

# BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Students intending to enter this program at the freshman level should have completed two years of algebra and one semester of trigonometry in high school. One year each of high school geometry and physics, as well as basic knowledge of computer organization and programming, are very desirable.

All lower-division courses (course numbers below 300) included among the degree requirements are available at many community colleges in California; students intending to enter the program upon transferring to San Francisco State University from a community college should take as many of those courses there as possible.

Students should plan their program of study in the major with the help of a departmental advisor as soon as possible so that the correct sequence of courses is taken and a proper set of electives is chosen. It is also suggested that students consult with an advisor before selecting courses to meet the General Education requirements. (See program below for acceptable science electives.)

Students are encouraged to participate in the Computer Science Cooperative Education Program at SF State. Under this program, they may obtain industrial employment related to their academic studies. This combination of on-the-job training and academic experience can greatly enhance the value of an undergraduate degree in Computer Science.

An Endowed Scholarship Fund, established in the memory of Jules H. Strauss, offers an annual award to a computer science major who shows scholarly accomplishment and demonstrates financial need.

An Entrepreneurship Program and Developers Prize, funded by our alumni, encourage and support innovation and entrepreneurship among students.

Students are advised that CR/NC grades are not acceptable in courses to be counted for the Computer Science major or minor programs with the exception of the CSC 211 lab.

## Program Learning Outcomes

1. Students will be able to design, develop, document, and test software using current techniques.
2. Students will understand the fundamentals of computer architecture and computing theory.
3. Students will be able to solve problems working in group settings.
4. Students will demonstrate the ability to give presentations and write technical reports.
5. Students will demonstrate an understanding of the importance of social and ethical issues related to the profession.

## Computer Science (B.S.) 71 units

### Mathematics and Physics (22 units)

Code	Title	Units
MATH 226	Calculus I	4
MATH 227	Calculus II	4
MATH 324	Probability and Statistics with Computing	3
MATH 325	Linear Algebra	3

PHYS 220	General Physics with Calculus I	3
PHYS 222	General Physics with Calculus I Laboratory	1
PHYS 230	General Physics with Calculus II	3
PHYS 232	General Physics with Calculus II Laboratory	1

### Core Computer Science Requirements (25 units)

Code	Title	Units
CSC 210	Introduction to Computer Programming	3
CSC 211	Introduction to Software Lab	1
CSC 220	Data Structures	3
CSC 230	Discrete Mathematical Structures for Computer Science	3
CSC 256	Machine Structures	3
CSC 300GW	Ethics, Communication, and Tools for Software Development - GVAR	3
CSC 317	Introduction to Web Software Development	3
CSC 340	Programming Methodology	3
CSC 413	Software Development	3

### Advanced Computer Science Requirements (12 units)

Code	Title	Units
CSC 415	Operating System Principles	3
CSC 510	Analysis of Algorithms I	3
CSC 600	Programming Paradigms and Languages	3
CSC 648	Software Engineering	3

### Senior Presentations

Each student is required to make an oral presentation during their senior year. Guidelines for the presentations are available on the Computer Science website: [cs.sfsu.edu](http://cs.sfsu.edu) (<http://cs.sfsu.edu>).

### Electives (12 units)

All students must complete four 3-unit senior electives. At least 9 units must be CSC courses. In addition to the courses listed below, any 600-level CSC course, with the exception of the advanced requirements courses CSC 600 and CSC 648, can be used as an elective. The department also allows one CSC graduate course to be used as a senior elective (700-level or higher, and non-paired excluding 895, 898, 897, 899). Exceptions must be approved in advance by a senior advisor.

Code	Title	Units
CSC 508	Machine Learning and Data Science for Personalized Medicine	3
CSC 520	Theory of Computing	3
CSC 615	UNIX Programming	3
CSC 620	Natural Language Technologies	3
CSC 621	Biomedical Imaging and Analysis	3
CSC 630	Computer Graphics Systems Design	3
CSC 631	Multiplayer Game Development	3
CSC 637	Software Techniques for Computer Music	3
CSC 641	Computer Performance Evaluation	3
CSC 642	Human-Computer Interaction	3
CSC 645	Computer Networks	3
CSC 651	System Administration	3
CSC 652	Introduction to Security and Data Privacy	3

CSC 656	Computer Organization	3
CSC 658	Programming Cafe	3
CSC 664	Multimedia Systems	3
CSC 665	Artificial Intelligence	3
CSC 667	Internet Application Design and Development	3
CSC 668	Advanced Object Oriented Software Design and Development	3
CSC 675	Introduction to Database Systems	3
CSC 690	Interactive Multimedia Application Development	3
CSC 698	Topics in Computing	3
CSC 699	Independent Study	1-3
MATH 400	Numerical Analysis	3
MATH 425	Applied and Computational Linear Algebra	3

Global Perspectives	LD or UD	3	GP
Social Justice	LD or UD	3	SJ

Note: LD = Lower-Division; UD = Upper-Division.

## First-Time Student Roadmap (4 Year)

1. In order to choose your English Composition A2 course and your QR/Math B4 course, please complete the online advising activities at [writingadvising.sfsu.edu](https://writingadvising.sfsu.edu) ([https://writingadvising.sfsu.edu/](https://writingadvising.sfsu.edu)) and [mathadvising.sfsu.edu](https://mathadvising.sfsu.edu) (<https://mathadvising.sfsu.edu/>). Questions? Contact Gator Smart Start. (<https://gatorsmartstart.sfsu.edu/>)
2. Select the row that matches your English course choice for A2.\*
3. Select the column that matches your QR/Math course choice for B4.
4. Click the Roadmap that lines up with your row and column.

For example, if you select ENG 104/ENG 105 and a multi-semester QR/math sequence for your first year, then choose Roadmap D.

Course Choice	One-Semester Course	Two-Semester Sequence or Support Course
ENG 114	Roadmap A ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-i-ii-eng/">http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-i-ii-eng/</a> )	Roadmap C ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-iii-iv-eng/">http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-iii-iv-eng/</a> )
ENG 104/ENG 105	Roadmap B ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-i-ii-stretch/">http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-i-ii-stretch/</a> )	Roadmap D ( <a href="http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-iii-iv-stretch/">http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/roadmap-iii-iv-stretch/</a> )

\* Composition for Multilingual Students: If taking ENG 209 as your first English course, choose the ENG 114 row. If taking ENG 201 or ENG 212 for your first English course, choose the ENG 104/ENG 105 row.

## Transfer Student Roadmap (2 Year)

For students with an AS-T in **Computer Science**. [This roadmap opens in a new tab \(http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/adt-roadmap/\)](http://bulletin.sfsu.edu/colleges/science-engineering/computer-science/bs-computer-science/adt-roadmap/).

## This degree program is an approved pathway (“similar” major) for students earning the ADT in Computer Science

California legislation SB 1440 (2009) mandated the creation of the Associate Degree for Transfer (ADT) to be awarded by the California Community Colleges. Two types of ADTs are awarded: Associate in Arts for Transfer (AA-T) and Associate in Science for Transfer (AS-T).

Note: no specific degree is required for admission as an upper-division student. However, the ADT includes specific guarantees related to admission and graduation and is designed to clarify the transfer process and strengthen lower-division preparation for the major.

## General Education Requirements

Requirement	Course Level	Units	Area Designation
Oral Communication	LD	3	A1
Written English Communication	LD	3	A2
Critical Thinking	LD	3	A3
Physical Science	LD	3	B1
Life Science	LD	3	B2
Lab Science	LD	1	B3
Mathematics/Quantitative Reasoning	LD	3	B4
Arts	LD	3	C1
Humanities	LD	3	C2
Arts or Humanities	LD	3	C1 or C2
Social Sciences	LD	3	D1
Social Sciences: US History	LD	3	D2
Lifelong Learning and Self-Development (LLD)	LD	3	E
Ethnic Studies	LD	3	F
Physical and/or Life Science	UD	3	UD-B
Arts and/or Humanities	UD	3	UD-C
Social Sciences	UD	3	UD-D
<b>SF State Studies</b>			
Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), a major or minor, or an elective.			
American Ethnic and Racial Minorities	LD or UD	3	AERM
Environmental Sustainability	LD or UD	3	ES

An ADT totals 60 units and in most cases includes completion of all lower-division General Education requirements and at least 18 units in a specific major. (The Biology, Chemistry, and Environmental Science AS-T degrees defer 3 units in lower-division GE area C and 3 units in lower-division GE area D until after transfer.) Students pursuing an ADT are guaranteed admission to the CSU if minimum eligibility requirements are met, though not necessarily to the CSU campus of primary choice.

Upon verification that the ADT has been awarded prior to matriculation at SF State, students are guaranteed B.A. or B.S. completion in 60 units if pursuing a "similar" major after transfer. Determinations about "similar" majors at SF State are made by faculty in the discipline.

Degree completion in 60 units cannot be guaranteed when a student simultaneously pursues an additional major, a minor, certificate, or credential.

A sample advising roadmap for students who have earned an ADT and continue in a "similar" major at SF State is available on the Roadmaps tab on the degree requirements page for the major. The roadmap displays:

- How many lower-division units required for the major have been completed upon entry based on the award of a specific ADT;
- Which lower-division requirements are considered complete upon entry based on the award of a specific ADT;
- How to complete the remaining 60 units for the degree in four semesters.

Students who have earned an ADT should seek advising in the major department during the first semester of attendance.

## General Advising Information for Transfer Students

1. Before transfer, complete as many lower-division requirements or electives for this major as possible.
2. The following courses are not required for admission but are required for graduation. Students are strongly encouraged to complete these units before transfer; doing so will provide more flexibility in course selection after transfer.
  - a course in U.S. History
  - a course in U.S. & California Government

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit <http://www.assist.org> (<http://assist.org>). Check any geographically accessible CCCs; sometimes options include more than one college. Use ASSIST to determine:

- Which courses at a CCC satisfy any lower-division major requirements for this major;
- Which courses at a CCC satisfy CSU GE, US History, and US & CA Government requirements.

Remedial courses are not transferable and do not apply to the minimum 60 semester units/90 quarter units required for admission.

Additional units for courses that are repeated do not apply to the minimum 60 units required for upper-division transfer (for example, if a course was not passed on the first attempt or was taken to earn a better grade).

Before leaving the last California Community College of attendance, obtain a summary of completion of lower-division General Education units (IGETC or CSU GE Breadth). This is often referred to as a GE certification worksheet. SF State does not require delivery of this certification to Admissions, but students should retain this document for verifying degree progress after transfer.

Credit for Advanced Placement, International Baccalaureate, or College-Level Examination Program courses: AP/IB/CLEP credit is not automatically transferred from the previous institution. Units are transferred only when an official score report is delivered to SF State. Credit is based on the academic year during which exams were taken. Refer to the University Bulletin in effect during the year of AP/IB/CLEP examination(s) for details regarding the award of credit for AP/IB/CLEP.

Students pursuing majors in science, technology, engineering, and mathematics (STEM) disciplines often defer 6-9 units of lower-division General Education in Areas C and D until after transfer to focus on preparation courses for the major. This advice does not apply to students pursuing associate degree completion before transfer.

## Transferring From Institutions Other Than CCCs or CSUs

Review SF State's lower-division General Education requirements. Note that, as described below, the four basic skills courses required for admission meet A1, A2, A3, and B4 in the SF State GE pattern. Courses that fulfill the remaining areas of SF State's lower-division GE pattern are available at most two-year and four-year colleges and universities.

Of the four required basic skills courses, a course in critical thinking (A3) may not be widely offered outside the CCC and CSU systems. Students should attempt to identify and take an appropriate course no later than the term of application to the CSU. To review more information about the A3 requirement, please visit [bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL](http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL).

Waiting until after transfer to take a single course at SF State that meets both US and CA/local government requirements may be an appropriate option, particularly if transferring from outside of California.

## All Students Must Meet the Transfer Eligibility Requirements Outlined Below for Admission.

For more information, visit the Undergraduate Admissions section (<http://bulletin.sfsu.edu/undergraduate-admissions/>).

- Complete 60 or more transferable semester units or 90 or more quarter units.
- Earn a college grade point average of 2.0 or better in all transferable courses. Non-local area residents may be held to a higher GPA standard.
- Be in good standing at the last college or university attended.
- Complete 30-semester units (45-quarter units) of General Education, including four basic skills courses:
  - a. One course in oral communication (same as CSU GE Area A1)
  - b. One course in written composition (same as CSU GE Area A2)
  - c. One course in critical thinking (same as CSU GE Area A3)
  - d. One course in mathematics or quantitative reasoning (same as CSU GE Area B4)
- The four basic skills courses and a minimum of 60 transferable semester units (90-quarter units) must be completed by the spring

semester prior to fall admission, or by the fall semester prior to spring admission. Earn a C- or better grade in each basic skills course.