In the College of Sciences

Computer Science

OFFICE: Geology/Mathematics/Computer Science 413
TELEPHONE: 619-594-6191
http://www.cs.sdsu.edu

Faculty
Emeritus: Anantha, Baase-Mayers, Beck, Donald, Lane, Marovac,
Stewart, Vinge, Vuskovic
Chair: Beck
Professors: Carroll, Edwards, Roch, Tarokh, Valafar, Xie
Associate Professors: Eckberg, Whitney
Assistant Professors: Liu, Wang
Lecturers: Bajic, Kraft, Riggins
Adjunct: Root

Offered by the Department
Master of Science degree in computer science.
Major in computer science with the B.S. degree in applied arts and
sciences.
Minor in computer science.
Certificate in geographic information science.
Certificate in web and mobile applications development
(refer to the Graduate Bulletin).

The Major
Computer Science is the study of computers and their applica-
tions. It is concerned with methods for storing and retrieving infor-
mation, with the design and use of languages for writing computer
programs, with the hardware systems that interpret such languages,
and with the theoretical principles that form the foundations of
computing. Computer Science includes a wide variety of specialties
and application areas such as artificial intelligence, robotics,
graphics, systems programming, simulation, and computer networks.
The Bachelor of Science in Computer Science is designed to
provide students with a fundamental understanding of modern
computing methodology and programming practices along with a
complementary knowledge of hardware. The first two years provide
the basic preparation in programming, data structures and archi-
tecture. The final two years are devoted to more advanced funda-
mentals and specialized electives.

Computers are used to store and manage information, to analyze
scientific data, and in a wide variety of other applications. Computing
technology is found in an almost limitless number of settings, ranging
from automobiles to household appliances to toys. Because of this, a
wide range of jobs are open to people trained in Computer Science.
Employment opportunities are expected to remain very strong.

Impacted Program
The computer science major is an impacted program. To be
admitted to the computer science major, students must meet the
following criteria:
a. Complete preparation for the major. Computer Science 107,
108, 237; Mathematics 150, 151, 245, 254; and Statistics 250
must be completed with a minimum grade of C (2.0) or better
and cannot be taken for credit/no credit (Cr/NC);
b. Complete a minimum of 60 transferable semester units;
c. Have a minimum cumulative GPA of 2.0.

To complete the major, students must fulfill the degree requirements
for the major described in the catalog in effect at the time they are
accepted into the premajor at SDSU (assuming continuous enrollment).

Major Academic Plans (MAPs)
Visit http://www.sdsu.edu/mymap for the recommended courses
needed to fulfill your major requirements. The MAPs website was
created to help students navigate the course requirements for their
majors and to identify which General Education course will also fulfill
a major preparation course requirement.

Computer Science Major
With the B.S. Degree in Applied Arts and Sciences
(Major Code: 07011) (SIMS Code: 773801)
(SIMS Code: 773804 - Georgia)

All candidates for a degree in applied arts and sciences must complete
the graduation requirements listed in the section of this catalog on “Graduation Requirements.”
A minor is not required for this major.

Preparation for the Major. Computer Science 107, 108, 237;
Mathematics 150, 151, 245, 254; Statistics 250. These courses must
be completed with a minimum grade of C (2.0) or better and cannot
be taken for credit/no credit (Cr/NC). (26 units)

Additional Lower Division Coursework Required. Twelve units
of science courses selected with approval of adviser. Courses must
include one of the following two-semester sequences with laboratory:
Biology 203, 203L, 204, 204L; or Chemistry 200, 201; or Physics
195, 195L, 196, 196L. The remainder of the 12 units must be science
courses or courses that enhance the student’s ability to apply the
scientific method.

Graduation Writing Assessment Requirement. Passing the
Writing Placement Assessment with a score of 10 or completing one
of the approved upper division writing courses (W) with a grade of C
(2.0) or better. See “Graduation Requirements” section for a complete
listing of requirements.

Major. A minimum of 37 upper division units to include Computer
Science 310, 320, 370, 440, 490, 530, 560, 570; at least one course
selected from Mathematics 541, 579, Statistics 350A, 550, or 551A;
and 12 units of computer science electives selected with the approval
of a computer science major adviser. At least nine units of electives
must be in computer science.

Master Plan. Students should follow the Master Plan Advising
Guide to ensure completion of major requirements. Download it at
http://www.cs.sdsu.edu/degree-requirements.

Computer Science Minor
(SIMS Code: 773801)
The minor in computer science consists of a minimum of 18-23 units
in computer science and mathematics to include Computer
Science 107, 108; and at least 12 upper division units, or at least nine
upper division units if the student completes a full calculus sequence,
i.e., Mathematics 150 and 151. The courses selected are subject to
the approval of the minor adviser. A list of approved electives is listed

Courses in the minor may not be counted toward the major, but may
be used to satisfy preparation for the major and general education
requirements, if applicable. A minimum of six upper division units
must be completed in residence at San Diego State University.

Geographic Information Science Certificate*
(SIMS Code: 112949)
The purpose of the program is to prepare students to acquire,
analyze, manage, visualize, and develop applications with geospatial
data in public and private organizations. Students must apply for
admission to the program before the completion of 12 certificate units
and must complete the required units with a 2.5 grade point average.
The certificate requires 27 units distributed between the depart-
ments of Computer Science and Geography as follows: 12-15 units
selected from Computer Science 107, 108, 310, 320, 503, 514, 520,
535, 537, and 12-15 units selected from Geography 104, 381, 484,
581-592. Courses with relevant content (e.g. Computer Science 596
or Geography 596) may be substituted for the computer science
and geography courses with the approval of the certificate adviser.
Courses in the certificate may be counted toward the major in
computer science if applicable.

* Additional prerequisites required for this certificate.
Courses (CS)
Refer to Courses and Curricula and University Policies sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

LOWER DIVISION COURSES

CS 100. Computational Thinking (3) [GE]
Prerequisite: Satisfaction of the Entry-Level Mathematics requirement.

CS 107. Introduction to Computer Programming (3)
Prerequisite: Satisfaction of the Entry-Level Mathematics requirement.
Programming methodology and problem solving. Basic concepts of computer systems, algorithm design and development, data types, program structures. Extensive programming in Java.

CS 108. Intermediate Computer Programming (3)
Prerequisite: Computer Science 107.
Further training in program design and development. Object-oriented programming to include inheritance, polymorphism, and generic code. Extensive programming in Java. Introduction to data structures.

CS 237. Machine Organization and Assembly Language (3)
Prerequisite: Computer Science 108.
General concepts of machine and assembly language, data representation, looping and addressing techniques, arrays, subroutines, macros. Extensive assembly language programming.

CS 296. Experimental Topics (1-4)
Selected topics. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

CS 299. Special Study (1-3)
Prerequisite: Consent of instructor.
Individual study. Maximum credit six units.

UPPER DIVISION COURSES (Intended for Undergraduates)

CS 301. Computers and Society (3) [GE]
Prerequisite: Completion of the General Education requirement in Foundations of Learning II.A., Natural Sciences and Quantitative Reasoning.
Impact of computers and computing technology on society; applications, benefits, and risks. Topics include privacy, copyright, computer crime, constitutional issues, risks of computer failures, evaluating reliability of computer models, computers in the workplace, trade and communications in the global village. Not open to computer science majors or to students with credit in Computer Science 440.

CS 310. Data Structures (3)
Prerequisite: Computer Science 108.
Representations and operations on basic data structures. Arrays, linked lists, stacks, queues, and recursion; binary search trees and balanced trees; hash tables, dynamic storage management; introduction to graphs. An object oriented programming language will be used.

CS 320. Programming Languages (3)
Prerequisite: Computer Science 108.
Principles of high-level programming languages, including formal techniques for syntax specification and implementation issues. Languages studied should include at least C++, FORTRAN, and LISP.

CS 370. Computer Architecture (3)
Prerequisite: Computer Science 237.
Logic gates, combinational circuits, sequential circuits, memory and bus system, control unit, CPU, exception processing, traps and interrupts, input-output and communication, reduced instruction set computers, use of simulators for analysis and design of computer circuits, and traps/interrupts.

CS 425. Tcl and Tk Interface Programming (3)
Prerequisite: Computer Science 320.
Presentation of Toolkit Command Language (Tcl) and Toolkit (Tk) languages, a portable programming environment for creating graphical user interfaces under X Windows, Microsoft Windows, and Macintosh. Writing scripts for Tcl, Tk, and extensions such as Expect.

CS 440. Social, Legal, and Ethical Issues in Computing (3)
Prerequisite: Computer Science 108.
Impact of computers, applications, and benefits, copyright, privacy, computer crime, constitutional issues, risks of computer failures, evaluating reliability of computer models, trade and communications in the global village, computers in the workplace, responsibilities of the computer professional. Not open to students with credit in Computer Science 301.

CS 470. UNIX System Administration (3)
Prerequisite: Computer Science 370.
Installing the UNIX operating system on a UNIX workstation, adding user accounts, backing up and restoring user files, installing windows, adding network capabilities, adding printers and other peripherals.

CS 490. Senior Seminar (1)
Prerequisite: Fifteen units of upper division computer science courses.
Preparation and delivery of oral presentations on advanced topics in computer science. General principles of organization and style appropriate for presenting such material.

CS 496. Experimental Topics (1-4)
Selected topics. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

CS 497. Undergraduate Research Seminar (3)
Six hours of laboratory and one hour with adviser.
Prerequisites: Computer Science 560 or 570, minimum grade point average of 3.3, and consent of instructor.
Designing and carrying out independent research in one of the areas of computer science. Literature search, technical report writing, and oral presentation of results.

CS 498. Undergraduate Honors Thesis (3)
Prerequisites: Computer Science 497 and consent of instructor.
Directed research in computer science and completion of honors thesis. Thesis to be presented at the annual SDSU Research Symposium and/or defended before a committee of faculty. Maximum credit six units.

CS 499. Special Study (1-3)
Prerequisite: Consent of instructor.
Individual study. Maximum credit six units.

UPPER DIVISION COURSES (Also Acceptable for Advanced Degrees)

CS 503. Scientific Database Techniques (3)
Prerequisites: Computer Science 310 and Mathematics 245.
Fundamental data models for handling scientific data, including flat file, indexed compressed files, relational databases, and object oriented databases, and their associated query technologies; e.g. file formats, input/output libraries, string searching, structured query language, object-oriented structured query language, hypertext markup language/common gateway interface, and other specialized interfaces. Designed for computational science students. Computer science majors must obtain adviser approval. See Computer Science 514.

CS 514. Database Theory and Implementation (3)
Prerequisites: Computer Science 310 and Mathematics 245.
Database systems architecture. Storage structures and access techniques. Relational model, relational algebra and calculus, normalization of relations, hierarchical and network models. Current database systems.

CS 520. Advanced Programming Languages (3)
Prerequisites: Computer Science 237, 310, and 320.
Object oriented programming, concurrent programming, logic programming, implementation issues.
more widely used modern programming languages.

detailed examination of internationalization features provided by one or

of software localizable to multiple languages and/or cultures, including

project required.

Theory and methodology of programming complex computer

software. Analysis, design, and implementation of programs. Team

projects required.

Prerequisites: Computer Science 310 and 320.

Basic concepts of object-oriented programming: classes, objects,

messages, data abstraction, inheritance, encapsulation. Object-

oriented design methodology.

Prerequisite: Computer Science 310 or Geography 484.

Customization of Geographic Information Science application
development platforms with emphasis on object oriented

programming and component architecture. Prominent examples are

Map Objects with Visual Basic, Map Objects with Java. Considerable

programming effort required, especially in Graphical User Interface

development.

Prerequisite: Computer Science 310.

Principles, techniques, and resources for design and implementation

of software localizable to multiple languages and/or cultures, including
detailed examination of internationalization features provided by one or

more widely used modern programming languages.

World Wide Web application development. XHTML, CSS,

JavaScript, client-side and server-side scripting, PHP and CGI

programming with Perl. Application integration with SQL database

systems.

Prerequisites: Computer Science 310 and 320.

Common interface idioms and support available for loose

integration into aesthetically appealing and practical, efficient

interaction between humans and machine. Editors, browsers, games,

networking sites, posting boards, etc. Principles that are ubiquitous

among tools for HCI development.

Prerequisites: Computer Science 310 and 320.

Principles and practice of dynamic and scripting and functional

languages used in web applications. Basic language concepts,
data structures in dynamic languages, code structure, code quality,
testing, string manipulation, dynamic code generation.

Prerequisites: Computer Science 310 and either Mathematics 245

or 523.

Heuristic approaches to problem solving. Systematic methods

of search of the problem state space. Theorem proving by machine.

Resolution principle and its applications.

Prerequisites: Computer Science 320, Mathematics 254,

knowledge of the C programming language.

Robotic systems including manipulators, actuators, sensors, and

controllers. Kinematics of planar robots. Design and implementation

of robot joint controllers. Robot programming languages and

environments, and robot command interfaces.

Prerequisites: Computer Science 310 and Statistics 550.

Methodology of simulation for discrete and continuous dynamic

systems. State-of-the-art programming techniques and languages.

Statistical aspects of simulation. Students will design, program,

execute, and document a simulation of their choice.

Prerequisites: Computer Science 310 and Mathematics 254.

Algorithms and computer methods for processing of images.

Visual perception as a computational problem, image formation,

characterization of images, feature extraction, regional and edge
detection, computer architectures for machine vision.

Prerequisites: Computer Science 310 and Mathematics 245.

Algorithms for solving frequently occurring problems. Analysis

techniques and solutions to recurrence relations. Searching and

sorting algorithms. Graph problems (shortest paths, minimal spanning

trees, graph search, etc.). NP complete problems. Not acceptable for

the M.S. degree in Computer Science.

Definition of finite automata. Classification of finite automaton

definable languages. Minimization of finite automata. Nondeterministic

finite automata. Sequential machines with output. Regular sets and

expressions. Introduction to grammars.

Prerequisites: Computer Science 310, 370, and knowledge of the

C programming language.

File systems, processes, CPU scheduling, concurrent

programming, memory management, protection. Relationship

between the operating system and underlying architecture. Not

acceptable for the M.S. degree in Computer Science.

Architecture of state-of-the-art microprocessor. Internal pipeline,

internal cache, external cache, and memory management.

Programming a uniprocessor. Communication among computers

in a distributed environment. Architecture and programming of a

multiprocessor system.

Prerequisites: Computer Science 310, Mathematics 245, and

credit or concurrent registration in Computer Science 570.

Principles of computer security and application of principles to

operating systems, database systems, and computer networks. Topics

include encryption techniques, access controls, and information flow

controls.

Basic networking concepts to include seven-layer reference

models, transmission media, addressing, subnetting and supernetting,

networking devices, LANs and WANs, internetworking, distributed

processing, and client-server model. Basic concepts and protocols

of TCP/IP protocol suite and basic Internet services.

Basic concepts in computational linguistics including regular

expressions, finite-state automata, finite-state transducers, weighted

finite-state automata, and n-gram language models. Applications to

phonology, orthography, morphology, syntax. Probabilistic models.

Statistical techniques for speech recognition.

Prerequisite: Computer Science 310.

Fundamentals of speech processing and speech recognition.

Physical aspects of speech production and perception. Mathematical

models for speech recognition. Corpus development: data collection,

processing, and evaluation. Applications of speech processing and

associated research topics.
CS 583. 3D Game Programming (3)
Prerequisite: Computer Science 310 or equivalent programming background.
Development of programming skills using software environment of a game engine and its scripting language. 3D concepts for game play, modeling, and programming. Roles needed in software development team. Contrast creation of original 3D object models for game world with incorporation of pre-created generic models.

CS 596. Advanced Topics in Computer Science (1-4)
Prerequisite: Consent of instructor.
Selected topics in computer science. May be repeated with the approval of the instructor. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor’s degree. Credit for 596 and 696 applicable to a master’s degree with approval of the graduate adviser.

For additional courses useful to computer scientists, see:
Mathematics 541. Introduction to Numerical Analysis and Computing
Mathematics 542. Introduction to Computational Ordinary of Differential Equations
Mathematics 579. Combinatorics

GRADUATE COURSES
Refer to the Graduate Bulletin.