

Department of Computer Science

(College of Humanities, Arts and Sciences)

www.cs.uni.edu/

The Department of Computer Science offers the following undergraduate and program certificates. Specific requirements for these programs are listed within this Department of Computer Science section in the following order:

Undergraduate Majors (B.S.)

- Computer Science (p. 1)
- Networking and System Administration (p. 2)

Undergraduate Major (B.A.)

- Computer Science (p. 2)

Minor

- Computer Science (p. 3)
- Data Science (p. 3) (also listed in Department of Mathematics and Department of Physics)

Program Certificates

- Computer Science (p. 4)
- Computer Science Education (p. 4)

Notes:

1. Undergraduate students who have been admitted to the university provisionally because of non-satisfaction of the high school mathematics requirements may not enroll in any computer science credit course before this requirement has been met.
2. All courses counting toward a major or minor in the Department of Computer Science must be passed with a grade of C- or better.
3. Prerequisite courses in the Department of Computer Science must be passed with a grade of C before taking a subsequent course.
4. All majors in the Department of Computer Science require a project course (marked with asterisk in the degree statements). The course used to meet this requirement is to be taken in the area of specialization, i.e., an area in which at least three courses are taken.
5. All courses in a prerequisite chain to a course are considered regressive to it - students may not take them for credit after passing the later course. Additionally, CS 1120, CS 1130, CS 1160, CS ED 1310, and CS ED 1320 are regressive to CS 1520 and any course having it as prerequisite.
6. A student with a major in the Department of Computer Science cannot also receive a Computer Science minor.
7. A student with a major in the Department of Computer Science cannot also receive a Certificate in Computer Science.
8. A student with a minor in the Department of Computer Science cannot also receive a Certificate in Computer Science.

Bachelor of Science Degree Programs

Computer Science Major

The B.S. Computer Science major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Required

Computer Science:

| | | |
|--------------|---------------------------|---|
| CS 1410 | Computer Organization | 3 |
| CS 1510 | Introduction to Computing | 4 |
| CS 1520 | Data Structures | 4 |
| CS 1800 | Discrete Structures | 3 |
| CS 2530 | Intermediate Computing | 3 |
| CS 3730/5730 | Project Management | 1 |

Research:

| | | |
|---------|---|---|
| CS 4800 | Undergraduate Research in Computer Science (topic pre-approved by department) | 1 |
|---------|---|---|

Electives

Mathematics:

Select four from the following: 13

| | | |
|----------------|-------------------------------------|--|
| MATH 1420 | Calculus I ^{^,#} | |
| MATH 1421 | Calculus II [#] | |
| MATH 2500 | Linear Algebra for Applications | |
| MATH 3440/5440 | Numerical Analysis | |
| MATH 3530/5530 | Combinatorics | |
| MATH 3752/5752 | Introduction to Probability | |
| STAT 1772 | Introduction to Statistical Methods | |

Computer Science: 24

Eight courses including:

A specialty of three courses from the Foundations area

A specialty of three courses from one other area

One course from each of the remaining two areas

One of the specialty areas must include a project course (marked with an asterisk *)

Foundations:

| | | |
|--------------|---|--|
| CS 3530 | Design and Analysis of Algorithms | |
| CS 3540 | Programming Languages and Paradigms | |
| CS 3810/5810 | Theory of Computation | |
| CS 4550/5550 | Translation of Programming Languages * | |
| CS 4880/5880 | Topics in Computer Science [†] | |

Data and Applications:

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| | | |
|---|--|-----------|
| CS 3140/5140 | Database Systems | |
| CS 3150/5150 | Information Storage and Retrieval | |
| CS 3610/5610 | Artificial Intelligence # | |
| CS 3650/5650 | Computational Biology | |
| CS 4620/5620 | Intelligent Systems * | |
| CS 4880/5880 | Topics in Computer Science † | |
| Software Engineering: | | |
| CS 2720 | Software Engineering | |
| CS 3120/5120 | User Interface Design | |
| CS 3750/5750 | Software Verification and Validation | |
| CS 4740/5740 | Real-Time Embedded Systems *,# | |
| CS 4880/5880 | Topics in Computer Science † | |
| Systems: | | |
| CS 2420 | Computer Architecture and Parallel Programming | |
| CS 3430/5430 | Operating Systems | |
| CS 3470/5470 | Networking | |
| CS 4400/5400 | System Administration | |
| CS 4410/5410 | System Security * | |
| CS 4420 | Applied Systems Forensics * | |
| CS 4880/5880 | Topics in Computer Science † | |
| Electives: | | 6 |
| Two courses selected from among the Computer Science "area" courses and 2000-level or above courses meeting the Mathematics requirements. | | |
| Total Hours | | 62 |

- ^ MATH 1420 has prerequisite of MATH 1140, or MATH 1110 and MATH 1130, or equivalent.
- * A project course must be taken as one of the three in the specialty area.
- # MATH 1420, MATH 1421, and CS 4740/5740 are 4-hour courses. CS 3610/5610 is a 4-hour course if taken with lab.
- † CS 4880/5880 may be counted in a specialty area with department approval for the specific topic.

Networking and System Administration Major

The B.S. Networking and System Administration major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Required

| | | |
|-------------------|---------------------------|---|
| Mathematics: | | |
| MATH 1420 | Calculus I ^ | 4 |
| MATH 1421 | Calculus II | 4 |
| Computer Science: | | |
| CS 1410 | Computer Organization | 3 |
| CS 1510 | Introduction to Computing | 4 |
| CS 1520 | Data Structures | 4 |
| CS 1800 | Discrete Structures | 3 |

| | | |
|--------------|--|---|
| CS 3430/5430 | Operating Systems | 3 |
| CS 3470/5470 | Networking | 3 |
| CS 3730/5730 | Project Management | 1 |
| CS 4400/5400 | System Administration | 3 |
| CS 4410/5410 | System Security | 3 |
| CS 4420 | Applied Systems Forensics | 3 |
| CS 4800 | Undergraduate Research in Computer Science (1 hr.) | 1 |

Physics:

| | | |
|--|--|---|
| PHYSICS 4300/5300 | Introduction to Electronics | 4 |
| Choose ONE of the following sequences: | | |
| PHYSICS 1511 | General Physics I | |
| PHYSICS 1512 | General Physics II | |
| OR | | |
| PHYSICS 1701 | Physics I for Science and Engineering | |
| PHYSICS 1702 | Physics II for Science and Engineering | |

Electives **6**

| | | |
|--|------------------------------------|--|
| Computer Science: | | |
| from courses numbered 2420 or above, excluding CS 2880, CS 3110, and CS 3510 * | | |
| Technology: | | |
| TECH 1037 | Introduction to Circuits | |
| TECH 1039 | Circuits and Systems | |
| TECH 2041 | Introduction to Analog Electronics | |
| TECH 3152 | Advanced Analog Electronics | |
| TECH 3156 | Advanced Digital Electronics | |
| TECH 4103/5103 | Electronic Communications | |
| TECH 4104/5104 | Applied Digital Signal Processing | |

Total Hours **57**

- ^ Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

Bachelor of Arts Degree Programs Computer Science Major

The B.A. Computer Science major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Required

| | | |
|-------------------|---------------------------|----------|
| Computer Science: | | |
| CS 1410 | Computer Organization | 3 |
| CS 1510 | Introduction to Computing | 4 |
| CS 1520 | Data Structures | 4 |
| CS 1800 | Discrete Structures | 3 |
| CS 2530 | Intermediate Computing | 3 |
| CS 3730/5730 | Project Management | 1 |
| Electives | | 3 |

Mathematics:

Select two of the following: 6

| | |
|----------------|-------------------------------------|
| MATH 1420 | Calculus I ^{^,#} |
| MATH 1421 | Calculus II [#] |
| MATH 2500 | Linear Algebra for Applications |
| MATH 3440/5440 | Numerical Analysis |
| MATH 3530/5530 | Combinatorics |
| MATH 3752/5752 | Introduction to Probability |
| STAT 1772 | Introduction to Statistical Methods |

Computer Science: 18

Six courses including:

- Three courses from one specialty area
 - One course from each of the remaining three areas
 - Specialty area must include a project course (*)
- Foundations:

| | |
|--------------|---|
| CS 3530 | Design and Analysis of Algorithms |
| CS 3540 | Programming Languages and Paradigms |
| CS 3810/5810 | Theory of Computation |
| CS 4550/5550 | Translation of Programming Languages [*] |
| CS 4880/5880 | Topics in Computer Science [†] |

Data and Applications:

| | |
|--------------|---|
| CS 3140/5140 | Database Systems |
| CS 3150/5150 | Information Storage and Retrieval |
| CS 3610/5610 | Artificial Intelligence [#] |
| CS 3650/5650 | Computational Biology |
| CS 4620/5620 | Intelligent Systems [*] |
| CS 4880/5880 | Topics in Computer Science [†] |

Software Engineering:

| | |
|--------------|---|
| CS 2720 | Software Engineering |
| CS 3120/5120 | User Interface Design |
| CS 3750/5750 | Software Verification and Validation |
| CS 4740/5740 | Real-Time Embedded Systems ^{*,#} |
| CS 4880/5880 | Topics in Computer Science [†] |

Systems:

| | |
|--------------|--|
| CS 2420 | Computer Architecture and Parallel Programming |
| CS 3430/5430 | Operating Systems |
| CS 3470/5470 | Networking |
| CS 4400/5400 | System Administration |
| CS 4410/5410 | System Security [*] |
| CS 4420 | Applied Systems Forensics [*] |
| CS 4880/5880 | Topics in Computer Science [†] |

Electives 3

One course selected from among the Computer Science "area" courses and 2000-level or above courses meeting the Mathematics requirement.

Total Hours 45

- [^] MATH 1420 has prerequisite of MATH 1140, or MATH 1110 and MATH 1130, or equivalent.
- ^{*} A project course must be taken as one of the three in the specialty area.
- [#] MATH 1420, MATH 1421, and CS 4740/5740 are 4-hour courses. CS 3610/5610 is a 4-hour course if taken with lab.
- [†] CS 4880 may be counted in a specialty area with department approval for the specific topic.

Minors

Computer Science Minor

A student with a major in the Department of Computer Science cannot also receive a Computer Science minor.

Required

| | | |
|-------------------|---------------------------|---|
| Computer Science: | | |
| CS 1410 | Computer Organization | 3 |
| CS 1510 | Introduction to Computing | 4 |
| CS 1520 | Data Structures | 4 |
| CS 1800 | Discrete Structures | 3 |
| CS 2530 | Intermediate Computing | 3 |

| | | |
|--|--|---|
| Electives | | |
| any Computer Science course that counts toward the Computer Science B.A. major | | 9 |

Total Hours 26

Data Science Minor

The Data Science minor is an interdisciplinary program that integrates computer programming, machine learning, statistics, predictive modeling and visualization to provide students with broad based skills for extracting gainful information from data that originate from a variety of sources. A final project (ideally with corporate or non-profit partnerships) will ensure that students employ their skills to solve a real-world problem.

| | | |
|----------------|-------------------------------------|---|
| Statistics: | | |
| STAT 1772 | Introduction to Statistical Methods | 3 |
| STAT 4784/5784 | Introduction to Machine Learning | 3 |

| | | |
|-------------------|---|-----|
| Computer Science: | | |
| CS 1510 | Introduction to Computing | 4 |
| CS 2150 | Computing for Data Science | 3-7 |
| or | | |
| CS 1520 & CS 1800 | Data Structures and Discrete Structures | |
| CS 3140/5140 | Database Systems | 3 |

| | | |
|-------------------|---|---|
| Physics: | | |
| PHYSICS 4160/5160 | Data Visualization, Modeling and Simulation | 3 |

| | | |
|-------------------------------|--|-----|
| Required Data Science Project | | 2-3 |
|-------------------------------|--|-----|

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| | | |
|--------------------|--|--------------|
| CS 4800 | Undergraduate Research in Computer Science | |
| or MATH 4990 | Undergraduate Research in Mathematics | |
| or PHYSICS 3000 | Undergraduate Research in Physics | |
| Total Hours | | 21-26 |

Program Certificates

The University of Northern Iowa makes available, in addition to traditional programs, the opportunity for students to earn program certificates. Program certificates provide an alternative to programs leading to a degree, a major, or a minor; they certify that an individual has completed a program approved by the university. For information on the following certificates, contact the Department of Computer Science or the Office of the Registrar, which serves as the centralized registry.

Certificate in Computer Science

A student with a major in the Department of Computer Science cannot also receive a Certificate in Computer Science.

Required

| | | |
|--|---|--------------|
| Computer Science: | | |
| CS 1520 | Data Structures | 4 |
| one course from the following: | | 3-4 |
| CS 1120 | Media Computation | |
| CS 1130 | Visual BASIC Programming | |
| CS 1160 | C/C++ Programming | |
| CS ED 1310 | Programming Environments for Elementary Education | |
| CS ED 1320 | Fundamentals of Programming | |
| CS 1510 | Introduction to Computing | |
| Two courses, from ONE of the following groups: | | 6 |
| Group 1: | | |
| CS 1800 | Discrete Structures | |
| CS 2530 | Intermediate Computing | |
| or Group 2: | | |
| CS 1410 | Computer Organization | |
| CS 2420 | Computer Architecture and Parallel Programming | |
| Total Hours | | 13-14 |

Certificate in Computer Science Education

This Computer Science Education certificate is appropriate for students interested in adding experience in computer science to a teaching license. It is for students with a teaching major in a discipline outside of computer science. It consists of the coursework approved by the Iowa Board of Educational Examiners to qualify for the addition of the state's 5-12 Computer Science endorsement #278 on a state teaching license.

Required:

| | | |
|-----------------|---|---|
| CS ED 1320 | Fundamentals of Programming | 3 |
| CS ED 2310 | Foundational Concepts in Computer Science | 3 |
| CS ED 3310/5310 | Teaching and Learning Programming | 3 |

| | | |
|--------------------|---------------------------------------|-----------|
| CS ED 3320/5320 | Data Structures and Algorithms | 3 |
| CS ED 4330/5330 | Methods for Teaching Computer Science | 3 |
| Total Hours | | 15 |

Computer Science, B.S.

Goal 1: Students will be able to effectively communicate computing information to colleagues and the public.

Outcome 1: Students will be able to prepare and produce written communications using standard computing style and format.

Outcome 2: Students will be able to prepare and deliver an oral presentation on computing topics.

Goal 2: Students will be able to apply computing knowledge to problems involving data and process.

Outcome 3: Students will demonstrate proficient knowledge and application of computing content.

Goal 3: Students will be able to think critically about computing problems.

Outcome 4: Students will be able to specify a computing module's interface and design its implementation.

Outcome 5: Students will be conduct a research or development project in which they specify a computing problem, investigate possible solutions, and implement a working system.

Goal 4: Students will demonstrate the skills needed to work on a team successfully.

Outcome 6: Students will work on a team to analyze a computing problem and implement its solution.

Networking and System Administration, B.S.

Goal 1: Students will be able to effectively communicate networking and computer system information to colleagues and the public.

Outcome 1: Students will be able to prepare and produce written communications using standard computing style and format.

Outcome 2: Students will be able to prepare and deliver an oral presentation on networking and computer system topics.

Goal 2: Students will be able to apply networking and computer system knowledge to problems involving data and process.

Outcome 3: Students will demonstrate proficient knowledge and application of networking and computer system content.

Goal 3: Students will be able to think critically about networking and computer system problems.

Outcome 4: Students will be able to specify a computing systems's interface and design its implementation.

Outcome 5: Students will be conduct a research or development project in which they specify a networking or computer system problem, investigate possible solutions, and implement a working system.

Goal 4: Students will demonstrate the skills needed to work on a team successfully.

Outcome 6: Students will work on a team to analyze a networking or computer system problem and implement its solution.

Computer Science, B.A.

Goal 1: Students will be able to effectively communicate computing information to colleagues and the public.

Outcome 1: Students will be able to prepare and produce written communications using standard computing style and format.

Outcome 2: Students will be able to prepare and deliver an oral presentation on computing topics.

Goal 2: Students will be able to apply computing knowledge to problems involving data and process.

Outcome 3: Students will demonstrate proficient knowledge and application of computing content.

Goal 3: Students will be able to think critically about computing problems.

Outcome 4: Students will be able to specify a computing module's interface and design its implementation.

Goal 4: Students will demonstrate the skills needed to work on a team successfully.

Outcome 5: Students will work on a team to analyze a computing problem and implement its solution.