

[ARCHIVED CATALOG]

Computer Science, Minor

Students pursuing a minor in Computer Science are required to:

- Complete 24 credits.
- Complete a minimum of 12 credits in the minor that are not duplicated by the major or any other minor.
- Complete 6 credits upper division credits in the minor in residence at Chapman.
- Complete a minimum of 9 upper division credits in the minor.
- Achieve a 2.000 cumulative GPA in the minor and a 2.000 GPA for all upper-division coursework in the minor.

lower-division requirements (15 credits)

[CPSC 230 - Computer Science I](#)

CPSC 230 - Computer Science I

Students are introduced to problem-solving methods and algorithm development through an interactive and easy-to-learn programming language, Python. (Offered every semester.) **3 credits**

[CPSC 231 - Computer Science II](#)

CPSC 231 - Computer Science II

Prerequisite, [CPSC 230](#), or equivalent. This course is a comprehensive study of object-oriented computing with a mainstream programming language, Java. The course introduces the principal features of the language with a focus on object-oriented development, code reuse, and large program structure. The course also covers advance topics such as concurrency and graphical user interfaces. (Offered every semester.) **3 credits**

[CPSC 236 - Visual Programming](#)

CPSC 236 - Visual Programming

Prerequisite, [CPSC 230](#). Students learn the essentials of visual programming language such as C# or Visual Basic. Emphasis is placed on using controls to build graphical user interfaces. (Offered every semester.) **3 credits**

[MATH 250 - Discrete Mathematics I](#)

MATH 250 - Discrete Mathematics I

Prerequisite, [MATH 101](#) or equivalent. This course provides the student with an introduction to the fundamental mathematics of discrete phenomena and computation. This is a key course in the CPSC curriculum as it provides the theoretical background needed for many upper-division courses including Data Structures (combinatorics, formal languages), Logic Design (Boolean algebras, number representation) and Integrated Circuit Design (automata theory, finite state minimization, graph layout). Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

[CPSC 350 - Data Structures and Algorithms](#)

CPSC 350 - Data Structures and Algorithms

Prerequisite, [CPSC 231](#) or [CENG 231](#). Students study core data structures and algorithms, such as arrays, stacks, lists, queues, trees, hash tables, graphs; search and sort. Students engage on projects that involve individually chosen advanced data structures and algorithms. The focus is on applications of data structures and algorithms, utilization of existing practical data sets, and performance trade-offs. Letter grade. (Offered every semester.) **3 credits**

electives (9 credits)

three of the following

[SE 310 - Software Design](#)

SE 310 - Software Design

Prerequisite, [CPSC 231](#). Corequisite, [SE 300](#). Students gain hands-on experience designing software from a formal set of functional and non-functional software requirements. (Offered fall semester.) **3 credits**

[SE 320 - The Software Development Lifecycle](#)

SE 320 - The Software Development Lifecycle

Prerequisites, [CPSC 350](#), [SE 300](#), [SE 310](#). Students apply their theoretical knowledge of the software development lifecycle to a year-long project spanning all facets of the requirements, design, implementation, test, and maintenance processes. (Offered spring semester.) **3 credits**

[CPSC 330 - Digital Logic Design I](#)

CPSC 330 - Digital Logic Design I

(Same as [PHYS 330](#).) Prerequisite, [CPSC 231](#) or [CENG 231](#). Corequisite, [CPSC 330L](#). Students learn the fundamental principles and practice of digital logic. The course covers binary numbers and arithmetic. Students study Boolean algebra as a method of reasoning about sequential circuits including truth tables and Karnaugh maps, logic minimization, gates and flip-flops, sequential logic and combinatorial logic. The course requires one hour of supervised work in a laboratory in addition to three hours per week of lecture. Letter grade. (Offered spring semester.) **3 credits**

AND

[CPSC 330L - Lab - Digital Logic Design I](#)

CPSC 330L - Lab - Digital Logic Design I

(Same as [PHYS 330L](#).) Prerequisite, [CENG 231](#) or [CPSC 231](#). Corequisite, [CPSC 330](#). Laboratory component of [CPSC 330](#). Letter grade. (Offered spring semester.) **1 credit**

[CPSC 351 - Computer Architecture I](#)

CPSC 351 - Computer Architecture I

Prerequisite, [CPSC 330](#). Students learn the organization and structure of the major hardware components of computers to understand the mechanics of information transfer and control within a digital computer system and the fundamentals of logic design. (Offered fall semester.) **3 credits**

[CPSC 353 - Data Communications and Computer Networks](#)

CPSC 353 - Data Communications and Computer Networks

Prerequisite, [CENG 231](#) or [CPSC 231](#). Students explore the principles and techniques of data communications and give special emphasis to networks and distributed systems. The I.S.O. Reference Model for open systems interconnection will be investigated and the function and operation of each protocol layer analyzed in detail. Letter grade with

Pass/No Pass option. (Offered every semester.) **3 credits**

[CPSC 354 - Programming Languages](#)

CPSC 354 - Programming Languages

Prerequisites, [MATH 250](#), [CPSC 350](#). Students develop an understanding of the organization and design of programming languages through writing interpreters for three different toy languages illustrating a range of programming concepts from pure functional languages to imperative languages with memory management. Moreover, the course will open windows into topics of programming languages research such as parsing, operational and denotational semantics, term rewriting, Hoare logic, verification, and theorem proving. Letter grade with Pass/No Pass option. (Offered fall semester.) **3 credits**

[CPSC 355 - Human Computer Interaction](#)

CPSC 355 - Human Computer Interaction

Prerequisite, [CPSC 231](#). Students study the foundations of human-interaction, with emphasis on user-centered design methodologies. Topics such as usability, human factors, user studies, and multi-model interfaces will be explored, and the theory put into practice through programming projects that develop graphical user interfaces and applications for the Android or iPhone/iPad. (Offered every year.) **3 credits**

[CPSC 356 - Android Application Development](#)

CPSC 356 - Android Application Development

Prerequisite, [CPSC 231](#). An introduction to app development using the Android operating system and development kit. Students will learn the fundamentals of mobile embedded programming and apply their skills to implement non-trivial projects on target hardware such as smart phones and tablets. (Offered every year.) **3 credits**

[CPSC 357 - iOS Application Development](#)

CPSC 357 - iOS Application Development

Prerequisite, [CPSC 231](#). An introduction to app development using the iOS operating system and Swift. Students will learn the fundamentals of mobile embedded programming and apply their skills to implement non-trivial projects on target hardware such as ipads, iphones, and watches. (Offered every year.) **3 credits**

[CPSC 360 - Computer Graphics](#)

CPSC 360 - Computer Graphics

Prerequisite, [CPSC 350](#). The fundamental concepts of graphics software, hardware, and standards are examined. The course gives special emphasis to three-dimensional graphics and provides an introduction to graphical user interfaces. (Offered interterm, alternate years.) **3 credits**

[CPSC 370 - Topics in Computer Science](#)

CPSC 370 - Topics in Computer Science

May be repeated for credit. (Offered as needed.) **3 credits**

[CPSC 380 - Operating Systems](#)

CPSC 380 - Operating Systems

Prerequisite, [CPSC 350](#). The course emphasizes the major principles of operating system design and the interrelationship between the operating system and the hardware. (Offered every year.) **3 credits**

[CPSC 390 - Artificial Intelligence](#)

CPSC 390 - Artificial Intelligence

Prerequisite, [CPSC 350](#). Students study the tools, techniques, and applications of artificial intelligence. Students will be introduced to the programming techniques utilized in artificial intelligence applications. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

[CPSC 392 - Introduction to Data Science](#)

CPSC 392 - Introduction to Data Science

Prerequisites, [CPSC 230](#), and [MATH 203](#) or [MATH 303](#) or [MGSC 209](#). This course provides a survey of algorithms, tools, and techniques for computing with Big Data. Students will be exposed to fundamental concepts in data mining, machine learning, and information retrieval systems, with special emphasis on statistical techniques for data visualization and analysis. Recent advances in high performance computing, such as map-reduce, will be presented in the context of Big Data. Students will apply data mining algorithms to data sets from biology, chemistry, social media, and industry. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

[CPSC 393 - Machine Learning](#)

CPSC 393 - Machine Learning

Prerequisite, [CPSC 392](#). This course provides a survey of algorithmic techniques for machine learning, including statistical techniques for pattern recognition. Topics include neural networks, deep learning, support vector machines, and kernel methods. (Offered as needed.) **3 credits**

[CPSC 402 - Compiler Construction](#)

CPSC 402 - Compiler Construction

Prerequisites, [CPSC 350](#), [CPSC 354](#). Students will learn the software tools and programming techniques needed to design and build a prototype implementation of a domain-specific language. On the theoretical side, students will learn enough of the mathematical underpinnings of the tools to apply them with confidence. On the practical side, students will write a grammar and build a lexer, parser, type checker, and interpreter for a fragment of C++. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

[CPSC 406 - Algorithm Analysis](#)

CPSC 406 - Algorithm Analysis

Prerequisite, [CPSC 350](#). Students study ideas and techniques useful for designing and analyzing data structures and algorithms. In particular, the analytic tools needed for analyzing upper bounds for algorithms and lower bounds for problems will be covered. Problem areas include sorting, graph-based problems, dynamic programming, combinatorial algorithms, computational geometry, encryption, parallel and distributed models, and NP-completeness. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

[CPSC 408 - Database Management](#)

CPSC 408 - Database Management

Prerequisite, [CPSC 350](#). Students learn data management concepts and the representation and structure of data in the context of applications and system software. The emphasis is on design of databases and developing applications in a client-server environment using SQL as the query language. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

[CPSC 430 - Computational Economics](#)

CPSC 430 - Computational Economics

Prerequisites, [MATH 110](#) and [CPSC 230](#) or [CPSC 236](#) or consent of instructor. This course will introduce students to the computational tools required to understand electronic exchange systems and implement economic experiments. Students will be required to become familiar with numerical analysis, computer simulation and programming of experiments. Letter grade. (Offered as needed.) **4 credits**

CPSC 445 - High Performance Computing

Prerequisite, [CPSC 350](#), or consent of instructor. The course introduces students to parallel computing architectures and programming models. Students learn and practice parallel programming techniques using shared memory and message passing. Course topics include parallel computing fundamentals, Unix and C, shared memory parallel computing (with OpenMP), message passing parallel computing (with MPI), parallel performance evaluation, and multilevel parallel computing (with OpenMP and MPI combined). (Offered alternate years.) **3 credits**

CPSC 453 - Network Implementation and Security

Prerequisite, [CPSC 353](#). Students explore the principles and techniques for implementing TCP/IP based networks using Microsoft Windows and Linux servers and clients, including the skills to configure, customize, optimize, troubleshoot, and integrate networks. (Offered as needed.) **3 credits**

total credits 24
