School of Computer Science

Tom Mitchell, Interim Dean
Guy Blelloch, Associate Dean for Undergraduate Education
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Location: GHC 4115
www.cs.cmu.edu/undergraduate-programs

Carnegie Mellon founded one of the first Computer Science departments in the world in 1965. As research and teaching in computing grew at a tremendous pace at Carnegie Mellon, the university formed the School of Computer Science at the end of 1988. Carnegie Mellon was one of the first universities to elevate Computer Science into its own academic college at the same level as the Mellon College of Science and the College of Engineering. Today, the School of Computer Science consists of seven departments and institutes, including the Computer Science Department that started it all, along with the Human-Computer Interaction Institute, the Institute for Software Research, the Computational Biology Department, the Language Technologies Institute, the Machine Learning Department, and the Robotics Institute. Together, these units make the School of Computer Science a world leader in research and education. Recently, the School of Computer Science launched two new undergraduate majors: Computational Biology and Artificial Intelligence. These new majors, along with the highly-ranked Computer Science major, give students in the School of Computer Science distinct paths in the field of computing with ample opportunities in industry and advanced research.

The School of Computer Science offers the following majors and minors:

- B.S. in Artificial Intelligence
- B.S. in Computational Biology
- B.S. in Computer Science
- Bachelor's in Computer Science and Art (joint with the College of Fine Arts)
- Additional major in Computational Biology
- Additional major in Computer Science
- Additional major in Human-Computer Interaction
- Additional major in Robotics
- Minor in Computer Science
- Minor in Computational Biology
- Minor in Human-Computer Interaction
- Minor in Language Technologies
- Minor in Machine Learning
- Minor in Neural Computation
- Minor in Robotics
- Minor in Software Engineering

Information for these majors and minors can be found through the navigation menu or through the links below:

- Artificial Intelligence (http://coursecatalog.web.cmu.edu/schools-colleges/schoolofcomputerscience/artificialintelligence) (B.S. degree)
- Computational Biology (http://coursecatalog.web.cmu.edu/schools-colleges/schoolofcomputerscience/undergraduatecomputationalbiology) (B.S. degree, additional major, minor)
- Computer Science (http://coursecatalog.web.cmu.edu/schools-colleges/schoolofcomputerscience/undergraduatecomputerscience) (B.S. degree, additional major, minor)
- SCS additional majors and minors (http://coursecatalog.web.cmu.edu/schools-colleges/schoolofcomputerscience/addmajorsminors)

Students who apply to, and are directly admitted into, the School of Computer Science can choose between three primary majors: Artificial Intelligence, Computational Biology or Computer Science. Students admitted into the School of Computer Science and the College of Fine Arts are also given the option to pursue a joint major in Computer Science and Art. Suitable prepared students from other Carnegie Mellon colleges are eligible to apply for internal transfer to the School of Computer Science (for Computational Biology or Computer Science) and will be considered for transfer if grades in specific requirements are sufficiently high and space is available. Computation-oriented programs are also available within the Mellon College of Science, the Dietrich College of Humanities and Social Sciences, the College of Engineering and the College of Fine Arts.

Policies & Procedures

Academic Standards and Actions

Grading Practices

Grades given to record academic performance in SCS are detailed under Grading Practices at Undergraduate Academic Regulations (http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateacademicregulations).

Dean's List WITH HIGH HONORS

SCS recognizes each semester those undergraduates who have earned outstanding academic records by naming them to the Dean's List with High Honors. The criterion for such recognition is a quality point average of at least 3.75 while completing a minimum of 36 factorable units and earning no incomplete grades.

Academic Actions

In the first year, quality point averages below 1.75 in either semester invoke an academic action. For all subsequent semesters an academic action will be taken if the semester quality point average or the cumulative quality point average (excluding the first year) is below 2.00.

Probation: The action of probation will be taken in the following cases based on QPA:

1. One semester of the first year is below 1.75 QPA;
2. The semester QPA of a student in good standing beyond the first year falls below 2.00.

The term of probation is one semester as a full-time student. First year students are no longer on probation at the end of the second semester if the second semester’s QPA is 1.75 or above. Students in the third or subsequent semester of study are no longer on probation at the end of one semester if the semester QPA and cumulative QPA (excluding the first year) are 2.00 or above.

Probation Continued: A student who has had one semester on probation and is not yet meeting minimum requirements but whose record indicates that the standards are likely to be met at the end of the next semester of study is occasionally continued on probation. This action is normally taken only when a student’s semester QPA is above 2.0 but their cumulative QPA is not yet above 2.0.

Suspension: A student who does not meet minimum standards based on QPA at the end of one semester of probation will be suspended:

1. A first year student will be suspended if the QPA from each semester is below 1.75.
2. A student on probation in the third or subsequent semester of study will be suspended if the semester QPA is below 2.00.

The minimum period of suspension is one academic year (two non-summer semesters). At the end of that period a student may return to campus (on probation) by:

1. completing a Return from Leave form from the HUB, and
2. submitting an additional written statement to the SCS Assistant Dean for Undergraduate Education, minimum one page, that outlines what the student did while on leave to address the issues that led to the suspension and that would indicate future success on return, and
3. (optional) submitting up to two letters of support from individuals supporting the student’s return, and
4. written approval from the student's academic advisor and the Assistant Dean for Undergraduate Education, in consultation with the Office of Student Affairs and the Office of International Education as appropriate.

Students who have been suspended or have withdrawn are required to absent themselves from the campus (including residence halls and Greek houses) within a maximum of two days after the action and to remain off the campus for the duration of the time specified. This action includes debarment from part-time or summer courses at the university for the duration of the period of the action. Although suspended students may not hold student jobs, students on academic suspension may, under certain circumstances, have a non-student job with the university. Students on disciplinary or administrative suspension may not.
Drop: This is a permanent severance. Students who have been suspended and who fail to meet minimum standards in the semester that they return to school will be dropped.

Students who have been dropped are required to absent themselves from the campus (including residence halls and Greek houses) within a maximum of two days after the action.

Other Actions: In addition to academic actions based on QPA, the Associate Dean for Undergraduate Education may place students on probation, or subsequent suspension, if they do not demonstrate reasonable progress through the core curriculum of their major (e.g., not completing a core class after 3 attempts, not completing the required 100-level core courses by the end of the sophomore year, etc.). Students are encouraged to consult with their academic advisor about any concerns with regard to lack of progress in their chosen SCS major.

The relation indicated above between probation, suspension and drop is nominal. In unusual circumstances, SCS College Council may suspend or drop a student without prior probation.

Return from Leave of Absence

SCS undergraduate students may elect to take a leave of absence for a variety of reasons, after consultation with their academic advisor. Students returning from a leave of absence are required to submit a Return from Leave of Absence form to their academic advisor for approval by the student's academic advisor and the SCS Assistant Dean for Undergraduate Education. In addition, the student must also supply a letter that explains the reason for the leave, the actions that were performed during the leave to prepare the student for a successful return, and a description of the on-campus resources, if required, that would be used by the student in order to increase the likelihood of success. Students returning from a leave are also encouraged to provide up to two letters of support from people close to the student (e.g. family, friends, clergy, teachers, coaches, others as appropriate). Requests to return are reviewed by the student's academic advisor, the Assistant Dean and the Student Affairs liaison to determine eligibility and any resources that need to be put into place to assist the student upon return. Contact the CS Undergraduate Office for more information.

Internal Transfer

First year students admitted to SCS are considered undeclared during their first year. These students declare their SCS major in the second semester of their freshman year. SCS students who wish to transfer from one SCS major to another SCS major may do so by applying for transfer by mid-semester break during the semester the transfer is desired. These students should consult with their academic advisor and the program director of the intended major for more information about specific course requirements and academic plans. Internal SCS transfers do not have any grade requirements. Transfers are approved based on demonstrated interest, ability, and available space in the intended major.

Transfer into SCS / Dual-Degree

Undergraduate students admitted to colleges at CMU other than SCS and wishing to transfer to Computer Science or pursue a dual degree in Computer Science should consult with the SCS Assistant Dean for Undergraduate Education during their first year. Students wishing to transfer to Computational Biology or pursue a dual degree in Computational Biology should consult the Assistant Department Head for complete information concerning minimum requirements, instructions and deadlines.

External Transfer

A student currently enrolled at another university or college who wishes to transfer to SCS should first apply through the Office of Admission. If the Office of Admission believes the applicant meets admission guidelines, the student's record is sent to SCS for evaluation. Admission is based on seat availability, overall academic performance and course rigor from the student's current institution, ability to complete the rigorous SCS program on time, and the application material including recommendations and reflection essay. It is important to note that extremely few external transfers are admitted to the SCS program at Carnegie Mellon University. At this time, no transfers will be allowed into the Artificial Intelligence program for non-CMU students. External transfers who are admitted for Computer Science or Computational Biology may not subsequently transfer into the Artificial Intelligence program due to high demand within CMU.

Graduation Requirements

1. A requirement for graduation is the completion of the program specified for a degree with a cumulative quality point average of 2.00 or higher for all courses taken after the first year.
2. Students must be recommended for a degree by the faculty of SCS.
3. A candidate for the bachelor's degree must complete at the University a minimum of four semesters of full-time study, or the equivalent of part-time study, comprising at least 180 units of course work.
4. Students will be required to have met all financial obligations to the university before being awarded a degree.

A student who does not meet the QPA requirement above must petition SCS College Council for a waiver of the first requirement.

General Education Requirements

All undergraduate degrees in the School of Computer Science include a depth in their particular field of study but also breadth through the general education requirements. General education requirements are part of SCS degrees to give students an opportunity to learn more about the world from scientific and humanistic points of view. These additional skills are useful for graduates since computing is often embedded in domains that are not entirely within the bounds of computing. SCS students will need to use their computing skills to solve problems alongside scientists and engineers, artists, social and cognitive scientists, historians, linguists, economists and business experts, and SCS students will need to communicate effectively and understand the ethical implications of their work. The general education requirements help SCS students gain this broad perspective so they can work well in a wide variety of domains.

Science and Engineering

All candidates for a B.S. degree in the School of Computer Science must complete a minimum of 36 units offered by the Mellon College of Science and/or the College of Engineering (CIT).

Computational Biology majors

For Computational Biology majors, consult the Computational Biology program page for specific science and engineering requirements. The required science and engineering courses for the Computational Biology major also satisfy the General Education requirement for SCS.

Artificial Intelligence and Computer Science majors

For graduates since computing is often embedded in domains that are not entirely within the boundaries of computing.
For Artificial Intelligence and Computer Science majors, four courses in science and engineering are required, 9 units or more for each course, at least one course must have a laboratory component and at least two courses must be from the same department.

Non-lab courses that can be taken by AI and CS majors to satisfy this requirement are given in the list below. (Consult your academic advisor for additional choices available each semester.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-223</td>
<td>Personalized Medicine: Understanding Your Own Genome (can be paired with a course in Biology 03-xxx for two courses in one department)</td>
<td>9</td>
</tr>
<tr>
<td>03-121</td>
<td>Modern Biology</td>
<td>9</td>
</tr>
<tr>
<td>03-125</td>
<td>Evolution</td>
<td>9</td>
</tr>
<tr>
<td>03-132</td>
<td>Basic Science to Modern Medicine</td>
<td>9</td>
</tr>
<tr>
<td>03-133</td>
<td>Neurobiology of Disease</td>
<td>9</td>
</tr>
<tr>
<td>06-100</td>
<td>Introduction to Chemical Engineering</td>
<td>12</td>
</tr>
<tr>
<td>06-221</td>
<td>Thermodynamics</td>
<td>9</td>
</tr>
<tr>
<td>09-105</td>
<td>Introduction to Modern Chemistry I</td>
<td>10</td>
</tr>
<tr>
<td>09-106</td>
<td>Modern Chemistry I</td>
<td>10</td>
</tr>
<tr>
<td>09-217</td>
<td>Organic Chemistry I</td>
<td>9</td>
</tr>
<tr>
<td>09-218</td>
<td>Organic Chemistry II</td>
<td>9</td>
</tr>
<tr>
<td>09-225</td>
<td>Climate Change: Chemistry, Physics and Planetary Science</td>
<td>9</td>
</tr>
<tr>
<td>12-100</td>
<td>Exploring CEE: Infrastructure and Environment in a Changing World</td>
<td>12</td>
</tr>
<tr>
<td>12-201</td>
<td>Geology</td>
<td>9</td>
</tr>
<tr>
<td>18-100</td>
<td>Introduction to Electrical and Computer Engineering</td>
<td>12</td>
</tr>
<tr>
<td>18-220</td>
<td>Electronic Devices and Analog Circuits</td>
<td>12</td>
</tr>
<tr>
<td>18-240</td>
<td>Structure and Design of Digital Systems</td>
<td>12</td>
</tr>
<tr>
<td>24-101</td>
<td>Fundamentals of Mechanical Engineering</td>
<td>12</td>
</tr>
<tr>
<td>24-231</td>
<td>Fluid Mechanics</td>
<td>10</td>
</tr>
<tr>
<td>24-261</td>
<td>Statics</td>
<td>10</td>
</tr>
<tr>
<td>24-351</td>
<td>Dynamics</td>
<td>10</td>
</tr>
<tr>
<td>33-114</td>
<td>Physics of Musical Sound</td>
<td>9</td>
</tr>
<tr>
<td>33-120</td>
<td>Science and Science Fiction</td>
<td>9</td>
</tr>
<tr>
<td>33-121</td>
<td>Physics I for Science Students</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>or 33-151 Matter and Interactions I</td>
<td></td>
</tr>
<tr>
<td>33-142</td>
<td>Physics II for Engineering and Physics Students</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>or 33-152 Matter and Interactions I</td>
<td></td>
</tr>
<tr>
<td>33-224</td>
<td>Stars, Galaxies and the Universe</td>
<td>9</td>
</tr>
<tr>
<td>42-101</td>
<td>Introduction to Biomedical Engineering</td>
<td>12</td>
</tr>
<tr>
<td>42-202</td>
<td>Physiology</td>
<td>9</td>
</tr>
<tr>
<td>42-341</td>
<td>Introduction to Biomechanics</td>
<td>9</td>
</tr>
<tr>
<td>85-219</td>
<td>Biological Foundations of Behavior (can be paired with a course in Biology 03-xxx for two courses in one department)</td>
<td>9</td>
</tr>
</tbody>
</table>

At present, courses meeting the lab requirement are:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-261</td>
<td>Quantitative Cell and Molecular Biology Laboratory (can be paired with a course in Biology 03-xxx for two courses in one department)</td>
<td>9</td>
</tr>
<tr>
<td>03-124</td>
<td>Modern Biology Laboratory</td>
<td>9</td>
</tr>
<tr>
<td>09-101</td>
<td>Introduction to Experimental Chemistry (This 3 unit lab together with 09-105 satisfies the lab requirement.)</td>
<td>3</td>
</tr>
<tr>
<td>09-221</td>
<td>Laboratory I: Introduction to Chemical Analysis</td>
<td>12</td>
</tr>
<tr>
<td>27-100</td>
<td>Engineering the Materials of the Future</td>
<td>12</td>
</tr>
<tr>
<td>33-104</td>
<td>Experimental Physics</td>
<td>9</td>
</tr>
<tr>
<td>42-203</td>
<td>Biomedical Engineering Laboratory</td>
<td>9</td>
</tr>
<tr>
<td>85-310</td>
<td>Research Methods in Cognitive Psychology</td>
<td>9</td>
</tr>
<tr>
<td>85-314</td>
<td>Cognitive Neuroscience Research Methods</td>
<td>9</td>
</tr>
</tbody>
</table>

The following MCS and CIT courses cannot be used to satisfy the Science and Engineering requirement:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-511</td>
<td>Computational Molecular Biology and Genomics</td>
<td>9</td>
</tr>
<tr>
<td>03-512</td>
<td>Computational Methods for Biological Modeling and Simulation</td>
<td>9</td>
</tr>
<tr>
<td>06-262</td>
<td>Mathematical Methods of Chemical Engineering</td>
<td>12</td>
</tr>
<tr>
<td>09-103</td>
<td>Atoms, Molecules and Chemical Change</td>
<td>9</td>
</tr>
<tr>
<td>09-231</td>
<td>Mathematical Methods for Chemists</td>
<td>9</td>
</tr>
<tr>
<td>12-271</td>
<td>Introduction to Computer Application in Civil &amp; Environmental Engineering</td>
<td>9</td>
</tr>
<tr>
<td>18-090</td>
<td>Twisted Signals: Civil Engineering</td>
<td>10</td>
</tr>
<tr>
<td>18-200</td>
<td>ECE Sophomore Seminar</td>
<td>1</td>
</tr>
<tr>
<td>18-202</td>
<td>Mathematical Foundations of Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td>18-213</td>
<td>Introduction to Computer Systems</td>
<td>12</td>
</tr>
<tr>
<td>18-345</td>
<td>Introduction to Telecommunication Networks</td>
<td>12</td>
</tr>
<tr>
<td>18-411</td>
<td>Computational Techniques in Engineering</td>
<td>12</td>
</tr>
<tr>
<td>18-482</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>18-487</td>
<td>Introduction to Computer Security</td>
<td>12</td>
</tr>
<tr>
<td>18-540</td>
<td>Rapid Prototyping of Computer Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-101</td>
<td>Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-211</td>
<td>Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-325</td>
<td>Technology and Policy Writing for Lay Audiences</td>
<td>9</td>
</tr>
<tr>
<td>19-402</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-411</td>
<td>Global Competitiveness: Firms, Nations and Technological Change</td>
<td>9</td>
</tr>
<tr>
<td>19-432</td>
<td>Special Topics: Bitcoin and Cryptocurrencies</td>
<td>6</td>
</tr>
<tr>
<td>27-410</td>
<td>Computational Techniques in Engineering</td>
<td>12</td>
</tr>
<tr>
<td>33-100</td>
<td>Basic Experimental Physics</td>
<td>6</td>
</tr>
<tr>
<td>33-115</td>
<td>Physics for Future Presidents</td>
<td>9</td>
</tr>
<tr>
<td>33-124</td>
<td>Introduction to Astronomy</td>
<td>9</td>
</tr>
<tr>
<td>33-232</td>
<td>Mathematical Methods of Physics</td>
<td>10</td>
</tr>
<tr>
<td>42-201</td>
<td>Professional Issues in Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or 33-151 Matter and Interactions I</td>
<td></td>
</tr>
</tbody>
</table>

All Electrical and Computer Engineering graduate courses [18-6xx, 18-7xx, 18-8xx, 18-9xx] cannot be used for this requirement. In general, any MCS or CIT courses that are cross-listed with SCS courses or have significant mathematical or computational content cannot be used for this requirement. Consult with a CS undergraduate advisor about any course to be used for the Science and Engineering requirement before registration.

### Humanities and Arts

All candidates for a B.S. degree in the School of Computer Science must complete a minimum of 63 units offered by the College of Humanities & Social Sciences and/or the College of Fine Arts as prescribed below. Students pursuing a Bachelor’s in Computer Science and Art (http://coursecatalog.web.cmu.edu/servicesandoptions/intercollegeprograms/bxaintercarssite#bcscurriculumtext) should consult the general education requirements for that program.

#### A. Freshman Writing Requirement (9 units)

Complete one of the following writing options for 9 units:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>76-101</td>
<td>Interpretation and Argument</td>
<td>9</td>
</tr>
<tr>
<td>76-102</td>
<td>Advanced First Year Writing: Special Topics (by invitation only)</td>
<td>9</td>
</tr>
</tbody>
</table>

or two of these three writing minis for 9 units total:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>76-106</td>
<td>Writing about Literature, Art and Culture</td>
<td>4.5</td>
</tr>
<tr>
<td>76-107</td>
<td>Writing about Data</td>
<td>4.5</td>
</tr>
<tr>
<td>76-108</td>
<td>Writing about Public Problems</td>
<td>4.5</td>
</tr>
</tbody>
</table>

#### B. Breadth Requirement (minimum 27 units: 9 units each)

Complete three courses, one each from Category 1, Category 2, and Category 3. Students may use two minis totaling 9 units or more to satisfy one of the categories, with permission of the Assistant Dean for Undergraduate Education, if the minis meet the goals of the desired category. **NOTE:** Artificial Intelligence majors replace Category 1 with Category 1A: Cognitive Studies which is a subset of Category 1.

Category 1 (for Computational Biology and Computer Science majors): Cognition, Choice and Behavior - this requirement explores the process of thinking, decision making, and behavior in the context of the individual.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-311</td>
<td>Organizational Behavior</td>
<td>9</td>
</tr>
<tr>
<td>80-130</td>
<td>Introduction to Ethics</td>
<td>9</td>
</tr>
<tr>
<td>80-150</td>
<td>Nature of Reason</td>
<td>9</td>
</tr>
<tr>
<td>80-180</td>
<td>Nature of Language</td>
<td>9</td>
</tr>
<tr>
<td>80-221</td>
<td>Philosophy of Social Science</td>
<td>9</td>
</tr>
<tr>
<td>80-241</td>
<td>Ethical Judgments in Professional Life</td>
<td>9</td>
</tr>
</tbody>
</table>
### School of Computer Science

#### 80-242 Conflict and Dispute Resolution...
- 80-270 Philosophy of Mind...
- 80-271 Philosophy and Psychology...
- 80-275 Metaphysics...
- 80-281 Language and Thought...
- 80-102 Introduction to Psychology...
- 81-211 Cognitive Psychology...
- 81-213 Human Information Processing and Artificial Intelligence...
- 81-221 Principles of Child Development...
- 81-241 Social Psychology...
- 81-251 Personality...
- 81-261 Abnormal Psychology...
- 81-370 Perception...
- 81-390 Human Memory...
- 81-408 Visual Cognition...
- 81-421 Language and Thought...
- 81-120 Reason, Passion and Cognition...

#### Category 1A (for Artificial Intelligence majors): Cognitive Studies...
- 81-211 Cognitive Psychology...
- 81-213 Human Information Processing and Artificial Intelligence...
- 81-370 Perception...
- 81-390 Human Memory...
- 81-408 Visual Cognition...
- 81-421 Language and Thought...

#### Category 2 (all SCS majors): Economic, Political and Social Institutions...
- 19-101 Introduction to Engineering and Public Policy...
- 36-303 Sampling, Survey and Society...
- 70-322 Business, Society and Ethics...
- 73-102 Principles of Microeconomics...
- 73-103 Principles of Macroeconomics...
- 74-245 Capitalism and Individualism in American Culture...
- 79-299 From Newton to the Nuclear Bomb: History of Science, 1750-1950...
- 79-300 Guns in American History: Culture, Violence, and Politics...
- 79-320 Women, Politics, and Protest...
- 79-331 Body Politics: Women and Health in America...
- 79-341 The Cold War in Documents and Film...
- 79-383 The History of Capitalism...
- 80-135 Introduction to Political Philosophy...
- 80-136 Social Structure, Public Policy & Ethics...
- 80-243 Ethics of Leadership...
- 80-244 Environmental Ethics...
- 80-245 Medical Ethics...
- 80-324 Philosophy of Economics...
- 80-335 Social and Political Philosophy...
- 80-341 Computers, Society and Ethics...
- 84-104 Decision Processes in American Political Institutions...
- 84-275 Comparative Politics...
- 84-310 International Political Economy...
- 84-320 Domestic Politics and International Affairs...
- 84-322 Nonviolent Conflict and Revolution...
- 84-324 The Future of Democracy...
- 84-326 Theories of International Relations...
- 84-362 Diplomacy and Statecraft...
- 84-380 Grand Strategy in the United States...
- 84-386 The Privatization of Force...
- 84-389 Terrorism and Insurgency...
- 84-393 Legislative Decision Making: US Congress...
- 84-402 Judicial Politics and Behavior...

#### 84-414 International and Subnational Security...
- 88-257 Experimental Economics...

#### Category 3 (all SCS majors): Cultural Analysis...
- 57-173 Survey of Western Music History...
- 60-205 Critical Theory in Art III...
- 62-306 Music-Cinema-Culture...
- 62-371 Photography, The First 100 Years, 1839-1939...
- 70-342 Managing Across Cultures...
- 76-221 Books You Should Have Read by Now: 16th & 17th C. Pop Culture...
- 76-227 Comedy...
- 76-232 Introduction to Black Literature...
- 76-239 Introduction to Film Studies...
- 76-241 Introduction to Gender Studies...
- 79-104 Global Histories...
- 79-201 Introduction to Anthropology...
- 79-202 Flesh and Spirit: Early Modern Europe, 1400-1750...
- 79-223 Mexico: From the Aztec Empire to the Drug War...
- 79-226 African History: Earliest Times to 1780...
- 79-229 Origins of the Arab-Israeli Conflict, 1880-1948...
- 79-230 Arab-Israeli Conflict Since 1948...
- 79-240 Development of American Culture...
- 79-241 African American History: Africa to the Civil War...
- 79-242 African American History: Reconstruction to the Present...
- 79-261 The Last Emperors: Chinese History and Society, 1600-1900...
- 79-262 Modern China: From the Birth of Mao...to Now...
- 79-265 Russian History: From the First to the Last Tsar...
- 79-281 Introduction to Religion...
- 79-282 Europe and the World Since 1800...
- 79-311 Paleokitchen: Food and Cooking in the Ancient World...
- 79-316 Photography, the First 100 Years, 1839-1939...
- 79-333 Sex, Gender & Anthropology...
- 79-345 Roots of Rock & Roll...
- 79-350 Early Christianity...
- 79-368 Un-natural Disasters: Societies and Environmental Hazards in Global Perspective...
- 79-395 The Arts in Pittsburgh...
- 79-396 Music and Society in 19th and 20th Century Europe and the U.S. ...
- 80-100 Introduction to Philosophy...
- 80-250 Ancient Philosophy...
- 80-251 Modern Philosophy...
- 80-253 Continental Philosophy...
- 80-254 Analytic Philosophy...
- 80-255 Pragmatism...
- 80-261 Experience, Reason, and Truth...
- 80-276 Philosophy of Religion...
- 82-267 Topics in Italian Language & Culture...
- 82-273 Introduction to Japanese Language and Culture...
- 82-293 Russian Cinema: From the Bolshevik Revolution to Putin’s Russia...
- 82-294 Topics in Russian Language and Culture...
- 82-303 Introduction to French Culture...
- 82-304 The Francophone World...
- 82-314 Literature of the Arabic-speaking World...
- 82-327 The Emergence of the German Speaking World...
- 82-333 Introduction to Chinese Language and Culture...
- 82-342 Spain: Language and Culture...
- 82-343 Latin America Language and Culture...
- 82-344 U.S. Latinos: Language and Culture...
- 82-345 Introduction to Hispanic Literary & Cultural Studies...

### C. Humanities and Arts Electives (minimum 27 units)
Complete 3 non-technical courses of at least 9 units each from any of the departments in the College of Humanities & Social Sciences or the College of Fine Arts. Some of the courses taught in these units are considered technical courses and may not be used to satisfy this requirement (see Deletions below). Additionally, a select set of courses from Business Administration and from Environmental and Public Policy can also count for this requirement (see Additions below). Students may combine humanities/arts courses with lower units together to form a single course of 9 units or more. Students are encouraged, but not required, to take courses from different departments to gain additional breadth and to create new opportunities for engagement with the university community.

The most up-to-date list of additions and deletions can be found at http://www.csd.cs.cmu.edu/content/bscs-humanities-and-arts-requirements and supersedes the lists given below. Consult with a CS undergraduate advisor for additional information.

Deletions

The following courses may not count toward the unconstrained electives in Humanities and Arts in SCS due to the technical (computing and/or mathematical) nature of the courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-319</td>
<td>Global Technology Consulting Groundwork</td>
<td>3</td>
</tr>
<tr>
<td>67-324</td>
<td>Accelerating Innovation and Entrepreneurship</td>
<td>9</td>
</tr>
<tr>
<td>67-327</td>
<td>Web Application Security</td>
<td>6</td>
</tr>
<tr>
<td>67-328</td>
<td>Mobile to Cloud: Building Distributed Applications</td>
<td>9</td>
</tr>
<tr>
<td>67-329</td>
<td>Contemporary Themes in Global Systems</td>
<td>9</td>
</tr>
<tr>
<td>67-330</td>
<td>Technology Consulting in the Community</td>
<td>9</td>
</tr>
<tr>
<td>67-331</td>
<td>Technology Consulting in the Global Community</td>
<td>3</td>
</tr>
<tr>
<td>67-344</td>
<td>Organizational Intelligence in the Information Age</td>
<td>9</td>
</tr>
<tr>
<td>67-353</td>
<td>IT &amp; Environmental Sustainability</td>
<td>6</td>
</tr>
<tr>
<td>67-364</td>
<td>Practical Data Science</td>
<td>9</td>
</tr>
<tr>
<td>67-373</td>
<td>Information Systems Consulting Project</td>
<td>12</td>
</tr>
<tr>
<td>67-390</td>
<td>Independent Study in Information Systems</td>
<td>Var.</td>
</tr>
<tr>
<td>67-391</td>
<td>Independent Study in Information Systems</td>
<td>Var.</td>
</tr>
<tr>
<td>67-440</td>
<td>IdeTe Mobile Application Design &amp; Development</td>
<td>9</td>
</tr>
<tr>
<td>67-442</td>
<td>Mobile Application Development in iOS</td>
<td>9</td>
</tr>
<tr>
<td>67-475</td>
<td>Innovation in Information Systems</td>
<td>12</td>
</tr>
<tr>
<td>67-490</td>
<td>Practicum in Information Systems</td>
<td>Var.</td>
</tr>
<tr>
<td>73-230</td>
<td>Intermediate Microeconomics</td>
<td>9</td>
</tr>
<tr>
<td>73-240</td>
<td>Intermediate Macroeconomics</td>
<td>9</td>
</tr>
<tr>
<td>73-274</td>
<td>Econometrics I</td>
<td>9</td>
</tr>
<tr>
<td>73-347</td>
<td>Game Theory for Economists</td>
<td>9</td>
</tr>
<tr>
<td>73-374</td>
<td>Econometrics II</td>
<td>9</td>
</tr>
<tr>
<td>76-481</td>
<td>Introduction to Multimedia Design</td>
<td>12</td>
</tr>
<tr>
<td>76-487</td>
<td>Web Design</td>
<td>12</td>
</tr>
<tr>
<td>80-110</td>
<td>Nature of Mathematical Reasoning</td>
<td>9</td>
</tr>
<tr>
<td>80-210</td>
<td>Logic and Proofs</td>
<td>9</td>
</tr>
<tr>
<td>80-211</td>
<td>Logic and Mathematical Inquiry</td>
<td>9</td>
</tr>
<tr>
<td>80-222</td>
<td>Measurement and Methodology</td>
<td>9</td>
</tr>
<tr>
<td>80-223</td>
<td>Causality and Probability</td>
<td>9</td>
</tr>
<tr>
<td>80-310</td>
<td>Formal Logic</td>
<td>9</td>
</tr>
<tr>
<td>80-311</td>
<td>Undecidability and Incompleteness</td>
<td>9</td>
</tr>
<tr>
<td>80-314</td>
<td>Causal Discovery, Statistics, and Machine Learning</td>
<td>9</td>
</tr>
<tr>
<td>80-315</td>
<td>Moda Logic</td>
<td>9</td>
</tr>
<tr>
<td>80-405</td>
<td>Game Theory</td>
<td>9</td>
</tr>
<tr>
<td>80-411</td>
<td>Proof Theory</td>
<td>9</td>
</tr>
<tr>
<td>80-413</td>
<td>Category Theory</td>
<td>9</td>
</tr>
<tr>
<td>80-521</td>
<td>Seminar on Formal Epistemology</td>
<td>Var.</td>
</tr>
<tr>
<td>85-213</td>
<td>Human Information Processing and Artificial Intelligence</td>
<td>9</td>
</tr>
<tr>
<td>85-219</td>
<td>Biological Foundations of Behavior</td>
<td>9</td>
</tr>
<tr>
<td>85-370</td>
<td>Perception</td>
<td>9</td>
</tr>
<tr>
<td>85-414</td>
<td>Cognitive Neuropsychology</td>
<td>9</td>
</tr>
<tr>
<td>88-251</td>
<td>Empirical Research Methods</td>
<td>9</td>
</tr>
</tbody>
</table>

Additions

The following courses outside of Dietrich College and the College of Fine Arts may count toward the Humanities and Arts requirement in SCS:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-333</td>
<td>Privacy Policy, Law, and Technology (formerly 08-533)</td>
<td>9</td>
</tr>
<tr>
<td>17-562</td>
<td>Law of Computer Technology (formerly 08-332)</td>
<td>9</td>
</tr>
<tr>
<td>19-101</td>
<td>Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-402</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-403</td>
<td>Policies of Wireless Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-411</td>
<td>Global Competitiveness: Firms, Nations and Technological Change</td>
<td>9</td>
</tr>
<tr>
<td>32-102</td>
<td>Seapower and Maritime Affairs</td>
<td>6</td>
</tr>
<tr>
<td>32-201</td>
<td>Leadership &amp; Management</td>
<td>9</td>
</tr>
<tr>
<td>32-402</td>
<td>Leadership and Ethics</td>
<td>9</td>
</tr>
<tr>
<td>70-160</td>
<td>Graphic Media Management</td>
<td>9</td>
</tr>
<tr>
<td>70-311</td>
<td>Organizational Behavior</td>
<td>9</td>
</tr>
<tr>
<td>70-321</td>
<td>Negotiation and Conflict Resolution</td>
<td>9</td>
</tr>
<tr>
<td>70-332</td>
<td>Business, Society and Ethics</td>
<td>9</td>
</tr>
<tr>
<td>70-340</td>
<td>Business Communications</td>
<td>9</td>
</tr>
<tr>
<td>70-341</td>
<td>Team Dynamics and Leadership</td>
<td>9</td>
</tr>
</tbody>
</table>
Honors Research Thesis

Students considering going on to graduate school in Computer Science or related disciplines should take a wide variety of Computer Science and Mathematics courses, as well as consider getting involved in independent research as early as possible. This would be no later than the junior year and can begin even earlier. Students interested in graduate school in computer science or its related areas are strongly encouraged to participate in the SCS Honors Undergraduate Research Thesis program. Additionally, graduate CS courses can be taken with permission of the instructor and in consultation with an academic advisor.

The goal of the SCS Honors Undergraduate Research Thesis Program is to introduce students to the breadth of tasks involved in independent research, including library work, problem formulation, experimentation, analysis, technical writing and public speaking. In particular, students write a survey paper summarizing prior results in their desired area of research, present a public poster session in December of their senior year describing their current progress, present their final results in an oral summary in the year-end university-wide Undergraduate Research Symposium (Meeting of the Minds) and submit a written thesis at the end of their senior year. Students work closely with faculty research advisors to plan and carry out their research. The SCS Honors Undergraduate Research Thesis (07-599) typically starts in the fall semester of the senior year, and spans the entire senior year. Students receive a total of 36 units of academic credit for the thesis work, 18 units per semester. Students should prepare their research prospectus (i.e. proposal of work) during the spring semester of their junior year, and students in this program are advised to plan their schedules carefully to ensure there is ample time to perform the required research for the thesis during the senior year.

Students interested in research are urged to consult with their undergraduate advisor and the SCS Assistant Dean no later than the end of their sophomore year in order to plan their workload effectively. Although there is no specific GPA requirement to participate, students are expected to have at least a 3.5 GPA in the core SCS topics relevant to their proposed research to be successful in their work. For those students with no background in research, they may consider using Research and Innovation in Computer Science (15-300, 9 units) as an introduction to the research process in their junior year since this course will introduce students to various research projects going on in the School of Computer Science and important skills that are needed to be an effective researcher. This course leads to a subsequent Research Practicum in Computer Science (15-400, 12 units) that allows students to complete a small-scale research study or experiment and present a research poster. Students who use 15-400 to start their senior thesis can use these units toward the required 36 units. Students should consult with their academic advisor concerning how the units earned toward the senior thesis can be used toward elective requirements for their major.

Interested juniors should submit a project prospectus of no more than three pages by the end of their junior year, although submissions over the summer prior to the senior year will also be considered for review. A prospectus must include:

- The name of the research advisor (an SCS faculty member)
- A short abstract (two paragraphs, max)
- A description of the problem to be worked on and its significance
- A tactical description of the proposed research plan, including:
  - a description of the background reading to be carried out,
  - a description of the research contribution,
  - a description of the expected results of the research, and
  - a reasonably detailed timeline for the thesis work
- A bibliography of related work (all references belong here)
- The signature of the research advisor, signifying endorsement of the project and willingness to supervise and evaluate it

Students who need help finding potential advisors should get in touch with the Associate Dean or Assistant Dean for Undergraduate Education. Applications to the program are due by the end of the semester prior to the start of the thesis, typically the end of the Junior Spring semester.

Students successfully completing this thesis will earn SCS College Honors and can compete for various SCS research awards given out during commencement.

Faculty

UMUT ACAR, Associate Professor, Computer Science Department - Ph.D., Carnegie Mellon University; Carnegie Mellon, 2012-

ANIL ADA, Associate Teaching Professor, Carnegie Mellon University - Ph.D., McGill University; Carnegie Mellon, 2014-

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