Mathematics and Computer Science

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The undergraduate major in mathematics and computer science leads to a bachelor of arts or bachelor of science degree. The major combines elements of the mathematics and computer and information science curricula into a four-year program that offers an alternative to the undergraduate degree programs in either field. It serves students who want knowledge in both fields but are not ready to specialize in either. The courses selected for the program provide a solid foundation for professional work or for advanced study.

The program is designed to develop team players for information-based occupations. Its graduates have the tools to analyze complex problems and compute the answers to them. Consistent with its emphasis on teamwork and communication, the program requires college-level exposure to an additional scientific field and an upper-division writing course.

Students with strong mathematics backgrounds in high school are frequently advised to major in computer science at the university, often without a clear idea of what the field of study is actually like. The joint major program offers such students the chance to experiment with computer science while retaining the anchor to mathematics. It also allows students the possibility of changing easily to the single-major program in either mathematics or CIS with no loss of credit and, at least through the junior year, without jeopardizing degree completion in four years.

Careers

Graduates with this major can enter industrial positions that require computer science skills and mathematical problem-solving ability. They are particularly well suited for positions in the high-performance computing industry, developing the software tools for large-scale scientific computation. The combination of mathematics and computer science forms an excellent professional background for secondary-school mathematics teachers, and the major program also provides a solid foundation for actuarial, financial, and related professions. Graduates are also prepared to enter advanced programs of study in either mathematics or computer science, or in applied areas such as biological computational science.

Preparation

A high school student planning to major in mathematics and computer science should pursue a strong academic program with four years of mathematics. Courses in algebra, geometry, trigonometry, and more advanced topics should be included. Experience preparing substantial written reports is highly desirable.

Transfer Students

College transfer students who have completed a year of calculus should be able to fit the remaining mathematics courses for the degree into just two years, provided that they have already completed the bulk of their general-education requirements before they transfer.

Transfer students should call or write to the Department of Computer and Information Science to determine whether computer courses they have taken can be counted toward the joint major requirements. Sequential subjects such as mathematics and computer science typically require several years to progress from introductory to senior-level courses. The joint program lets students move forward in both fields at once with limited prerequisites, making it relatively accessible to transfer students and to students who change from other major programs. Students who want to pursue the material in greater depth need to consider prerequisite paths carefully.

Students attending community college in Oregon are encouraged to obtain the Associate of Arts Oregon Transfer degree before entering the University of Oregon. While earning this degree, community college transfer students should take as much discrete mathematics, calculus, and computer science as possible, and also try to complete the science requirement for the major. The associate degree does not automatically satisfy the science requirement for this major.

Faculties and Facilities

The faculties and facilities in both the mathematics and the computer and information science departments are available to students in the combined major program. For detailed descriptions, see those sections of this catalog. Information is also available online.

Honors Program

Both of the cooperating departments offer departmental honors programs to their undergraduate majors. After obtaining advance approval from both of their advisors, students in the joint degree program are eligible to attain honors in mathematics and computer science by meeting the honors requirements of either department, including writing a thesis.

Preparation for Kindergarten through Secondary School Teaching Careers

The College of Education offers a fifth-year program for middle-secondary licensure in mathematics and for elementary teaching. More information is available from the mathematics department's education advisor, Shlomo Libeskind; see also the **College of Education** section of this catalog.

Minor

Minors are offered by the Department of Mathematics and the Department of Computer and Information Science. There is no joint minor in mathematics and computer science.

- **Bachelor of Arts**
- **Bachelor of Science**

Undergraduate Studies

Bachelor of Arts Degree Requirements

Code	Title	Credits
Core Courses		
CIS 210–212	Computer Science I-III	12
MATH 231–232	Elements of Discrete Mathematics I-II	8
MATH 251–253	Calculus I-III	12
or MATH 261–263	Calculus with Theory I-III	
Mathematics Requirements		
Select one of the following:		

MATH 316	Fundamentals of Analysis I	
MATH 347	Fundamentals of Number Theory I	
MATH 391	Fundamentals of Abstract Algebra I	
MATH 341–342	Elementary Linear Algebra	8
MATH 351–352	Elementary Numerical Analysis I-II	8
or MATH 461–462	Introduction to Mathematical Methods of Statistics I-II	
Upper-level mathematics course [1]		4
Computer and Information Science		
CIS 313	Intermediate Data Structures	4
CIS 314	Computer Organization	4
CIS 315	Intermediate Algorithms	4
CIS 425	Principles of Programming Languages	4
Select one of the following:		4
CIS 322	Introduction to Software Engineering	4
CIS 330	C/C++ and Unix	
CIS 420	Automata Theory	
CIS 422	Software Methodology I	
Two other upper-division CIS courses [2]		8
Writing Requirements		
WR 320	Scientific and Technical Writing	4
or WR 321	Business Communications	
Science Requirements		
Select 12 credits from the following:		12
Biology [3]		
BI 211,213	General Biology I,III	
or BI 211–212	General Biology I-II	
Chemistry [3]		
CH 111	Introduction to Chemical Principles	
or CH 113	The Chemistry of Sustainability	
or CH 221	General Chemistry I	
or CH 224H	Honors General Chemistry	
CH 221–223	General Chemistry	
or CH 224H–226H	Honors General Chemistry	
Geography		
GEOG 141	The Natural Environment	
Select two of the following:		
GEOG 321	Climatology	
GEOG 322	Geomorphology	
GEOG 323	Biogeography	
Earth Sciences		
GEOL 201	Earth's Interior Heat and Dynamics	
GEOL 202	Earth Surface and Environmental Geology	
GEOL 203	Evolution of the Earth	
Physics [3]		
PHYS 201–203	General Physics	
or PHYS 251–253	Foundations of Physics I	
Psychology		
PSY 201	Mind and Brain	
PSY 202	Mind and Society	
Select one of the following:		
PSY 304	Biopsychology	
PSY 348	Music and the Brain	
Total Credits		**100**

1 Excludes Statistical Methods I-II (MATH 425–426)

2 Special Studies: [Topic] (CIS 399) and Experimental Course: [Topic] (CIS 410) courses used as electives must have a prerequisite of Intermediate Data Structures (CIS 313) and have regular class meetings and homework assignments. At least one course must be numbered 410 or above.

3 Students are encouraged to complete the accompanying lab courses.

Bachelor of Science Degree Requirements

Code	Title	Credits
Core Courses		
CIS 210–212	Computer Science I-III	12
MATH 231–232	Elements of Discrete Mathematics I-II	8
MATH 251–253	Calculus I-III	12
or MATH 261–263	Calculus with Theory I-III	
Mathematics Requirements		
Select one of the following:		
MATH 316	Fundamentals of Analysis I	
MATH 347	Fundamentals of Number Theory I	
MATH 391	Fundamentals of Abstract Algebra I	
MATH 341–342	Elementary Linear Algebra	8
MATH 351–352	Elementary Numerical Analysis I-II	8
or MATH 461–462	Introduction to Mathematical Methods of Statistics I-II	
Upper-level mathematics course [1]		4
Computer and Information Science		
CIS 313	Intermediate Data Structures	4
CIS 314	Computer Organization	4
CIS 315	Intermediate Algorithms	4
CIS 425	Principles of Programming Languages	4
Select one of the following:		4
CIS 322	Introduction to Software Engineering	4
CIS 330	C/C++ and Unix	
CIS 420	Automata Theory	
CIS 422	Software Methodology I	
Two other upper-division CIS courses [2]		8
Writing Requirements		
WR 320	Scientific and Technical Writing	4
or WR 321	Business Communications	
Science Requirements		
Select 12 credits from the following:		12
Biology [3]		
BI 211,213	General Biology I,III	
or BI 211–212	General Biology I-II	
Chemistry [3]		
CH 111	Introduction to Chemical Principles	
or CH 113	The Chemistry of Sustainability	

or CH 221	General Chemistry I
or CH 224H	Honors General Chemistry
CH 221–223	General Chemistry
or CH 224H–226H	Honors General Chemistry
Geography	
GEOG 141	The Natural Environment
Select two of the following:	
GEOG 321	Climatology
GEOG 322	Geomorphology
GEOG 323	Biogeography
Earth Sciences	
GEOL 201	Earth's Interior Heat and Dynamics
GEOL 202	Earth Surface and Environmental Geology
GEOL 203	Evolution of the Earth
Physics [3]	
PHYS 201–203	General Physics
or PHYS 251–253	Foundations of Physics I
Psychology	
PSY 201	Mind and Brain
PSY 202	Mind and Society
Select one of the following:	
PSY 304	Biopsychology
PSY 348	Music and the Brain
Total Credits	**100**

1. Excludes Statistical Methods I-II (MATH 425–426)
2. Special Studies: [Topic] (CIS 399) and Experimental Course: [Topic] (CIS 410) courses used as electives must have a prerequisite of Intermediate Data Structures (CIS 313) and have regular class meetings and homework assignments. At least one course must be numbered 410 or above.
3. Students are encouraged to complete the accompanying lab courses.

Additional Bachelor Requirements

Students must earn no grade below a B– in required lower-division mathematics and computer science courses—Computer Science I (CIS 210), Computer Science II (CIS 211), Computer Science III (CIS 212), Elements of Discrete Mathematics I (MATH 231), Elements of Discrete Mathematics II (MATH 232)—for automatic advancement to upper-division computer and information science courses. At least 12 of the mathematics upper-division credits applied to the degree must be taken in residence at the university. The science courses may be taken pass/no pass (P/N) or for letter grades.

Advising and Program Planning

Each major is assigned two advisors, one in the Department of Mathematics and one in the Department of Computer and Information Science. One of the two is designated as the advisor of record for the student, but both cooperate in planning the student's program. Because of the interrelationship between mathematics and computer science courses, it is especially important that a student planning for the combined major consult closely with both advisors. Since both mathematics and computer science are sequential subjects, prerequisite planning should be discussed with the student's advisors.

Programming Experience

Students who take Computer Science I-III (CIS 210–212) are expected to have programming experience, which may have been acquired in a high school course, through employment, or in a course such as Introduction to Programming and Problem Solving (CIS 122). Students who are unsure about their level of preparation should meet with a CIS advisor.

Sequence of Courses

Elements of Discrete Mathematics I-II (MATH 231–232) and Computer Science I-III (CIS 210–212) go well together, as do calculus and physics. Students with advanced placement credit in calculus and programming experience may want to take Elements of Discrete Mathematics I-II (MATH 231–232) and Computer Science I-III (CIS 210–212) in the freshman year. Students with little or no programming experience should plan to take Introduction to Programming and Problem Solving (CIS 122), Calculus I-III (MATH 251–253), and the major science requirement in the freshman year. In the sophomore year, students should take whichever of calculus or computer science was not taken freshman year, and continue into the 300 level of the branch that was taken.

Major Progress Review and Major in Good Standing

Each major must meet with a CIS advisor to file a Major Progress Review form after completing 12 credits of the upper-division core, including at least one course from each department. Mathematics and computer science courses and at least 8 credits of upper-division CIS courses used to satisfy upper-division major requirements must be taken for letter grades and passed with grades of C– or better. At least 12 of the upper-division mathematics credits and 12 of the upper-division computer and information science credits applied to the degree must be taken in residence at the university. A student who receives two grades below C– in the upper-division core or three grades below C– in any upper-division courses may be removed from the major.

MATH 316	Fundamentals of Analysis I	4
MATH 341–342	Elementary Linear Algebra	8
CIS 313	Intermediate Data Structures	4
CIS 314	Computer Organization	4
CIS 315	Intermediate Algorithms	4
CIS 425	Principles of Programming Languages	4
One of the following:		4
CIS 330	C/C++ and Unix	
CIS 420	Automata Theory	
CIS 422	Software Methodology I	

Four-Year Degree Plan

The degree plan shown is only a sample of how students may complete their degrees in four years. There are alternative ways. Students should consult their advisor to determine the best path for them.

Bachelor of Arts in Mathematics and Computer Science

Course	Title	Credits	Milestones
First Year			
Fall			
CIS 122	Introduction to Programming and Problem Solving	4	
MATH 112	Elementary Functions	4	
WR 121	College Composition I	4	
200-level language sequence		4	
	Credits	**16**	
Winter			
CIS 210	Computer Science I	4	
MATH 231	Elements of Discrete Mathematics I	4	
WR 122	College Composition II	4	
200-level language sequence		4	
	Credits	**16**	
Spring			
CIS 211	Computer Science II	4	
MATH 232	Elements of Discrete Mathematics II	4	
General education course in arts and letters		4	
200-level language sequence		4	
	Credits	**16**	
	Total Credits	**48**	

Course	Title	Credits	Milestones
Second Year			
Fall			
CIS 212	Computer Science III	4	
MATH 251	Calculus I	4	
Mathematics and computer science course		4	
General education course in social science		4	
	Credits	**16**	
Winter			
CIS 313	Intermediate Data Structures	4	
MATH 252	Calculus II	4	
Mathematics and computer science course		4	
General-education arts and letters or multicultural course		4	
	Credits	**16**	
Spring			
CIS 315	Intermediate Algorithms	4	
MATH 253	Calculus III	4	
Mathematics and computer science course		4	
General-education social science or multicultural course		4	
	Credits	**16**	
	Total Credits	**48**	

Course	Title	Credits	Milestones
Third Year			
Fall			
CIS 314	Computer Organization	4	
MATH 316 or MATH 347 or MATH 391	Fundamentals of Analysis I or Fundamentals of Number Theory I or Fundamentals of Abstract Algebra I	4	
General education course in arts and letters		4	
CIS 322 or CIS 420	Introduction to Software Engineering or Automata Theory	4	
	Credits	**16**	
Winter			
CIS 322 or CIS 330 or CIS 422	Introduction to Software Engineering or C/C++ and Unix or Software Methodology I	4	
MATH 341	Elementary Linear Algebra	4	
General education course in social science		4	
General education course in arts and letters		4	
	Credits	**16**	
Spring			
CIS 425	Principles of Programming Languages	4	
MATH 342	Elementary Linear Algebra	4	
General education course in social science		4	
Elective course		4	
	Credits	**16**	
	Total Credits	**48**	

Course	Title	Credits	Milestones
Fourth Year			
Fall			
Elective course with CIS subject code		4	
MATH 351 or MATH 461	Elementary Numerical Analysis I or Introduction to Mathematical Methods of Statistics I	4	
Elective course		4	
	Credits	**12**	
Winter			
Elective course with CIS subject code		4	
MATH 352 or MATH 462	Elementary Numerical Analysis II or Introduction to Mathematical Methods of Statistics II	4	
Elective course		4	
	Credits	**12**	
Spring			
WR 320 or WR 321	Scientific and Technical Writing or Business Communications	4	
Elective course with MATH subject code		4	
Elective course		4	
Elective course		4	
	Credits	**16**	
	Total Credits	**40**	

Bachelor of Science in Mathematics and Computer Science

Course	Title	Credits Milestones
First Year		
Fall		
MATH 112	Elementary Functions	4
CIS 122	Introduction to Programming and Problem Solving	4
WR 121	College Composition I	4
General education course in arts and letters		4
	Credits	**16**
Winter		
MATH 231	Elements of Discrete Mathematics I	4
CIS 210	Computer Science I	4
WR 122	College Composition II	4
General education course in social science		4
	Credits	**16**
Spring		
MATH 232	Elements of Discrete Mathematics II	4
CIS 211	Computer Science II	4
General education course in arts and letters		4
General education course in social science		4
	Credits	**16**
	Total Credits	**48**

Course	Title	Credits Milestones
Second Year		
Fall		
MATH 251	Calculus I	4
CIS 212	Computer Science III	4
General education course in arts and letters also satisfies a multicultural requirement		4
Mathematics and computer science requirement		4
	Credits	**16**
Winter		
CIS 313	Intermediate Data Structures	4
MATH 247 or MATH 252 or MATH 262	Calculus for the Biological Sciences II or Calculus II or Calculus with Theory II	4
Mathematics and computer science requirement		4
General education course in social science also satisfies a multicultural requirement		4
	Credits	**16**
Spring		
CIS 315	Intermediate Algorithms	4
MATH 253 or MATH 263	Calculus III or Calculus with Theory III	4
Mathematics and computer science requirement		4
General education course in social science		4
	Credits	**16**
	Total Credits	**48**

Course	Title	Credits Milestones
Third Year		
Fall		
CIS 314	Computer Organization	4
MATH 316 or MATH 347 or MATH 391	Fundamentals of Analysis I or Fundamentals of Number Theory I or Fundamentals of Abstract Algebra I	4
General education course in arts and letters		4
CIS 322 or CIS 420	Introduction to Software Engineering or Automata Theory	4
	Credits	**16**
Winter		
CIS 322 or CIS 330 or CIS 422	Introduction to Software Engineering or C/C++ and Unix or Software Methodology I	4
MATH 341	Elementary Linear Algebra	4
Elective courses		8
	Credits	**16**
Spring		
CIS 425	Principles of Programming Languages	4
MATH 342	Elementary Linear Algebra	4
Elective courses		8
	Credits	**16**
	Total Credits	**48**

Course	Title	Credits Milestones
Fourth Year		
Fall		
Elective course with a CIS subject code		4
MATH 351 or MATH 461	Elementary Numerical Analysis I or Introduction to Mathematical Methods of Statistics I	4
Elective course		4
	Credits	**12**
Winter		
Elective course with a CIS subject code		4
MATH 352 or MATH 462	Elementary Numerical Analysis II or Introduction to Mathematical Methods of Statistics II	4
Elective course		4
	Credits	**12**
Spring		
Elective course with MATH subject code		4
WR 320 or WR 321	Scientific and Technical Writing or Business Communications	4
Elective course		4
	Credits	**12**
	Total Credits	**36**