

# Computer Science and Design, BS (Boston)

The combined major in Computer Science and Design integrates a strong programming foundation with the practice of understanding humans, their surrounding contexts and systems, and designing alternative futures. Students focus on the fundamentals of program design, software development, computer organization, systems and networks, theories of computation, principles of languages, and advanced algorithms and data for developing digital interfaces and applications that allow audiences to take an active role to achieve meaningful goals.

The program also offers students a choice of a design option: Experience Design, a holistic and integrative approach that focuses on the quality of the human experience in concrete situations; Graphic Design, the integration of text and image to communicate critical concepts; Information Design, the visualization and physicalization of data to enhance human understanding of complex knowledge, or Interaction Design: the creation navigable interfaces and systems that allow audiences to take an active role to achieve meaningful goals.

## Program Requirements

Complete all courses listed below unless otherwise indicated. Also complete any corequisite labs, recitations, clinicals, or tools courses where specified and complete any additional courses needed beyond specific college and major requirements to satisfy graduation credit requirements.

## Universitywide Requirements

All undergraduate students are required to complete the Universitywide Requirements (<https://catalog.northeastern.edu/undergraduate/university-academics/university-wide-requirements/>).

## NUpath Requirements

All undergraduate students are required to complete the NUpath Requirements (<https://catalog.northeastern.edu/undergraduate/university-academics/nupath/>).

## Computer Science Courses

| Code                                                                                                                                                                                                                                                               | Title                                                                           | Hours |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------|
| <b>Computer Science Overview</b>                                                                                                                                                                                                                                   |                                                                                 |       |
| Must be taken in alignment with your home college:                                                                                                                                                                                                                 |                                                                                 |       |
| CS 1200<br>or ARTF 1000                                                                                                                                                                                                                                            | First Year Seminar<br>Art and Design at Northeastern                            | 1     |
| CS 1210<br>or EEAM 2000                                                                                                                                                                                                                                            | Professional Development for Khoury Co-op<br>Professional Development for Co-op | 1     |
| <b>Computer Science Fundamental Courses</b>                                                                                                                                                                                                                        |                                                                                 |       |
| All students can take a self-assessment to attempt to place out of CS 2000 and CS 2001. Students who place out of CS 2000 and CS 2001 will instead substitute 4-5 SH of CS, CY, or DS coursework at the 3000 level or higher not otherwise required in the degree. |                                                                                 |       |
| CS 1800<br>and CS 1802                                                                                                                                                                                                                                             | Discrete Structures<br>and Seminar for CS 1800                                  | 5     |
| CS 2000<br>and CS 2001                                                                                                                                                                                                                                             | Introduction to Program Design and Implementation<br>and Lab for CS 2000        | 5     |
| CS 2100<br>and CS 2101                                                                                                                                                                                                                                             | Program Design and Implementation 1<br>and Lab for CS 2100                      | 5     |
| <b>Computer Science Required Courses</b>                                                                                                                                                                                                                           |                                                                                 |       |
| CS 2484                                                                                                                                                                                                                                                            | Principles of Human-Computer Interaction                                        | 4     |
| CS 3000                                                                                                                                                                                                                                                            | Algorithms and Data                                                             | 4     |
| CS 3100<br>and CS 3101                                                                                                                                                                                                                                             | Program Design and Implementation 2<br>and Lab for CS 3100                      | 5     |
| CS 4530<br>or CS 4535                                                                                                                                                                                                                                              | Fundamentals of Software Engineering<br>Professional Practicum Capstone         | 4     |
| <b>Khoury Approved Electives</b>                                                                                                                                                                                                                                   |                                                                                 |       |
| With advisor approval, directed study, research, project study, and appropriate graduate-level courses may also be taken as upper-division electives.                                                                                                              |                                                                                 |       |
| Complete 8 semester hours from within the following options:                                                                                                                                                                                                       |                                                                                 | 8     |
| CS 2500 or higher, except CS 5010                                                                                                                                                                                                                                  |                                                                                 |       |
| CY 2000 or higher, except CY 4930                                                                                                                                                                                                                                  |                                                                                 |       |

|                                   |                                                                   |  |
|-----------------------------------|-------------------------------------------------------------------|--|
| DS 2500 or higher, except DS 4900 |                                                                   |  |
| MKTG 4606                         | Digital, Analytics, Technology, and Automation Research Practicum |  |

## Design Requirements

| Code                                                                                                                                                                                                       | Title                                                                                              | Hours |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------|
| <b>Art + Design Fundamentals Required</b>                                                                                                                                                                  |                                                                                                    |       |
| ARTF 1220                                                                                                                                                                                                  | Elements of Visual Composition (with optional ARTF 1221)                                           | 2     |
| <b>Art + Design Fundamentals Electives</b>                                                                                                                                                                 |                                                                                                    |       |
| Complete 6 semester hours of the following:                                                                                                                                                                |                                                                                                    | 6     |
| ARTF 1200                                                                                                                                                                                                  | Representational Drawing                                                                           |       |
| ARTF 1210                                                                                                                                                                                                  | Abstract Drawing                                                                                   |       |
| ARTF 1230<br>and ARTF 1231                                                                                                                                                                                 | Making with Form and Materials<br>and Making with Form and Materials Tools                         |       |
| ARTF 1240<br>and ARTF 1241                                                                                                                                                                                 | Making with Video, Sound, and Animation<br>and Making with Video, Sound, and Animation Tools       |       |
| ARTF 1250<br>and ARTF 1251                                                                                                                                                                                 | Designing Interactive Experiences<br>and Designing Interactive Experiences Tools                   |       |
| <b>Design Required</b>                                                                                                                                                                                     |                                                                                                    |       |
| ARTG 1001<br>and ARTG 1002                                                                                                                                                                                 | Design Perspectives: An Introduction to Design in the World<br>and Seminar for Design Perspectives | 4     |
| ARTG 1270<br>and ARTG 1271                                                                                                                                                                                 | Design: Process + Practices<br>and Studio for Design: Process + Practices                          | 4     |
| ARTG 1290<br>and ARTG 1291                                                                                                                                                                                 | Typographic Systems<br>and Studio for Typographic Systems                                          | 4     |
| <b>Design Elective</b>                                                                                                                                                                                     |                                                                                                    |       |
| Complete 4 semester hours of ARTG courses, as long as prerequisites have been met and that is not used to fulfill other requirements of the program. ARTG 2262 and ARTG 2263 are recommended. <sup>1</sup> |                                                                                                    | 4     |
| <b>Art + Design History Elective</b>                                                                                                                                                                       |                                                                                                    |       |
| Complete 4 semester hours of ARTH courses. ARTH 1001 Visual Intelligence and ARTH 1002 Seminar in Visual Intelligence is recommended to fulfill this requirement                                           |                                                                                                    | 4     |
| <b>Art + Design Elective</b>                                                                                                                                                                               |                                                                                                    |       |
| Complete 4 semester hours of ARTD, ARTE, ARTF, ARTG, ARTH, ARTS, or GAME courses as long as prerequisites have been met.                                                                                   |                                                                                                    | 4     |
| <b>Degree Capstone Project</b>                                                                                                                                                                             |                                                                                                    |       |
| ARTG 4550                                                                                                                                                                                                  | Design Degree Project                                                                              | 4     |

<sup>1</sup> In place of Prototyping with Code (ARTG 2262) and Lab for ARTG 2262 (ARTG 2263), Visualization Technologies 1: Fundamentals (ARTG 5330) is recommended for students considering the Plus One pathway to a graduate program in Information Design and Data Visualization.

## Design Option

| Code                                   | Title                                             | Hours |
|----------------------------------------|---------------------------------------------------|-------|
| Complete one of the following options: |                                                   | 8     |
| <b>Creative Fabrication</b>            |                                                   |       |
| ARTG 2810                              | Creative Fabrication Design Principles            |       |
| ARTG 3810                              | Topics in Creative Fabrication Inquiry            |       |
| <b>Experience Design Option</b>        |                                                   |       |
| ARTG 3462                              | Experience Design Principles                      |       |
| ARTG 3464                              | Topics In Experience Design Inquiry               |       |
| <b>Graphic Design Option</b>           |                                                   |       |
| ARTG 2252                              | Graphic Design Principles                         |       |
| ARTG 3452                              | Topics In Graphic Design Inquiry                  |       |
| <b>Information Design Option</b>       |                                                   |       |
| ARTG 2242                              | Information Design Principles                     |       |
| ARTG 3444                              | Topics in Information Design Inquiry <sup>2</sup> |       |
| <b>Interaction Design Option</b>       |                                                   |       |

|           |                                                         |
|-----------|---------------------------------------------------------|
| ARTG 2400 | Interaction Design Principles (with optional ARTG 2401) |
|-----------|---------------------------------------------------------|

|           |                                      |
|-----------|--------------------------------------|
| ARTG 3400 | Topics In Interaction Design Inquiry |
|-----------|--------------------------------------|

<sup>2</sup> Instead of ARTG 3444, ARTG 5100 is recommended for students considering the Plus One in Information Design and Data Visualization.

## Degree-Focused Electives

| Code                                                | Title | Hours |
|-----------------------------------------------------|-------|-------|
| Complete 8 Semester Hours from the following lists: |       | 8     |

### Art + Design

Complete any ARTG course as long as prerequisites have been met. If ARTG 5000 (or any other topics course in the subject listed) is completed more than once, the additional completions may be allowed toward the electives.

### Psychology

|           |                           |
|-----------|---------------------------|
| PSYC 1101 | Foundations of Psychology |
|-----------|---------------------------|

|           |                          |
|-----------|--------------------------|
| PSYC 3452 | Sensation and Perception |
|-----------|--------------------------|

|           |                        |
|-----------|------------------------|
| PSYC 3464 | Psychology of Language |
|-----------|------------------------|

|           |           |
|-----------|-----------|
| PSYC 3466 | Cognition |
|-----------|-----------|

### Computer Science

|         |                    |
|---------|--------------------|
| CS 2386 | Game Programming 1 |
|---------|--------------------|

|         |                           |
|---------|---------------------------|
| CS 3200 | Introduction to Databases |
|---------|---------------------------|

|         |                    |
|---------|--------------------|
| CS 3520 | Programming in C++ |
|---------|--------------------|

|         |                  |
|---------|------------------|
| CS 3650 | Computer Systems |
|---------|------------------|

|         |                       |
|---------|-----------------------|
| CS 3800 | Theory of Computation |
|---------|-----------------------|

|         |                         |
|---------|-------------------------|
| CS 4100 | Artificial Intelligence |
|---------|-------------------------|

|         |                              |
|---------|------------------------------|
| CS 4150 | Game Artificial Intelligence |
|---------|------------------------------|

|         |                   |
|---------|-------------------|
| CS 4300 | Computer Graphics |
|---------|-------------------|

|         |                       |
|---------|-----------------------|
| CS 4400 | Programming Languages |
|---------|-----------------------|

|         |                                |
|---------|--------------------------------|
| CS 4520 | Mobile Application Development |
|---------|--------------------------------|

|         |                 |
|---------|-----------------|
| CS 4550 | Web Development |
|---------|-----------------|

|         |                      |
|---------|----------------------|
| CS 4700 | Network Fundamentals |
|---------|----------------------|

|         |                     |
|---------|---------------------|
| CS 4730 | Distributed Systems |
|---------|---------------------|

|         |                       |
|---------|-----------------------|
| CS 4850 | Building Game Engines |
|---------|-----------------------|

|         |          |
|---------|----------|
| CS 4991 | Research |
|---------|----------|

|         |                |
|---------|----------------|
| CS 4992 | Directed Study |
|---------|----------------|

|         |                             |
|---------|-----------------------------|
| DS 3000 | Foundations of Data Science |
|---------|-----------------------------|

|         |                                            |
|---------|--------------------------------------------|
| DS 4200 | Information Presentation and Visualization |
|---------|--------------------------------------------|

|         |                                               |
|---------|-----------------------------------------------|
| DS 4300 | Large-Scale Information Storage and Retrieval |
|---------|-----------------------------------------------|

|         |                                    |
|---------|------------------------------------|
| DS 4400 | Machine Learning and Data Mining 1 |
|---------|------------------------------------|

|         |                                    |
|---------|------------------------------------|
| DS 4420 | Machine Learning and Data Mining 2 |
|---------|------------------------------------|

## Integrative Requirement

| Code                                                                                       | Title | Hours |
|--------------------------------------------------------------------------------------------|-------|-------|
| The following courses are used in the major but also count as the integrative requirement: |       |       |

|           |                       |
|-----------|-----------------------|
| ARTG 4550 | Design Degree Project |
|-----------|-----------------------|

|         |                                          |
|---------|------------------------------------------|
| CS 2484 | Principles of Human-Computer Interaction |
|---------|------------------------------------------|

## Supporting Course

| Code                               | Title | Hours |
|------------------------------------|-------|-------|
| <b>Computing and Social Issues</b> |       |       |

|                                |  |   |
|--------------------------------|--|---|
| Complete one of the following: |  | 4 |
|--------------------------------|--|---|

|           |                                         |
|-----------|-----------------------------------------|
| AFCS 2600 | Issues in Race, Science, and Technology |
|-----------|-----------------------------------------|

|         |                                                              |
|---------|--------------------------------------------------------------|
| CY 4170 | The Law, Ethics, and Policy of Data and Digital Technologies |
|---------|--------------------------------------------------------------|

|         |                                               |
|---------|-----------------------------------------------|
| CY 5240 | Cyberlaw: Privacy, Ethics, and Digital Rights |
|---------|-----------------------------------------------|

|         |                              |
|---------|------------------------------|
| DS 1300 | Knowledge in a Digital World |
|---------|------------------------------|

|              |                              |
|--------------|------------------------------|
| or PHIL 1300 | Knowledge in a Digital World |
|--------------|------------------------------|

|           |                                                                 |
|-----------|-----------------------------------------------------------------|
| HIST 2220 | History of Technology                                           |
| INSH 2102 | Bostonography: The City through Data, Texts, Maps, and Networks |
| JRNL 3700 | Data Storytelling                                               |
| PHIL 1145 | Technology and Human Values                                     |
| SOCL 1280 | The Twenty-First-Century Workplace                              |
| SOCL 2485 | Environment, Technology, and Society                            |
| SOCL 4528 | Technology and Society                                          |

Computer Science Writing Requirement

| Code                                       | Title                                                 | Hours |
|--------------------------------------------|-------------------------------------------------------|-------|
| <b>College Writing</b>                     |                                                       |       |
| ENGW 1111                                  | First-Year Writing                                    | 4     |
| <b>Advanced Writing in the Disciplines</b> |                                                       |       |
| ENGW 3302                                  | Advanced Writing in the Technical Professions         | 4     |
| or ENGW 3314                               | Advanced Writing in the Arts, Media, and Design       |       |
| or ENGW 3315                               | Interdisciplinary Advanced Writing in the Disciplines |       |

Required General Electives

| Code                                             | Title | Hours |
|--------------------------------------------------|-------|-------|
| Complete 24 semester hours of general electives. |       | 24    |

NUpath Requirements Satisfied

- Engaging with the Natural and Designed World
- Exploring Creative Expression and Innovation
- Conducting Formal and Quantitative Reasoning
- Analyzing and Using Data
- Writing in the First Year
- Advanced Writing in the Disciplines
- Writing-Intensive in the Major
- Demonstrating Thought and Action in a Capstone

Integrating Knowledge and Skills Through Experience is satisfied through co-op.

Khoury College GPA Requirement

Minimum cumulative 2.000 GPA required in all CS, CY, DS and IS courses

Computer Science and Design Major Credit Requirement

96 SH are required in the major.

Program Requirement

129 total semester hours required

Plan of Study

Sample Plans of Study

FOUR YEARS, TWO CO-OPS IN SPRING/SUMMER FIRST HALF

| Year 1                                  |       |                                  |       |                                         |       |            |       |
|-----------------------------------------|-------|----------------------------------|-------|-----------------------------------------|-------|------------|-------|
| Fall                                    | Hours | Spring                           | Hours | Summer 1                                | Hours | Summer 2   | Hours |
| ARTG 1001<br>and ARTG 1002              |       | 4 ARTG 1270<br>and ARTG 1271     |       | 4 CS 3100<br>and CS 3101                |       | 5 Vacation |       |
| ARTF 1220 (with optional<br>ARTF 1121)  | 2     | ARTG 1290<br>and ARTG 1291       | 4     | Art + Design Fundamentals<br>Elective 2 | 2     |            |       |
| Art + Design Fundamentals<br>Elective 1 | 2     | CS 2100<br>and CS 2101           | 5     | Art + Design Fundamentals<br>Elective 3 | 2     |            |       |
| CS 1200 or ARTF 1000                    | 1     | ENGW 1111                        | 4     |                                         |       |            |       |
| CS 1800<br>and CS 1802                  | 5     | EEAM 2000 (for CAMD<br>Students) | 1     |                                         |       |            |       |

|                                  |       |                             |  |       |           |   |       |                    |       |
|----------------------------------|-------|-----------------------------|--|-------|-----------|---|-------|--------------------|-------|
| CS 2000<br>and CS 2001           |       | 5                           |  |       |           |   |       |                    |       |
|                                  |       | 19                          |  | 18    |           | 9 |       | 0                  |       |
| Year 2                           |       |                             |  |       |           |   |       |                    |       |
| Fall                             | Hours | Spring                      |  | Hours | Summer 1  |   | Hours | Summer 2           | Hours |
| ARTG 2262<br>and ARTG 2263       |       | 4 Co-op                     |  |       | 0 Co-op   |   |       | 0 General Elective | 4     |
| CS 1210 (For Khoury<br>Students) |       | 1                           |  |       |           |   |       | General Elective   | 4     |
| CS 3000                          |       | 4                           |  |       |           |   |       |                    |       |
| Design Option level 1            |       | 4                           |  |       |           |   |       |                    |       |
| Degree-focused elective 1        |       | 4                           |  |       |           |   |       |                    |       |
|                                  |       | 17                          |  | 0     |           | 0 |       | 8                  |       |
| Year 3                           |       |                             |  |       |           |   |       |                    |       |
| Fall                             | Hours | Spring                      |  | Hours | Summer 1  |   | Hours | Summer 2           | Hours |
| CS 2484                          |       | 4 Co-op                     |  |       | 0 Co-op   |   |       | 0 General Elective | 4     |
| Art+Design History elective      |       | 4                           |  |       | ENGW 3302 |   |       | 4 General Elective | 4     |
| Computing and social<br>issues   |       | 4                           |  |       |           |   |       |                    |       |
| Design Option level 2            |       | 4                           |  |       |           |   |       |                    |       |
|                                  |       | 16                          |  | 0     |           | 4 |       | 8                  |       |
| Year 4                           |       |                             |  |       |           |   |       |                    |       |
| Fall                             | Hours | Spring                      |  | Hours |           |   |       |                    |       |
| CS 4530 or 4535                  |       | 4 ARTG 4550                 |  |       | 4         |   |       |                    |       |
| Art + Design Elective            |       | 4 Khoury Elective 1         |  |       | 4         |   |       |                    |       |
| General Elective                 |       | 4 Khoury Elective 2         |  |       | 4         |   |       |                    |       |
| General Elective                 |       | 4 Degree-focused elective 2 |  |       | 4         |   |       |                    |       |
|                                  |       | 16                          |  | 16    |           |   |       |                    |       |

Total Hours: 131

**FOUR YEARS, TWO CO-OPS IN SUMMER SECOND HALF/FALL**

| Year 1                                  |       |                                    |       |                                           |       |            |       |  |  |
|-----------------------------------------|-------|------------------------------------|-------|-------------------------------------------|-------|------------|-------|--|--|
| Fall                                    | Hours | Spring                             | Hours | Summer 1                                  | Hours | Summer 2   | Hours |  |  |
| ARTG 1001<br>and ARTG 1002              |       | 4 ARTG 1270<br>and ARTG 1271       |       | 4 CS 3100<br>and CS 3101                  |       | 5 Vacation |       |  |  |
| ARTF 1220 (with optional<br>ARTF 1221)  |       | 2 ARTG 1290<br>and ARTG 1291       |       | 4 Art + Design Fundamentals<br>Elective 2 |       | 2          |       |  |  |
| Art + Design Fundamentals<br>Elective 1 |       | 2 CS 2100<br>and CS 2101           |       | 5 Art + Design Fundamentals<br>Elective 3 |       | 2          |       |  |  |
| CS 1200 or ARTF 1000                    |       | 1 ENGW 1111                        |       | 4                                         |       |            |       |  |  |
| CS 1800<br>and CS 1802                  |       | 5 EEAM 2000 (For CAMD<br>Students) |       | 1                                         |       |            |       |  |  |
| CS 2000<br>and CS 2001                  |       | 5                                  |       |                                           |       |            |       |  |  |
|                                         | 19    |                                    | 18    |                                           | 9     |            | 0     |  |  |
| Year 2                                  |       |                                    |       |                                           |       |            |       |  |  |
| Fall                                    | Hours | Spring                             | Hours | Summer 1                                  | Hours | Summer 2   | Hours |  |  |
| ARTG 2262<br>and ARTG 2263              |       | 4 CS 1210 (For Khoury<br>Students) |       | 1 General Elective                        |       | 4 Co-op    | 0     |  |  |
| CS 3000                                 |       | 4 CS 2484                          |       | 4 General Elective                        |       | 4          |       |  |  |
| Design Option level 1                   |       | 4 Art + Design History<br>Elective |       | 4                                         |       |            |       |  |  |
| Degree-focused elective 1               |       | 4 Computing and Social<br>Issues   |       | 4                                         |       |            |       |  |  |

|                  |       |                           |       |                  |       |           |       |
|------------------|-------|---------------------------|-------|------------------|-------|-----------|-------|
|                  |       | Design Option level 2     |       | 4                |       |           |       |
|                  |       | 16                        |       | 17               |       | 8         |       |
| Year 3           |       |                           |       |                  |       | 0         |       |
| Fall             | Hours | Spring                    | Hours | Summer 1         | Hours | Summer 2  | Hours |
| Co-op            | 0     | CS 4530 or 4535           | 4     | General Elective | 4     | Co-op     | 0     |
|                  |       | Art + Design Elective     | 4     | General Elective | 4     | ENGW 3302 | 4     |
|                  |       | General Elective          | 4     |                  |       |           |       |
|                  |       | General Elective          | 4     |                  |       |           |       |
|                  |       | 0                         |       | 16               |       | 8         |       |
| Year 4           |       |                           |       |                  |       | 4         |       |
| Fall             | Hours | Spring                    | Hours |                  |       |           |       |
| Co-op            | 0     | ARTG 4550                 | 4     |                  |       |           |       |
|                  |       | Khoury Elective 1         | 4     |                  |       |           |       |
|                  |       | Khoury Elective 2         | 4     |                  |       |           |       |
|                  |       | Degree-focused elective 2 | 4     |                  |       |           |       |
|                  |       | 0                         |       | 16               |       |           |       |
| Total Hours: 131 |       |                           |       |                  |       |           |       |