

BA in Computer Science

Overview. Computer Science is the study of information processes. Computer scientists learn how to describe information processes, how to reason about and predict properties of information processes, and how to implement information processes elegantly and efficiently in hardware and software. The Computer Science BA degree concentrates on developing the deep understanding of computing and critical thinking skills that will enable graduates to pursue a wide variety of possible fields and to become academic, cultural, and industrial leaders in areas that integrate the arts and sciences with computing. The BA Computer Science degree is designed to provide students entering the University without previous background in computing with an opportunity to major in Computer Science, while taking courses in arts, humanities, and sciences to develop broad understanding of other areas and their connections to computing. Computing connects closely with a wide range of disciplines including, but not limited to, the visual arts, music, life sciences including biology and cognitive science, the physical sciences, linguistics, mathematics, and the social sciences. The core curriculum focuses on developing methods and tools for describing, implementing, and analyzing information processes and for managing complexity including abstraction, specification, and recursion.

The BA Computer Science degree is administered by a Computer Science BA Committee, composed of faculty from the College and the Computer Science Department. The BA Committee is responsible for the BA curriculum, student advising, and deciding on exceptions to the major requirements.

After declaring the major, students are assigned two advisors: a primary advisor from the Computer Science department (who will be the contact point for approval signatures) and a secondary advisor from Arts and Sciences.

Major Subject Requirements

Gateway courses:

CS150: Computing from Ada and Euclid to Quantum Computing the World Wide Web

Introduction to computer science for students with no previous background. Focuses on describing and reasoning about information processes using language and logic. Uses motivating examples from liberal arts and sciences areas such as art, biology, economics, narrative, physics, and sociology.

CS205: Engineering Software

Covers tools and techniques used to manage complexity needed to build, analyze, and test complex software systems including abstraction, analysis, and specification.

Core courses:

The following core courses are long-standing, regularly offered courses. After completing CS205, CLAS Computer Science students will have comparable background to the SEAS CS majors entering these courses.

CS202: Discrete Mathematics I

Introduces discrete mathematics and proof techniques involving first order predicate logic and induction. Application areas include sets (finite and infinite), elementary combinatorial problems, and finite state automata. Development of tools and mechanisms for reasoning about discrete problems.

Prerequisite: CS150

CS216: Program and Data Representation

Introduces programs and data representation at the machine level. Data structuring techniques and the representation of data structures during program execution. Operations and control structures and their representation during program execution. Representations of numbers, arithmetic operations, arrays, records, recursion, hashing, stacks, queues, trees, graphs, and related concepts.

Prerequisite: CS 205 and CS 202 with grades of C- or higher.

CS333: Computer Architecture

Includes the organization and architecture of computer systems hardware; instruction set architectures; addressing modes; register transfer notation; processor design and computer arithmetic; memory systems; hardware implementations of virtual memory, and input/output control and devices.

Prerequisite: CS216

CS432: Algorithms

Introduces the analysis of algorithms and the effects of data structures on them. Algorithms selected from areas such as sorting, searching, shortest paths, greedy algorithms, backtracking, divide- and-conquer, and dynamic programming. Data structures include heaps and search, splay, and spanning trees. Analysis techniques include asymptotic worst case, expected time, amortized analysis, and reductions between problems.

Prerequisite: CS216

Computing Electives

Four computing-intensive electives selected from a list of approved courses. The list of approved courses will initially comprise current Computer Science courses at 300-level or above. Additional courses will be added to the list of approved computing electives based on approval by the BA committee.

Integration Electives

Four courses selected with the approval of the student's advisor from the list of computing-related courses approved by the BA CS committee. These courses are offered by departments other than Computer Science, and should either provide fundamental computing depth and background or explore applications of computing to arts and sciences fields. The list of approved integration electives is maintained by the CS BA committee and is available from the CS BA website: <http://www.cs.virginia.edu/ba/>.

Distinguished Majors Program

Distinguished majors complete the BA degree requirements in addition to a fourth year thesis project that is approved by two advisors, one from Computer Science and one from Arts and Sciences. Both advisors must approve the student's plan of study, thesis proposal, and thesis report.