COMPUTER SCIENCE

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The Department of Mathematics and Computer Science offers majors and minors in both Computer Science and Mathematics.

The computer science program at Pacific University is characterized by small classes, close interaction with the faculty, and a deep yet broad curriculum rarely encountered at a small university. To prepare students for a discipline that is constantly changing, the curriculum integrates a variety of programming languages in a manner that emphasizes a thorough understanding of language structure. The student experience culminates with a two-semester software engineering capstone sequence that results in a substantial piece of original software. The confidence and knowledge gained from the program allows each student to pursue either a graduate education in computer science or immediate employment with such industry leaders as Intel, Microsoft and Google.

The computer science program maintains common goals for all of its students (majors, minors, and others). Students in our courses learn strategies for abstract problem solving, gain a basic understanding of computers and the broad implications of their use and have the opportunity to hone their computational skills.

Student Learning Outcomes

- Demonstrate a fundamental understanding of computation and programming.
- Apply strategies for abstract problem solving
- Discuss the theoretical basis of the mathematics and symbolic concepts that underlie computing.
- Apply knowledge through the design and implementation of a large scale computer application.
- Be able to communicate in a collaborative environment, present ideas, and document work at all stages of software development.
- Identify the skills necessary to become a lifelong learner in the rapidly changing field of Computer Science.

Computer Science: Requirements for the Major

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 226</td>
<td>Calculus I</td>
<td>4 credits</td>
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<tr>
<td>MATH 240</td>
<td>Discrete Mathematics</td>
<td>4 credits</td>
</tr>
<tr>
<td>CS 150</td>
<td>Introduction to Computer Science I</td>
<td>4 credits</td>
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<tr>
<td>CS 250</td>
<td>Introduction to Computer Science II</td>
<td>4 credits</td>
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<tr>
<td>CS 260</td>
<td>Introduction to Java and Android Programming</td>
<td>2 credits</td>
</tr>
<tr>
<td>CS 300</td>
<td>Data Structures</td>
<td>4 credits</td>
</tr>
<tr>
<td>CS 310</td>
<td>Theoretical Computer Science</td>
<td>4 credits</td>
</tr>
<tr>
<td>CS 380</td>
<td>Algorithm Design and Analysis</td>
<td>4 credits</td>
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<tr>
<td>CS 435</td>
<td>Computer Security</td>
<td>4 credits</td>
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<tr>
<td>CS 460</td>
<td>Operating Systems</td>
<td>4 credits</td>
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<tr>
<td>CS 485</td>
<td>Advanced Object-Oriented Programming</td>
<td>4 credits</td>
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<tr>
<td>CS 493</td>
<td>Software Engineering I</td>
<td>2 credits</td>
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<tr>
<td>CS 494</td>
<td>Software Engineering II</td>
<td>2 credits</td>
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<tr>
<td>CS 498</td>
<td>Senior Capstone</td>
<td>2 credits</td>
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Four credits selected from the following courses:

- Math 207 General Elementary statistics 4 credits
- Math 301 Mathematical Modeling 4 credits
- Math 306 Linear Algebra 4 credits

Eight credits selected from the following courses:

- CS 315 Introduction to Human Computer Interaction 4 credits
- CS 360 Special Topics* 4 credits
- CS 445 Introduction to Database Systems 4 credits
- PHY 364 Electronics 4 credits

TOTAL: 60 credits

* Note: CS 360 may be counted twice as an elective as long as the topics are different.

Restrictions

At least 24 credits of upper-division Computer Science courses must be taken from Pacific University (credit by examination not acceptable)

At most, 1 course passed with a grade below C- may count toward the Computer Science major. All courses in the Software Engineering sequence (CS 493, CS 494) must be passed with a grade of C or better.

Computer Science: Requirements for the Minor

<table>
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<tr>
<th>Course Code</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 150</td>
<td>Introduction to Computer Science I</td>
<td>4 credits</td>
</tr>
<tr>
<td>CS 250</td>
<td>Introduction to Computer Science II</td>
<td>4 credits</td>
</tr>
</tbody>
</table>

Electives: 12 credits

Electives are selected from: CS 205, CS 260, CS 300, CS 310, CS 315, CS 360, CS 380, CS 430, CS 445, CS 460, CS 480, MATH 306, MATH 240, PHY 364.

At least one of the following:

- MATH 125 Precalculus 4 credits
- MATH 226 Calculus 4 credits

TOTAL: 24 Credits

Restrictions: Eight of the elective credits must be upper-division Computer Science courses taken at Pacific University.

COURSES

CS-121 Our Digital World
An exploration of the impact and effects of the Internet on all aspects of our lives as global citizens. This course examines the ethical, cultural, economic and political aspects of the Internet as a social technology. Also listed as MEDA 121. 2 credits.
CS-122  Introduction to Digital Media
An introduction to producing, editing and publishing computer-based media including computer graphics, Web sites, and streaming media. Includes a survey of modern communications formats such as blogs, podcasts, and social networks. Also listed as MEDA 122. 2 credits.

CS-130  Introduction to Software Tools
Many disciplines are finding the need to gather, manipulate, analyze, and graph data. This course will introduce students to software tools that aid in this process. Software that is widely used at Pacific includes: a Statistics Software Package, Excel, Word, and PowerPoint. Class includes lab projects. Prerequisite: MATH 125 with a minimum grade of C. 2 credits.

CS-150  Introduction to Computer Science I
A first course in computer programming fundamentals: no previous programming experience is required. This course will be taught in C++ and include programming projects in a variety of areas. Course content includes data types, selection structures, repetition structures, functions, arrays, structures and I/O. In addition to three lectures per week, the class meets weekly for a laboratory session. Corequisite: MATH 125. 4 credits.

CS-155  Special Topics
See department for course description.

CS-205  Intro to Programming for Multimedia
This course introduces students with little or no programming experience to the design and development of software applications using a high-level, object-oriented programming language such as JavaScript. Prerequisite: CS 122 or MEDA 122 with a minimum grade of C. Offered alternate years. 4 credits.

CS-232  Mobile Data Collection & Analysis
This course will show students how to use modern mobile data collection systems in laboratory and field applications. Experiments will be designed and carried out using mobile devices for data collection and software tools for data analysis and reporting. Sample experiments might revolve around topics such as blood pressure, EKG, flow rate, GPS with Google Maps, pH, light, pressure, and temperature. Prerequisite: CS 130 and MATH 125, both with a minimum grade of C. 2 credits.

CS-250  Introduction to Computer Science II
A second course in programming that is a continuation of CS 150. The focus of this course is object-oriented programming in C++. Concepts taught include pointers, classes, operator overloading, inheritance, and polymorphism. These concepts will be reinforced with advanced programming projects including introductory game programming. Prerequisite: CS 150 and MATH 125 each with a minimum grade of C. 4 credits.

CS-255  Special Topics
See department for course description.

CS-260  Intro to Java & Android Programming
The focus of this course is programming using Java and Android Devices including Smartphones. Students will design, develop, and test Java programs. Topics will include the Java API, Smartphone hardware features, and Event Driven Programming. Prerequisite: CS 250 with a minimum grade of C. 2 credits.

CS-275  Internship
See department for details. Internship contract required.

CS-295  Independent Study
See department for details. Independent study contract required.

CS-300  Data Structures
Data structures are fundamental to advanced, efficient programming. Topics including asymptotic analysis, stacks, queues, linked lists, trees, and hash tables will be covered in discussions centering around more sophisticated programming concepts, problem solving techniques, and software reusability. Prerequisite: CS 250 with a minimum grade of C. 4 credits.

CS-310  Theoretical Computer Science
This course introduces the foundations of formal language theory, computability, and complexity, shows the relationship between automata and various classes of languages, addresses the issue of which problems can be solved by computational means and studies the complexity of their solutions. It also studies Turing machines and equivalent models of computation, the Chomsky hierarchy, context free grammars, push-down automata, and computability. Prerequisite: CS 250 with a minimum grade of C. Offered alternate years. 4 credits.

CS-315  Intro to Human Computer Interaction
Humans interact with computers through user interfaces; designing useful and effective interfaces involves many challenges for both designers and programmers. This course will cover the basics of the field of human computer interaction including the human factors of interactive software, methods to develop and assess interfaces, interaction styles and design considerations. The class will include research and design projects as well as a programming project. Prerequisite: CS 250 or MEDA 265 with a minimum grade of C. Offered alternate years. 4 credits.

CS-355  Special Topics
See department for course description.

CS-360  Special Topics
The topic of this course changes from year to year depending on the latest developments in Computer Science and the research interests of the faculty. Recent topics include Client/Server Programming Using Java, Artificial Intelligence and Robotics, Windows Programming, and Computer Networking. Programming projects will build on existing APIs. Prerequisite: CS 250 with a minimum grade of C. May be repeated for credit. 4 credits.

CS-380  Algorithm Design and Analysis
An introduction to the formal techniques that support the design and analysis of algorithms, focusing on both the underlying mathematical theory and the practical considerations of efficiency. Topics include asymptotic complexity bounds, techniques of analysis, algorithmic strategies, advanced data structures, graph theory and other selected topics. Coursework includes object-oriented programming in C++ and covers templates, STL, and exception handling. Prerequisite: CS 300 and MATH 240 each with a minimum grade of C. Offered alternate years. 4 credits.

CS-395  Independent Study
See department for details. Independent study contract required.
CS-435  Computer Security
Introduces the fundamental issues and principles of computer and information security. The course will cover security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics include common attacking techniques such as virus, trojan, worms and memory exploits; the formalisms of information security such as the access control and information flow theory; the basic cryptography, RSA, cryptographic hash function, and password system; and legal and ethical issues in computer security. Students will learn how to design secure systems and write secure code. Prerequisites: Math 240 and CS 300. Offered alternate years. 4 credits.

CS-445  Introduction to Database Systems
An introduction to both the theory and application of Database Management Systems using a modern DBMS and web application front-end. Topics covered will include database design including normalization and optimization, the relational model, relational algebra, security, transaction management, and the query language SQL. Distributed and web architectures will be discussed. All topics in the course will be implemented concretely using a modern DBMS. Prerequisite: CS 300 with a minimum grade of C. Offered alternate years. 4 credits.

CS-455  Special Topics
See department for course description.

CS-460  Operating Systems
This course provides a hands-on introduction to operating systems including the development of a command line shell and kernel modules. Topics covered include processes and threads, CPU scheduling, memory management, I/O systems, distributed file systems, operating system history and design, and synchronization. Prerequisite: CS 300 with a minimum grade of C. Offered alternate years. 4 credits.

CS-475  Internship
See department for details. Internship contract required.

CS-485  Advanced Object Oriented Design
Extends the object oriented design knowledge gained in CS 250. This course will cover the decomposition of a software system into objects emphasizing: building an object hierarchy, information hiding, abstraction of behavior, and reusability of objects. Object Oriented Design Patterns will be introduced. Students will apply various Design Patterns to classroom assignments as well as refactor an existing software project to use the proper Design Patterns. Students will be required to work in teams to produce a large software system as a final project. Prerequisites: CS 300. Offered alternate years. 4 credits.

CS-493  Software Engineering I
This course will cover the theory behind software development. Topics covered include software architecture, requirements analysis, prototyping, and project management tools. These topics are critical to the success of the student senior capstone projects. Prerequisite: Senior standing (90 or more completed credits), declared CS major, and one 400 level CS course with a minimum grade of C taken at Pacific. 2 credits.

CS-494  Software Engineering II
During this course, students will study the implementation and maintenance of a large software project. This includes the study of software development techniques, managing requirement and design changes during implementation, verification and validation, and defect management. In addition, students will participate in code reviews, study professionalism and job interview techniques, and meet with industry professionals and local technology companies. Prerequisite: CS 493 with a minimum grade of C. 2 credits.

CS-495  Independent Research
See department for details. Independent study contract required.

CS-498  Senior Capstone
Students will have the opportunity to use their Computer Science skills and knowledge to implement an original project of their choice under the supervision of faculty in Computer Science. The project will result in a software application and final presentation. Prerequisite: CS 493 with a minimum grade of C. 2 credits.