COMPUTER SCIENCE

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Computer science is the system of principles and theory which deals with what computers do. It studies the nature of computation. For any given problem, it asks whether the answer can be computed, and, if so, what are the most efficient and practical ways to do the computation. (Often the methods that are best for machines are quite different from those that are practical for human beings.)

Computers are machines that manipulate abstract symbols according to specified rules. Therefore, computer science relies heavily on abstract reasoning and mathematics. The mathematics involved is usually quite different, however, from traditional mathematics. Much of it has been developed recently in response to the development of computers.

As an academic discipline within the liberal arts tradition, computer science has ties with many other disciplines. The natural sciences provide the physical principles upon which computers are built. Computer science serves the sciences, engineering and business in providing the means to perform complex calculations and to analyze large amounts of data. Psychology and philosophy share with computer science the desire to understand the nature of reason, language and intelligence.

The most important skills needed by a prospective computer scientist are an excellent command of one's native language and the ability to think in a mathematical way.

The Computer Science Major (BS)

Preparation for the Major

Code	Title	Units
Required Courses		
COMP 110	Computational Problem Solving	3.5
COMP 120	Programming Abstractions and Methodologies	3.5
COMP 230	Advanced Computational Problem Modeling	3.5
COMP 280	Introduction to Computer Systems	3.5
MATH 150	Calculus I	4
MATH 151	Calculus II	4
MATH 222		3
MATH 320	Linear Algebra	3
ISYE 330	Engineering Probability and Statistics	3
Natural Science [1]		6
Total Units		37

[1] Approved natural science classes include BIOL 240, BIOL 242, BIOL 300, CHEM 151, CHEM 152, EOSC 104, EOSC 105, EOSC 110, EOSC 123, EOSC 220, PHYS 136, PHYS 137, PHYS 270, PHYS 271, and their associated laboratories. Please consult with a computer science advisor for additional information.

Major Requirements

Code	Title	Units
Required Core Computer Science Courses		
COMP 305	Object-Oriented Design and Programming	3
COMP 370	Automata, Computability and Formal Languages	3
COMP 480	Algorithms	3
COMP 491	Senior Project I	3
COMP 492	Senior Project II	3
Systems Courses		
Select two of the following courses:		7
COMP 300	Principles of Digital Hardware	
COMP 310	Operating Systems	
COMP 375	Networking	
Upper-Division Elective Courses		
Select nine upper-division units from the following:		9
COMP 340	Numerical Analysis	
COMP 341	Numerical Analysis II	
COMP 345	Database Management Systems Design	
COMP 350	Computer Graphics	
COMP 360	Principles of Programming Languages	
COMP 365	Principles of Information Security	
COMP 380	Neural Networks	
COMP 382	Introduction to Data Mining	
COMP 421	Embedded Software Development	
COMP 422	Advanced Embedded Software Development	
COMP 494	Special Topics in Computer Science	
COMP 499	Independent Study	
CYBR 500	Foundations of Cyber Security (6 units)	
Total Units		31

Notes:
1) At least 15 of the the upper-division units in the the major must be completed at USD.
2) Students may not receive credit towards their undergraduate degree for both COMP 365 and CYBR 500.

Additional Requirements:

All computer science majors must satisfy the core curriculum specified by the university and the Connect Career Readiness Program (https://www.sandiego.edu/engineering/resources/careers/connect).

Recommended Program of Study: Computer Science (BS)

First Year

Semester I		Units
COMP 110	Computational Problem Solving	3.5
MATH 150	Calculus I	4
Core Curriculum		9

Semester II

COMP 120	Programming Abstractions and Methodologies	3.5
MATH 151	Calculus II	4
MATH 222		3
Core Curriculum		6
Second Year		
Semester I		
COMP 280	Introduction to Computer Systems	3.5
ISYE 330	Engineering Probability and Statistics	3
Core Curriculum		9.5-11.5
Semester II		
COMP 230	Advanced Computational Problem Modeling	3.5
COMP Systems Course		3.5
MATH 320	Linear Algebra	3
Core Curriculum and Electives		6.5-8.5
Third Year		
Semester I		
COMP 305	Object-Oriented Design and Programming	3
COMP Systems Course or Upper-Division COMP Elective		3-3.5
Core Curriculum and Electives		9-12
Semester II		
COMP 370	Automata, Computability and Formal Languages	3
COMP Systems Course or Upper-Division COMP Elective		3-3.5
Upper-Division COMP Elective		3
Core Curriculum and Electives		6
Senior Year		
Semester I		
COMP 480	Algorithms	3
COMP 491	Senior Project I	3
Core Curriculum and Electives		9-12
Semester II		
COMP 492	Senior Project II	3
Upper-Division COMP Elective		3
Core Curriculum and Electives		9-12

Concentrations in Computer Science (9 - 9.5 units)

Concentrations allow majors to develop a level of depth in a particular area of computer science. Courses taken toward a concentration may also apply to the upper-division elective requirements of the major. Concentrations are optional, and so are not required by the computer science major.

Code	Title	Units
Concentration in Embedded Software Development		
COMP 421	Embedded Software Development	3
COMP 422	Advanced Embedded Software Development	3
One of the following courses:		3-3.5
COMP 365	Principles of Information Security	
COMP 375	Networking	
Total Units		9-9.5

Code	Title	Units
Concentration in Cyber Security		
CYBR 500	Foundations of Cyber Security	6
One of the following:		3-3.5
COMP 375	Networking	
An additional CYBR course		
Total Units		9-9.5

Notes:
1) Students choosing the Embedded Software Development, or Cyber Security concentration may not use COMP 375 to satisfy the Systems Course requirement in the Computer Science major.
2) Students completing the Cyber Security concentration by taking nine units of 500-level CYBR classes must be enrolled in the Combined Undergraduate Computer Science and MS in Cyber Security Engineering program at the time the second CYBR course is taken.

Combined BS or BA Computer Science and Master of Science in Cyber Security Engineering (MSCSE) Program

A student who has applied, accepted, and indicated that they will enter the MSCSE program, can apply up to twelve 500-level CYBR units to both their undergraduate degree requirements in Computer Science, and to the requirements of the MSCSE program. Those units shall include CYBR 500 and any of the following: CYBR courses: 520, 530, 540, 550, 560, 570, 580, 590.

The MSCSE program requires 30 units (computer science majors do not need to take a 6-unit course in software fundamentals that would bring the unit count to 36), and MSCSE students take 6 units per semester. So a student who completes 12 units as an undergraduate can complete the remaining 18 units in three terms (summer, fall, and spring). Thus, a student can earn a BS or BA in computer science plus an MS in Cyber Security Engineering in 4 years of undergraduate coursework plus 1 year of graduate coursework.

The Computer Science Major (BA)

Preparation for the Major

Code	Title	Units
Required Courses		
COMP 110	Computational Problem Solving	3.5
COMP 120	Programming Abstractions and Methodologies	3.5
COMP 230	Advanced Computational Problem Modeling	3.5
COMP 280	Introduction to Computer Systems	3.5
MATH 150	Calculus I	4
MATH 222		3
Elective Math Course		
Select one of the following:		3
ISYE 330	Engineering Probability and Statistics	
MATH 320	Linear Algebra	
Total Units		24

Major Requirements

Code	Title	Units
Required Core Computer Science Courses		
COMP 305	Object-Oriented Design and Programming	3
COMP 480	Algorithms	3
COMP 491	Senior Project I	3
COMP 492	Senior Project II	3
Systems Course		
Select one of the following courses:		3.5
COMP 300	Principles of Digital Hardware	
COMP 310	Operating Systems	

COMP 375	Networking	
Upper-Division Elective Courses		
Select nine upper-division units from the following:		9
COMP 340	Numerical Analysis	
COMP 341	Numerical Analysis II	
COMP 345	Database Management Systems Design	
COMP 350	Computer Graphics	
COMP 360	Principles of Programming Languages	
COMP 365	Principles of Information Security	
COMP 370	Automata, Computability and Formal Languages	
COMP 380	Neural Networks	
COMP 382	Introduction to Data Mining	
COMP 421	Embedded Software Development	
COMP 422	Advanced Embedded Software Development	
COMP 494	Special Topics in Computer Science	
COMP 499	Independent Study	
CYBR 500	Foundations of Cyber Security	
Total Units		24.5

Notes:
1) At least 15 of the upper-division units in the major must be completed at USD.
2) Students may not receive credit towards their undergraduate degree for both COMP 365 and CYBR 500.

Additional Requirements:

All computer science majors must satisfy the core curriculum specified by the university and the Connect Career Readiness Program (https://www.sandiego.edu/engineering/resources/careers/connect).

Recommended Program of Study: Computer Science (BA)

First Year		
Semester I		**Units**
COMP 110	Computational Problem Solving	3.5
MATH 150	Calculus I	4
Core Curriculum		9
Semester II		
COMP 120	Programming Abstractions and Methodologies	3.5
MATH 222		3
Core Curriculum		9
Second Year		
Semester I		
COMP 280	Introduction to Computer Systems	3.5
ISYE 330 or MATH 320	Engineering Probability and Statistics Linear Algebra	3
CC		9-11.5
Semester II		
COMP 230	Advanced Computational Problem Modeling	3.5
Core Curriculum and Electives		12-14.5
Third Year		
Semester I		
COMP 305	Object-Oriented Design and Programming	3
COMP Systems Course or Upper-Division COMP Elective		3
Core Curriculum and Electives		10-12
Semester II		
COMP Systems Course or Upper-Division COMP Elective		3
Upper-Division COMP Elective		3
Core Curriculum and Electives		10-12
Senior Year		
Semester I		
COMP 480	Algorithms	3
COMP 491	Senior Project I	3
Core Curriculum and Electives		9-12
Semester II		
COMP 492	Senior Project II	3
Upper-Division COMP Elective		3
Core Curriculum and Electives		9-12

Concentrations in Computer Science (9 - 9.5 units)

Concentrations allow majors to develop a level of depth in a particular area of computer science. Courses taken toward a concentration may also apply to the upper-division elective requirements of the major. Concentrations are optional, and so are not required by the computer science major.

Code	Title	Units
Concentration in Embedded Software Development		
COMP 421	Embedded Software Development	3
COMP 422	Advanced Embedded Software Development	3
One of the following courses:		3-3.5
COMP 365	Principles of Information Security	
COMP 375	Networking	
Total Units		9-9.5

Code	Title	Units
Concentration in Cyber Security		
CYBR 500	Foundations of Cyber Security	6
One of the following:		3-3.5
COMP 375	Networking	
An additional CYBR course numbered CYBR 520 or higher		
Total Units		9-9.5

Notes:
1) Students choosing the Embedded Software Development, or Cyber Security concentration may not use COMP 375 to satisfy the Systems Course requirement in the Computer Science major.
2) Students completing the Cyber Security concentration by taking nine units of 500-level CYBR classes must be enrolled in the Combined Undergraduate Computer Science and MS in Cyber Security Engineering program at the time the second CYBR course is taken.

Combined BS or BA Computer Science and Master of Science in Cyber Security Engineering (MSCSE) Program

A student who has applied, accepted, and indicated that they will enter the MSCSE program, can apply up to twelve 500-level CYBR units to both their undergraduate degree requirements in Computer Science, and to the requirements of the MSCSE program. Those units shall include CYBR 500 and any of the following: CYBR courses: 520, 530, 540, 550, 560, 570, 580, 590.

The MSCSE program requires 30 units (computer science majors do not need to take a 6-unit course in software fundamentals that would bring the unit count to

36), and MSCSE students take 6 units per semester. So a student who completes 12 units as an undergraduate can complete the remaining 18 units in three terms (summer, fall, and spring). Thus, a student can earn a BS or BA in computer science plus an MS in Cyber Security Engineering in 4 years of undergraduate coursework plus 1 year of graduate coursework.

The Computer Science Minors

Students wishing to major in another field while also developing competency in the use of computers are encouraged to choose one of the minors described below.

The Minor in Computer Science

The computer science minor is intended for students who have a general interest in the workings and uses of computers. Minimum requirements for the minor in computer science are:

Code	Title	Units
COMP 110	Computational Problem Solving	3-3.5
or COMP 150	Computer Programming I	
COMP 120	Programming Abstractions and Methodologies	3-3.5
or COMP 151	Computer Programming II	
12 additional units [1]		12
Total Units		18-19

[1] At least 9 of which are in upper division courses, excluding COMP 498.

Note: Neither COMP 100 nor COMP 498 may be applied toward the requirements for the minor in computer science.

The Minor in Information Science

The information science minor is intended for students who have a special interest in the analysis, design, implementation, and use of computer-based information systems and organizations. Minimum requirements for the minor in information science are:

Code	Title	Units
COMP 150	Computer Programming I	3
COMP 151	Computer Programming II	3
COMP 285	Data Structures & Algorithms	3
ITMG 350	Management Information Systems	3
Nine additional units [1]		9

[1] At least 6 of which are in upper division courses chosen from:

1. the computer science offerings listed in this course catalog, excluding COMP 100 and COMP 498. COMP 345 is highly recommended.
2. ITMG 350 Management Information Systems

COMP 100 | INTRODUCTORY COMPUTER PROGRAMMING
Units: 3 Repeatability: No
An elementary introduction to computer programming and applications for non-majors and non-minors. Computer organization; problem solving; algorithms; structured programming in a simple computer language; computer applications; and current issues and trends in computer science. This course does not satisfy any of the requirements for the computer science major or minor and is not a substitute for COMP 150.

COMP 110 | COMPUTATIONAL PROBLEM SOLVING
Units: 3.5 Repeatability: No
Prerequisites: MATH 115
An introduction to computational problem solving using the Python programming language. Students will learn the basic elements of programming (e.g. conditionals, loops, inputs/outputs), modular program design, and the basics of data abstraction through object-oriented programming.

COMP 120 | PROGRAMMING ABSTRACTIONS AND METHODOLOGIES
Units: 3.5 Repeatability: No
Prerequisites: COMP 110
A continued exploration of computational problem solving, with a focus on using abstraction to manage program complexity. Students will learn to use both functional and data abstractions, analyze the time and space complexity of algorithms, and utilize functional, object-oriented, and event-driven paradigms within their programs.

COMP 150 | COMPUTER PROGRAMMING I
Units: 3
Prerequisites: MATH 115 or Passing the appropriate departmental placement test within the previous year or MATH 130 or MATH 150
Algorithms and programming in a selected computer language; expressions, statements, basic data types; sequence, decision, iteration; functions and procedures; arrays; recursion; file input and output; loop invariants; syntax analysis; and program design, documentation, validation, and debugging. Prereq: MATH 115 with a minimum grade of C-, or pass Level 2 mathematics placement exam. COMP 100 is not a prerequisite.

COMP 151 | COMPUTER PROGRAMMING II
Units: 3 Repeatability: No
Prerequisites: COMP 150
Continuation of COMP 150. Basic data structures, including lists, stacks, queues, and binary trees; abstract data types; sorting and searching algorithms; exception handling; event driven programming;.

COMP 160 | PROGRAMMING LANGUAGES
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Prerequisites: COMP 150
Introduction to a particular high-level programming language such as C, C++, Python, Ruby, MATLAB, and Maple. Programming assignments appropriate to the language studied. Prereq: COMP 150 with a grade of C- or better. This course does not satisfy any of the requirements for the major in computer science.

COMP 230 | ADVANCED COMPUTATIONAL PROBLEM MODELING
Units: 3.5 Repeatability: No
Prerequisites: (COMP 120 or COMP 151) and (MATH 160 or MATH 260 or MATH 222 or MATH 262)
Advanced data structures (e.g. graphs, priority queues, quad trees, etc.) from the perspective of solving advanced computational problems. Students will learn to program in the Java programming language using object-oriented features such as inheritance, interfaces and generics.

COMP 280 | INTRODUCTION TO COMPUTER SYSTEMS
Units: 3.5 Repeatability: No
Prerequisites: COMP 120 or COMP 151
Introduction to computer systems; data representation; machine/assembly languages; memory organization; virtual memory; and concurrency.

COMP 285 | DATA STRUCTURES & ALGORITHMS
Units: 3
Prerequisites: (COMP 151 and MATH 160)
Data structures, algorithm analysis and general programming design and applications; balanced trees, hashing, priority queues, sets, and graphs; more on sorting and searching; Prereq: COMP 151 with a grade of C- or better and MATH 160 with a grade of C- or better.

COMP 294 | SPECIAL TOPICS IN COMPUTER SCIENCE
Units: 1-4 Repeatability: Yes (Can be repeated for Credit)
Special topics course in areas of special interest to computer science. May be repeated for credit with a different topic.

COMP 299 | INDEPENDENT STUDY
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Individual study including library or laboratory research or program writing. A written report is required. Project proposal must be submitted and approved prior to enrollment. May be repeated for credit.

COMP 300 | PRINCIPLES OF DIGITAL HARDWARE
Units: 3.5 Repeatability: No
Prerequisites: MATH 160 and COMP 280
Combinational and sequential logic, registers, arithmetic units. Introduction to computer architecture. Three lectures and one laboratory per week.

COMP 305 | OBJECT-ORIENTED DESIGN AND PROGRAMMING
Units: 3 Repeatability: No
Prerequisites: COMP 230 or COMP 285
Classes, encapsulation, inheritance, polymorphism, class derivation, abstract classes, namespaces, function overloading and overriding, function name overload resolution, container classes, template classes; unified modeling language (UML); constructing conceptual models, system sequence diagrams; design patterns; case studies.

COMP 310 | OPERATING SYSTEMS
Units: 3.5 Repeatability: No
Prerequisites: COMP 280
Principles of computer operating systems; process management; memory management; file systems; protection; deadlock. Concurrent programming.

COMP 340 | NUMERICAL ANALYSIS
Units: 3
Prerequisites: MATH 151 and COMP 150
Approximate computations and round-off errors; Taylor expansions; numerical solution of equations and systems of equations; systems of linear equations; numerical integration; numerical solution of differential equations; interpolation; and problem solving on the computer. Prereq: COMP 150 with a grade of C- or better and MATH 151 with a grade of C- or better. Cross-listed as MATH 340.

COMP 341 | NUMERICAL ANALYSIS II
Units: 3
Prerequisites: MATH 250 and MATH 320 and MATH 330 (Can be taken Concurrently) and COMP 340
Estimation of eigenvalues and eigenvectors of matrices; numerical solutions of differential equations, existence, and stability theory; and computer lab assignments. Prereq: MATH 250, 320, 330 (may be taken concurrently), and COMP 340, all with a grade of C- or better. Cross-listed as MATH 341.

COMP 345 | DATABASE MANAGEMENT SYSTEMS DESIGN
Units: 3 Repeatability: No
Prerequisites: COMP 230 or COMP 285
Introduction to database concepts; data models; query facilities; and file organization and security.

COMP 350 | COMPUTER GRAPHICS
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and MATH 320
The development of high-level, device-independent graphics routines; basic line drawing algorithms, text design, and other graphics primitives; 2-D representations of coordinate systems, image segmentation, and windowing.

COMP 355 | DIGITAL MODELING AND SIMULATION
Units: 3
Prerequisites: MATH 151 and COMP 305
Mathematical modeling; probabilistic and deterministic simulations; pseudo-random number generators; event generators; queuing theory; game theory; and continuous models involving ordinary and partial differential equations. Prereq: COMP 305 with a grade of C- or better and MATH 151 with a grade of C- or better.

COMP 360 | PRINCIPLES OF PROGRAMMING LANGUAGES
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and (MATH 160 or MATH 222) or (MATH 260 or MATH 262)
The organization of programming languages with emphasis on language semantics; language definition, data types, and control structures of various languages.

COMP 365 | PRINCIPLES OF INFORMATION SECURITY
Units: 3 Repeatability: No
Prerequisites: COMP 280
Introduction to fundamental concepts in cyber security: policies, threats, vulnerabilities, risk and controls; Identification and authentication; Access control; Cryptographic mechanisms: Ciphers, hashes, message authentication codes, and digital certificates; Malware, infection vectors, and mitigations; Attacks on various application domains, such as web applications; Tools and techniques for developing secure software.

COMP 370 | AUTOMATA, COMPUTABILITY AND FORMAL LANGUAGES
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and (MATH 160 or MATH 222 or MATH 262)
Finite state machines; formal grammars; computability and Turing machines.

COMP 375 | NETWORKING
Units: 3.5 Repeatability: No
Prerequisites: COMP 280
Introduction to the design and implementation of computer and communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet's success. Topics covered will include MAC layer design (Ethernet/802.11), the TCP/IP protocol stack, routing algorithms, congestion control and reliability, and applications (HTTP, FTP, etc.) and advanced topics such as peer-to-peer networks and network simulation tools. Recent trends in networking such as multimedia networking, mobile/cellular networks and sensor networks will also be discussed. Prereq: COMP 280 with a grade of C- or better.

COMP 380 | NEURAL NETWORKS
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and MATH 320
A study of the fundamental concepts, architectures, learning algorithms and applications of various artificial neural networks, including perceptron, Kohonen self organizing maps, learning vector quantization, backpropagation, and radial basis functions.

COMP 382 | INTRODUCTION TO DATA MINING
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and ISYE 330
The course provides a comprehensive introduction to data mining with a primary focus on fundamental concepts, algorithms and applications of association analysis, classification and clustering modeling. It will also cover ethical issues related to data mining.

COMP 421 | EMBEDDED SOFTWARE DEVELOPMENT
Units: 3 Repeatability: No
Prerequisites: COMP 280
Development of "bare metal" embedded software, running on a microcontroller with no operating system support. Real-time requirements for finishing tasks within a fixed interval of time and for responding to asynchronous events are emphasized, along with techniques for writing reliable code for a memory-constrained microcontroller. All code is written in C using freely available development tools.

COMP 422 | ADVANCED EMBEDDED SOFTWARE DEVELOPMENT
Units: 3 Repeatability: No
Prerequisites: COMP 421 or GENG 421
Development of embedded software (firmware) using a real-time operating system (RTOS). Development of an application as a set of independent threads that communicate with each other via message queues and semaphores.

COMP 465W | SOFTWARE ENGINEERING
Units: 3
Core Attributes: Writing-Pre F17 CORE
Prerequisites: COMP 305
Theoretical and practical aspects of software development; project planning; requirements and specification; general and detailed design; implementation; validation and verification; formal documentation. Students will participate in developing documentation for a large software project. Prereq: COMP 305 with a grade of C- or better.

COMP 480 | ALGORITHMS
Units: 3 Repeatability: No
Prerequisites: (COMP 230 or COMP 285) and (MATH 222 or MATH 160)
Advanced theory of algorithms. Topics may include: algorithm analysis; algorithm design techniques; and computational complexity.

COMP 491 | SENIOR PROJECT I
Units: 3 Repeatability: No
Prerequisites: COMP 305
Students will develop professional skills in realistic software design and engineering, including human/computer interface design techniques, software architecture, teamwork, and project management, incorporating technical and non-technical considerations. Work will prepare students for implementing, testing and documenting the project in COMP 492, Senior Project II.

COMP 492 | SENIOR PROJECT II
Units: 3 Repeatability: No
Core Attributes: Advanced Integration
Prerequisites: COMP 491
This course is the second semester of the required two semester senior capstone experience for the computer science majors. In this course, students working in teams integrate their training in computer science and other disciplines, to implement, test, and document a significant piece of software based on a design developed in the first semester of the capstone experience, COMP 491. Students document their work, and demonstrate it in multiple public venues.

COMP 494 | SPECIAL TOPICS IN COMPUTER SCIENCE
Units: 1-4 Repeatability: Yes (Can be repeated for Credit)
Special topics course in areas of special interest to computer science. May be repeated for credit with a different topic.

COMP 495 | SENIOR PROJECT
Units: 2
Prerequisites: COMP 465W
The course involves participation in a capstone senior project of substantial interest to computer scientists. Emphasis is on the design and implementation of computer systems for real-world problems. A final written report and oral presentation in the presence of other students and faculty are required. Prereq: COMP 465W with a grade of C- or better and senior standing.

COMP 496 | UNDERGRADUATE RESEARCH
Units: 0.5-3 Repeatability: Yes (Can be repeated for Credit)
Faculty-directed undergraduate research in computer science. Problem proposal must be submitted and approved prior to enrollment. Written report required. Upper division standing in engineering. Prior approval by department chair is required. May be repeated for credit.

COMP 498 | INTERNSHIP
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Core Attributes: Law - Experiential
Practical experience in the application of the principles of computer science. Students will be involved in a software or hardware project. Enrollment is arranged on an individual basis according to the student's interest, background, and the availability of positions. A written report is required. Units may not normally be applied toward the major or minor in computer science. COMP 498 may be repeated for a total of three units.

COMP 499 | INDEPENDENT STUDY
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Individual study including library or laboratory research or program writing. A written report is required. Project proposal must be submitted and approved prior to enrollment. May be repeated for credit.