COMPUTER SCIENCE (CS)

Courses

CS 201. QR: Operating Systems. 0 or 3 Credits.
Supervisory and control software for multiprogrammed computer systems. Processes, threads, synchronization, interprocess communication, scheduling, memory management, resource allocation, performance evaluation, secondary storage, case studies. Prerequisites: CS 120 and CS 121.

CS 202. Compiler Construction. 3 Credits.
Covers the design and construction of compilers and translation of high-level programming languages to assembly language. Topics include code representation, register allocation, optimization, static analysis, mutable data, garbage collection, and compilation of higher-order language features. Prerequisites: CS 124, CS 125.

CS 204. QR: Database Systems. 3 Credits.
Techniques for processing very large collections of data. Secondary storage. Database design and management. Query languages and optimization. Database recovery. Prerequisite: CS 124.

CS 205. QR: Software Engineering. 3 Credits.
Treatment of software engineering problems and principles, with a focus on iterative software development. A significant part of the course is devoted to two multi-week team projects. Prerequisite: CS 120.

CS 206. QR: Evolutionary Robotics. 3 Credits.
Exploration of the automated design of autonomous machines using evolutionary algorithms. Coursework involves reading of research papers, programming assignments and a final project. Prerequisites: Junior standing and programming experience, or Instructor permission.

CS 211. Data Privacy. 3 Credits.
Explores the research field of data privacy, including privacy attacks on anonymized data, and formal approaches like k-Anonymity and differential privacy. Applies the theory of data privacy to real problems in programming projects. Prerequisites: CS 124, CS 125.

CS 222. QR: Computer Architecture. 3 Credits.
Architecture of computing systems. Control unit logic, input/output processors and devices, asynchronous processing, concurrency, parallelism, and memory hierarchies. Prerequisite: CS 121.

CS 224. QR: Algorithm Design & Analysis. 3 Credits.
Comprehensive study of algorithms including greedy algorithms, divide and conquer, dynamic programming, graph algorithms and network flow. Computational intractability. Approximation, local search and randomization. Prerequisite: CS 124. Pre/co-requisites: Recommended: CS 125; STAT 143, STAT 151, or CS 128.

CS 225. QR: Programming Languages. 3 Credits.
The principles of programming language design and fundamental implementation concepts. Syntax, semantics, and static program analysis for various paradigms. Programming language metatheory, including confluence and type safety. Stack-based implementation and memory management issues. Prerequisites: CS 124, CS 125.

CS 226. QR: Software Verification. 3 Credits.
Principles and practice of software specification and verification. Design of algorithms which are verified correct using interactive or automated, software-based tools. Emphasis on the design space for software specification, and the spectrum of verification goals ranging from shallow to deep verification. Includes a course project. Prerequisites: CS 124, CS 125.

CS 228. QR: Human-Computer Interaction. 3 Credits.
The design, implementation, and evaluation of user interfaces for computers and other complex, electronic equipment. Includes a significant project. Pre/co-requisites: Programming experience and Junior standing or Instructor permission.

CS 237. QR: Intro to Numerical Analysis. 3 Credits.
Error analysis, root-finding, interpolation, least squares, quadrature, linear equations, numerical solution of ordinary differential equations. Prerequisites: Math 121; MATH 122 or MATH 124 or MATH 271; CS 020 or CS 021. Cross-listed with: MATH 237.

CS 243. QR: Theory of Computation. 3 Credits.
Reducibility and decidability, recursion theory, time and space complexity, P, NP, NP-completeness, PSPACE, PSPACE-completeness, L and NL, advanced topics in computability and complexity. Prerequisites: CS 124 and CS 125.

CS 253. QR: Reinforcement Learning. 3 Credits.
Students will program agents that learn to optimize a reward function using Reinforcement Learning: Markov Decision Processes with discrete states, Value Iteration, Policy Iteration, Q-learning and SARSA, methods for value function approximation in complex domains using linear and non-linear methods. Prerequisites: CS 064 or MATH 052; STAT 151 or STAT 251; CS 110. Pre/Co-requisites: MATH 122 or MATH 124; CS 125.

CS 254. QR: Machine Learning. 3 Credits.
Introduction to machine learning algorithms, theory, and implementation, including supervised and unsupervised learning; topics typically include linear and logistic regression, learning theory, support vector machines, decision trees, backpropagation artificial neural networks, and an introduction to deep learning. Includes a team-based project. Prerequisites: STAT 151 or STAT 251; MATH 122 or MATH 124.

CS 256. QR: Computer Networks. 3 Credits.
Introduction to the theoretical and pragmatic principles and practices of computer networking. Topics include: the Internet; wired and wireless communications protocols; network security protocols. Prerequisites: CS 110; CS 121.

CS 266. QR: Network Security & Cryptography. 3 Credits.
CS 275. QR: Mobile App Development I. 3 Credits.
A projects-based course focusing on software development for mobile
devices, including the concepts of event-driven programming, GUI
design and implementation, utilization of hardware sensors, and
client/server applications. A significant part of the course is devoted
to a multi-month team development project. Prerequisite: CS 120,
Senior standing. Pre/co-requisites: Recommended: CS 148 or
CS 204.

CS 287. QR: Data Science I. 3 Credits.
Data harvesting, cleaning, and summarizing. Working with non-
traditional, non-numeric data (social network, natural language
textual data, etc.). Scientific visualization using static and interactive
‘infographics.’A practical focus on real datasets, and developing good
habits for rigorous and reproducible computational science. Project-
based. Prerequisites: CS 020 or CS 021; STAT 141 or STAT 143 or
STAT 211. Pre/co-requisites: Recommended: CS 110; Math 122 or

CS 288. QR: Statistical Learning. 3 Credits.
Statistical learning methods and applications to modern problems in
science, industry, and society. Topics include: linear model selection,
cross-validation, lasso and ridge regression, tree-based methods,
bagging and boosting, support vector machines, and unsupervised
learning. Prerequisites: STAT 143, STAT 183 or STAT 211. Cross-
listed with: STAT 288.

CS 294. Undergraduate Research. 1-18 Credits.
Undergraduate student work on individual or small team research
projects under the supervision of a faculty member, for which credit is
awarded. Offered at department discretion.

CS 302. Modeling Complex Systems. 3 Credits.
Integrative breadth-first introduction to computational methods for
modeling complex systems; numerical methods, cellular automata,
agent-based computing, game theory, genetic algorithms, artificial
neural networks, and complex networks. Semester team-based
project. Prerequisite: Graduate standing. Pre/Co-requisites:
Computer programming in any language, calculus; linear algebra

CS 352. Evolutionary Computation. 3 Credits.
Theory and practice of biologically-inspired search strategies,
including genetic algorithms, genetic programming, and evolution
strategies. Applications include optimization, parameter estimation,
and model identification. Significant project. Students from
multiple disciplines encouraged. Pre/co-requisites: Familiarity with
programming, probability, and statistics. Cross-listed with: CSYS 352.

CS 354. Deep Learning. 3 Credits.
Introduction to Deep Learning algorithms and applications, including
basic neural networks, convolutional neural networks, recurrent
neural networks, deep unsupervised learning, generative adversarial
networks and deep reinforcement learning. Includes a semester team-
based project. Prerequisite: CS 254.

CS 387. Data Science II. 3 Credits.
Advanced data analysis, collection, and filtering. Statistical modeling,
monte carlo statistical methods, and in particular Bayesian data
analysis, including necessary probabilistic background material.
A practical focus on real datasets and developing good habits for
rigorous and reproducible computational science. Prerequisite:
STAT 287 or CS 287 or Instructor permission. Cross-listed with:
STAT 387.

CS 391. Master’s Thesis Research. 1-18 Credits.

CS 392. Master’s Project. 1-6 Credits.
Prerequisite: Department permission.

CS 395. Advanced Special Topics. 1-18 Credits.
Subject will vary from year to year. May be repeated for credit with
Instructor permission.

CS 491. Doctoral Dissertation Research. 1-18 Credits.
Credit as arranged.

CS 496. Advanced Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.