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| Computer Science Major Checksheet - Modified April 2024 | 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. |
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**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 & <u>AA 101</u> | |
| ANTH 120 & <u>ANTH 121</u> | |
| BZ 110 & <u>BZ 111</u> ; <u>BZ 120</u> | |
| (CHEM 107 & <u>CHEM 108</u>) or (CHEM 111 & <u>CHEM 112</u>) | |
| GEOL 120 & <u>GEOL 121</u> ; GEOL 122 & <u>GEOL 121</u> ; GEOL 124 & <u>GEOL 121</u> ; <u>GEOL 150</u> | |
| HONR 292A | |
| <u>LIFE 102</u> , <u>LIFE 103</u> , LIFE 201A; LIFE 201B; LIFE 220/LAND 220 | |
| NR 150 | |
| <u>(PH 121 or PH 141)</u> ; <u>(PH 122 or PH 142)</u> | |
| # Applicable to Pre-Fall 2020, and Fall 2020, and Fall 2021 curriculum also | |
| <i>Underlined courses can fulfill lab requirement.</i> | |

| Intro CS Courses | | | |
|--|----------------------|---|---------|
| Complete <u>One Group</u> of Courses in this List | | | |
| Status | Course | Course Title | Credits |
| | Group A: | | |
| | 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/Humanities | | 3 |
| | Total | | 7 |
| | Group C: | | |
| | CS 163 | CS 1 - No Prior Programming Experience | 4 |
| | AUCC Arts/Humanities | | 3 |
| | Total | | 7 |

| CS Common Core | | | |
|---|---------------------------|-------------------------------|---------|
| Must Complete <u>All Courses</u> 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 | | | |
| ± CS 370 not required for Computing for Creatives concentration | | | |

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 | Computer 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 for Creatives | The Computing for Creatives concentration is intended for students who seek to work at the interface of computer science and creative fields such as design. The concentration combines the core computing curriculum with computationally-focused study in creative fields. This degree will provide advanced computing skills to create artifacts such as games and 3D simulations that interact with people visually and aurally, as well as demonstrate design, narrative, and human factors skills required to create those artifacts. |
| 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 | 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 | 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 |

| 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 (#, +) |
|--|
| 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 |
| + , §, Δ Any CS, CT, DSCI, IDEA, MATH, or STAT course numbered 300-or above |

| 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 |

Δ 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)

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) | |
| | Select 2 Breadth courses: CS 430, 435, 440, 453, 455, 462, 464 | |
| | CIS 320 | 3 |
| | CIS 360 | 3 |
| | Total | 28-29 |

| 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 |

| Status | Computing for Creatives Concentration | Credits |
|--------|--|--------------|
| | IDEA 210 | 3 |
| | CS 345 | 3 |
| | △Select 1 CS Course numbered 300- or above | 3-4 |
| | 1) | |
| | Select 1 Capstone Course: CS 462, 464 | 4 |
| | 1) | |
| | △Select 2 CS courses numbered 400- or above | 8 |
| | 1) | |
| | 2) | |
| | Select 9 credits of Design Thinking Courses: IDEA 310B, 310H, 310L, 310O, 310Q, 450, or IDEA/MGT 455 | 9 |
| | Total | 30-31 |

| 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 |
|--|
| ± 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 |
| Any STAT course numbered 300- or above, excluding 301, 302A, 307, 315, 380-399 and 480-499 |

△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 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 |

| | | |
|--------|----------------------|-------|
| 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 454 | Principles of Programming Languages | Varies |
| 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 | Fall 2024 |
| CS 465 | Multimodal Interaction for 3D User Interfaces | Spring 2025 |
| CS 475 | Parallel Programming | Varies |
| 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