MAJOR IN COMPUTER SCIENCE, COMPUTING SYSTEMS CONCENTRATION

Computing systems are integrated devices that input, output, process, and store data and information. Computing systems encompass a wide range, from simple sensors and hardware components to phones, laptops, desktops, and entire data centers. Computing systems specialists are challenged to provide ever increasing levels of performance from these systems.

The Computing Systems concentration provides students the necessary tools to solve important and demanding systems problems at scale. Students will learn how to design and assess computer systems from a holistic perspective that encompasses distributed and parallel algorithms, big data, systems software, networking, compiler design, and artificial intelligence/machine learning.

Data is our most valuable resource. Large scale data are being generated by programs, sensors, and simulations. Drawing timely and effective insights from these data are at the heart of modern problems in computer science and society in general. The Computing Systems concentration includes courses that teach you how to accomplish this goal, from storing, transporting, organizing, and extracting insights from data to expressing programs that execute in parallel and distributed environments encompassing hundreds of thousands of cores.

Learning Objectives

Upon successfully completing this program, students will be able to:

1. Design scalable systems for computational and data intensive problems.
2. Design distributed and parallel algorithms to analyze large data sets.
3. Leverage diverse computing architectures in support of problem solutions.
4. Program accelerators/coprocessors (e.g., for deep learning).
5. Confidently pursue graduate studies or professional employment in computer systems and computer science.

Potential Occupations

In addition to the career opportunities open to all computer science graduates, the Computing Systems concentration opens career paths that include:

Cloud applications designer, systems designer, data scientist, big data analyst, compiler designer, database specialist, and supercomputing applications specialist.

Requirements Effective Fall 2025

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

Freshman

		AUCC	Credits
CO 150	College Composition (GT-CO2)	1A	3
CS 201/PHIL 201	Ethical Computing Systems (GT-AH3)	3B	3
MATH 156 or 160[1]	Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)	1B	4
Select one group from the following:[2]			5-9
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:			
CS 152	Python for STEM		
CS 162 or 164	CS1--Introduction to Java Programming CS1--Computational Thinking with Java		
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities)		3B	
Group C:			
CS 163	CS1---No Prior Programming Experience		
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-and-humanities)		3B	
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	Geology and Society (GT-SC2)	3A	
GEOL 122 & GEOL 121	Geoscience--Climate and Environmental Change (GT-SC2)	3A	
GEOL 124 & GEOL 121	Earth Resources and Sustainability (GT-SC2)	3A	
GEOL 150	Dynamic Earth (GT-SC2)	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	
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Electives[3]			1-5
	Total Credits		**30**

Sophomore

CS 165	CS2--Data Structures	4
CS 220	Discrete Structures and the Applications	4
Select one group from the following:		4-5
Group A		
CS 214	Software Development	
CT 301	C++ Fundamentals	
Group B		
CS 253	Software Development with C++	
Select one course from the following:		4
CS 250	Computer Systems Foundations	
CS 270	Computer Organization	
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 (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Electives			0-4
	Total Credits		**30**
Junior			
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
Two Technical Electives (see list below)			6-8
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)		2	3
Electives			2-6
	Total Credits		**30**
Senior			
Systems Courses - select three courses from the following (one of the selected courses will fulfill AUCC 4C):			12
CS 435	Introduction to Big Data	4C	
CS 453	Introduction to Compiler Construction	4C	
CS 455	Introduction to Distributed Systems	4C	
CS 457	Computer Networks and the Internet	4C	
CS 475	Parallel Programming	4C	
Systems Elective - select one course from the following:			4
CS 422	Automata, Logic, and Computation		
CS 440	Introduction to Artificial Intelligence		
CS 445	Introduction to Machine Learning		
Electives[4]			14
	Total Credits		**30**
	Program Total Credits:		**120**

Technical Electives (6 credits)

Select a minimum of 6 credits, of which 3 credits must be upper-division.

Code	Title	Credits
BZ 350	Molecular and General Genetics	4
BZ 360	Bioinformatics and Genomics	4
CIS 320	Project Management for Information Systems	3
CS 300-379		
CS 400-479		
CT 300-379 excluding CT 301		
CT 400-479		
DSCI 235	Data Wrangling	2
DSCI 300-379 excluding DSCI 369		
DSCI 400-479		
ECE 452	Computer Organization and Architecture	3
ENGR 422	Technology Entrepreneurship	3
IDEA 300-379		
IDEA 400-479		
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
MATH 300-379 excluding MATH 369		
MATH 400-479		
MGT 330	Creativity, Innovation, and Value Creation	3
MGT 340	Fundamentals of Entrepreneurship	3
MGT 420	New Venture Creation	3
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

STAT 300-379 excluding STAT 301, STAT 302A, STAT 307, STAT 315	
STAT 400-479	

1. MATH 156 recommended for computer science majors who do not already have MATH 160 credit.
2. Recommended sequence for most incoming students is Group A: CS 150B to CS 164.
3. CS 192 or other seminar course is a recommended elective for incoming first semester students.
4. 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).

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 Technical Elective courses which are required for graduation.

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
CO 150	College Composition (GT-CO2)	X		1A	3
First course from Group A, B, or C (See options in Concentration Requirements Tab)		X		3B	3
Department Approved Science (See list on Concentration Requirements Tab)		X		3A	4
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		X		1C	3
Elective			X		1
MATH 124 and MATH 126 may be necessary for some students to fulfill pre-calculus requirements.		X			
	Total Credits				**14**

Semester 2		Critical	Recommended	AUCC	Credits
CS 201/PHIL 201	Ethical Computing Systems (GT-AH3)	X		3B	3
MATH 156 or 160	Mathematics for Computational Science I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)	X		1B	4
Remaining course(s) from Group A, B, or C (See options in Concentration Requirements Tab)		X			2-6
Department Approved Science with Lab (See list on Concentration Requirements Tab)		X		3A	3
Electives			X		0-4
CO 150 must be completed by the end of Semester 2 with a grade of C or better.		X			
	Total Credits				**16**

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
CS 165	CS2--Data Structures	X			4
CS 220	Discrete Structures and the Applications	X			4
Select one course from the following:		X			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 (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			X	3D	3
Electives			X		0-4
	Total Credits				**14-16**

Semester 4		Critical	Recommended	AUCC	Credits
Select one group from the following:		X			4-5
Group A					

CS 214	Software Development				
CT 301	C++ Fundamentals				
Group B					
CS 253	Software Development with C++				
Select one course from the following:		X			4
CS 250	Computer Systems Foundations				
CS 270	Computer Organization				
Select one course from the following:		X			3-4
DSCI 369	Linear Algebra for Data Science				
MATH 369	Linear Algebra I				
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)			X	3C	3
CS 165 and CS 220 and (CS 250 or 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			
	Total Credits				**14-16**

Junior

Semester 5		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 320	Algorithms--Theory and Practice	X			3
CS 370	Operating Systems	X			3
Technical Elective (See list on Concentration Requirements Tab)		X			3-4
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)				2	3
Elective			X		2-3
CS 253 must be completed by the end of Semester 5.		X			
	Total Credits				**15**

Semester 6		**Critical**	**Recommended**	**AUCC**	**Credits**
CS 314	Software Engineering	X			3
Two CS courses numbered 300- or above, excluding 380-399 and 480-499		X			6-8
Technical Elective (See list on Concentration Requirements Tab)		X			3-4
Elective			X		0-3
CS 314 and CS 320 and CS 370 must be completed by the end of Semester 6.		X			
	Total Credits				**15**

Senior

Semester 7		**Critical**	**Recommended**	**AUCC**	**Credits**
Systems Course (See list on the Concentration Requirements Tab)		X		4C	4
Systems Elective (See list on the Concentration Requirements Tab)		X			4
Electives			X		7
At least four Upper-Division CS classes must be completed by the end of Semester 7.		X			
	Total Credits				**15**

Semester 8		**Critical**	**Recommended**	**AUCC**	**Credits**
Systems Courses (See list on the Concentration Requirements Tab)		X		4C	8
Electives			X		7
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
	Total Credits				**15**
	Program Total Credits:				**120**