COMPUTER SCIENCE DEGREE

Students must also complete the Undergraduate Registration Requirement (https://catalogs.northwestern.edu/undergraduate/requirements-policies/undergraduate-registration-requirement/) and the degree requirements of their home school.

Requirements (48 units)

Core Courses (27 units) [1]

Course	Title
4 mathematics courses	
MATH 220-1	Single-Variable Differential Calculus
MATH 220-2	Single-Variable Integral Calculus
MATH 228-1	Multivariable Differential Calculus for Engineering
COMP_SCI 212-0	Math Foundations of CS Part 1: Discrete Math for CS
4 units of basic science chosen according to McCormick basic science guidelines (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)	
4 engineering analysis and computer proficiency courses	
GEN_ENG 205-1 & GEN_ENG 205-2 & GEN_ENG 205-3	Engineering Analysis I and Engineering Analysis II and Engineering Analysis III
or GEN_ENG 206-1 & GEN_ENG 206-2 & GEN_ENG 206-3	Honor Engineering Analysis and Honors Engineering Analysis and Honors Engineering Analysis
COMP_SCI 111-0	Fundamentals of Computer Programming [2]
3 design and communications courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)	
7 social sciences/humanities courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)	
5 unrestricted electives (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)	

Major Program (21 units)

Course	Title
5 required courses	
COMP_SCI 150-0	Fundamentals of Computer Programming 1.5
COMP_SCI 211-0	Fundamentals of Computer Programming II
COMP_SCI 213-0	Introduction to Computer Systems
COMP_SCI 214-0	Data Structures & Algorithms
COMP_SCI 262-0	Mathematical Foundations of Computer Science - Part 2
or IEMS 201-0	Introduction to Statistics
or IEMS 303-0	Statistics
or ELEC_ENG 302-0	Probabilistic Systems
or STAT 210-0	Introduction to Probability and Statistics
3 advanced elective courses	
Any 300-level or higher class, or introductory courses that directly support computer science (COG_SCI 207-0, COMP_ENG 203-0, COMP_ENG 205-0, COMP_SCI 260-0, COMP_SCI 296-0, COMP_SCI 298-0, MECH_ENG 233-0)	
5 breadth courses chosen from the options below	
6 technical electives chosen from the options below	
2 project courses chosen from the options below	

[1] See general requirements (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) for details.

[2] COMP_SCI 110-0 Introduction to Computer Programming may be used as an unrestricted elective if taken before COMP_SCI 111-0 Fundamentals of Computer Programming. It may not, however, be applied to the computer science major requirements.

Breadth Courses

Majors must take one course from each area. Minors must take one course from each of any three areas.

Theory

Course	Title
COMP_SCI 335-0	Introduction to the Theory of Computation
COMP_SCI 336-0	Design & Analysis of Algorithms

Systems

Course	Title
COMP_SCI 322-0	Compiler Construction
COMP_SCI 339-0	Introduction to Database Systems
COMP_SCI 340-0	Introduction to Networking
COMP_SCI 343-0	Operating Systems
COMP_SCI 345-0	Distributed Systems
COMP_SCI 346-0	Microcontroller System Design
COMP_SCI 350-0	Introduction to Computer Security
COMP_SCI 354-0	Computer System Security
COMP_SCI 440-0	Advanced Networking
COMP_SCI 441-0	Resource Virtualization
COMP_SCI 443-0	Advanced Operating Systems
COMP_SCI 446-0	Kernel and Other Low-level Software Development
COMP_SCI 450-0	Internet Security
COMP_ENG 303-0	Advanced Digital Design
COMP_ENG 346-0	Microcontroller System Design
COMP_ENG 358-0	Introduction to Parallel Computing
COMP_ENG 361-0	Computer Architecture I

Artificial Intelligence

Course	Title
COMP_SCI 325-0	Artificial Intelligence Programming
COMP_SCI 337-0	Natural Language Processing: Classical Approaches
COMP_SCI 344-0	Design of Computer Problem Solvers
COMP_SCI 348-0	Introduction to Artificial Intelligence
COMP_SCI 349-0	Machine Learning
COMP_SCI 371-0	Knowledge Representation and Reasoning
COMP_SCI 372-0	Designing and Constructing Models with Multi-Agent Languages

Interfaces

Course	Title
COMP_SCI 313-0	Tangible Interaction Design and Learning
COMP_SCI 315-0	Design, Technology, and Research
COMP_SCI 329-0	HCI Studio
COMP_SCI 330-0	Human Computer Interaction
COMP_SCI 331-0	Introduction to Computational Photography
COMP_SCI 333-0	Interactive Information Visualization
COMP_SCI 351-1	Introduction to Computer Graphics
COMP_SCI 352-0	Machine Perception of Music & Audio
COMP_SCI 370-0	Computer Game Design

COMP_SCI 372-0	Designing and Constructing Models with Multi-Agent Languages
COMP_SCI 376-0	Computer Game Design and Development
COMP_SCI 377-0	Game Design Studio
ELEC_ENG 332-0	Introduction to Computer Vision

Software Development and Programming Languages

Course	Title
COMP_SCI 310-0	Scalable Software Architectures
COMP_SCI 321-0	Programming Languages
COMP_SCI 338-0	Practicum in Intelligent Information Systems
COMP_SCI 377-0	Game Design Studio
COMP_SCI 392-0	Rapid Prototyping for Software Innovation
COMP_SCI 393-0	Software Construction
COMP_SCI 394-0	Agile Software Development

Project Courses

Majors must take two courses from this list.

Project course list

Course	Title
COMP_SCI 311-0	Inclusive Making
COMP_SCI 312-0	Data Privacy
COMP_SCI 315-0	Design, Technology, and Research
COMP_SCI 322-0	Compiler Construction
COMP_SCI 329-0	HCI Studio
COMP_SCI 330-0	Human Computer Interaction
COMP_SCI 331-0	Introduction to Computational Photography
COMP_SCI 337-0	Natural Language Processing: Classical Approaches
COMP_SCI 338-0	Practicum in Intelligent Information Systems
COMP_SCI 339-0	Introduction to Database Systems
COMP_SCI 340-0	Introduction to Networking
COMP_SCI 343-0	Operating Systems
COMP_SCI 344-0	Design of Computer Problem Solvers
COMP_SCI 345-0	Distributed Systems
COMP_SCI 346-0	Microcontroller System Design
COMP_SCI 351-1	Introduction to Computer Graphics
COMP_SCI 351-2	Intermediate Computer Graphics
COMP_SCI 354-0	Computer System Security
COMP_SCI 355-0	Digital Forensics and Incident Response
COMP_SCI 367-0	Wireless and Mobile Health: Passive Sensing Data Analytics
COMP_SCI 370-0	Computer Game Design
COMP_SCI 371-0	Knowledge Representation and Reasoning
COMP_SCI 372-0	Designing and Constructing Models with Multi-Agent Languages
COMP_SCI 377-0	Game Design Studio
COMP_SCI 392-0	Rapid Prototyping for Software Innovation
COMP_SCI 393-0	Software Construction
COMP_SCI 394-0	Agile Software Development
COMP_SCI 397-0	Special Projects in Computer Science
COMP_SCI 412-0	Data Privacy
COMP_SCI 415-0	Design, Technology, and Research
COMP_SCI 433-0	Wireless Protocols for the Internet of Things
COMP_SCI 441-0	Resource Virtualization
COMP_SCI 445-0	Internet-scale Experimentation
COMP_SCI 446-0	Kernel and Other Low-level Software Development
COMP_SCI 450-0	Internet Security
COMP_SCI 461-0	Deep Learning for Natural Language Processing
COMP_SCI 497-0	Special Projects in Computer Science
COMP_ENG 346-0	Microcontroller System Design
COMP_ENG 366-0	Embedded Systems
COMP_ENG 466-0	Embedded Systems
ELEC_ENG 332-0	Introduction to Computer Vision

Technical electives

Majors must take six technical electives. **Any 300- or 400-level COMP_SCI course** may be taken as a technical elective. In addition the following courses may also be taken as technical electives:

Course	Title
COMP_ENG 303-0	Advanced Digital Design
COMP_ENG 329-0	The Art of Multicore Concurrent Programming
COMP_ENG 334-0	Fundamentals of Blockchains and Decentralization
COMP_ENG 346-0	Microcontroller System Design
COMP_ENG 355-0	ASIC and FPGA Design
COMP_ENG 356-0	Introduction to Formal Specification & Verification
COMP_ENG 357-0	Design Automation in VLSI
COMP_ENG 358-0	Introduction to Parallel Computing
COMP_ENG 361-0	Computer Architecture I
COMP_ENG 362-0	Computer Architecture Projects
COMP_ENG 364-0	CyberPhysical Systems Design and Application
COMP_ENG 365-0	Internet-of-things Sensors, Systems, And Applications
COMP_ENG 366-0	Embedded Systems
COMP_ENG 368-0	Programming Massively Parallel Processors with CUDA
COMP_ENG 452-0	Adv Computer Architecture
COMP_ENG 453-0	Parallel Architectures
COMP_ENG 456-0	Modern Topics in Computer Architecture
COMP_ENG 459-0	VLSI Algorithmics
COMP_ENG 464-0	Cyber-Physical Systems Design and Application
COMP_ENG 465-0	Internet-of-things Sensors, Systems, And Applications
COMP_ENG 466-0	Embedded Systems
COMP_ENG 468-0	Programming Massively Parallel Processors with CUDA
ELEC_ENG 326-0	Electronic System Design I
ELEC_ENG 332-0	Introduction to Computer Vision
ELEC_ENG 375-0	Machine Learning: Foundations, Applications, and Algorithms
ELEC_ENG 433-0	Statistical Pattern Recognition
ELEC_ENG 435-0	Deep Learning: Foundations, Applications, and Algorithms

Note

Courses that fulfill the breadth and project courses also fulfill the technical elective requirement. However, a given course may only be applied to a single requirement for the major. In such cases where a single course could be applied to multiple requirements, a student must choose which requirement to apply a given course to. A course may not be counted toward multiple requirements at once.

Concentrations

Computer Science students have the option to declare one concentration from the list below, to highlight specialization in a specific sub-field of computer science:

- Artificial Intelligence
- Systems
- Foundations
- Security and Privacy
- Software Engineering and Programming Languages
- Robotics
- Computer Hardware and Architecture
- Human-Computer Interaction

To fulfill a concentration, a student must complete four classes from that concentration's list of courses within their 21 Major Program Courses (CS Advanced Electives, Breadth, Project and Technical Electives).

The list of courses for each concentration, as well as the full details and requirements for concentrations can be found on the Computer Science department web site (https://www.mccormick.northwestern.edu/computer-science/academics/undergraduate/bachelors/).