistry I (GT-SC2)	3A	
GEOL 120 & GEOL 121	Exploring Earth - Physical Geology (GT-SC2)	3A	
GEOL 122 & GEOL 121	The Blue Planet - Geology of Our Environment (GT-SC2)	3A	
GEOL 124 & GEOL 121	Geology of Natural Resources (GT-SC2)	3A	
GEOL 150	Physical Geology for Scientists and Engineers	3A	
HONR 292A	Honors Seminar: Knowing in the Sciences	3A	
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	
LIFE 103	Biology of Organisms-Animals and Plants (GT-SC1)	3A	
LIFE 201A	Introductory Genetics: Applied/Population/Conservation/Ecological (GT-SC2)	3A	
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3A	
LIFE 220/LAND 220	Fundamentals of Ecology (GT-SC2)	3A	
NR 150	Oceanography (GT-SC2)	3A	
PH 121	General Physics I (GT-SC1)	3A	
PH 122	General Physics II (GT-SC1)	3A	
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	
Diversity, Equity, and Inclusion ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion</a> )		1C	3
Electives <sup>3</sup>			3
<b>Total Credits</b>			<b>30</b>
<b>Sophomore</b>			
CS 165	CS2--Data Structures		4
CS 220	Discrete Structures and their Applications		4
CS 253	Software Development with C++		4
CS 270	Computer Organization		4
Select one course from the following:			3-4
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
Select one course from the following:			1-3
STAT 301	Introduction to Applied Statistical Methods		
STAT 302A	Statistics Supplement: General Applications		
STAT 307	Introduction to Biostatistics		
STAT 315	Intro to Theory and Practice of Statistics		
Historical Perspectives ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> )		3D	3
Social and Behavioral Sciences ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences</a> )		3C	3
Electives			1-3
<b>Total Credits</b>			<b>30</b>
<b>Junior</b>			
CS 314	Software Engineering	4A,4B	3
CS 320	Algorithms--Theory and Practice		3

CS 370	Operating Systems		3
Two CS courses numbered 300- or above, excluding 380-399 and 480-499			6-8
Advanced Writing ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing</a> )		2	3
Electives			10-12

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<b>Total Credits</b>	<b>30</b>
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**Senior**

Capstone Course - select one course from the following:	4
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CS 410	Introduction to Computer Graphics	4C
CS 414	Object-Oriented Design	4C
CS 420	Introduction to Analysis of Algorithms	4C
CS 425	Introduction to Bioinformatics Algorithms	4C
CS 430	Database Systems	4C
CS 435	Introduction to Big Data	4C
CS 440	Introduction to Artificial Intelligence	4C
CS 445	Introduction to Machine Learning	4C
CS 453	Introduction to Compiler Construction	4C
CS 454	Principles of Programming Languages	4C
CS 455	Introduction to Distributed Systems	4C
CS 456	Modern CyberSecurity	4C
CS 457	Computer Networks and the Internet	4C
CS 458	Blockchain Principles and Applications	4C
CS 462	Engaging in Virtual Worlds	4C
CS 464	Principles of Human-Computer Interaction	4C
CS 470	Computer Architecture	4C
CS 475	Parallel Programming	4C

Two CS courses numbered 400- or above, excluding 480-499	8
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Select one group from the following - Technology Focus or Minor/Second Major:	10
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Group A - Technology Focus

Technology Focus Electives (6 credits) - see list below

CS course numbered 400- or above, excluding 480-499, not taken elsewhere in the program (4 credits)

Group B - Minor or Second Major<sup>4</sup>

Electives <sup>5</sup>	8
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<b>Total Credits</b>	<b>30</b>
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<b>Program Total Credits:</b>	<b>120</b>
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**Technology Focus Electives**

If Group A - Technology Focus is selected Senior year, select at least 6 credits from the list below, not taken elsewhere in the program. At least 3 credits must be upper-division (300- to 400-level).

Code	Title	Credits
Any CS, CT, DSCI, IDEA, or MATH Courses numbered 300- or above, excluding 380-399 and 480-499, and MATH 369 and DSCI 369		
Any STAT Courses numbered 300- or above, excluding 301, 302A, 307, 315, 380-399 and 480-499		
BZ 350	Molecular and General Genetics	4
BZ 360	Bioinformatics and Genomics	3
CIS 320	Project Management for Information Systems	3
CIS 350	Operating Systems and Networks	3
CIS 360	Systems Analysis and Design	3

CIS 413	Advanced Networking and Security	3
CIS 455	Advanced Database Management	3
ECE 452	Computer Organization and Architecture	3
ENGR 422	Technology Entrepreneurship	3
JTC 372	Web Design and Development	3
JTC 472	Advanced Web Design and Development	3
MATH 161	Calculus for Physical Scientists II (GT-MA1)	4
MATH 256	Mathematics for Computational Science II	4
MGT 330	Creativity, Innovation, and Value Creation	3
MGT 340	Fundamentals of Entrepreneurship	3
MGT 420	New Venture Creation	3
NR 322	Intro. to Geographic Information Systems	4
PHIL 410	Gödel's Incompleteness Theorems	3
PHIL 411	Logic in Philosophy and Beyond	3
PHIL 415	Logic and Scientific Method	3

PSY 252	Mind, Brain, and Behavior	3
PSY 352	Learning and Memory	3
PSY 452	Cognitive Psychology	3
PSY 454	Biological Psychology	3
PSY 456	Sensation and Perception	3
PSY 458	Cognitive Neuroscience	3

<sup>4</sup> Of the 21 credits for the minor or second major, none may be from CS.  
<sup>5</sup> Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- to 400-level).

- <sup>1</sup> MATH 156 recommended for computer science majors who do not already have MATH 160 credit.
- <sup>2</sup> Recommended sequence for most incoming students is Group A: CS 150B to CS 164.
- <sup>3</sup> CS 192 or other seminar course is a recommended elective for incoming first semester students.

## Major Completion Map

### Distinctive Requirements for Degree Program:

**To prepare for first semester:** The curriculum for the Computer Science major assumes students enter college prepared to take calculus. Entering students who are not prepared to take calculus will need to fulfill pre-calculus requirements in the first semester. All students must maintain a C (2.000) or better in CO 150 and in all CS, DSCI, MATH, STAT and departmental Technology Focus Elective courses which are required for graduation.

### Freshman

Semester 1	Critical	Recommended	AUCC	Credits
CO 150 College Composition (GT-CO2)			1A	3
First course from Group A, B, or C (See options in Concentration Requirements Tab)		X		2-4
Department Approved Science (See list on Concentration Requirements Tab)			3A	3
Diversity, Equity, and Inclusion ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion</a> )	X		1C	3
Electives				3
MATH 124 and MATH 126 may be necessary for some students to fulfill pre-calculus requirements.	X			
<b>Total Credits</b>				<b>15</b>

Semester 2	Critical	Recommended	AUCC	Credits
CS 201/PHIL 201 Ethical Computing Systems (GT-AH3)			3B	3
MATH 156 or 160 Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)			1B	4
Remaining course(s) from Group A, B, or C (See options in Concentration Requirements Tab)	X			2-7
Department Approved Science with Lab (See list on Concentration Requirements Tab)			3A	4
Elective				0-2
CO 150 must be completed by the end of Semester 2 with a grade of C or better.	X			
<b>Total Credits</b>				<b>15</b>

### Sophomore

Semester 3	Critical	Recommended	AUCC	Credits
CS 165 CS2--Data Structures		X		4
CS 220 Discrete Structures and their Applications		X		4
Select one course from the following:				1-3
STAT 301 Introduction to Applied Statistical Methods				
STAT 302A Statistics Supplement: General Applications				
STAT 307 Introduction to Biostatistics				
STAT 315 Intro to Theory and Practice of Statistics				
Historical Perspectives ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> )			3D	3
Electives				1-3
<b>Total Credits</b>				<b>15</b>

<b>Semester 4</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>
CS 270	Computer Organization				4
CS 253	Software Development with C++		X		4
Select one course from the following:					3-4
DSCI 369	Linear Algebra for Data Science	X			
MATH 369	Linear Algebra I	X			
Social and Behavioral Sciences ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences</a> )				3C	3
Electives					0-1
CS 165 and CS 220 and CS 270 must be completed by the end of Semester 4.		X			
MATH 156 or MATH 160 and MATH 369 or DSCI 369 must be completed by the end of Semester 4.		X			
<b>Total Credits</b>					<b>15</b>
<b>Junior</b>					
<b>Semester 5</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>
CS 314	Software Engineering		X	4A,4B	3
CS 320	Algorithms--Theory and Practice		X		3
CS 370	Operating Systems		X		3
Advanced Writing ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing</a> )				2	3
Electives					3
CS 253 must be completed by the end of Semester 5.		X			
<b>Total Credits</b>					<b>15</b>
<b>Semester 6</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>
Two CS courses numbered 300- or above, excluding 380-399 and 480-499			X		6-8
Electives					7-9
CS 314 and CS 320 and CS 370 must be completed by the end of Semester 6.		X			
<b>Total Credits</b>					<b>15</b>
<b>Senior</b>					
<b>Semester 7</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>
Capstone Course (See Capstone Course List on Concentration Requirements tab)		X		4C	4
CS course numbered 400- or above, excluding 480-499			X		4
Technology Focus or Minor/Second Major courses					6
At least 2 Upper-Division CS classes must be completed by the end of Semester 7.		X			
<b>Total Credits</b>					<b>14</b>
<b>Semester 8</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>
CS*** Course numbered 400- or above		X			4
Technology Focus or Minor/Second Major courses		X			4
Electives					8
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
<b>Total Credits</b>					<b>16</b>
<b>Program Total Credits:</b>					<b>120</b>