

# COMPUTER SCIENCE

## Natural and Applied Sciences Division

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<http://www.cabrillo.edu/programs>

## Computer Science

### Program Description:

The Computer Science program is intended to meet the needs of students majoring in computer science, and students from other science disciplines where computer programming is required. These disciplines include computer engineering, networking and system administration, business, bioinformatics, information systems management, economics, business and information systems, engineering, and engineering technology.

The Computer Science Program offers two degree programs, four certificates of achievement, and two skills certificates. Both the A.S./A.A. Degree programs transfer to four-year colleges and universities. Note: UC will accept a total of 6 courses from Computer Science. One of the following courses is recommended for all potential computer science/computer engineering majors early in their academic career to help determine their interest in pursuing the major: CS 1 or CS 2 or CS 11 (C++), or CS 12J (Java).

### Model Program for Computer Science

The following Model Program fulfills requirements for the A.A./A.S. Degree in Computer Science at Cabrillo College. Specific lower division major preparation at four-year public institutions in California can be found at [www.assist.org](http://www.assist.org). Please see a counselor for advisement for transfer to any four-year institution.

### A.A. Degree: Computer Science

**A.A. General Education** **30 Units**

#### Computer Science Majors

#### Core courses for all transfer students (30 units)

CS 19	C++ Programming . . . . .	4
or		
CS 20J	Java Programming . . . . .	4
CS 21	*Introduction to Data Structures and Algorithms . . . . .	4
CS 23	**Discrete Mathematics . . . . .	4
or		
MATH 23	***Discrete Mathematics . . . . .	4
MATH 5A	Analytic Geometry and Calculus I . . . . .	5
MATH 5B	Analytic Geometry and Calculus II . . . . .	5

The following core courses are required for transfer for most computer science majors and transfer universities.

CS 24	**Elementary Computer Organization . . . . .	4
MATH 5C	Analytic Geometry and Calculus III . . . . .	5
MATH 6	*Introduction to Linear Algebra . . . . .	3
MATH 7	Introduction to Differential Equations . . . . .	3
CHEM 1A	General Chemistry I . . . . .	5
CHEM 1B	General Chemistry II . . . . .	5
or		
PHYS 4A	Physics for Scientists and Engineers . . . . .	5
PHYS 4B	**Physics for Scientists and Engineers . . . . .	5
PHYS 4C	*Physics for Scientists and Engineers . . . . .	5
or		
BIO 1A	Cell and Molecular Biology . . . . .	5
BIO 1B	Animal Diversity and Evolutionary Principles . . . . .	5

**Total Units** **60**

\*Spring only; \*\*Fall only; \*\*\*spring only, even years; \*\*\*\*fall only, even years

### Computer Engineering Majors

#### Core courses for all transfer students (30 units)

CS 19	C++ Programming . . . . .	4
or		
CS 20J	Java Programming . . . . .	4
MATH 5A	Analytic Geometry and Calculus I . . . . .	5
MATH 5B	Analytic Geometry and Calculus II . . . . .	5
MATH 5C	Analytic Geometry and Calculus III . . . . .	5
MATH 6	*Introduction to Linear Algebra . . . . .	3
MATH 7	Introduction to Differential Equations . . . . .	3
CHEM 1A	General Chemistry I . . . . .	5
PHYS 4A	Physics for Scientists and Engineers . . . . .	5
and		
PHYS 4B	**Physics for Scientists and Engineers . . . . .	5

The following core courses are required for transfer for most computer engineering majors and transfer universities:

CS 21	*Introduction to Data Structures and Algorithms . . . . .	4
CS 23	***Discrete Mathematics . . . . .	4
or		
MATH 23	***Discrete Mathematics . . . . .	4
CS 24	****Elementary Computer Organization . . . . .	4
PHYS 4C	*Physics for Scientists and Engineers . . . . .	5
or		
CHEM 1B	General Chemistry II . . . . .	5
or		
BIO 1A	Cell and Molecular Biology . . . . .	5
BIO 1B	Animal Diversity and Evolutionary Principles . . . . .	5

**Total Units** **60**

\*Spring only; \*\*Fall only; \*\*\*Spring only, even years; \*\*\*\*Fall only, even years.

**A.S. Degree: Computer Science**

**A.S. General Education 21 Units**

**Computer Science Majors: Because this is a suggested Model Program the following core courses are required for most transfer students. (39 units)**

CS 19	C++ Programming . . . . .	4
or		
CS 20J	Java Programming . . . . .	4
CS 21	*Introduction to Data Structures and Algorithms. . . . .	4
CS 23	***Discrete Mathematics. . . . .	4
or		
MATH 23	***Discrete Mathematics. . . . .	4
MATH 5A	Analytic Geometry and Calculus I . . . . .	5
MATH 5B	Analytic Geometry and Calculus II . . . . .	5

**The following core courses are required for transfer for most computer science majors and transfer universities.**

CS 24	****Elementary Computer Organization . . . . .	4
MATH 5C	Analytic Geometry and Calculus III . . . . .	5
MATH 6	*Introduction to Linear Algebra . . . . .	3
MATH 7	Introduction to Differential Equations . . . . .	3
CHEM 1A	General Chemistry I . . . . .	5
and		
CHEM 1B	General Chemistry II . . . . .	5
or		
PHYS 4A	Physics for Scientists and Engineers . . . . .	5
PHYS 4B	**Physics for Scientists and Engineers . . . . .	5
PHYS 4C	*Physics for Scientists and Engineers . . . . .	5
or		
BIO 1A	Cell and Molecular Biology. . . . .	5
BIO 1B	Animal Diversity and Evolutionary Principles. . . . .	5

**Computer Engineering Majors**

**Core courses for most transfer students (40 units)**

CS 19	C++ Programming . . . . .	4
or		
CS 20J	Java Programming . . . . .	4
MATH 5A	Analytic Geometry and Calculus I . . . . .	5
MATH 5B	Analytic Geometry and Calculus II . . . . .	5
MATH 5C	Analytic Geometry and Calculus III . . . . .	5
MATH 6	*Introduction to Linear Algebra . . . . .	3
MATH 7	Introduction to Differential Equations . . . . .	3
CHEM 1A	General Chemistry I . . . . .	5
PHYS 4A	Physics for Scientists and Engineers . . . . .	5
PHYS 4B	**Physics for Scientists and Engineers . . . . .	5

**The following core courses are required for transfer for most computer engineering majors and transfer universities:**

CS 21	*Introduction to Data Structures and Algorithms . . . . .	4
CS 23	***Discrete Mathematics. . . . .	4
or		
MATH 23	***Discrete Mathematics. . . . .	4
CS 24	****Elementary Computer Organization . . . . .	4
PHYS 4C	*Physics for Scientists and Engineers . . . . .	5
or		
CHEM 1B	General Chemistry II . . . . .	5

or		
BIO 1A	Cell and Molecular Biology. . . . .	5
BIO 1B	Animal Diversity and Evolutionary Principles. . . . .	5
<b>For Computer Engineering Majors: core is 40 units for a total of 61 units.</b>		
<b>Total Units</b>		<b>60</b>
<i>*Spring only, **Fall only; ***Spring only, even years; ****Fall only, even years.</i>		

**Certificate of Achievement: Computer Science C++ Programming**

**Required Courses**

CS 1	Introduction to Computers and Computer Technology. . . . .	3
and		
CS 1L	Technology Tools . . . . .	2
or		
CS 12AL	Intro to Programming for the Non-Major. . . . .	4
CS 11	Introduction to Programming Concepts and Methodology, C++ . . . . .	4
or		
CIS 132	Introduction to Internet Programming . . . . .	4
CS 19	C++ Programming . . . . .	4
MATH 4	Precalculus Algebra and Trigonometry . . . . .	5
or		
MATH 2	Precalculus Algebra . . . . .	4
and		
MATH 3	Precalculus Trigonometry . . . . .	3
COMM 2	Group Discussion. . . . .	3
or		
COMM 10	Communication Process . . . . .	3
ENGL 1A/1AH/1AMC/1AMCH . . . . .		3
<b>Total Units</b>		<b>23 - 26</b>

**Certificate of Achievement: Java Programming**

**Required Courses**

CS 1	Introduction to Computers and Computer Technology . . . . .	3
and		
CS 1L	Technology Tools . . . . .	2
or		
CS 12AL	Intro to Programming for the Non-Major. . . . .	4
CS 12J	Introduction to Programming Concepts and Methodology, Java . . . . .	4
or		
CS 12GP	Introduction to Programming Using Games and Simulations . . . . .	4
CS 20J	Java Programming. . . . .	4
MATH 4	Precalculus Algebra and Trigonometry . . . . .	5
or		
MATH 2	Precalculus Algebra . . . . .	4
and		
MATH 3	Precalculus Trigonometry . . . . .	3
COMM 2	Group Discussion. . . . .	3
or		
COMM 10	Communication Process . . . . .	3
ENGL 1A/1AH/1AMC/1AMCH . . . . .		3
<b>Total Units</b>		<b>23 - 26</b>

**Certificate of Achievement: Programming**

**Required Courses**

CS 19	C++ Programming . . . . .	4
or		
CS 20J	Java Programming. . . . .	4
CS 21	*Introduction to Data Structures and Algorithms . . . . .	4
CS 23	***Discrete Mathematics. . . . .	4
or		
MATH 23	***Discrete Mathematics. . . . .	4
CS 24	****Elementary Computer Organization . . . . .	4
<b>Take 2 of the following CIS courses:</b>		
CIS 130	UNIX/Linux Shell Programming . . . . .	4
CIS 131	*****Perl Programming in a Unix Environment. . . . .	4
CIS 132	Introduction to Internet Programming. . . . .	4
And		
MATH 5A	Analytic Geometry and Calculus I . . . . .	5
COMM 2	Group Discussion. . . . .	3
or		
COMM 10	Communication Process . . . . .	3
ENGL 1A/1AH/1AMC/1AMCH . . . . .		3
<b>Total Units</b>		<b>35</b>

\*Spring only, \*\*Fall only; \*\*\*Spring only, even years; \*\*\*\*Fall only, even years;\*\*\*\*\*Summer only

**Certificate of Achievement: Web Programming**

**Required Courses:**

CS 12J	Introduction to Programming Concepts and Methodology, Java . . . . .	4
or		
CS 20J	Java Programming. . . . .	4
CIS 131	*Perl Programming in a Unix Environment . . . . .	4
CIS 132	Introduction to Internet Programming. . . . .	4
CIS 165PH	Introduction to Programming Database-Driven Websites With PHP . . . . .	4
MATH 154	Elementary Algebra . . . . .	5
or		
MATH 4	Precalculus Algebra and Trigonometry . . . . .	5
or		
MATH 2	Precalculus Algebra . . . . .	4
and		
MATH 3	Precalculus Trigonometry . . . . .	3
COMM 2	Group Discussion. . . . .	3
or		
COMM 10	Communication Process . . . . .	3
ENGL 1A/1AH/1AMC/1AMCH . . . . .		3
<b>Total Units</b>		<b>27 - 29</b>
<i>*summer only</i>		

**Skills Certificate**

**Game Programming**

**Required Courses**

CS 11	Introduction to Programming Concepts and Methodology, C++ . . . . .	4
or		
CS 12J	Introduction to Programming Concepts and Methodology, Java. . . . .	4
CS 20J	Java Programming. . . . .	4
CS 12GP	Introduction to Programming Using Games and Simulations. . . . .	4
<b>Total Units</b>		<b>12</b>

**Skills Certificate: Web Programming**

**Fundamentals**

**Required Courses**

CS 12J	Introduction to Programming Concepts and Methodology, Java. . . . .	4
or		
CS 20J	Java Programming. . . . .	4
CIS 132	Introduction to Internet Programming. . . . .	4
CIS 165PH	Introduction to Programming Database-Driven Websites With PHP . . . . .	4
DM 173B	Interactive Programming Using Flash . . . . .	3
<b>Total Units</b>		<b>15</b>

## Computer Science Courses

### CS 1

#### Introduction to Computers and Computer Technology

3 units; 3 hours Lecture, 2 hours Laboratory

Recommended Preparation: Eligibility for ENGL 100 and READ 100; Eligibility for MATH 154.

Surveys the fields of study within computer science and computer technology with a focus on computer literacy in the 21st century. Includes: hardware, software, development systems, the Internet, and networks, including PC and Macintosh. Students interested in a hands-on lab course to coincide with this class may enroll in CS 1L. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 1L

#### Technology Tools

2 units; 2 hours Lecture, 2 hours Laboratory

Recommended Preparation: CS 1 (may be taken concurrently); Eligibility for ENGL 100 and READ 100; Eligibility for MATH 154.

Covers the fundamentals of college-level information literacy, computational logic, and computer proficiency. Topics include the online research process, essential skills in using computer operating systems, word processing, spreadsheets, email, image manipulation, and presentation software at a college level. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 11

#### Introduction to Programming Concepts and Methodology, C++

4 units; 3 hours Lecture, 5 hours Laboratory

Recommended Preparation: CS 1 and MATH 154; Eligibility for ENGL 100 and READ 100.

Presents an introduction to computer programming using the C++ programming language beginning with basic principles and progressing to object-oriented programs. Includes: algorithms, data types, declarations, expressions, selection, repetition, functions, recursion, libraries, arrays, classes, objects, files and streams. Prepares students for CS 19 or CS 20J. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 12AL

#### Intro to Programming for the Non-Major

4 units; 3 hours Lecture, 5 hours Laboratory

Recommended Preparation: Eligibility for ENGL 100 and READ 100; Eligibility for MATH 154.

Covers computer programming concepts and methodology using 3D animation software. Designed specifically for students who have no previous programming experience. Computer science majors are directed to take CS 11 or CS 12J as a beginning programming course. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 12GP

#### Introduction to Programming Using Games and Simulations

4 units; 3 hours Lecture, 5 hours Laboratory

Prerequisite: MATH 154.

Recommended Preparation: Eligibility for ENGL 100 and READ 100.

Presents an introduction to computer programming concepts and methodologies by developing games and simulations in the Java programming language. Topics include: algorithms, data types, declarations, expressions, selection, repetition, methods, recursion, libraries, arrays, classes, objects, 2D graphics, animation, sound, files and streams. Prepares students for CS 19 or CS 20J. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 12J

#### Introduction to Programming Concepts and Methodology, Java

4 units; 3 hours Lecture, 5 hours Laboratory

Recommended Preparation: CS 1 and MATH 154; Eligibility for ENGL 100 and READ 100.

Presents an introduction to computer programming using the Java programming language beginning with basic principles and progressing to object-oriented programs and visual programming. Includes: algorithms, data types, declarations, expressions, selection, repetition, methods, recursion, libraries, arrays, classes, objects, components, events, files and streams. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

### CS 19

#### C++ Programming

4 units; 3 hours Lecture, 5 hours Laboratory

Prerequisite: MATH 4 or MATH 2 and MATH 3.

Recommended Preparation: CS 11 or CS 12J or equivalent skills; Previous programming experience strongly recommended; Eligibility for ENGL 100 and READ 100.

Presents programming, documentation, and software design methodologies using C++. Assumes that students have been introduced to classes and objects, control structures, repetition, functions, and logical operators. Includes a brief review of functions, arrays, pointers and strings. New topics include classes, operator overloading, and inheritance. Prepares students for CS 21 and CS 23. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

**CS 20J****Java Programming**

4 units; 3 hours Lecture, 5 hours Laboratory

Prerequisite: MATH 4 or MATH 2 and MATH 3.

Recommended Preparation: CS 11 or CS 12J or equivalent skills; Eligibility for ENGL 100 and READ 100.

Presents programming, documentation, and software-design methodologies using Java. Includes a brief review of control structures, methods and arrays as students rapidly progress to object-oriented programs of moderate complexity. Advanced topics include: inheritance, polymorphism, exceptions, graphics, graphical-user interfaces, files, streams, threads and dynamic data structures. Prepares students for CS 21 and CS 24. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

**CS 21****Introduction to Data Structures and Algorithms**

4 units; 3 hours Lecture, 5 hours Laboratory

Prerequisite: CS 19 or CS 20J or equivalent skills and MATH 5A.

Recommended Preparation: Eligibility for ENGL 100 and READ 100.

Provides an introduction to data structures, algorithms, and software engineering techniques using the C++ or Java language. Presents the development of large programs including definition, implementation, analysis, use and reuse of abstract data types and associated algorithms. Reviews and elaborates arrays, lists, queues, stacks, sets, trees, priority queues, heaps, tables, hashing, balanced trees, graphs, recursion, searching and sorting. Offered spring only. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

**CS 23****Discrete Mathematics**

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: MATH 5A or equivalent skills.

Recommended Preparation: CS 19 or CS 20J or equivalent skills; Eligibility for ENGL 100 and READ 100.

Presents discrete mathematical systems including methods of proof that shape the foundations of computer science. Includes propositional logic, set and number theory, Boolean Algebra, deductive and inductive proof, functions and relations, combinatorics, discrete probability, graph theory and network models, and efficiency of algorithms. Math majors should enroll in MATH 23 (identical to CS 23). Offered spring only even years. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.

**CS 24****Elementary Computer Organization**

4 units; 3 hours Lecture, 5 hours Laboratory

Prerequisite: CS 19 or CS 20J and MATH 5A.

Recommended Preparation: Eligibility for ENGL 100 and READ 100.

Introduces organization of computer systems, machine level programming and systems software. Includes processor organization, introduction to operating systems and assembly language programming on microprocessors. Offered fall only. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU, UC.