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

Prerequisite, MATH 100. Students are introduced to problem-solving methods and algorithm development through an interactive and easy-to-learn programming language, Python. Letter grade with Pass/No Pass option. (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. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

CPSC 285 - Social and Ethical Issues in Computing

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This course considers a range of ethical and social issues related to the effects of computers on how we live, focusing on broad social issues as well as individual responsibilities. Privacy and intellectual property (e.g. P2P downloading), software licenses, software reliability, and risks. Letter grade with Pass/No Pass option. (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

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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

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

SE 320 - The Software Development Lifecycle

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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. Letter grade. (Offered spring semester.) **3 credits**

CENG 330 - Digital Logic Design I

CENG 330 - Digital Logic Design I

Prerequisite, CPSC 231 or CENG 231. Corequisite, CENG 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 with Pass/No Pass option. (Offered every semester.) **3 credits**

AND

CENG 330L - Lab - Digital Logic Design I

CENG 330L - Lab - Digital Logic Design I

Prerequisite, CENG 231 or CPSC 231. Corequisite, CENG 330. Laboratory component of CENG 330. Letter grade with Pass/No Pass option. (Offered every semester.) **1 credit**

CENG 351 - Computer Architecture I

CENG 351 - Computer Architecture I

Prerequisite, CENG 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. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

CPSC 353 - Data Communications and Computer Networks

CPSC 353 - Data Communications and Computer Networks

Prerequisite, CENG 231 or CPSC 231 or CPSC 236. 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

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 349 - Human Factors

Prerequisite, CPSC 230 or GAME 230. Students study the foundations of human factors, with emphasis on user interface design and user experience. Topics include engineering psychology, design constraints, memory models, visual and auditory processing, and human-centered design. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

CPSC 355 - Human Computer Interaction

Prerequisites, CENG 231 or CPSC 231 or CPSC 236 and CPSC 349. 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. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

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. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

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. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

CPSC 360 - Computer Graphics

CPSC 360 - Computer Graphics

Prerequisites, CENG 231 or CPSC 231 or CPSC 236 and MATH 215. 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. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

CPSC 370 - Topics in Computer Science

CPSC 370 - Topics in Computer Science

Letter grade with Pass/No Pass option. 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**

CENG 381 - Modeling and Simulation

CENG 381 - Modeling and Simulation

Prerequisite, CENG 231. Fundamentals and techniques for designing and using simulation, modeling, and optimization algorithms with applications in system performance modeling, business infrastructure modeling, and distributed and parallel computing. An introduction to advanced complex systems models. Letter grade with Pass/No Pass option. (Offered as needed.) **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. Letter grade with Pass/No Pass option. (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, MATH 250 and 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

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 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). Letter grade. (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. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

CPSC 458 - Web Engineering

Prerequisites, CPSC 350. Students explore the principles and techniques for developing and managing web applications using HTML5, CSS and JavaScript, as well as other web development frameworks such as Ruby on Rails. Students will acquire skills to develop, install, configure, customize, optimize, and troubleshoot web applications. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

total credits 24