Computer Science Major Checksheet - Modified April 2023	Computer science is about creating innovative solutions to complex, real-world problems. Students in this major study step-by-step computational methods for solving problems by encoding, storing, tracking and transforming information. Computer science is much broader than just programming. It is informed by the theory and architecture of computing devices, and the tools and practices used to design and implement software.

A Computer Science degree includes AUCC courses, CS starting courses, CS common core, and a concentration as defined on the following sheets. Please review with a CS Advisor.

120 total credits required

42 upper division credits required

AUCC (All-University Core Curriculum)

Status	Category	Course	Credits
	1A) Intermediate Writing	CO 150 or HONR 193	3
	1B) Quantitative Reasoning	MATH 156 or MATH 160	4
	1C) Diversity, Equity, and Inclusion		3
	2) Advanced Writing		3
	3A) Biological and Physical Science w/ lab (from CS list)		4
	3A) Biological and Physical Science (from CS list)		3
	3B) Arts & Humanities	See Intro CS Courses below	
	3B) Arts & Humanities	CS 201/PHIL 201	3
	3C) Social & Behavioral Sciences	Recommend PSY 100, esp. for HCC. EDUC 275 required in Educ Concentration	3
	3D) Historical Perspective		3
	Total		29

CS-Approved Biological & Physical Sciences (#)
AA 100 & AA 101
ANTH 120 & ANTH 121
BZ 110 & BZ 111; BZ 120
(CHEM 107 & CHEM 108) or (CHEM 111 & CHEM 112)
GEOL 120 & GEOL 121; GEOL 122 & GEOL 121; GEOL 124 & GEOL 121; GEOL 150
HONR 292A
LIFE 102, LIFE 103, LIFE 201A; LIFE 201B; LIFE 220/LAND 220
NR 150
(PH 121 or PH 141); (PH 122 or PH 142)
Applicable to Pre-Fall 2020, and Fall 2020, and Fall 2021 curriculum also

Intro CS Courses

Complete One Group of Courses in this List

Status	Course	Course Title	Credits
	Group A:		
	CS 150A or CS 150B	Culture and Coding (Arts & Humanities AUCC)	3
	CS 164	CS 1 - Computational Thinking with Java	4
		Total	7
	Group B:		
	CS 152	Python for STEM	2
	CS 162	CS 1 - Introduction to Java Programming	2
	AUCC Arts/Humanitites		3
		Total	7
	Group C:		
	CS 163	CS 1 - No Prior Programming Experience	4
	AUCC Arts/Humanitites		3
		Total	7

CS Common Core

Must Complete All Courses in this List

Status	Course	Course Title	Credits
	MATH 369 or DSCI 369	Linear Algebra	3-4
	STAT 301, 307, or 315 (†)	Statistics	3
	CT 301 (*)	Programming with C++	2
	CS 165	CS2 - Data Structures	4
	CS 214 (*)	Software Development	3
	CS 220	Discrete Structures	4
	CS 250 (*)	Computer Systems Foundations	4
	CS 314	Software Engineering	3
	CS 320	Algorithms: Theory & Practice	3
	CS 370	Operating Systems	3
		Total	32-33

† STAT 302A can also be used if a student already has credit for STAT 201 or 204

* CS 253 will meet the requirement for CS 214 and CT 301; and CS 270 or CS 280a1 will meet requirement for CS 250

Computer Science Major Concentrations

Concentration Choices	Description
Computer Science - General	The general Computer Science major provides students with a broad background in the field of computer science as well as optionally gives students the opportunity to complement their computer science major with a minor in a field of their choosing. Students will find that there is a great need for knowledge in the combination of computer science with other disciplines.
Artificial Intelligence and Machine Learning	Artificial intelligence (AI) and machine learning (ML) are about creating intelligent systems – systems that perceive and respond to the world around them. AI and ML systems are everywhere, in our cars and smartphones, and businesses of all sizes are investing in these areas. The AI/ML concentration combines a rigorous computer science degree with coursework in AI, ML, and big data. This concentration also provides you the necessary foundational coursework and skills in math, statistics, and data science.
Computer Science Education	Computers Science Educators seek to advance the fundamental quality of computer science education by having a deeper understanding on how students learn combined with the complexities of the computational mindset that is developed through computer science. Computer Science Education students will engage in coursework related to both computer science and education, and their intersection, the growing field of computer science education. Through course work, service learning, and student teaching, this degree will prepare students to enter the field as a K-12 teachers. Furthermore, this degree will serve as preparation for admission into advanced degree programs and college level teaching and research in the field of computer science education. Course work includes the same core foundation expected of all computer science concentrations, and course work specific to computer science education and teaching standards including web development, software engineering, and networking.
Computing Systems	Computer 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. Computer systems specialists are challenged to provide ever increasing levels of performance from these systems. The computer systems concentration provides you the necessary tools to solve important and demanding systems problems at scale. You 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.
Human-Centered Computing	Human-centered computing (HCC) focuses on developing tools that improve the relationship between people and technology so that people can concentrate on the problem rather than the technology. The ultimate goal of HCC is to make the computer invisible. Human-centered computing involves designing, developing, and deploying human-centric computer systems. In this concentration you will learn techniques for human-computer interaction using gestures, mobile devices, large surfaces, and virtual environments. You will also learn how to design and conduct human-subject experiments and understand the role of HCC in developing human-centric artificial intelligence systems. The concentration provides rich interdisciplinary training in computer vision, machine learning, design and psychology.
Networks and Security	Networks connect computers and other devices so they can share information. The networks and security concentration involves designing, building, and maintaining networks and protecting them from cyberattacks. Network and security technology is vitally important to almost every modern field of human endeavor including biology, physics, agriculture, medicine, defense, and more. There is explosive demand for professionals who can understand the underlying principles of networks and security, incorporate them into products and practices, and provide defensive capabilities against cyber threats.
Software Engineering	Software engineering involves designing, implementing, and maintaining computer programs. Developing modern software systems requires more than programming skills and core computer science concepts. It requires software engineering skills, which are in high demand in the software industry. The software engineering concentration focuses on the concepts, techniques, and tools necessary for software analysis, design, testing, maintenance, and teamwork. Your courses will include hands-on work with the software engineering tools used in industry.

Computer Science Major Concentration Requirements

Status	Software Engineering Concentration	Credits
	CS 356	3
	CS 414	4
	CS 415	4
	△Select 1 Software Engineering Upper Division Elective course: CS 312, CS 345, CS 400- or above	3-4
	1)	
	Select 2 Breadth courses: CS 430, 435, 440, 453, 455, 462, 464	8
	1)	
	2)	
	CIS 320	3
	CIS 360	3
	Total	28-29

△CS course numbered 300- or above; or 400- or above excludes CS 380-399 and CS 480-499 unless explicitly stated

Status	Computer Science Education Concentration	Credits
	△Select 2 CS course numbered 300- or above	6-8
	1)	
	2)	
	Select 2 CS Education Standards courses: CS 312, 414, 430, 457	7-8
	1)	
	2)	
	△Select 1 CS course numbered 400- or above	4
	1)	
	EDUC 275 (Social Behavioral Sciences AUCC)	3
	EDUC 340 - Literacy and the Learner	3
	EDUC 331 - Educational Technology and Assessment	2
	EDUC 350 - Instruction I - Individualization/Management	3
	EDUC 386 - Practicum: Instruction I	1
	EDUC 450 - Instruction II - Standards and Assessment	4
	EDUC 486E - Practicum: Instruction II	1
	EDCT 465 - Methods and Materials in Technology Education	3
	EDCT 485 - Student Teaching	11
	EDUC 496A - Seminar: Professional Relations	1
	Total	49-52

Computer Science Major Concentration Requirements

Status	Computer Science - General Concentration	Credits
	△Select 2 CS course numbered 300- or above	6-8
	1)	
	2)	
	△Select 3 CS courses numbered 400- or above	12
	1)	
	2)	
	3)	
	Choose Group A or B	
	Group A:	
	△CS course numbered 400- or above	4
	1)	
	✛Select 6 credits of Technical Electives (At least 3 credits must be upper division)	6-8
	Group B:	
	Minor or Second Major (at least 12 credits must be unique from CS major requirements. See CS Advisor to discuss further)	~21
	Total	>=28

Status	Networks and Security Concentration	Credits
	CS 356	3
	△Select 1 CS Course numbered 300- or above	3-4
	1)	
	CS 456	4
	CS 457	4
	Select 1 course from: CS 430, CS 458	4
	1)	
	△Select 1 CS course numbered 400- or above	4
	1)	
	✛Select 6 credits Technical Electives (At least 3 credits must be upper division)	6-8
	Total	28-31

Status	Computing Systems Concentration	Credits
	△Select 2 CS Courses numbered 300- or above	6-8
	1)	
	2)	
	Select 3 Systems Courses from: CS 435, 453, 455, 457, 475	12
	1)	
	2)	
	3)	
	Select 1 system elective: CS 440, 445, 422	4
	1)	
	✛Select 6 credits of Technical Electives (At least 3 credits must be upper division)	6-8
	Total	28-31

Technical Electives for General Concentration, Networks & Security Concentration, Computing Systems Concentration (#, ✛)

✛,§, △ Any CS, CT, DSCI, IDEA, MATH, or STAT course numbered 300-or above
BZ 350, BZ 360
CIS 320, CIS 350, CIS 360, CIS 413, CIS 455
ECE 452
ENGR 422
JTC 372, 472
MATH 161, 256
MGT 330, MGT 340, MGT 420
NR 322
PHIL 410, 411, 415
PSY 252, PSY 352, PSY 452, PSY 454, PSY 456, PSY 458

Status	Artificial Intelligence and Machine Learning Concentration	Credits
	MATH 161 or 256	4
	CS 345	3
	△Select 1 CS Course numbered 300- or above	3-4
	1)	
	Select 2 capstone courses: from CS 425, 440, 445	8
	1)	
	2)	
	Select 1 CS course from: CS 425, 430, 435, 440, 445, 455, 462, 464, 475	4
	1)	
	Select 1 CS systems course from: CS 435, 455, 475	4
	1)	
	✛Select 6 credits AI/ML Technical Electives (At least 3 credits must be upper division) (to the right)	6-8
	Total	32-35

Technical Electives for AI & ML Concentration

DSCI 320, DSCI 335, DSCI 336, DSCI 473, DSCI 475
MATH 261, MATH 301, MATH 331, MATH 360, MATH 430/ECE 430, MATH 450
STAT 341, STAT 342, STAT 400, STAT 420

Status	Human-Centered Computing Concentration	Credits
	CS 345	3
	△Select 1 course from: CS 310H/IDEA 310H; CS 312, CS 400- or above	3-4
	1)	
	△Select 1 CS Course numbered 300- or above	3-4
	1)	
	CS 464	4
	Select 2 CS Depth Courses from: CS 440, 445, 462	8
	1)	
	2)	
	✛Select 9 credits of HCC Technical Electives (at least 6 credits must be upper division) (to the left)	9
	Total	30-32

Technical Electives for HCC Concentration

Any STAT course numbered 300- or above, excluding 301, 302A, 307, 315, 380-399 and 480-499
✛ IDEA 210, Any IDEA course numbered 300- or above, excluding 380-399 and 480-499
PSY 252, PSY 253, PSY 452, PSY 454, PSY 456, PSY 458

△ Excludes STAT 301, 302A, 307, 315, 380-399 and 480-499
§ Excludes 380-399 and 480-499 courses unless explicitly stated
# Applicable to Pre-Fall 2020, and Fall 2020 curriculum also
△CS course numbered 300- or above; or 400- or above excludes CS 380-399 and CS 480-499 unless explicitly stated
✛Double counting of required course for AUCC's or CS Common Core as technical elective credits is not allowed (including MATH 369, DSCI 369, and IDEA 210)

CS Lower Division Courses		
Course Number	**Course Name**	**Semester Offered**
CS 110	Personal Computing	F / S
CS 150B	Culture and Coding: Python	F / S
CS 152	Python for STEM	F / S
CS 162	CS 1 - Introduction to Java Programming	F / S
CS 163	CS 1 - No Prior Programming Experience	Last time offered: FA 2022
CS 164	CS 1 - Computation Thinking with Java	F / S / SS
CS 165	CS 2 - Data Structures	F / S / SS
CS 192	First-Year Seminar - Computer Science	F
CS 201 (same as PHIL 201)	Ethical Computing Systems	F / S / SS
CS 214	Software Development	F / S
CS 220	Discrete Structures and their Applications	F / S / SS
CS 250	Computer Systems Foundations	F / S / SS
CS 253	Software Development with C++	No longer offered - see CS 214 and CT 301
CS 270	Computer Organization	No longer offered - see CS 250
CS 295	Independent Study	F / S / SS

Course Number	Course Name	Semester Offered
CT 301	Programming with C++	F / S

CS Upper Division Courses		
Course Number	**Course Name**	**Semester Offered**
CS 310H	Design Thinking Toolbox: Mixed Reality Design	Every other F, even years
CS 312	Modern Web Applications	S
◇ CS 314	Software Engineering	F / S
◇ CS 320	Algorithms: Theory & Practice	F / S
CS 345	Machine Learning Foundations	F / S
CS 356	System Security	F / S / SS
◇ CS 370	Operating Systems	F / S / SS
CS 414	Object Oriented Design	F
CS 415	Software testing	S
CS 420	Introduction to Analysis of Algorithms	*S
CS 422	Automata, Logic, and Computation	*F
CS 425	Introduction to Bioinformatics Algorithms	S
CS 430	Database Systems	S / SS
CS 435	Introduction to Big Data	F
CS 440	Introduction to Artificial Intelligence	F
CS 445	Introduction to Machine Learning	S
CS 453	Introduction to Compiler Construction	*S
CS 455	Introduction to Distributed Systems	S
CS 456	Modern CyberSecurity	F
CS 457	Computer Networks and the Internet	F
CS 458	Blockchain Principles and Applications	S
CS 462	Engaging in Virtual Worlds	F
CS 464	Principles of Human Centered Computing	S
CS 475	Parallel Programming	*F
CS 48x	Special offerings that often can sub for CS upper division requirement, example CS 481A4 Digital Forensics	*F, *S
◇ CS 486	Practicum (Internship)	F / S / SS
◇ CS 495	Independent Study	F / S / SS
◇ CS 498	Research	F / S / SS

* Semester offered, if offered	
◇ Cannot be used to fulfill concentration (CS Upper Division: CS 300- or above) or tech elective credits	

Computer Science Course Prerequisites (rev. Apr 2023)

Legend

- **Solid:** required prereq
- **Dashed:** choose one as prereq
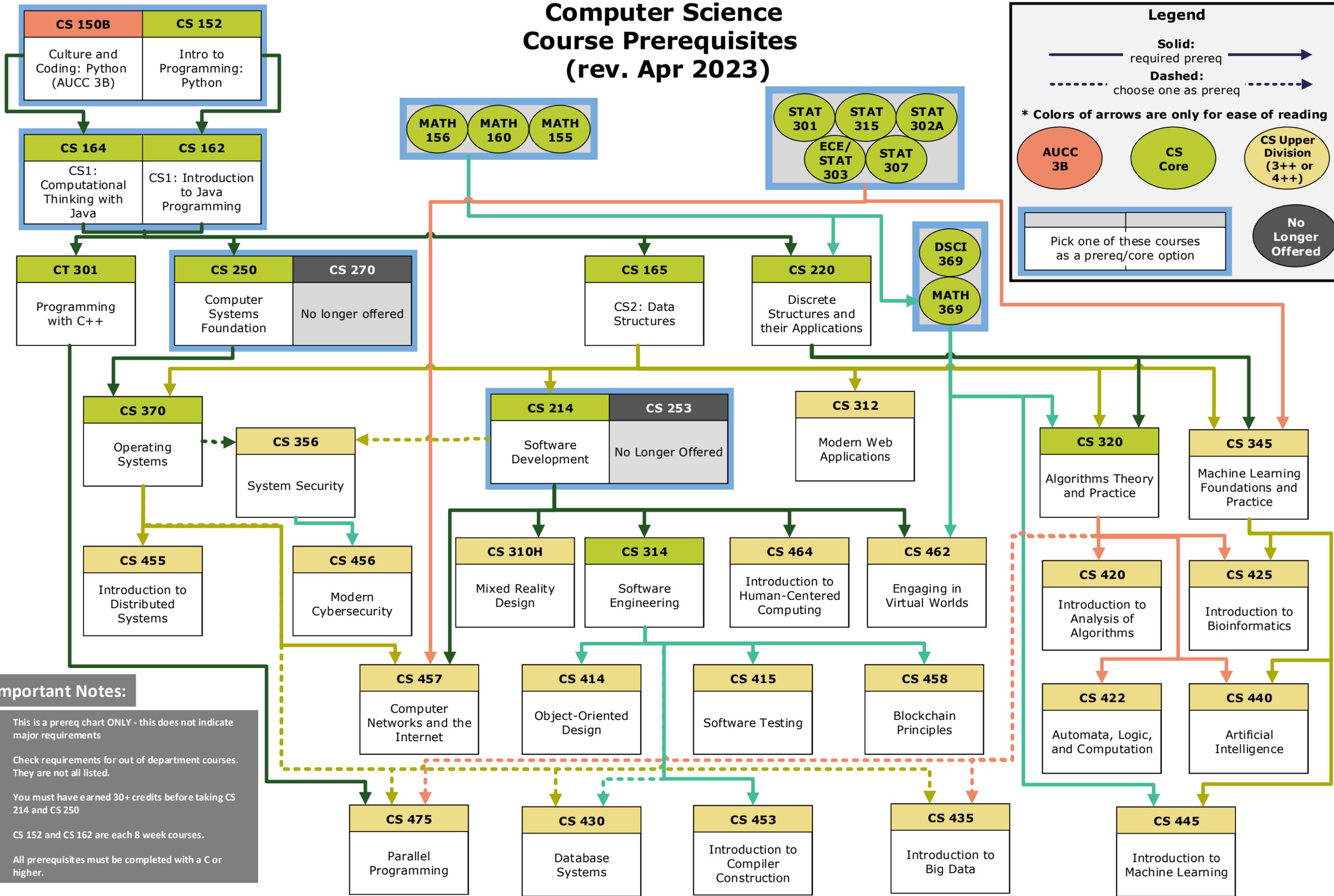- * Colors of arrows are only for ease of reading
- AUCC 3B
- CS Core
- CS Upper Division (3++ or 4++)
- Pick one of these courses as a prereq/core option
- No Longer Offered

CS 150B — Culture and Coding: Python (AUCC 3B)
CS 152 — Intro to Programming: Python
CS 164 — CS1: Computational Thinking with Java
CS 162 — CS1: Introduction to Java Programming

MATH 156 · MATH 160 · MATH 155

STAT 301 · STAT 315 · STAT 302A · ECE/STAT 303 · STAT 307

DSCI 369 · MATH 369

CT 301 — Programming with C++
CS 250 — Computer Systems Foundation
CS 270 — No longer offered
CS 165 — CS2: Data Structures
CS 220 — Discrete Structures and their Applications

CS 370 — Operating Systems
CS 356 — System Security
CS 214 — Software Development
CS 253 — No Longer Offered
CS 312 — Modern Web Applications
CS 320 — Algorithms Theory and Practice
CS 345 — Machine Learning Foundations and Practice

CS 455 — Introduction to Distributed Systems
CS 456 — Modern Cybersecurity
CS 310H — Mixed Reality Design
CS 314 — Software Engineering
CS 464 — Introduction to Human-Centered Computing
CS 462 — Engaging in Virtual Worlds
CS 420 — Introduction to Analysis of Algorithms
CS 425 — Introduction to Bioinformatics

CS 457 — Computer Networks and the Internet
CS 414 — Object-Oriented Design
CS 415 — Software Testing
CS 458 — Blockchain Principles
CS 422 — Automata, Logic, and Computation
CS 440 — Artificial Intelligence

CS 475 — Parallel Programming
CS 430 — Database Systems
CS 453 — Introduction to Compiler Construction
CS 435 — Introduction to Big Data
CS 445 — Introduction to Machine Learning

Important Notes:

- This is a prereq chart ONLY - this does not indicate major requirements
- Check requirements for out of department courses. They are not all listed.
- You must have earned 30+ credits before taking CS 214 and CS 250
- CS 152 and CS 162 are each 8 week courses.
- All prerequisites must be completed with a C or higher.