Computer Science

The Association for Computing Machinery has developed a curriculum for computer science that is published annually. Much of the attached text is copied and reworded from the text for *Computer Science Curriculum 2008*.

**Objectives**

Computing is a broad field that extends well beyond the boundaries of computer science, drawing its foundations from a wide variety of disciplines. Computer science increasingly plays a methodological role in other disciplines and the impact of technology is a significant subject of study in fields like political science and journalism.

Majors in computer science learn to utilize concepts from many different fields, integrate theory and practice, and appreciate the value of good engineering design. They develop a high-level understanding of systems as a whole and an appreciation for the structure of computer systems, and the processes involved in their construction and analysis, that transcends the implementation details of the various components. They attain an understanding of the theoretical underpinnings of the discipline and how that theory influences practice. Many recurring themes such as abstraction, complexity, and evolutionary change are encountered during their course of study. Students are also educated as engineers, learning how to design, develop and maintain, large complex software systems and applications, integrating them into workplaces, and developing interfaces to them that support human use. Given the rapid continuous development of the field, majors are educated to be lifelong learners.

In recognition of the increasing significance of computer science as an important discipline for many students throughout the university, the department also offers a selection of courses relevant to students majoring in other disciplines or students double majoring in computer science and another concentration. Several courses enable students to develop skills and understanding of web technology and the impact of the Internet on society. Other courses provide students with the relevant skills and knowledge for assessing the adoption of new technology within an organization. Non-majors can learn the computing and modeling skills that support their work in their core discipline. Students in the social sciences can learn how the skills and methods from their core discipline are relevant for the development of user friendly technology, or the introduction of technology into the workplace.

**Skills**

Majors in computer science will develop a number of skills.

- Understanding the elements of computational thinking.
- Understanding the trade-off involved in design choices.
- Identifying and analyzing criteria and specifications appropriate to specific problems, and planning strategies for their solution. Analyzing the extent to which a computer-based system meets the criteria defined for its current use and future development.
- Deploying appropriate theory, practices, and tools for the specification, design, implementation, and maintenance as well as the evaluation of computer-based systems.
- Specifying, designing, and implementing computer-based systems.
- Evaluating systems in terms of general quality attributes and possible tradeoffs presented within the given problem.
- Applying the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and
video.
• Awareness of security issues. Exposure to issues associated with access, encryption, and
networking.
• Applying the principles of human-computer interaction to the evaluation and construction of
a wide range of materials including user interfaces, web pages, multimedia systems and
mobile systems.
• Learning to deploy effectively the tools used for the construction and documentation of soft-
ware, with particular emphasis on understanding the whole process involved in using com-
puters to solve practical problems.
• Awareness of the existence of publicly available software (such as APIs or open source
materials). Effective engagement in open-source projects. Exposure to effective software
reuse.
• Operating computing equipment and software systems effectively.

Additional skills prepare the majors for success as professionals:

• Communication. Making succinct presentations to a range of audiences about technical
problems and their solutions. This may involve face-to-face, written, or electronic communi-
cation.
• Teamwork. Learning to work effectively as a member of a disciplinary or interdisciplinary
development team.
• Numeracy. Understanding and explaining the quantitative dimensions of a problem.
• Self-management. Managing one’s own learning and development, including time manage-
ment and organizational skills
• Professional development. Learning the skills necessary to continue one’s own professional
development after graduation.

Knowledge

Majors have the opportunity to be exposed to a diverse set of core knowledge areas:

Discrete structures
Programming fundamentals Graphics and visual computing
Algorithms and complexity Intelligent systems and Machine Learning
Data Compression Computational Linguistics
Architecture and organization Bioinformatics
Operating systems, concurrency, and security Artificial life
Distributed Computing and Networking Data management
Programming languages Software engineering
(exposure to different programming paradigms) Numerical methods, simulation and modeling
Human-Computer Interaction Entrepreneurial Computer Science
Computer Supported Cooperative Work Internet & Society

Social Justice

The department does not currently offer a specific course to cover social and professional
issues. However, many of these issues are distributed throughout the curriculum. Lifelong learning
is a common theme of many of the elective courses. There are many opportunities for experiential
learning and the development of oral communication and teamwork skills. Open software, freedom
of information, patent and copyright law, software pirating, social inclusion and the digital divide,
and the effect of the Internet on political discourse and free speech, are among the topics covered in the Internet & Society course.

**Upon Graduating**

The BS curriculum is intended for students who want to work as computer scientists in a technical firm or plan to attend graduate school in computer science. The BS requires more rigorous training in the analytic and engineering foundations of computer science. It includes a breadth component that exposes students to a range of topics within computer science, and it also includes a depth component that requires students to explore a sequence of courses in one area of computer science.

The BA requirement reduces the ACM curriculum to the basic set of skills and knowledge. Students graduating with the BA will be prepared to work as application programmers or in secondary areas related to computation like informatics or library science. The BA curriculum is also ideal for students who plan to use their degree in computer science as a basis for graduate study in a professional school or graduate programs in other areas of science or social science.