Computer Science

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The science of computing is a rapidly growing field of study. Computers are used in almost every facet of life, and a grasp of their fundamentals can lead to challenging and rewarding activity in many fields. Principia's computer science courses stress the principles that underlie computing as well as practical experience in creating software and problem solving.

Students develop programming skills from beginning to advanced levels and also learn about the fundamental design and architectural considerations of computer systems. In the process, students have plenty of opportunities to demonstrate the discipline and persistence needed to bring a program to completion—all the while gaining confidence in their ability to think systematically and to recognize everyone's natural ability to do so.

Because a thorough understanding of content from CSCI 171 Introduction to Programming and CSCI 182 Intro to Data Structures is essential to later CSCI courses, a student must earn at least a C in both of these courses in order to proceed with a CSCI major or minor. To complete a major or minor offered by the Computer Science Department, a student must earn a cumulative average of 2.000 or higher for the courses (required and elective, within the department or outside it, such as math and engineering) taken for that program.

For all majors and minors, if CSCI 181 Accelerated Intro Programming is substituted for CSCI 171 Introduction to Programming, the total semester hours required will be two fewer.

In addition to both a B.S. and a B.A. in computer science, the Computer Science Department offers two minors, one in computer science and a second in management information systems. The minor in management information systems is designed to prepare students to work with business programming, emphasizing a professional approach. Students in this minor will study methodologies for complex software system development, database management, database design, and professional ethics. Further, an individualized major or minor (http://catalog.principiacollege.edu/majors-minors/individualized-majors/) is available in Computer Engineering.

A student may earn only one major or minor in computer science.

Departmental Learning Outcomes

1. Our students will be able to specify, design, write, and test high quality software using current best practices.
2. Our students will be prepared for lifelong learning in their field, including experience with self-instruction while at Principia.
3. Our students will always strive to uphold the highest level of conduct in every aspect of their lives, including professionalism, teamwork, and ethics.

Majors

- B.S. in Computer Science (http://catalog.principiacollege.edu/majors-minors/computer-science/bs/)
- B.A. in Computer Science (http://catalog.principiacollege.edu/majors-minors/computer-science/ba/)

Minors

- Minor in Computer Science (http://catalog.principiacollege.edu/majors-minors/computer-science/minor/)
- Minor in Management Information Systems (http://catalog.principiacollege.edu/majors-minors/computer-science/minor-management-information-systems/)

CSCI 170   Intro to Computer Science   4.0 SH   [GESN]
Modern computing concepts, components, history from the abacus to the modern PC. Introduction to computer arithmetic, logic, circuits, a low-level language and a high-level language, elementary systems, peripherals, networks and ethics. Encourages presentation development and delivery. Addresses the fear of technology. Does not teach computer applications (such as word processing) but explores the science of computing. Does not count toward the CSCI major or the MIS minor.

CSCI 171   Introduction to Programming   4.0 SH   [GESN]
Focus on fundamental concepts of problem solving by analyzing problems and using a computer language (C++, Java, or Python) as a tool to design, code, document, and test solutions, learned through textbook study, lectures, examples, and considerable practice in the computer science programming laboratory. Professional approaches are emphasized. (A student may receive credit for only one of the courses CSCI 171 or CSCI 181.).

CSCI 181   Accelerated Intro Programming   2.0 SH   [ ]
Students entering the computer science program with considerable programming experience may take this course as a replacement for CSCI 171 as a major requirement.
Prerequisite: successful completion of a programming competency test. (A student may receive credit for only one of the courses CSCI 171 or CSCI 181.).

CSCI 182   Intro to Data Structures   4.0 SH   [ ]
In-depth coverage of programming concepts, with emphasis on data structures, including arrays, structs, class objects, stacks, queues, and lists. Algorithms and complexity analysis for searching and maintaining sorted and unsorted lists. Explicit pointer data type and dynamic allocation of memory. Introduction to object-oriented programming and recursive functions.
Prerequisite: Either CSCI 171 or CSCI 181 with a grade of C or better.

CSCI 202   Internship   1.0 SH   [ ]
Software development internship. Students will complete an industrial internship involving software testing or development, identifying a portion of their effort that is individually performed, and is academically meritorious.
Prerequisite: CSCI 182.

CSCI 220   Programming Languages   4.0 SH   [ ]
A survey and comparison of programming languages, learned through study and considerable programming practice. Intended to form the programming language basis for courses in object-oriented programming and database management systems.
Prerequisite: CSCI 171 and CSCI 182 with a grade of C or better in both courses.

CSCI 240   Object-Oriented Programming   4.0 SH   [ ]
Students design, code, document, and debug computer programs using classes, object-oriented design, inheritance, polymorphism, and recursion. They demonstrate problem-solving skills using object-oriented concepts.
Prerequisite: Completion of or concurrent enrollment in CSCI 220.

CSCI 263   Computer Software Architecture   3.0 SH   [ ]
Topics include assembly language programming and ISA design issues, low-level OS concepts including memory management, cache, I/O and process/thread management.
Prerequisite: CSCI 171 and CSCI 182 with a grade of C or better in both courses and ENGR 262.

CSCI 310   Software Engineering   3.0 SH   [ ]
Methodologies for developing and maintaining large complex software systems. Case studies and team exercises are included. Focus on complete software life cycle, including specification, design, implementation, testing, debugging, and documentation.
Prerequisite: Either CSCI 171 or CSCI 181 with a grade of C or better and CSCI 182 with a grade of C or better.
Class Level Restriction: Junior and Senior only.

CSCI 316   Professional Software Dev   4.0 SH   [ ]
Practical industrial software development, including methods for mastering and contributing to existing large codebases, and the use of standard tools for source control, testing, and documentation.
Prerequisite: CSCI 240.

CSCI 320   Database Management Systems   4.0 SH   [ ]
The utilization of database systems within organizational settings. Includes features of database management systems, various data models, database design, normalization, SQL, various indexing techniques, and data integrity and recovery issues.
Prerequisite: CSCI 171 and CSCI 182 with a grade of C or better.
Class Level Restriction: Sophomore and Junior and Senior only.

CSCI 324   Web Development   4.0 SH   [ ]
Design and development of client and server-side web applications, using libraries, and technologies relevant as of the time of course offering. Coverage of scripting language concepts including closure, dynamic typing, and prototypes. The class is project-oriented, and students will complete a significant web application.
Prerequisite: CSCI 320.
Class Level Restriction: Junior and Senior only.

CSCI 330   Operating Systems   3.0 SH   [ ]
The inner workings of several popular multiprogramming operating systems are compared. Topics include processor scheduling, device management, memory management, and parallel processing.
Prerequisite: CSCI 263.
Class Level Restriction: Junior and Senior only.

CSCI 333   Computer Networking   3.0 SH   [ ]
Introduction to Local Area and Wide Area computer networks. Topics include network topologies, ISO protocols, Ethernet, TCP/IP, and network support for distributed computing. The course emphasizes the science of networking (as opposed to network administration).
Prerequisite: Either CSCI 171 or CSCI 181 with a grade of C or better and CSCI 182 with a C or better.
Class Level Restriction: Junior and Senior only.

CSCI 335   Cloud Computing   3.0 SH   [ ]
Learn how to configure a cloud-resident website or mobile app able to scale to millions of users. Build sophisticated software rapidly by integrating existing cloud-resident services into software to meet particular needs.
Prerequisite: CSCI 240.
Class Level Restriction: Junior and Senior only.

CSCI 337   Cybersecurity   3.0 SH   [ ]
This course introduces the importance of cybersecurity and covers its various components, including writing software that is invulnerable to cyberattack, common methods of cyberattack, secure encryption algorithms, firewall configuration, intrusion prevention/detection, and honeypots.
Prerequisite: CSCI 240.
Class Level Restriction: Junior and Senior only.

CSCI 340   Advanced Algorithms   4.0 SH   [ ]

Survey of algorithms, with an emphasis on the application of algorithmic theory to the solution of practical problems. Categories include algorithm taxonomy, greedy algorithms, dynamic programming, divide-and-conquer, and intelligent search. Various specific algorithms exemplifying these categories are drawn from a variety of application areas such as compression, encryption, graph problems, sorting, computational geometry, and string matching.

Prerequisite: CSCI 240.

Class Level Restriction: Junior and Senior only.

CSCI 342   Machine Learning   4.0 SH   [ ]

Mathematics and software design of machine learning systems, including dense, convolutional, and recurrent deep learning architectures, the mathematics of high-dimensional pattern spaces and gradient descent optimization, and non deep-learning algorithms such as support vector machines and decision trees. Students will build and train a machine learning system.

Prerequisite: CSCI 240 with a grade of C- or better.

Class Level Restriction: Sophomore and Junior and Senior only.

CSCI 344   Data Science   4.0 SH   [ ]

Theoretical and practical aspects of the analysis of very large datasets, including classic statistical methods like correlation and PCA, unsupervised learning methods like K-means and other clustering, supervised methods like decision trees and SVMs. An extra credit project may also involve using recent mathematical tools for causality analysis.

Prerequisite: CSCI 240 and MATH 273.

Class Level Restriction: Junior and Senior only.

CSCI 350   Computer Graphics   4.0 SH   [ ]

Graphics software development and use of application programming interfaces for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. Completion of a graphics software project.

Prerequisite: CSCI 240 with a grade of C or better.

Class Level Restriction: Junior and Senior only.

CSCI 380   Compilers   4.0 SH   [ ]

Concepts necessary for designing and developing a compiler. Topics include lexical analysis, parsing, semantic analysis, symbol table management, and code generation. Students will implement a small compiler as a project.

Prerequisite: CSCI 240 and CSCI 263.

Class Level Restriction: Junior and Senior only.

CSCI 390   Topics in Computer Science   1.0-5.0 SH   [ ]

Topics will vary from year to year based on the needs and interests of students and instructor. All offerings will involve in-depth study of a specific topic, software design, the construction of working software, and self-instruction in addition to standard instruction. May be taken more than once if topics are different.

Prerequisite: CSCI 240.

CSCI 410   Capstone Proposal   1.0 SH   [ ]

Students research and prepare a capstone proposal in preparation for completing a computer science capstone project. The proposal must be approved by the computer science faculty prior to taking CSCI 415.

Class Level Restriction: Junior and Senior only.

CSCI 415   Capstone   3.0 SH   [ ]

A student-designed project with a significant programming component which pulls together the student's major. Choices include independents, internships, or group projects.

Prerequisite: CSCI 410.

Class Level Restriction: Junior and Senior only.

CSCI 421   Computer Issues Seminar   **3.0 SH**   **[ ]**

An examination and discussion of pressing computer issues facing society. Topics include personal impact, societal impact, artificial intelligence, privacy, and ethics. Majors from other disciplines are encouraged to take this course if they have taken any other computer science course.
Class Level Restriction: Junior and Senior only.