SoIC Bulletin

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Overview

Moore's Law says that computing power doubles every 18 months. Regardless of whether that law is literally correct, it illustrates the rapid changes in information technology that will continue for the foreseeable future. The School of Informatics and Computing prepares students to meet the continuing demand for information technology professionals who know how to grow and adapt to this environment of rapid technological change.

Informatics and Computing is focused on the best applications of technologies, and emphasizes the social and psychological aspects of information technology. Some have called informatics "technology with a human face." Informatics and Computing prepares professionals to use information technology to solve problems in a variety of settings. The degrees emphasize the development of new uses for technologies, always keeping in mind the needs of people and the best and most appropriate uses for technology.

Informatics and Computing students have the following:

- A technical understanding of how computing systems and programs operate
- An ability to adapt/assess and apply new trends in information technology (IT)
- Well-developed problem-solving skills
- Experience working on a team, such as those formed for the senior capstone experience
- Well-developed communications skills to clearly convey solutions and observations to others
- An understanding of social and ethical principles as they relate to IT issues

Degrees from the School of Informatics and Computing are unique because they involve students in learning how information technology relates to a traditional discipline in the sciences, liberal arts, or professions. In the School of Informatics and Computing, a student learns to use technology to solve problems in the chosen area of emphasis and is prepared to use technology to solve problems in a wide variety of career settings.

The undergraduate curriculum looks at information technology from a balanced perspective. It includes a technical core in the areas of mathematical foundations, distributed information, human-computer interaction, social/organization informatics, and new media. In addition to knowledge of core informatics and of informatics in the context of a traditional discipline, students must take a set of general-education courses to ensure that they can communicate clearly in both written and spoken English, read effectively, and reason quantitatively. They must be able to raise and rationally debate ethical concerns suggested by information technologies and their interactions with other people. Students also must have some knowledge of the world; its peoples and their cultural, artistic, and scientific achievements. To this end, the general-education requirement exposes students to the arts and humanities, social and historical studies, and the natural sciences.

The school offers a Bachelor of Science in Informatics degree, four specialized professional master's degrees, a Bachelor of Science in Computer Science degree, the Professional Master's Program in Computer Science, a variety of undergraduate and graduate programs in New Media, and the Undergraduate Program in Health Information Administration. Informatics research is conducted at the Informatics Research Institute, which provides expanded educational opportunities for both undergraduate and graduate students.

Information Technology in Today's Learning

When Indiana University was founded in 1820, only Greek and Latin were taught. The curriculum has obviously changed over time, in response to both intellectual and practical needs. The most recent school to be established at Indiana University, the School of Informatics and Computing, responds to the world's changing needs.

Today, one might say that programming languages and software tools are the Greek and Latin of our times, and no person can be called truly educated without mastery of these "languages." It is not intended to suggest that the classical languages or any natural languages have been supplanted by C++ and Java. Indeed, making available the classical corpus in searchable digital form was one of the first applications of computing to the humanities. The point is to suggest the pervasiveness of information technology in all of civilized life. Much as Greek and Latin opened doors to the scholarship of the nineteenth century, so information technology opens doors to art and science in the twenty-first century.

The development of networks and distributed systems over the past several decades has changed forever the notion of a computer as something that merely "computes." The computer is now an "information processor." Arthur C. Clarke once said that "a sufficiently advanced technology is indistinguishable from magic." Unfortunately, many people see computers and the Internet as magical. The mission of the School of Informatics and Computing is to educate citizens that advanced information technology is indistinguishable (or at least inseparable) from science and the arts.

History

The School of Informatics and Computing offers a new kind of computing education—one where students not only learn how technology works, but also what it can accomplish. Our interdisciplinary approach to research, as well as our innovative curriculum, is designed to instill a new generation of students with the knowledge, imagination, and flexibility to tackle complex issues from

global warming to national security. We are training a new kind of thinker, one who is ready to solve the problems of the 21st century.

Computing education has a long and storied history at Indiana University. The Department of Computer Science, founded in 1971, has graduated thousands of students who have gone on to become leaders and innovators in technology development.

The founding of the IU School of Informatics in 2000 added a new dimension to our technology programs. The School of Informatics was the first IT school of its kind—an innovative, interdisciplinary program where technology fuels discoveries in fields as diverse as music and microbiology. We offered the first Ph.D. in Informatics, as well as one of the first master's degrees in cybersecurity.

Recognizing the vital connection between these fields and wanting to provide students with a richer educational experience, the Department of Computer Science and the School of Informatics joined forces in 2005. Now known as the School of Informatics and Computing at IU Bloomington, the school was named one of *Computerworld* magazine's 10 innovative programs that are "IT Schools to Watch" in 2008.

Mission

The Indiana University School of Informatics includes the School of Informatics and Computing at Indiana University Bloomington, the School of Informatics at IUPUI and programs at IU East, IU Kokomo, IU South Bend, and IU Southeast.

The mission of the School is to excel and lead in education, research, and outreach spanning and integrating the full breadth of computing and information technology, including the scientific and technical core, a broad range of applications, and human and societal issues and implications.

The School aims to lead the nation in creating a new, broad and interdisciplinary view of computing and information technology, and uses this viewpoint as the foundation of its main areas of emphasis:

Education and Research

The School offers a broad array of B.S., M.S., and Ph.D. programs in informatics and computer science, and conducts research in a wide range of computing and informatics foundations, applications and implications. This range includes:

- foundational areas including algorithms, data and search, networks and systems, and programming languages
- interdisciplinary applications in areas including artificial intelligence, cognitive science and robotics, complex systems, cyber-infrastructure, digital media, health and life sciences, and security and privacy
- human and societal issues including human computer interaction and social informatics

Economic Development and Entrepreneurship

The School aims to provide talented graduates and professional expertise to a wide range of computing and information technology businesses and occupations, and places special emphasis on partnering with information technology businesses and needs in the state of Indiana. It also emphasizes and supports a culture of entrepreneurship in its students, faculty and alumni.

Diversity

The School aims to provide an environment that involves a diverse array of students, staff and faculty, including women and under-represented minorities, and people with a wide range of intellectual interests and talents. The broad view that the School takes of computing and information technology education and research provides a strong foundation for its diversity goals and being recognized as a national exemplar.

One School, Multiple Campuses

The School of Informatics spans the IU Bloomington (IUB), Indiana University-Purdue University Indianapolis (IUPUI), IU South Bend (IUSB), IU Kokomo (IUK), IU East (IUEA) and IU Southeast (IUSE) campuses. By combining the strengths of these six campuses, the School of Informatics is able to create a unique environment that enables students to earn degrees with strong information technology components in arts, humanities, science, and the professions. The expert faculty and excellent technological resources foster a synthesis of academic disciplines and cultures. Faculty from varied disciplines share developments in the fast-moving information technology areas through the School of Informatics and its degree programs. The school is actively forging cooperative arrangements with employers in the state and region; and creating internships, cooperative education programs, and opportunities for learning through service.

- IU Bloomington
- IUPUI
- IU East
- IU Kokomo
- IU South Bend
- IU Southeast

IU Bloomington

Indiana University Bloomington (IUB) is a residential campus that offers undergraduate, professional, and graduate degrees in more than 70 fields of study. In the fall semester of 2010, the campus had a total enrollment of 42,464, including 31,892 undergraduates and 8,344 students in graduate and professional programs. More than 30 schools and departments at IUB are ranked among the top 10 nationally, with more than 100 ranked in the top 20 in their respective fields.

University Libraries at IUB

The University Libraries at IUB rank fourth in collection size among the Big Ten universities, fifth in the Committee on Institutional Cooperation (CIC), and thirteenth in the nation among major research libraries. The libraries' collections include 7.8 million bound volumes, 4 million microforms, and more than 70,000 current serials. The Herman B Wells Library houses a core collection especially for undergraduates and extensive graduate research collections—as well as reference services, technical services, government publications, and other essential library services. The Wells Library also is home to the Information Commons, which has more than 350

computer workstations. These facilities are complemented by the 14 campus libraries serving diverse disciplines, such as music, optometry, chemistry, geology, education, business, journalism, and other areas.

University Information Technology Services at IUB

University Information Technology Services (UITS) at IUB supports the application, use, and development of information technology for research, teaching, and learning. UITS makes available more than 1,200 computer workstations, located in 43 Student Technology Centers, for both scheduled instruction and individual study and more than 200 “InfoStations” and other limited-use workstations in locations across campus for access to e-mail and the Web. The Assistive Technology Lab, located in the Wells Library, offers programs and specialized information technology services for students with disabilities. Research computing facilities on campus include two high-performance supercomputers (a 47-processor IBM SP and a 64-processor SGI/Cray Origin2000), a multiterabyte massive data storage system, and a state-of-the-art campus backbone network. Another strength that UITS brings is the Network Operations Centers for both Abilene (Internet 2) and TransPac. More fully described in the next section, they are housed on the IUPUI campus, but scholars and students in Bloomington also benefit from these high-speed communication links.

IUB Hutton Honors College

The School of Informatics and Computing encourages superior students to take advantage of the variety of opportunities offered through the Hutton Honors College and is pleased to help honors students plan their individual programs.

Grants and Scholarships at IUB

The School of Informatics and Computing is developing new sources of funding, and students are encouraged to review the School of Informatics and Computing Web site (http://www.soic.indiana.edu/).

Grants and scholarships also are available through other IU offices, such as the Hutton Honors College. Students are encouraged to consult with the Office of Student Financial Assistance (www.indiana.edu/~sfa) for additional funding opportunities.

IUPUI Indianapolis

IUPUI is an urban campus that combines IU and Purdue programs. In the fall semester of 2009 its schools had a total enrollment of over 30,300, including 22,190 undergraduates and 8,200 students in graduate and professional programs. IUPUI currently ranks among the 10 largest campuses in the nation that offer graduate professional degrees.

IUPUI University Library

The IUPUI University Library is a technology-based learning center that supports teaching and learning in a new Information Commons; at hundreds of workstations in the library; at computers throughout the campus; and in the homes of students, faculty, and staff.

The collection covers a wide range of academic disciplines—from liberal arts to science, engineering, and technology. The collection contains 4,145 subscriptions to electronic and print periodicals, more than 25,000 e-books, more than 1 million print and online volumes, and the Joseph and Matthew Payton Philanthropic Studies Library and Ruth Lilly Special Collections and Archives. The University Library also creates and hosts digital resources about the state of Indiana, including an electronic atlas and image collection.

The University Library information system hosts more than 350 computer workstations, permitting patrons to search for information through an extensive and sophisticated online research system. Word processing and other electronic applications are also available on these machines. The University Library has more than 500 general and graduate study carrels; 40 group-study rooms with seating for approximately 180; and class and meeting rooms, including a 100-seat auditorium.

University Information Technology Services at IUPUI

University Information Technology Services (UITS) at IUPUI supports the application, use, and development of information technology for research, teaching, and learning. Students have access to more than 500 public workstations on campus. UITS partners with academic schools on campus to provide consulting support in 16 student technology centers and operates another 2 centers as campus-wide resources. The network operations center for Abilene, the high-speed Internet2 backbone network, is located on the IUPUI campus, as is the network operations center for TransPAC, a high-speed network connecting the United States with countries in Asia and the Pacific Rim. The IUPUI campus also is home to the Cisco Networking Academy Training Center and the Cisco Certified Internetwork Expert (CCIE) Practice Lab. One of two such labs in the nation, the CCIE lab provides a testing environment for networking professionals worldwide who are candidates for certification as Cisco Certified Internetwork Experts.

Because Indiana’s government, business, industry, finance, health, service, and nonprofit organizations are centered in Indianapolis, the urban environment plays an important role as a learning resource for students enrolled in the informatics programs. Many of the state’s communication industries are concentrated in the capital city, and the larger organizations based here have made commitments to improve their communication and business processes through the use of information and information technology. IUPUI has established strong working relationships with both industry and government agencies in communications, information technology, and media arts and sciences.

IUPUI Honors Program

The IUPUI Honors Program offers special opportunities for academically superior students to do honors work or pursue department or general honors degrees. Undergraduates may enroll in independent study, H-Option courses, graduate courses, or designated honors courses. Students should check the Schedule of Classes for course offerings.

Students who have SAT scores of 1100 or above, rank in the top 10 percent of their high school class, or have a 3.30 grade point average are eligible to enroll in honors courses. For additional information on honors degrees, contact the Honors Office, University College 3140, at (317) 274-2660.

Information on the Informatics degree program can be located on the Web at http://informatics.iupui.edu/.

IU Kokomo

The Bachelor of Science in Informatics is offered on the Kokomo campus under the Science, Mathematics, and Informatics Department. Information on the Informatics degree program can be located on the Web at http://www.iuk.edu/academics/majors/smi/majors-minors-programs/bachelor-science-informatics/index.shtml.

IU South Bend

Indiana University South Bend provides all the services and opportunities of a large university combined with the advantages and atmosphere of a small college.

Information on the School of Informatics degree programs offered at the IUSB campus can be located on the Web at https://www.iusb.edu/informatics/.

IU Southeast

The Bachelor of Science in Informatics is offered on the Southeast campus under the Department of Natural Sciences. Information on the Informatics degree program can be located on the Web at http://www.ius.edu/informatics/.

IU East

The Bachelor of Science in Informatics is offered on the East campus. Information on the Informatics degree program can be located on the Web at http://www.iue.edu/informatics/.

Contact Information

Undergraduate Student Services

School of Informatics and Computing
919 E. 10th St.
Bloomington, IN 47408-3912
(812) 856-5754soicugrd@indiana.edu@

Graduate Student Services

Computer Science Program
Lindley Hall, Room 215
150 S. Woodlawn Avenue
Bloomington, IN 47405
(812) 855-6486
Fax: (812) 855-4829
graduate-cs@soic.indiana.edu

Informatics Program
Informatics West, Room 233
901 E. 10th Street
Bloomington, IN 47408
(812) 856-1802
Fax: (812) 856-1995
graduate@soic.indiana.edu

SoIC website: http://www.soic.indiana.edu/.

Disclaimer

While every effort is made to provide accurate and current information, Indiana University reserves the right to change without notice statements in the bulletin series concerning rules, policies, fees, curricula, or other matters.

Admission

Undergraduate Admissions - this link will describe the different facets of undergraduate admissions.

Students wishing to major in informatics or computer science must be admitted to Indiana University and first enter the University Division at IUB. Freshmen should begin to satisfy specific degree requirements in the first year. Undergraduates who wish to be admitted to the School of Informatics and Computing must first satisfy the following requirements:

Students pursuing a Bachelor of Science degree in informatics must satisfy the following requirements:

- Complete 26 credit hours of course work that can count toward a bachelor of science degree in informatics with a minimum cumulative grade point average of 2.5.
- Complete the English composition requirement (ENG-W 131 or equivalent) with a minimum grade of C.
- Complete INFO-I 101, Introduction to Informatics, with a minimum grade of C.
- Complete the fundamental math skills requirement (MATH-M 118, or equivalent) with a minimum grade of C.

Students pursuing a Bachelor of Science degree in computer science must satisfy the following requirements:

- Complete 26 credit hours of course work that can count toward a bachelor of science degree in computer science with a minimum cumulative grade point average of 2.0.
- Complete the English composition requirement (ENG-W 131 or equivalent) with a minimum grade of C.

Contact the Office of Admissions at (812) 855-0661, e-mail iuadmit@indiana.edu, or view the website at www.indiana.edu/~iuadmit/ for complete instructions. For specific information on the School of Informatics and Computing, phone (812) 856-5754, e-mail soicugrd@indiana.edu@, or view the website at www.soic.indiana.edu/.

Degree Programs

B.S. in Computer Science

B.S. in Informatics

B.A. in Computer Science (offered through the College of Arts and Sciences)

Certificates and Minors

Concurrent Degrees

Bachelor of Science in Informatics

- Common Ground - General Education Requirements
- Basic Requirements
- SoIC Degree and Major Requirements
- Cognates

Common Ground - General Education Requirements

In summer 2011, Indiana University Bloomington instituted a new campus-wide General Education Program. All

IUB undergraduate students who matriculate in or after first summer session 2011 will be required to complete the campus-wide GenEd program prior to graduation. Some courses may overlap and satisfy the Common Ground General Education requirements as well as some additional SoIC General Education requirements needed to complete INFOBS or CSCIBS majors. Please be aware that some courses in the INFOBS or CSCIBS majors require a higher gpa to fulfill a requirement than the same course in the General Education requirement (ex. ENG-W 131 satisfies the General Education requirement with a grade of "C-", but a grade of "C" is needed to satisfy the SoIC English Composition requirement).

The Common Ground

The bulletin with the GenEd requirements, course listings and information can be found at this url: http://www.indiana.edu/~bulletin/iub/general-education/2013-2014/index.shtml.

Basic Requirements

Students must successfully complete a minimum of 120 credit hours for the Bachelor of Science degree. Students must complete the specific degree requirements of the School of Informatics and Computing as follows:

- Students must have a minimum cumulative grade point average of 2.0 (C). Any course taken to satisfy the major requirements must be completed with a minimum grade of C- unless otherwise specified and the grade point average of all courses taken in the major must be at least 2.0. The major requirements for informatics include core courses, informatics electives and cognate area courses.
- Students must complete a minimum of 30 credit hours in courses at the 300-400 (junior-senior) level.
- Students must complete at least 12 credit hours of course work in the major field of study on the Bloomington campus.
- Students are expected to complete the requirements for their undergraduate degree within eight years of admission to Indiana University. Students are allowed to continue beyond this time period only at the discretion of the Student Services office.
- Courses that fulfill the requirements for a cognate area may also meet the general education distribution requirements.
- Cognate area courses cannot count as informatics core courses or informatics advanced/elective courses.

SoIC Degree and Major Requirements

**** Equivalent honors versions of regular courses may substitute for all requirements. Please see specific course descriptions, posted in respective bulletin, for prerequisites and other pertinent information. ****

SoIC Degree Requirements

English Composition (3 cr.) This applies only to students who fulfilled Common Ground English Composition with a grade of C-.

One of the following options with a minimum grade of C:

- CMLT-C 110 Writing the World
- ENG-W 131 Elementary Composition 1
- ENG-W 170 Introduction to Argumentative Writing (Topic: Projects in Reading and Writing)

Intensive Writing (3 cr.)

One intensive writing course at the 200 level or above, with a minimum grade of C, after completing the English composition requirement. Intensive writing courses at IUB are defined by the College of Arts and Sciences. Students must check the listings for courses in the online enrollment system each semester to make certain that the course section they have chosen fulfills the requirement.

Intensive Writing credit will not be awarded for transfer courses and will not be awarded for written work in courses that are not listed as Intensive Writing unless special arrangements have been completed and approved prior to the relevant deadline. All special arrangements must be approved by the director of undergraduate studies in the respective division. The deadline for submitting a proposal to satisfy Intensive Writing by special arrangement is the end of the 2nd week of classes (for regular semester-length courses) and the end of the first week of classes for a summer session course.

Math and Statistics (6 cr.)

One of the following Math options with a minimum grade of C:

- MATH-M 118 Finite Mathematics
- MATH-D 116-D 117 Introduction to Finite Mathematics I-II
- MATH-V 118 Finite Math with Applications
- MATH-M 348 Discrete Mathematical Models
- MATH-M 353 Discrete Mathematics
- CSCI-C 241 Discrete Structures for Computer Science

Select one of the following Statistics courses:

- ANTH-A 306 Anthropological Statistics
- CJUS-K 300 Techniques of Data Analysis
- ECON-E 370 Statistical Analysis for Business and Economics
- MATH-K 310 Statistical Techniques
- MATH-M 365 Introduction to Probability and Statistics
- POLS-Y 395 Quantitative Political Analysis
- PSY-K 300 Statistical Techniques
- PSY-K 310 Statistical Techniques
- SOC-S 371 Statistics in Sociology
- SPEA-K 300 Statistical Techniques
- STAT-K 310 Statistical Techniques
- STAT-S 300 Introduction to Applied Statistical Methods
- STAT-S 301 Applied Statistical Methods for Business
- STAT-S 320 Introduction to Statistics

Ethics (3 cr.)

Select one ethics course from the following.

- PHIL-P 140 Introduction to Ethics
- PHIL-P 242 Applied Ethics
- PHIL-P 340 Classics in Ethics
- PHIL-P 342 Problems of Ethics

- REL-R 170 Religion, Ethics, and Public Life
- INFO-I 453 Computer and Information Ethics

Arts and Humanities (6 Cr.)

Above Ethics course does not double-count as Arts and Humanities

Course lists located at http://college.indiana.edu/bulletin-courses/ OR http://www.indiana.edu/~bulletin/iub/general-education/2013-2014/courses/arts-and-humanities.shtml.

Natural and Mathematical Sciences (3 cr.)

8-9 credits of N&M courses, excluding INFO-I 101 and Finite Math. These courses may overlap with the Common Ground N&M. Course lists located at http://college.indiana.edu/bulletin-courses/ OR http://www.indiana.edu/~bulletin/iub/general-education/2013-2014/courses/natural-and-mathematical-sciences.shtml.

General Electives

Remaining credit hours may be used to fulfill minors or pursue personal interests. Students may obtain a maximum of three minors. A maximum of 4 combined HPER-E and SPH-I credit hours and 10 MUS-X credit hours below the 100 level may be used in total hours.

Major Requirements

12 hours in the major must be completed on the Bloomington campus.

Required Informatics Core Courses

- INFO-I 101 Introduction to Informatics
- INFO-I 201 Mathematical Foundations of Informatics
- INFO-I 202 Social Informatics OR INFO-I 222 The Information Society
- INFO-I 210 Information Infrastructure I
- INFO-I 211 Information Infrastructure II
- INFO-I 300 Human-Computer Interaction Design and Programming
- INFO-I 308 Information Representation
- INFO-Y 395 Career Development for Informatics Majors

Advanced Informatics Courses

Select two courses from the following:

* If pursuing an Information Technology or Computer Sciience Cognate, four courses must be completed if substituting CSCI-C 211/C 212 for INFO-I 210/I 211 in the major.

- INFO-I 303 Organizational Informatics
- INFO-I 310 Multimedia Arts and Technology
- INFO-I 320 Distributed Systems and Collaborative Computing
- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 356 Globalization, Where We Fit In
- INFO-I 399 Current Topics in Informatics
- INFO-I 400 Topics in Informatics
- INFO-I 421 Applications of Data Mining
- INFO-I 427 Search Informatics
- INFO-I 430 Security for Networked Systems
- INFO-I 433 Systems & Protocol Security & Information Assurance
- INFO-I 441 Human-Computer Interaction Design I
- INFO-I 453 Computer and Information Ethics
- INFO-I 485 Bioinspired Computing
- INFO-I 486 Artificial Life
- CSCI-B, C or P 300 level course
- CSCI-B, C or P 400 level course

Informatics Electives

Select two courses from the following:

All courses listed below are subject to the successful completion of prerequisites or approval of the instructor. Informatics elective courses do not double-count as advanced informatics courses.

- INFO-I 303 Organizational Informatics
- INFO-I 310 Multimedia Arts and Technology
- INFO-I 320 Distributed Systems and Collaborative Computing
- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 356 Globalization, Where We Fit In
- INFO-I 399 Current Topics in Informatics
- INFO-I 400 Topics in Informatics
- INFO-I 421 Applications of Data Mining
- INFO-I 427 Search Informatics
- INFO-I 430 Security for Networked Systems
- INFO-I 433 Systems & Protocol Security & Information Assurance
- INFO-I 441 Human-Computer Interaction Design I
- INFO-I 453 Computer and Information Ethics
- INFO-I 485 Bioinspired Computing
- INFO-I 486 Artificial Life
- BUS-S 305 Technology Infrastructure
- BUS-S 307 Data Management
- BUS-S 308 Business Application Development
- BUS-S 310 Systems Analysis and Project Management
- BUS-S 433 Information Systems Security
- COGS-Q 351 Introduction to Artificial Intelligence and Computer Simulation
- CSCI- Any course at the 300 or 400 level
- JOUR-J 300 Communications Law
- JOUR-J 448 Global Journalism: Issues and Research
- SOC-S 339 The Sociology of Media
- SPEA-V 369 Managing Information Technology
- TEL-T 321 Policymaking in Telecommunications
- TEL-T 351 Video Field and Post Production
- TEL-T 353 Audio Production
- TEL-T 354 Program Graphics and Animation
- TEL-T 356 TV Studio Production
- TEL-T 361 Flash for Games and Interactive Media
- TEL-T 364 Introduction to 3D Digital Modeling and Animation
- TEL-T 366 Multiplayer Game Design
- TEL-T 367 Theory and Practice of Game Design
- TEL-T 369 Sound Design
- TEL-T 421 Economics of Communications Industries
- TEL-T 427 International Telecommunications
- TEL-T 431 Video Documentary

- TEL-T 435 Documentary Production
- TEL-T 452 Topical Seminar in Design and Production (Topic: Advanced Video Game Design and Production)
- TEL-T 454 DVD Authoring
- TEL-T 460 Projects in Game Design
- TEL-T 461 Advanced Flash for Games and Interactive Media
- TEL-T 464 Advanced 3D Digital Modeling and Animation

Capstone
Select one of the following capstone options for a total of 6 hours:

- INFO-I 494/I 495 Design and Development of an Information System
- INFO-I 491 Capstone Project Internship
- INFO-I 492/I 493 Senior Thesis

Cognate Area Courses

Students should, in consultation with their academic advisor, choose a cognate area before their sophomore year. Students must receive a minimum grade of C- in each course and a cumulative GPA of 2.0 or higher in their cognate area. Cognate area courses cannot also count as informatics core courses or informatics advanced/elective courses. Please consult the cognate area of this bulletin for the list of cognate areas.

Bachelor of Science in Informatics with Honors

Students must satisfy the requirements for the B.S. in Informatics degree and the following additional requirements:

- Overall GPA 3.3 or greater
- Informatics major GPA 3.5 or greater
- Completion of at least 9 hours of INFO-H courses (excluding capstone) with H-course GPA 3.5 or greater
- Completion of honors capstone course (INFO-H 494/ H 495) or capstone thesis (INFO-I 492/I 493)

Cognates

**** Equivalent honors versions of regular courses may substitute for all requirements. Please see specific course descriptions, posted in respective bulletin, for prerequisites and other pertinent information. ****

Students must receive a minimum grade of C- in each cognate course and a cumulative GPA of 2.0 or higher in the cognate. Cognate area courses cannot also count as informatics core courses or informatics advanced/elective courses.

Note: Many cognates complete minor requirements.

- Biology
- Business
- Chemistry
- Cognitive Science
- Communication and Culture
- Computer Science
- Economics
- Fine Arts (2 options)
- Geography
- Human-Centered Computing
- Information Technology
- Journalism
- Linguistics
- Mathematics
- Medical Sciences
- Music
- Philosophy of Mind and Cognition
- Pre-Health Professions
- Psychology
- Public and Environmental Affairs (5 options)
- Public Health
- Security
- Telecommunications (3 options)

Biology Cognate

This cognate fulfills the Biology minor.

Required:

- BIOL-L 111 Foundations of Biology: Diversity, Evolution and Ecology
- BIOL-L 112 Foundations of Biology: Biological Mechanisms
- BIOL-L 113 Biology Laboratory
- BIOL-L 211 Molecular Biology
- Two additional courses at 300/400 level (BIOL-L 311, Genetics, is recommended)

Business Cognate

Students may pursue either option of the Business Cognate

Required:

- BUS-K 201 The Computer in Business (minimum grade of C required)

One of the following:

- BUS-A 200 Foundations of Accounting **OR** BUS-A 201 Introduction to Financial Accounting **OR** BUS-A 202 Introduction to Managerial Accounting
- BUS-L 201 Legal Environment of Business **OR** BUS-L 350 Online Law

Select 9 credit hours from the following:

- BUS-F 300 Introduction to Financial Management
- BUS-G 300 Introduction to Managerial Economics and Strategy
- BUS-J 306 Strategic Management and Leadership **OR** BUS-Z 302 Managing and Behavior in Organizations
- BUS-K 315 Business Process Management
- BUS-M 300 Introduction to Marketing
- BUS-P 300 Introduction to Operations Management
- BUS-S 305 Technology Infrastructure
- BUS-S 307 Data Management
- BUS-S 308 Business Application Development
- BUS-W 300 New Venture Management

OR

Required:

- BUS-A 200 Foundations of Accounting **OR** (BUS-A 100 Basics Accounting Skills and BUS-A 201

Introduction to Financial Accounting) **OR** (BUS-A 100 Basic Accounting Skills and BUS-A 202 Introduction to Managerial Accounting)
- BUS-K 201 The Computer in Business (minimum grade of C required)
- BUS-L 201 Legal Environment of Business **OR** BUS-L 350 Online Law

Select 6 credit hours from the following:

- BUS-F 300 Introduction to Financial Management
- BUS-G 300 Introduction to Managerial Economics
- BUS-J 306 Strategic Management and Leadership **OR** BUS-Z 302 Managing and Behavior in Organizations
- BUS-M 300 Introduction to Marketing
- BUS-P 300 Introduction to Operations Management
- BUS-W 300 Small Business Management

Please see Kelley School of Business bulletin for minor requirements.

Chemistry Cognate
This cognate fulfills the Chemistry minor.

Required:

- CHEM-C 117 Principles of Chemistry and Biochemistry I
- CHEM-C 341 Organic Chemistry I Lectures
- CHEM-C 342 Organic Chemistry II Lectures

Select 6 credits from the following:

- CHEM-A 314 Biological and Environmental Chemical Analysis
- CHEM-C 317 Equilibria and Electrochemistry
- CHEM-C 318 Spectrochemistry and Separation
- CHEM-N 330 Intermediate Inorganic Chemistry
- CHEM-C 360 Introductory Physical Chemistry
- CHEM-C 361 Physical Chemistry of Bulk Matter
- CHEM-C 362 Physical Chemistry of Molecules
- CHEM-C 430 Inorganic Chemistry
- CHEM-C 443 Organic Spectroscopy
- CHEM-C 460 Nuclear Chemistry
- CHEM-C 481 Physical Biochemistry
- CHEM-C 483 Biological Chemistry
- CHEM-C 484 Biomolecules and Catabolism
- CHEM-C 485 Biosynthesis and Physiology

Cognitive Science Cognate
Required:

- COGS-Q 240 Philosophical Foundations of the Cognitive and Information Sciences
- COGS-Q 260 Programming for the Cognitive and Information Sciences
- COGS-Q 270 Experiments and Models in Cognition
- COGS-Q 320 Computation in the Cognitive and Information Sciences

Select one course from the following:

- COGS-Q 301 Brain and Cognition
- COGS-Q 351 Introduction to Artificial Intelligence and Computer Simulation
- COGS-Q 360 Autonomous Robotics

Communication and Culture Cognate
This cognate fulfills the Communication and Culture minor.

Required:

- CMCL-C 190 Introduction to Media **OR** CMCL-C 205 Introduction to Communication and Culture
- CMCL-C 337 New Media
- CMCL-C 410 Media Theory

Select two courses from the following:
- CMCL-C 202 Media in the Global Context
- CMCL-C 306 Writing Media Criticism
- CMCL-C 315 Advertising and Consumer Culture
- CMCL-C 391 Media Audiences
- CMCL-C 392 Media Genres
- CMCL-C 411 Media Industries and Cultural Production
- CMCL-C 445 Media, Culture and Politics

Computer Science Cognate
This cognate fulfills the Computer Science minor.

Four, instead of two, Advanced Informatics courses must be completed if substituting CSCI-C 211/C 212 for INFO-I 210/I 211 in the major.

Required:

- CSCI-C 211 Introduction to Computer Science
- CSCI-C 212 Introduction to Software Systems
- CSCI-C 241 Discrete Structures for Computer Science
- CSCI-C 335 Computer Structures **OR** CSCI-C 343 Data Structures
- Select any additional CSCI course at 300/400 level

Economics Cognate
This cognate fulfills the Economics minor.

Required:

- MATH-M 119 Brief Survey of Calculus I **OR** MATH-M 211 Calculus I
- ECON-E 201 Introduction to Microeconomics
- ECON-E 202 Introduction to Macroeconomics
- ECON-E 321 Intermediate Microeconomic Theory
- Two additional 300/400 level ECON courses (excluding ECON-E 496 and Y 398). At least one of these courses must be numbered above ECON-E 321 (excluding ECON-E 370)

Fine Arts Cognate
Required:

- FINA-N 110 Introduction to Studio Art for Nonmajors
- FINA-S 250 Introduction to Design Practice
- FINA-D 210 Digital Art: Survey and Practice

Select three courses from one of the following areas:

Option I: Computer Art

- FINA-D 310 Interactive Multimedia
- FINA-D 318 3D Computer Graphics
- FINA-D 410 Advanced Multimedia

- FINA-D 418 Computer Graphical Environments

Option II: Graphic Design

- FINA-S 351 Typography I
- FINA-S 352 Production for the Graphic Designer
- FINA-S 451 Graphic Design Problem Solving

Students also may consider computer-based courses in printmaking, photography, and video. All courses selected for the cognate must be approved by the School of Fine Arts. Students are cautioned to review prerequisite requirements for upper-level courses.

Geography Cognate

This cognate fulfills the Geography minor.

Select one course from the following:

- GEOG-G 107 Physical Systems of the Environment
- GEOG-G 109 Weather and Climate
- GEOG-G 110 Introduction to Human Geography
- GEOG-G 120 World Regional Geography

Select four courses from the following:

- GEOG-G 237 Cartography and Geographic Information
- GEOG-G 250 Computer Methods in Geography
- GEOG-G 336 Environmental Remote Sensing
- GEOG-G 338 Geographic Information Science
- GEOG-G 436 Advanced Remote Sensing: Digital Image Processing
- GEOG-G 438 Advanced Geographic Information Science
- GEOG-G 488 Applied Spatial Statistics

Human-Centered Computing Cognate

This cognate fulfills the Human-Centered Computing minor.

Select 5 courses from the following:

- CSCI-A 216 Digital Multimedia Concepts and Technologies
- INFO-I 303 Organizational Informatics
- INFO-I 310 Multimedia Arts and Technology
- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 356 Globalization, Where We Fit In
- INFO-I 441 Human-Computer Interaction Design I
- INFO-I 453 Computer and Information Ethics
- Approved topic in INFO-I 399 Current Topics in Informatics or I 400 Topics in Informatics

Information Technology Cognate

This cognate fulfills the Information Technology minor.

Four, instead of two, Advanced Informatics courses must be completed if substituting CSCI-C 211/C 212 for INFO-I 210/I 211 in the major.

Required:

- CSCI-A 338 Network Technologies and Administration
- CSCI-C 211 Introduction to Computer Science and CSCI-C 212 Introduction to Software Systems
  OR
- CSCI-A 201 Introduction to Programming I and CSCI-A 202 Introduction to Programming II

Select one course (or option) from the following:

- CSCI-A 216 Digital Multimedia Concepts and Technologies
- CSCI-A 321 Computing Tools for Scientific Research
- CSCI-A 348 Mastering the World Wide Web
- Any three different topics of CSCI-A 290 Tools for Computing (if not part of a CSCI-A 202 course - see advisor for this exception)

Journalism Cognate

Required:

- JOUR-J 110 Foundations of Journalism and Mass Communication
- JOUR-J 200 Reporting, Writing, and Editing I
- JOUR-J 210 Visual Communication

Select one additional required course from the following:

- JOUR-J 303 Online Journalism
- JOUR-J 362 Journalism Multimedia Storytelling

Select two courses from the following:

- JOUR-J 360 Journalism Specialties
- JOUR-J 460 Topics Colloquium
- JOUR-J 463 Graphic Design I
- JOUR-J 465 Graphic Design II

Linguistics Cognate

Required:

- LING-L 303 Introduction to Linguistic Analysis
- LING-L 306 Phonetics

Select two courses from the following:

- LING-L 307 Phonology
- LING-L 308 Morphology
- LING-L 310 Syntax
- LING-L 325 Semantics
- LING-L 431 Field Methods

Select one course from the following:

- LING-L 445 The Computer and Natural Language
- LING-L 485 Topics in Linguistics
- MATH-M 385 Mathematics from Language
- Any course from outside the Department of Linguistics with sufficient computational content, subject to approval by the Linguistics Undergraduate Advisor.

Mathematics Cognate

This cognate fulfills the Mathematics minor.

Required:

- MATH-M 211 Calculus I
- MATH-M 212 Calculus II

Select one course from the following:

- MATH-M 301 Linear Algebra and Applications
- MATH-M 303 Linear Algebra for Undergraduates

Select two courses from the following:

- MATH-M 343 Introduction to Differential Equations with Applications I
- MATH-M 344 Introduction to Differential Equations with Applications II
- MATH-M 348 Discrete Mathematical Models
- MATH-M 353 Discrete Mathematics
- MATH-M 365 Introduction to Probability and Statistics
- MATH-M 371 Elementary Computational Methods
- MATH-M 447 Mathematical Models and Applications I
- MATH-M 453 Cryptography
- MATH-M 455 Quantum Computing I

Medical Sciences Cognate

This cognate fulfills the Medical Sciences minor **IF** the cognate GPA is 2.7 or above

Required:

- ANAT-A 215 Basic Human Anatomy
- PHSL-P 215 Basic Human Physiology

Select 6 credit hours from the following:

- ANAT-A 464 Human Tissue Biology
- ANAT-A 480 Human Anatomy for Medical Imaging Evaluation
- MSCI-M 131 Disease and the Human Body **OR** MSCI-M 216 Medical Science of Psychoactive Drugs
- MSCI-M 300 Topics in Medical Sciences
- MSCI-M 450 Undergraduate Research in Biomedical Sciences
- MSCI-M 470 Mechanisms of Human Disease
- MSCI-M 480 Molecular Biology of Cancer: Cell Signaling and Fate
- MSCI-M 485 Physiology of Human Disease
- MSCI-M 490 Special Topics in Biomedical Sciences
- PHSL-P 416 Comparative Animal Physiology
- PHYS-P 314 Introduction to Medical Physics

Music Cognate

Required:

- MUS-Z 361 Introduction to MIDI and Computer Music
- MUS-Z 362 Computer Music: Design/Perform

Select one of the following sequences:

- MUS-Z 111 Introduction to Music Theory and MUS-Z 211 Music Theory II
- MUS-T 151 Music Theory and Literature I and MUS-T 152 Music Theory and Literature II

Select one additional course:

- MUS-A 100 Introduction to Personal Recording
- MUS-Z 120 Music in Multimedia
- MUS-Z course at 300/400 level
-

Philosophy of Mind and Cognition Cognate

This cognate fulfills the Philosophy of Mind and Cognition minor.

Required:

- PHIL-P 360 Introduction to Philosophy of Mind
- COGS-Q 240 Philosophical Foundations of the Cognitive and Information Sciences

Select one course from the following:

- PHIL-P 250 Introductory Symbolic Logic
- PHIL-P 251 Intermediate Symbolic Logic
- PHIL-P 352 Logic and Philosophy

Select two courses from the following:

- PHIL-P 211 Modern Philosophy: Descartes through Kant
- PHIL-P 310 Topics in Metaphysics
- PHIL-P 312 Topics in the Theory of Knowledge
- PHIL-P 320 Philosophy and Language
- PHIL-P 366 Philosophy of Action

Pre-Health Professions Cognate

Required:

- BIOL-L 112 Foundations of Biology: Biological Mechanisms
- CHEM-C 117 Principles of Chemistry and Biochemistry I

Select 7 or more credit hours from the following:

- ANAT-A 215 Basic Human Anatomy
- BIOL-L 113 Biology Laboratory
- BIOL-L 211 Molecular Biology
- CHEM-C 341 Organic Chemistry I Lectures
- CHEM-C 342 Organic Chemistry II Lectures
- CHEM-C 343 Organic Chemistry I Laboratory
- CHEM-N 330 Intermediate Inorganic Chemistry
- PHSL-P 215 Basic Human Physiology
- PHYS-P 201 General Physics I **OR** PHYS-P 221 Physics I

Psychology Cognate

This cognate fulfills the Psychology minor.

Required:

Select one course (or sequence) from the following:

- PSY-P 101 Introductory Psychology I and PSY-P 102 Introductory Psychology II
- PSY-P 106 General Psychology, Honors
- PSY-P 155 Introduction to Psychological and Brain Sciences

Select one course (or approved course) from the following:

- PSY-P 211 Methods of Experimental Psychology
- PSY-K 300 Statistical Techniques
- PSY-K 310 Statistical Techniques
- approved College of Arts and Sciences statistics course

Select three courses from the following:

- PSY-P 325 Psychology of Learning
- PSY-P 329 Sensation and Perception
- PSY-P 330 Perception/Action
- PSY-P 335 Cognitive Psychology
- PSY-P 346 Neuroscience
- PSY-P 349 Cognitive Neuroscience
- PSY-P 350 Human Factors/Ergonomics

- PSY-P 461 Human Memory

Public and Environmental Affairs Cognates

Environmental Management Cognate This cognate fulfills the Environmental Management minor.

Required:

- SPEA-E 272 Introduction to Environmental Sciences
- SPEA-E 363 Environmental Management

Select one course from the following:

- SPEA-E 311 Introduction to Risk Assessment and Risk Communication
- SPEA-E 340 Environmental Economics and Finance
- SPEA-E 476 Environmental Law and Regulation

Select one course from the following:

- SPEA-E 325 Computing for Environmental Scientists
- SPEA-E 419 Applied Remote Sensing of the Environment

Select one course from the following: (if not used above)

- SPEA-E 325 Computing for Envioronmental Scientists
- SPEA-E 355 Introduction to Limnology
- SPEA-E 410 Introduction to Environmental Toxicology
- SPEA-E 411 Introduction to Groundwater Hydrology
- SPEA-E 412 Risk Communication
- SPEA-E 419 Applied Remote Sensing of the Environment
- SPEA-E 422 Urban Forest Management
- SPEA-E 431 Water Supply and Wastewater Treatment
- SPEA-E 440 Wetlands: Biology and Regulation
- SPEA-E 451 Air Pollution and Control
- SPEA-E 452 Solid and Hazardous Waste Management
- SPEA-E 456 Lake and Watershed Management
- SPEA-E 457 Introduction to Conservation Biology
- SPEA-E 460 Fisheries and Wildlife Management
- SPEA-E 461 Fisheries and Wildlife Management Laboratory

Health Systems Administration Cognate
This cognate fulfills the Health Systems Administration minor.

Required:

- SPEA-H 124 Heath Care Management and Policy
- SPEA-V 373 Human Resources Management in the Public Sector

Select three courses from the following:

- SPEA-H 352 Health Finance I
- SPEA-H 353 Health Finance II
- SPEA-H 354 Health Economics
- SPEA-H 401 Strategic Planning for Health Care Organizations
- SPEA-H 402 Hospital Administration
- SPEA-H 411 Chronic and Long-Term Care Administration

Policy Studies Cognate

This cognate fulfills the Policy Studies minor.

Select one course from the following:

- SPEA-V 160 National and International Policy
- SPEA-V 161 Urban Problems and Solutions

Required:

- SPEA-V 348 Management Science
- SPEA-V 370 Research Methods and Statistical Modeling
- SPEA-V 386 Case Studies for Policy Analysis
- SPEA-V 401 Financial and Cost-Benefit Analysis

Public Finance Cognate This cognate fulfills the Public Finance minor.

Required:

- SPEA-V 246 Elements of Government and Nonprofit Financial Accounting Cycle
- SPEA-V 346 Introduction to Government Accounting and Financial Reporting
- SPEA-V 361 Financial Management
- SPEA-V 372 Government Finance and Budgets

Select one course from the following (an alternative course may be chosen in consultation with a SPEA advisor and approval from the Director of Undergraduate Studies in Informatics):

- SPEA-V 401 Financial and Cost-Benefit Analysis
- SPEA-V 441 Topics in Financial Management and Policy

Urban Affairs Cognate

Required:

- SPEA-E 418 Vector-Based Geographic Information Systems OR SPEA-V 450 Contemporary Issues in Public Affairs
- SPEA-V 461 Computer Applications in Public Affairs
- SPEA-V 475 Database Management Systems

Select two courses from the following:

- SPEA-V 340 Urban Government Administration
- SPEA-V 368 Managing Government Operations
- SPEA-V 372 Government Finance and Budgets
- SPEA-V 421 Metropolitan Development

Public Health Cognate

Required:

- SPH-B 366 Community Health
- SPH-B 403 Public Health Program Planning
- SPH-H 311 Human Disease and Epidemiology
- SPH-H 381 Introduction to Health Information and Statistics
- SPH-H 494 Research and Evaluation Methods in Health and Safety

Security Cognate

This cognate fulfills the Security minor.

Required:

- INFO-I 130 Introduction to Cybersecurity
- INFO-I 230 Analytical Foundations of Security

- INFO-I 231 Introduction to the Mathematics of Cybersecurity

Select three courses from the following:

- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 400 Topics in Informatics—when security related, approval required
- INFO-I 430 Security for Networked Systems
- INFO-I 433 Systems & Protocol Security & Information Assurance
- INFO-I 453 Computer and Information Ethics

Telecommunications Cognate

All Telecommunications cognates fulfill the Telecommunications minor.

Applications
This cognate area focuses on video and multimedia production using computers. The applications option requires the completion of 18 credit hours.
Required:

- TEL-T 101 Media Life
- TEL-T 206 Introduction to Design and Production
- TEL-T 283 Introduction to Production Techniques and Practices **OR** TEL-T 284 Introduction to Interactive Media Design

Select 9 credit hours from the following:

- TEL-T 351 Video Field and Post Production
- TEL-T 353 Audio Production
- TEL-T 354 Program Graphics and Animation
- TEL-T 356 TV Studio Production
- TEL-T 361 Flash for Games and Interactive Media
- TEL-T 364 Introduction to 3D Digital Modeling and Animation
- TEL-T 366 Multiplayer Game Design
- TEL-T 367 Theory and Practice of Game Design
- TEL-T 369 Sound Design
- TEL-T 431 Video Documentary
- TEL-T 435 Documentary Production
- TEL-T 452 Topical Seminar in Design and Production
- TEL-T 454 DVD Authoring
- TEL-T 460 Projects in Game Design
- TEL-T 461 Advanced Flash for Games and Interactive Media
- TEL-T 464 Advanced 3D Digital Modeling and Animation

Implications
The implications cognate area allows students to tailor their studies to issues of particular interest.
Required:

- TEL-T 101 Media Life
- TEL-T 205 Introduction to Media and Society

Select 9 credit hours from the following:

- TEL-T 311 Media History
- TEL-T 312 Politics and the Media
- TEL-T 314 Telecommunications Processes and Effects
- TEL-T 316 Media Ethics and Professional Responsibility
- TEL-T 317 Children and Media
- TEL-T 416 Program Analysis and Criticism
- TEL-T 424 Telecommunications and the Constitution
- TEL-T 427 International Telecommunications

Foundations
The Foundations cognate area focuses specifically on the development and operation of advanced telecommunications networks.
Required:

- TEL-T 101 Media Life
- TEL-T 207 Introduction to Telecommunications Industry and Management

Select one course from the following:

- TEL-T 322 Telecommunications Networks
- TEL-T 326 Network Design
- TEL-T 327 Data Communications

Select two courses from the following:

- TEL-T 321 Policymaking in Telecommunications
- TEL-T 322 Telecommunications Networks (if not used above)
- TEL-T 326 Network Design (if not used above)
- TEL-T 327 Data Communications (if not used above)
- TEL-T 340 Electronic Media Advertising
- TEL-T 343 Electronic Media Sales
- TEL-T 344 Programming Strategies
- TEL-T 347 Promotion and Marketing in Telecommunications
- TEL-T 348 Audience Analysis
- TEL-T 413 Global Media Issues
- TEL-T 421 Economics of Communications Industries
- TEL-T 422 Business Applications in Telecommunications
- TEL-T 425 Telecommunications Regulation
- TEL-T 427 International Telecommunications
- TEL-T 441 Advanced Advertising Strategies
- TEL-T 446 Telecommunications Management

Bachelor of Science in Computer Science

- Common Ground - General Education Requirements
- Basic Requirements
- SoIC Degree and Major Requirements
- Specializations

Basic Degree Requirements

Students must successfully complete a minimum of 120 credit hours for the Bachelor of Science degree. Students must complete the specific degree requirements of the School of Informatics and Computing as follows:

- Students must have a minimum cumulative grade point average of 2.0 (C). Any course taken to satisfy the major requirements must be completed with a minimum grade of
  C- unless otherwise specified and the grade point average of all courses taken in the major must be at least 2.0. The major requirements for computer science include core courses, computer science

electives, math courses and specialization area courses.
- Students must complete a minimum of 30 credit hours in courses at the 300-400 (junior-senior) level.
- Students must complete at least 12 credit hours of course work in the major field of study on the Bloomington campus.
- Students are expected to complete the requirements for their undergraduate degree within eight years of admission to Indiana University. Students are allowed to continue beyond this time period only at the discretion of the Student Services office.
- Courses that fulfill the requirements for a specialization area may also meet the general education distribution requirements.
- Specialization area courses cannot count as computer science core courses, required math courses or computer science elective courses.
- If specialization area courses are equivalent to computer science major course requirements, students should substitute an alternate course.

SoIC Degree and Major Requirements

**** Equivalent honors versions of regular courses may substitute for all requirements. Please see specific course descriptions, posted in respective bulletin, for prerequisites and other pertinent information. ****

SoIC Degree Requirements

English Composition (3 cr.) This applies only to students who fulfilled Common Ground English Composition with a grade of C-.

One of the following options with a minimum grade of C:

- CMLT-C 110 Writing the World
- ENG-W 131 Elementary Composition 1
- ENG-W 170 Introduction to Argumentative Writing (Topic: Projects in Reading and Writing)

Intensive Writing (3 cr.)

One intensive writing course at the 200 level or above after completing the English composition requirement. Intensive writing courses at IUB are defined by the College of Arts and Sciences. Students must check the listings for courses in the online enrollment system each semester to make certain that the course section they have chosen fulfills the requirement.

Intensive Writing credit will not be awarded for transfer courses and will not be awarded for written work in courses that are not listed as Intensive Writing unless special arrangements have been completed and approved prior to the relevant deadline. All special arrangements must be approved by the director of undergraduate studies in the respective division. The deadline for submitting a proposal to satisfy Intensive Writing by special arrangement is the end of the 2nd week of classes (for regular semester-length courses) and the end of the first week of classes for a summer session course.

Natural Science (12 cr.)

Select twelve credit hours from the following:

- PSY-P 106 General Psychology, Honors
- PSY-P 211 Methods of Experimental Psychology
- COGS-Q 270 Experiments and Models in Cognition
- AST (any course)
- BIOL (any course)
- CHEM (any course)
- GEOL (any course)
- PHYS (any course)

General Electives

Remaining credit hours may be used to fulfill minors or pursue personal interests. Students may obtain a maximum of three minors. A maximum of 4 combined HPER-E and SPH-I credit hours and 10 MUS-X credit hours below the 100 level may be used in total hours.

Major Requirements

12 hours in the major must be completed on the Bloomington campus.

Students must complete the following:

Core courses:

- CSCI-C 211 Introduction to Computer Science
- CSCI-C 212 Introduction to Software Systems
- CSCI-C 241 Discrete Structures for Computer Science
- CSCI-C 343 Data Structures

One approved specialization (see specializations area in bulletin)

45 hours including Core courses and Specialization with the remaining courses drawn from the following list – at least 26 of the 45 hours must be at the 300 level or above.

- CSCI C, P, H and B courses numbered 200 and above
- CSCI-Y 390* Undergraduate Independent Study
- CSCI-Y 391* Undergraduate Independent System Development
- CSCI-Y 399* Project in Professional Practice
- CSCI-Y 499* Honors Research
- CSCI-H 498 Honors Seminar (at most 1 hour)
- MATH-M 471 Numerical Anaylsis I
- MATH-M 472 Numerical Anaylsis II
- INFO-I 101 Introduction to Informatics (if completed before or concurrently with CSCI-C 212)
- INFO-Y 395 Career Development for Informatics Major
- INFO-I 494/INFO-I 495 Design and Development of an Information System - authorization required, please see advisor

* Only 6 total hours in these 4 courses

Mathematical Science Requirement:

- MATH-M 211 Calculus I (or equivalent proficiency)

Select two from the following:

- MATH-M 212 Calculus II
- MATH-M 213 Accelerated Calculus
- MATH-M 300 (all 300 level courses)
- MATH-M 400 (all 400 level courses)
- MATH-T 336 Topics in Euclidean Geometry
- MATH-T 403 Modern Algebra for Secondary Teachers

- ECON-E 370 Statistical Analysis for Business and Economics
- LAMP-L 316 Junior Seminar: Analytical Problem Solving
- PHIL-P 251 Intermediate Symbolic Logic
- PHIL-P 350 Logic of Sets
- PHIL-P 352 Logic and Philosophy
- STAT-S 320 Introduction to Statisitics

Specialization Area Courses

Students should, in consultation with their academic advisor, choose a specialization area before their junior year. Students must receive a minimum grade of C– in each course and a cumulative GPA of 2.0 or higher in their specialization area. Please consult the specialization section of this bulletin for the list of specialization areas.

Bachelor of Science in Computer Science with Honors

Students must satisfy the requirements for the B.S. in Computer Science degree and the following additional requirements:

- Overall GPA 3.3 or greater
- Computer Science major GPA 3.3 or greater
- Completion of at least 11 hours of CSCI honors courses (CSCI-H or CSCI-Y 499)
- At least 29 of the 45 hours required for the major completed at the 300 level or above

Artificial Intelligence Specialization

1. CSCI-B 351 Introduction to Artificial Intelligence and Computer Simulation
2. Select one course from the following:
   - CSCI-B 355 Autonomous Robots
   - CSCI-B 490 Seminar in Computer Science (approved topic)
   - INFO-I 441 Human Computer Interaction Design
   - LING-L 445 The Computer and Natural Language
   - INFO-I 400 Topics in Informatics (approved topic)
   - INFO-I 485 Bioinspired Computing
   - INFO-I 486 Artificial Life
3. Select one course from the following:
   - CSCI-B 403 Introduction to Algorithm Design and Analysis
   - CSCI-P 415 Introduction to Verification
4. One CSCI P course (may be P 415)
5. INFO-I 427 Search Informatics

Note: CSCI-P 415 can satisfy #3 and #4 simultaneously

Data and Search Specialization

1. CSCI-B 403 Algorithm Design and Analysis
2. CSCI-B 461 Database Concepts
3. Select one project course from the following:
   - CSCI-P 434 Distributed Systems
   - CSCI-P 462 Database Applications Design and Implementation
   - INFO-I 427 Search Informatics
4. Select two additional courses from the following:
   - CSCI-B 351 Introduction to Artificial Intelligence and Computer Simulation
   - CSCI-P 434 Distributed Systems
   - CSCI-P 462 Database Applications Design and Implementation
   - INFO-I 427 Search Informatics
   - INFO-I 453 Computer and Information Ethics
   - CSCI-B 490 Topics course, as offered and approved

The data specialist has strong technical skills in the methodology behind databases, search engines and distributed repositories, and can create new technical solutions. For more information, please visit http://dataandsearch.org/dsi/undergraduate.

Foundations Specialization

1. CSCI-B 401 Fundamentals of Computing Theory
2. CSCI-B 403 Introduction to Algorithm Design and Analysis
3. Select one course from the following:
   - CSCI-P 415 Introduction to Verification
   - CSCI-B 461 Database Concepts
4. Select two courses from the following (in addition to BS Math requirement):
   - CSCI-C 311 Programming Languages
   - CSCI-P 423 Compilers
   - MATH-M 453 Cryptography
   - MATH-M 455 Quantum Computing I
   - MATH-M 301 Linear Algebra and Applications **OR** MATH-M 303 Linear Algebra for Undergraduates
   - MATH-M 365 Introduction to Probability and Statistics
   - MATH-M 471 Numerical Analysis I
   - MATH-M 584 Recursion Theory
   - STAT-S 320 Introduction to Statistics

Programming Languages Specialization

1. CSCI-C 311 Programming Languages
2. Select two courses from the following:
   - CSCI-C 335 Computer Structures
   - CSCI-P 423 Compilers (Recommended)
   - CSCI-P 436 Introduction to Operating Systems
   - CSCI-B 441 Digital Design
   - CSCI-B 443 Introduction to Computer Architecture
   - CSCI-B 490 Seminar in Computer Science (approved topic)
3. Select one course from the following:
   - CSCI-B 401 Fundamentals of Computing Theory
   - CSCI-B 403 Introduction to Algorithm Design and Analysis
   - CSCI-P 415 Introduction to Verification

Systems Specialization

1. CSCI-C 335 Computer Structures
2. Select one project course from the following:
   - CSCI-P 436 Introduction to Operating Systems
   - CSCI-P 438 Introduction to Computer Networks

- CSCI-P 442 Digital Systems
- CSCI-P 545 Embedded and Real-Time Systems

3. Select one additional systems course from the following:
   - CSCI-B 441 Digital Design
   - CSCI-B 443 Introduction to Computer Architecture
   - CSCI-B 490 Seminar in Computer Science (approved topic)
   - CSCI-P 434 Distributed Systems
   - CSCI-P 436 Introduction to Operating Systems
   - CSCI-P 438 Introduction to Computer Networks
   - CSCI-P 442 Digital Systems
   - CSCI-P 545 Embedded and Real-Time Systems
4. Select one course from the following:
   - CSCI-B 401 Fundamentals of Computing Theory
   - CSCI-B 403 Introduction to Algorithm Design and Analysis
   - CSCI-P 415 Introduction to Verification

Specializations

**** Equivalent honors versions of regular courses may substitute for all requirements. Please see specific course descriptions, posted in respective bulletin, for prerequisites and other pertinent information. ****

Students must receive a minimum grade of C- in each specialization course.

- Artificial Intelligence
- Data and Search
- Foundations
- Programming Languages
- Systems

Common Ground– General Education Requirements

In summer 2011, Indiana University Bloomington instituted a new campus-wide General Education Program. All IUB undergraduate students who matriculate in or after first summer session 2011 will be required to complete the campus-wide GenEd program prior to graduation. Some courses may overlap and satisfy the Common Ground General Education requirements as well as some additional SoIC General Education requirements needed to complete INFOBS or CSCIBS majors. Please be aware that some courses in the INFOBS or CSCIBS majors require a higher gpa to fulfill a requirement than the same course in the General Education requirement (ex. ENG-W 131 satisfies the General Education requirement with a grade of "C-", but a grade of "C" is needed to satisfy the SoIC English Composition requirement).

The Common Ground

The bulletin with the GenEd requirements, course listings and information can be found at this url: http://www.indiana.edu/~bulletin/iub/general-education/2013-2014/index.shtml.

Certificates & Minors

The undergraduate minors or certificate allows a student majoring in another school to get appropriate training in informatics and obtain certification as someone who knows how to apply informatics tools to that subject area. Students may obtain a maximum of three minors.

**** Equivalent honors versions of regular courses may substitute throughout the certificate or minor. ****

Certificate in Informatics

Students must be an IU admitted degree-seeking student and certificate will be awarded concurrently or after an IU degree.

Students may obtain an area certificate in Informatics by successfully completing 8 courses. INFO-I 101 must be completed with a minimum grade of C. A minimum grade of C- in all other courses with an overall certificate GPA of 2.0 is required.

Required Courses:

- INFO-I 101 Introduction to Informatics (minimum grade of C required in this course)
- INFO-I 201 Mathematical Foundations of Informatics
- INFO-I 202 Social Informatics OR INFO-I 222 The Information Society
- INFO-I 210 Information Infrastructure I
- INFO-I 211 Information Infrastructure II
- INFO-I 300 Human-Computer Interaction Design and Programming
- INFO-I 308 Information Representation

In addition, students must take one course from the list of informatics electives (list can be found under the BS Informatics area, SoIC Degree and Major Requirements). CSCI majors may not count upper level CSCI courses in this certificate if used in major requirements.

Minor in Informatics

Students may obtain a minor in Informatics by successfully completing five courses totaling a minimum of 17 credit hours. At least two of the five courses must be at the 300/400 level. INFO-I 101 must be completed with a minimum grade of C. A minimum grade of C- in all other courses with an overall minor GPA of 2.0 is required.

Required Course:

- INFO-I 101 Introduction to Informatics (minimum grade of C required in this course)

A programming course selected from the following:

- INFO-I 210 Information Infrastructure I
- CSCI-A 201 Introduction to Programming I
- CSCI-C 211 Introduction to Computer Science

Three additional Informatics courses.

- At least two of these courses must be at the 300/400 level. Excludes INFO-I 110, I 111, I 130, T 100, Y 100 and Y 395. Independent study, internship and capstone courses may only be counted with approval of the Director of Undergraduate Studies.

Minor in Human-Centered Computing

Students may obtain a minor in Human-Centered Computing by successfully completing a minimum of

15 credit hours. INFO-I 101 must be completed with a minimum grade of C. A minimum grade of C- in all other courses with an overall minor GPA of 2.0 is required.

The minor introduces students with little or no background in computing to the social, cultural, ethical and organizational dimensions of computing and information technology, as well as the role of design in the creation of new technology.

For Informatics Majors:
Select five courses from the following:

- CSCI-A 216 Digital Multimedia Concepts and Technologies
- INFO-I 303 Organizational Informatics
- INFO-I 310 Multimedia Arts and Technology
- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 356 Globalization, Where We Fit In
- INFO-I 441 Human-Computer Interaction Design I
- INFO-I 453 Computer and Information Ethics
- Approved topic in INFO-I 399 or I 400

For non-Informatics Majors:

Required Courses:

- INFO-I 101 Introduction to Informatics (minimum grade of C required in this course) **OR** CSCI-A 110 Introduction to Computers and Computing
- INFO-I 202 Social Informatics OR INFO-I 222 The Information Society
- INFO-I 300 Human-Computer Interaction Design and Programming

Select two courses from the following:

- CSCI-A 216 Digital Multimedia Concepts and Technologies
- INFO-I 303 Organizational Informatics
- INFO-I 310 Multimedia Arts and Technology
- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 356 Globalization, Where We Fit In
- INFO-I 441 Human-Computer Interaction Design I
- INFO-I 453 Computer and Information Ethics
- Approved topic in INFO-I 399 or I 400

Minor in Information Technology

Computer Science majors may not claim this minor.

Students may obtain a minor in Information Technology by successfully completing a minimum of 15 credit hours. A minimum grade of C- in each course and an overall minor GPA of 2.0 is required.

- CSCI-A 338 Network Technologies and Administration
- CSCI-C 211 Introduction to Computer Science and CSCI-C 212 Introduction to Software Systems
  OR
- CSCI-A 201 Introduction to Programming I and CSCI-A 202 Introduction to Programming II

Select one course from the following:

- CSCI-A 216 Digital Multimedia Concepts and Technologies
- CSCI-A 321 Computing Tools for Scientific Research
- CSCI-A 348 Mastering the World Wide Web
- 3 CSCI-A 290 Tools for Computing (if not part of a CSCI-A 202 course - see advisor for this exception)

Minor in Security Informatics

Students may obtain a minor in Security Informatics by successfully completing a minimum of 16 credit hours. A minimum grade of C- in each course and an overall minor GPA of 2.0 is required.

The minor is an appropriate addition for students interested in gaining significant exposure to issues, challenges and techniques relevant to computer based security.

Required Courses:

- INFO-I 130 Introduction to Cybersecurity
- INFO-I 230 Analytical Foundations of Security
- INFO-I 231 Math Foundations of Cybersecurity

Select three courses from the following:

- INFO-I 330 Legal and Social Informatics of Security
- INFO-I 400 Topics in Informatics (when security related, approval required)
- INFO-I 430 Security for Networked Systems
- INFO-I 433 Systems & Protocol Security & Information Assurance
- INFO-I 453 Computer and Information Ethics

Minor in Computer Science

Students may obtain a minor in Computer Science by successfully completing a minimum of 15 credit hours. A minimum grade of C- in each course and an overall minor GPA of 2.0 is required.

- CSCI-C 211 Introduction to Computer Science
- CSCI-C 212 Introduction to Software Systems
- CSCI-C 241 Discrete Structures for Computer Science
- CSCI-C 335 Computer Structures **OR** CSCI-C 343 Data Structures

Outside Minors

Students may pursue minors and certificates in other schools. Up to three minors may appear on the student's Indiana University transcript. Many cognates automatically complete minor requirements, including: Biology; Chemistry; Communication and Culture; Computer Science; Economics; Environmental Management; Geography; Health Systems Administration; Human-Centered Computing; Information Technology; Mathematics; Medical Sciences (if cognate GPA is 2.7); Philosophy of Mind and Cognition; Policy Studies; Psychology; Public Finance; Security; Telecommunications (all options);

For outside minor requirements, refer to the bulletin of the school offering the minor. The department offering the minor defines the requirements for the minor. Students are required to follow the department's rules regarding grades, prerequisites and course requirements.

Concurrent/Sequential Baccalaureate Degrees

Concurrent Degree

Students may be permitted to pursue a School of Informatics and Computing degree concurrently with another degree-granting IU-Bloomington school. Check with School of Informatics and Computing academic advisor for more details and approval. Students concurrently pursuing a Computer Science and Informatics degree may not double-count CSCI upper level courses.

Sequential Baccalaureate Degree

Students may be permitted to pursue a School of Informatics and Computing degree after completion of a first degree from Indiana University or another university. Students from another university must first be admitted to Indiana University as a degree seeking student. Please see http://www.indiana.edu/~iuadmit/ for admission information.

Students seeking second degree candidacy should review the guidelines available from the School of Informatics and Computing office. Check with School of Informatics and Computing academic advisor for more details and approval.

Students with a bachelor's degree who wish to further their education should also consider becoming qualified for admission to a graduate program.

Courses

Computer Science

Informatics

Key to Course Codes

AAAD	African American and African Diaspora Studies (COLL)
AFRI	African Studies (COLL)
AMID	Apparel Merchandising and Interior Design (COLL)
AMST	American Studies Program (COLL)
ANAT	Anatomy (Medical Sciences Program)
ANTH	Anthropology (COLL)
AST	Astronomy (COLL)
BIOL	Biology (COLL)
BUS	Kelley School of Business
CEUS	Central Eurasian Studies (COLL)
CHEM	Chemistry (COLL)
CLAS	Classical Studies (COLL)
COLL	College of Arts and Sciences
COGS	Cognitive Science Programs (COLL)
CMCL	Communication and Culture (COLL)
CMLT	Comparative Literature (COLL)
CJUS	Criminal Justice (COLL)
CSCI	Computer Science (School of Informatics and Computing)
EALC	East Asian Languages and Cultures (COLL)
ECON	Economics (COLL)
EDUC	School of Education
ENG	English (COLL)
FINA	Fine Arts (COLL)
FOLK	Folklore and Ethnomusicology (COLL)
FRIT	French and Italian (COLL)
GEOG	Geography (COLL)
GEOL	Geological Sciences (COLL)
GER	German Studies (COLL)
GNDR	Gender Studies (COLL)
HISP	Spanish and Portuguese (COLL)
HIST	History (COLL)
HPER	School of Health, Physical Education, and Recreation
HPSC	History and Philosophy of Science (COLL)
HON	Honors (COLL)
HUBI	Human Biology (COLL)
INFO	School of Informatics and Computing
INTL	International Studies Program (COLL)
JOUR	School of Journalism
JSTU	Jewish Studies (COLL)
LAMP	Liberal Arts and Management Program (COLL)
LING	Linguistics (COLL)
LTAM	Latin American and Caribbean Studies (COLL)
MATH	Mathematics (COLL)
MUS	School of Music
NELC	Near Eastern Languages and Cultures (COLL)
NURS	School of Nursing
PHIL	Philosophy (COLL)
PHSL	Physiology (Medical Sciences Program)
PHYS	Physics (COLL)
POLS	Political Science (COLL)
PSY	Psychological and Brain Sciences (COLL)
REL	Religious Studies (COLL)
SLAV	Slavic Languages and Literatures (COLL)
SLIS	School of Library and Information Science
SOC	Sociology (COLL)
SPEA	School of Public and Environmental Affairs

SPHS	Speech and Hearing Sciences (COLL)
STAT	Statistics (COLL)
TEL	Telecommunications (COLL)
THTR	Theatre and Drama (COLL)
WEUR	West European Studies (COLL)

Informatics

INFO-T 100 Topics in Informatics Technology (1-3 cr.) Variable topic. The course serves as an introduction to a specific information technology in a hands-on setting. Emphasis is on problem solving techniques using technology. Credit hours may not be applied toward satisfying major requirements in the School of Informatics.

INFO-Y 100 Exploring Informatics and Computer Science (1 cr.) Technology is everywhere and how it relates to the world today is very important to the future. The objective of this course is to offer students an opportunity to explore the many tracks within the fields of Informatics and Computer Science, while also learning about the multiple careers available to students majoring in the fields. Emphasis will be placed on the various ways technology affects the work world and how students can tailor a major to their individual interests. The course will promote a hands-on, interactive and self-reflective course environment. Offered as either a six or eight week course.

INFO-I 101 Introduction to Informatics (4 cr.) Problem solving with information technology; introductions to information representation, relational databases, system design, propositional logic, cutting-edge technologies: CPU, operation systems, networks; laboratory emphasizing information technology including Web page design, word processing, databases, using tools available on campus. Credit given for only one of INFO-I 101 or H 101.

INFO-H 101 Introduction to Informatics, Honors (4 cr.) Honors version of# INFO-I 101. Problem solving with information technology; introductions to information representation, relational databases, system design, propositional logic, cutting-edge technologies: CPU, operation systems, networks; laboratory emphasizing information technology including Web page design, word processing, databases, using tools available on campus. Credit given for only one of INFO-I 101 or H 101.

INFO-I 110 Basic Tools of Informatics I—Programming Concepts (1.5 cr.) P: CSCI-A 110, A 111, or equivalent computing experience. Introduction to programming for users of computer systems. Emphasis on problem-solving techniques. An eight-week lecture and laboratory course. Cross-listed with CSCI-A 112. Credit given for only one of the following: INFO-I 110 or CSCI-A 112.

INFO-I 111 Basic Tools of Informatics II—Introduction to Databases (1.5 cr.) P: CSCI-A 110, A 111, or equivalent computing experience. Introduction to database design concepts. Entering and modifying data, accessing data using visual tools and SQL, and building database applications using forms and application development tools. Emphasis on problem-solving techniques. An eight-week lecture and laboratory course. Cross-listed with CSCI-A 114. Credit given for only one of the following: INFO-I 111 or CSCI-A 114.

INFO-I 123 Data Fluency (3 cr.) Data is big. Data is everywhere. How can we possibly be expected to keep up in a world full of data, much of which is data about ourselves? This class provides fundmental skills for the 21st century: understanding data, extracting knowledge from data, generating predictions from data and presenting data.

INFO-I 130 Introduction to Cybersecurity (1 cr.) P: INFO-I 101. C: INFO-I 101. This course introduces students to cybersecurity. The course will primarily focus on introduction to three core areas (technical aspects of security, organizational aspects of security, and legal aspects of security). Through examples of security problems in real life, this course will illuminate fundamental ideas and concepts of information security. An eight-week course.

INFO-I 201 Mathematical Foundations of Informatics (4 cr.) P: INFO-I 101 and MATH-M 118, MATH-A 118, MATH-S 118, or MATH-D 116-117. An introduction to methods of analytical, abstract, and critical thinking; deductive reasoning; and logical and mathematical tools used in information sciences. The topics include propositional and predicate logic, natural deduction proof system, sets, functions and relations, proof methods in mathematics, mathematical induction, and graph theory. Credit given for only one INFO-I 201 or H 201.

INFO-H 201 Mathematical Foundations of Informatics, Honors (4 cr.) P: INFO-I 101, and MATH-M 118, MATH-A 118, or MATH-S 118. Honors version of INFO-I 201. An introduction to methods of analytical, abstract, and critical thinking; deductive reasoning; and logical and mathematical tools used in information sciences. The topics include propositional and predicate logic, natural deduction proof system, sets, functions and relations, proof methods in mathematics, mathematical induction, and graph theory. Credit given for only one INFO-I 201 or INFO-H 201.

INFO-I 202 Social Informatics (3 cr.) P: INFO-I 101. Introduction to key social research perspectives and literatures on the use of information and communication technologies. Discusses current topics such as information ethics, relevant legal frameworks, popular and controversial uses of technology (for example, peer-to-peer file sharing), digital divides, and so on. Outlines research methodologies for social informatics. Credit given for only one of #INFO-I 202 or H 202.

INFO-H 202 Social Informatics, Honors (3 cr.) P: INFO-I 101. Honors version of INFO-I 202. Introduction to key social research perspectives and literatures on the use of information and communication technologies. Discusses current topics such as information ethics, relevant legal frameworks, popular and controversial uses of technology (for example, peer-to-peer file sharing), digital divides, and so on. Outlines research methodologies for social informatics. Credit given for only one of #INFO-I 202 or H 202.

INFO-I 210 Information Infrastructure I (4 cr.) P: INFO-I 201. The software architecture of information systems. Basic concepts of systems and applications programming.

Credit given for only one of the following: #INFO-I 210 or H 210.

INFO-H 210 Information Infrastructure I, Honors (4 cr.) P: INFO-I 201. Honors version of INFO-I 210. The software architecture of information systems. Basic concepts of systems and applications programming. Credit given for only one of the following: #INFO-I 210 or H 210.

INFO-I 211 Information Infrastructure II (4 cr.) P: INFO-I 210 or CSCI-C 211. The systems architecture of distributed applications. Advanced programming, including an introduction to the programming of graphical systems. Credit given for only one of the following: INFO-I 211 or H 211.

INFO-H 211 Information Infrastructure II, Honors (4 cr.) P: INFO-I 210 or CSCI-C 211. Honors version of #INFO-I 211. The systems architecture of distributed applications. Advanced programming, including an introduction to the programming of graphical systems. Credit given for only one of the following: INFO-I 211 or H 211.

INFO-I 222 The Information Society (3 cr.) In this course, students will learn to think critically about what it means to live in an "Information Society." From printing press to telephone to computer to the Internet, they will explore the history and social implications of the various information revolutions that shaped contemporary commercial, scientific, organizational, political life.

INFO-I 230 Analytical Foundations of Security (3 cr.) P: INFO-I 130. This course will enable students to reevaluate and conceptualize material learned in discrete courses to consider the topics from their perspective of security. For example, computer system basics such as hardware (CPUs, memory) and software are reconsidered from the perspective of how their interactions create vulnerabilities. Vulnerabilities that combine standard hardware and software configurations will be examined because they illuminate both security and computer networks. Operating systems and file systems are examined from the perspective of access control, permissions, and availability of system services.

INFO-I 231 Introduction to the Mathematics of Cybersecurity (3 cr.) The goal of this course is for students to be introduced to the basic mathematical tools used in modern cybersecurity. The course covers introductory mathematical material from a number of disparate fields including probability theory, analysis of algorithms, complexity theory, number theory, and group theory.

INFO-I 300 Human-Computer Interaction Design and Programming (3 cr.) P: INFO-I 101 and I 202. The analysis of human factors and the design of computer application interfaces. A survey of current HCI designs with an eye toward what future technologies will allow. The course will emphasize learning HCI based on implementation and testing interfaces. Credit given for only one of INFO-I 300 or H 300.

INFO-H 300 Human-Computer Interaction Design and Programming, Honors (3 cr.) P: INFO-I 101 and I 202. Honors version of INFO-I 300. The analysis of human factors and the design of computer application interfaces. A survey of current HCI designs with an eye toward what future technologies will allow. The course will emphasize learning HCI based on implementation and testing interfaces. Credit given for only one of INFO-I 300 or H 300.

INFO-I 303 Organizational Informatics (3 cr.) P: INFO-I 101. Examines the various needs, uses, and consequences of information in organizational contexts. Topics include organizational types and characteristics, functional areas and business processes, information-based products and services, the use of and redefining the role of information technology, the changing character of work life and organizational practices, sociotechnical structures, and the rise and transformation of information-based industries.

INFO-I 308 Information Representation (3 cr.) P: INFO-I 101, I 201 and (I 210 or CSCI-C 211). The basic structure of information representation in digital information systems. Begins with low-level computer representations such as common character and numeric encodings. Introduces formal design and query languages through Entity Relationship Modeling, the Relational Model, XML, and XHTML. Laboratory topics include SQL and XPath querying. Credit given for only one of INFO-I 308 or H 308.

INFO-H 308 Information Representation, Honors (3 cr.) P: INFO-I 101, I 201 and (I 210 or CSCI-C 211). Honors version of #INFO-I 308. The basic structure of information representation in digital information systems. Begins with low-level computer representations such as common character and numeric encodings. Introduces formal design and query languages through Entity Relationship Modeling, the Relational Model, XML, and XHTML. Laboratory topics include SQL and XPath querying. Credit given for only one of INFO-I 308 or H 308.

INFO-I 310 Multimedia Arts and Technology (3 cr.) P: INFO-I 300. The study of the evolution of media arts and underlying principles of communication. Application development paradigms in current practice.

INFO-I 320 Distributed Systems and Collaborative Computing (3 cr.) P: INFO-I 211. An introductory treatment of distributed systems and programming. Topics range from the distributed and object models of computation to advanced concepts such as remote method invocations, object brokers, object services, open systems, and future trends for distributed information systems.

INFO-I 330 Legal and Social Informatics of Security (3 cr.) P: INFO-I 230, or consent of instructor. This course examines that set of ethical and legal problems most tightly bound to the issues of information control. The interaction and technology changes, but the core issues have remained: privacy, intellectual property, Internet law, concepts of jurisdiction, speech anonymity versus accountability, and ethical decision making in the network environment.

INFO-I 356 Globalization, Where We Fit In (3 cr.) Globalization changes how we work, what we buy, and who we know. Globalization involves people working eighty hour weeks in China and receiving free state-of-the-art drugs in Africa. Learn about the past, present and future of globalization, and what it means for you, your job, and your community.

INFO-I 371 Chemical Informatics I (1 cr.) Presents basic concepts of information representation, storage, and retrieval as they pertain to chemistry. The course is designed to give an overview of the techniques that make modern chemical informatics systems work. Looks at some of the coding techniques that form the basis for chemical information retrieval by structures, nomenclature, and molecular formulas. Examines various methods of coding for visualization of chemical structures and chemical data. In addition, some of the major algorithms and techniques used in the modern pharmaceutical industry to enhance their research efforts are presented in INFO-I 371.

INFO-I 372 Molecular Modeling (1 cr.) P: CHEM-C 341. Molecular modeling and computational chemistry; application of quantum mechanics and molecular mechanics to drive structural and energetic information about molecules; conformational analysis; quantitative structure activity relationships (QSAR) and related methods for drug design.

INFO-I 391 Internship in Informatics Professional Practice (1-3 cr.) P: Approval of dean and completion of 100- and 200-level requirements in informatics. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work. May be repeated for a maximum of 3 credit hours.

INFO-Y 395 Career Development for Informatics Majors (1 cr.) Helps students develop skills and knowledge to successfully pursue a career search, both at the time of graduation and as they progress through their careers. The course covers techniques and strategies to make the job search more efficient and effective. An eight-week course.

INFO-I 399 Current Topics in Informatics (1-3 cr.) Variable topic course. Emphasis is on new developments and research in informatics. May be repeated once with different topic.

INFO-I 400 Topics in Informatics (3 cr.) P: At least junior standing or permission of instructor. Variable topic. Emphasis is on new developments and research in informatics. Subject to approval of the dean. May be repeated twice (9 credit hours) for any combination of INFO-I 400 and H 400 when topic varies.

INFO-H 400 Topics in Informatics, Honors (3 cr.) P: At least junior standing or permission of instructor. Honors version of INFO-I 400. Variable topic. Emphasis is on development and research in informatics.Subject to approval of the dean. May be repeated twice (9 credit hours) for any combination of INFO-H 400 and I 400 when topic varies.

INFO-I 421 Applications of Data Mining (3 cr.) P: INFO-I 308. The course explores the use of data mining techniques in different settings, including business and scientific domains. The emphasis will be on using techniques instead of developing new techniques or algorithms. Students will select, prepare, visualize, analyze, and present data that leads to the discovery of novel and actionable information.

INFO-I 427 Search Informatics (3 cr.) Techniques and tools to automatically crawl, parse, index, store, and search Web information, organizing knowledge that can help meet the needs of organizations, communities and individual users. Social and business impact of search engine technology. As a project, students will build a real search engine and compare it with Google.

INFO-I 430 Security for Networked Systems (3 cr.) P: INFO-I 230, I 231 and (I 211 or C 212). This course is an extensive survey of network security. The course materials cover threats to information confidentiality, integrity, and availability in different Internet layers, and defense mechanisms that control these threats. The course also provides a necessary foundation on network security, such as cryptographic, primitives/ protocols, authentication, authorization and access control technologies; and hands-on experiences through programming assignments and course projects.

INFO-I 433 Systems & Protocol Security & Information Assurance (3 cr.) P: INFO-I 230, I 231 and (I 211 or C 212). This class covers the fundamentals of computer security by looking at how things can go wrong, and how people can abuse the system. This is a matter of creative cheating; to find loopholes and exploit them. After students learn how to attack the system, it is possible to propose ways to make the system secure. Students will gain a basic overview of existing security problems and be exposed to methods that can be used to secure against such problems. The course should be taken by any one designing, selecting, or using applications in which security or privacy plays a role.

INFO-I 441 Human-Computer Interaction Design I (3 cr.) Human-computer interaction design (HCID) describes the way a person or group accomplishes tasks with a computer—what the individual or group does and how the computer responds; what the computer does and how the individual or group responds. This course is organized around a collection of readings and three design projects applying human-computer interaction principles to the design, selection, and evaluation of interactive systems.

INFO-I 453 Computer and Information Ethics (3 cr.) Ethical and professionalization issues that arise in the context of designing and using networked information technologies and information resources. Examines frameworks for making ethical decisions, emergent technologies and their ethical implications, information/ computer professionalism. Topics include privacy, intellectual property, cybercrime, games, social justice, and codes of professional ethics.

INFO-I 485 Bioinspired Computing (3 cr.) P: INFO-I 211 or CSCI-C 212. Biological organisms cope with the demands of their environments using solutions quite unlike the traditional human-engineered approaches to problem solving. Biological systems tend to be adaptive, reactive, and distributed. Bio-inspired computing is a field devoted to tackling complex problems using computational methods modeled after design principles encountered in nature.

INFO-I 486 Artificial Life (3 cr.) Artificial Life is a broad discipline encompassing the origins, modeling, and synthesis of natural and artificial living entities and systems. Artificial Intelligence, as a discipline, tries to

model and understand intelligent systems and behavior, typically at the human level.

INFO-I 490 Professional Practicum/Internship for Undergraduates (0 cr.) P: Approval of the dean. Provides for participation in professional training and internship experience.

INFO-I 491 Capstone Project Internship (1-6 cr.) P: Approval of dean and completion of all required core informatics courses. Students put their informatics education in practice through the development of a substantial project while working in a professional information technology environment. May be repeated for a maximum of 6 credit hours.

INFO-I 492 Senior Thesis (3 cr.) P: Approval of dean and completion of all required core informatics courses. The senior student prepares and presents a thesis: a substantial, typically multichapter paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 493 Senior Thesis (3 cr.) P: Approval of dean and completion of all required core informatics courses. The senior student prepares and presents a thesis: a substantial, typically multichapter paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

INFO-I 494 Design and Development of an Information System (3 cr.) P: Approval of the dean and completion of required core informatics courses. Students work on capstone projects in supervised teams. They select an appropriate project (preferably based on cognate) and then learn to develop a plan that leads to success. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment. Credit given for only one of INFO-I 494 or H 494.

INFO-H 494 Design and Development of an Information System, Honors (3 cr.) P: Approval of the dean and completion of required core informatics courses. Honors version of INFO-I 494. Students work on capstone projects in supervised teams. They select an appropriate project (preferably based on cognate) and then learn to develop a plan that leads to success. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment. Credit given for only one of INFO-H 494 or I 494.

INFO-I 495 Design and Development of an Information System (3 cr.) P: Approval of the dean and completion of required core informatics courses. Students work on capstone projects in supervised teams. They select an appropriate project (preferably based on cognate) and then learn to develop a plan that leads to success. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment. Credit given for only one of INFO-I 495 or H 495.

INFO-H 495 Design and Development of an Information System, Honors (3 cr.) P: Approval of the dean and completion of required core informatics courses. Honors version of INFO-I 495. Students work on capstone projects in supervised teams. They select an appropriate project (preferably based on cognate) and then learn to develop a plan that leads to success. Teamwork, communication, and organizational skills are emphasized in a real-world-style environment. Credit given for only one of INFO-H 495 or I 495.

INFO-H 498 Honors Seminar (1-3-6 cr.) P: Junior or senior major in INFO with GPA at least 3.3 or permission of instructor. A survey of faculty research in computer related fields with different professors discussing their research each week. May be repeated for a maximum of 6 credit hours.

INFO-I 499 Readings and Research in Informatics (1-3 cr.) P: Consent of instructor and completion of 100- and 200-level requirements in informatics. Independent readings and research related to a topic of special interest to the student. Written report required. May be repeated for a maximum of 6 credit hours for any combination of INFO-I 499 and H 499.

INFO-H 499 Readings and Research in Informatics, Honors (1-3 cr.) P: Consent of instructor and completion of 100- and 200-level requirements in informatics. Honors version of INFO-I 499. Independent readings and research related to a topic of special interest to the student. Written report required. May be repeated for a maximum of 6 credit hours for any combination of INFO-H 499 and I 499.

Computer Science

CSCI-A courses are non-major courses and are listed first regardless of the course level.

CSCI-A 110 Introduction to Computers and Computing (3 cr.) CASE N&M P: One year of high school algebra or MATH-M 014. Basic principles of computers and software. Social and lifestyle effects of information technology. Emphasis on problem-solving techniques. Productivity software skills are taught using real-world projects. Lecture and laboratory. Credit given for only one of CSCI-A 106, A 110, or A 111.

CSCI-A 111 A Survey of Computers and Computing (1.5 cr.) P: One year of high school algebra or MATH-M 014, and some prior computing experience. Survey of computing concepts, with emphasis on problem-solving techniques. Experience in a variety of popular applications software for tasks such as word processing, Web browsing, spreadsheet calculations, and databases. Lecture and laboratory. An eight-week course. Credit given for only one of CSCI-A 106, A 110, or A 111.

CSCI-A 112 Programming Concepts (1.5 cr.) P: CSCI-A 110, A 111, or equivalent computing experience. Introduction to programming for users of computer systems. Emphasis on problem-solving techniques. Lecture and laboratory. An eight-week course.Crosslisted with INFO-I 110. Credit given for only one of CSCI-A 112 or INFO-I 110.

CSCI-A 113 Data Analysis Using Spreadsheets (1.5 cr.) P: CSCI-A 110, A 111, or equivalent. An introduction to data analysis using spreadsheets, including both scientific and business applications. Elementary statistical concepts and their applications to data analysis. Emphasis on problem-solving techniques. Lecture and laboratory. An eight-week course.

CSCI-A 114 Introduction to Databases (1.5 cr.) P: CSCI-A 110, A 111, or equivalent. Introduction to database design concepts. Entering and modifying data, accessing data using visual tools and SQL, building

database applications using forms and application development tools. Emphasis on problem-solving techniques. Lecture and laboratory. An eight-week course. Crosslisted with INFO-I 111. Credit given for only one of CSCI-A 114 or INFO-I 111.

CSCI-A 201 Introduction to Programming I (4 cr.) CASE N&M P: Two years of high school mathematics or MATH-M 014. Fundamental programming constructs, including loops, arrays, and files. General problem-solving techniques. Emphasis on modular programming and developing good programming style. Not intended for computer science majors. Credit given for only one of CSCI-A 201 or A 597.

CSCI-A 202 Introduction to Programming II (4 cr.) CASE N&M P: CSCI-A 201 or A 304. Advanced programming techniques: user-defined functions and types, recursion vs iteration, parameter-passing mechanisms; Classic abstract data types and algorithms. Programming style. Object-oriented programming. Web programming. May be counted toward computer science major requirements if completed prior to CSCI-C212. Advanced programming techniques: user-defined functions and types, recursion vs iteration, parameter-passing mechanisms; Classic abstract data types and algorithms. Programming style. Object-oriented programming. Web programming. May be counted toward computer science major requirements if completed prior to CSCI-C212.

CSCI-A 216 Digital Multimedia Concepts and Technologies (3 cr.) P: CSCI-A 110, A 111, or equivalent computing experience. **N & M** In-depth introduction to the technologies of digital hardware and software relevant to efficient multimedia communication methods. Lectures focus on computational foundations, underlying concepts, and digital methods. Laboratory provides direct experience with concepts presented in lecture, using latest available digital tools to create direct and Web-based multimedia content. Lecture and laboratory.

CSCI-A 290 Tools for Computing (1-2-6 cr.) Exploration of topics in computing. Common topics include tools for power users. Prerequisites vary by topic. Lecture and laboratory format. Three A 290 courses will count as one of seven advanced elective courses for majors. May be repeated for a maximum of 6 credit hours.

CSCI-A 304 Introductory C++ Programming (2 cr.) P: Programming experience. Topics include aspects of C++ that are not object-oriented, basic data structures, standard libraries, and UNIX tools for project management.

CSCI-A 306 Object-Oriented Programming in C++ (2 cr.) P: CSCI-A 201, A 304, A 597, or C 212. Topics include objects, classes, encapsulation, inheritance, polymorphism, templates, and exceptions.

CSCI-A 321 Computing Tools for Scientific Research (4 cr.) CASE N&M P: MATH-M 118 or higher required; MATH-M 211 recommended. Introduction to computer-based tools useful for analysis and understanding of scientific data. Basic methods of computation, data processing, and display in systems such as Matlab combined with elementary practical C/C++ programming. Techniques to support customized scientific research tasks, with particular emphasis on biological, neural, and behavioral sciences. Lecture and laboratory.

CSCI-A 338 Network Technologies and Administration (4 cr.) P: CSCI-A 110, EDUC-W 200, or equivalent computer literacy. Introduction to network principles and current network technology, both hardware and software. Network administration tools and techniques. Laboratory provides practical experience. Credit given for only one of CSCI-A 247 or A 338.

CSCI-A 346 User-Interface Programming (3 cr.) P: CSCI-A 202, A 306, A 597, C 212, or equivalent experience. Learn to prototype and build graphical user interfaces for computer applications. Contemporary software design methodology. Students design and implement prototype interfaces to applications provided by the instructor. Extensive use is made of both commercial and experimental software tools.

CSCI-A 348 Mastering the World Wide Web (3-4 cr.) P: Two semesters of programming experience, or equivalent, and some knowledge of operating systems. Project-oriented course leading to ability to maintain a fully functional Web site. Topics include Internet network protocols and Web programming, server administration, protocols, site design, and searching and indexing technologies.

CSCI-C 102 Great Ideas in Computing (3 cr.) Survey of great ideas in computing in the modern world. Explores how people use computing tools to realize their ideas. Emphasis on the impact of modern technology and the use of hardware and software to create solutions to everyday problems. Lecture and laboratory.

CSCI-C 211 Introduction to Computer Science (4 cr.) CASE N&M P: High school precalculus math. A first course in computer science for those intending to take advanced computer science courses. Introduction to programming and to algorithm design and analysis. Using the Scheme programming language, the course covers several programming paradigms. Lecture and laboratory. Credit given for only one of CSCI-C 211 or H 211.

CSCI-H 211 Introduction to Computer Science, Honors (4 cr.) CASE N&M P: High school precalculus math. Honors version of CSCI-C 211. A first course in computer science for those intending to take advanced computer science courses. Introduction to programming and to algorithm design and analysis. Using the Scheme programming language, the course covers several programming paradigms. Lecture and laboratory. Credit given for only one of CSCI-C 211 or H 211.

CSCI-C 212 Introduction to Software Systems (4 cr.) CASE N&M P: CSCI-C 211. Design of computer software systems and introduction to programming in the environment of a contemporary operating system. Topics include a modern object-oriented programming language; building and maintaining large projects; and understanding the operating system interface. Lecture and laboratory. Credit given for only one of CSCI-C 212 or H 212.

CSCI-H 212 Introduction to Software Systems, Honors (4 cr.) CASE N&M P: CSCI-C 211. Honors version of CSCI-C 212. Design of computer software systems and introduction to programming in the environment of a contemporary operating system. Topics include a

modern object-oriented programming language; building and maintaining large projects; and understanding the operating system interface. Lecture and laboratory. Credit given for only one of CSCI-C 212 or H 212.

CSCI-C 241 Discrete Structures for Computer Science (3 cr.) CASE N&M P: CSCI-C 211. MATH-M 211 recommended. Induction and recursive programs, running time, asymptotic notations, combinatorics and discrete probability, trees and lists, the relational data model, graph algorithms, propositional and predicate logic. Credit given for only one of CSCI-C 241 or H 241.

CSCI-H 241 Discrete Structures for Computer Science, Honors (3 cr.) CASE N&M P: CSCI-C 211. MATH-M 211 recommended. Honors version of CSCI-C 241. Induction and recursive programs, running time, asymptotic notations, combinatorics and discrete probability, trees and lists, the relational data model, graph algorithms, propositional and predicate logic. Credit given for only one of CSCI-C 241 or H 241.

CSCI-C 290 Tools in Computing (1-3-6 cr.) P: Prerequisites vary by topic. Exploration of topics in computing and computer science. Common topics include tools for power users. Prerequisites vary by topic. Lecture and laboratory format. May be repeated for a maximum of 6 credit hours.

CSCI-C 291 System Programming with C and Unix (1.5 cr.) P: CSCI-C 211 or CSCI-A 201 This course provides an introduction to programming in a Unix (Linux) environment using the C language. The key ideas to be discussed are: the Unix shell, file system and basic shell commands; the emacs text editor; and the C programming language.

CSCI-C 295 Leadership and Learning (1-6 cr.) P: CSCI-C 211 or A 201 or INFO-I 210. Students work within the community to foster interest, knowledge, and appreciation of the computing sciences by preparing and leading presentations and hands-on activities for children in middle and secondary schools. Not for major credit. May be repeated for a maximum of 6 credit hours.

CSCI-C 311 Programming Languages (4 cr.) CASE N&M P: CSCI-C 212. C: CSCI-C 241. Systematic approach to programming languages. Relationships among languages, properties and features of languages, and the computer environment necessary to use languages. Lecture and laboratory. Credit given for only one of CSCI-C 311 or H 311.

CSCI-H 311 Programming Languages, Honors (4 cr.) CASE N&M P: CSCI-C 212. C: CSCI-C 241. Honors version of CSCI-C 311. Systematic approach to programming languages. Relationships among languages, properties and features of languages, and the computer environment necessary to use languages. Lecture and laboratory. Credit given for only one of CSCI-C 311 or H 311.

CSCI-C 322 Object-Oriented Software Methods (4 cr.) P: CSCI-C 212. Design and implementation of complex software systems and applications exploiting the object-oriented paradigm. Selection and effective utilization of object-oriented libraries and interfaces.

CSCI-C 335 Computer Structures (4 cr.) CASE N&M P: CSCI-C 212. CSCI-C 241. C: CSCI-C 241. Lab fee. Structure and internal operation of computers. The architecture and assembly language programming of a specific computer are stressed, in addition to general principles of hardware organization and low-level software systems. Lecture and laboratory. Credit given for only one of CSCI-C 335 or H 335.

CSCI-H 335 Computer Structures, Honors (4 cr.) CASE N&M P: CSCI-C 212. CSCI-C 241. C: CSCI-C 241. Lab fee. Honors version of CSCI-C 335. Structure and internal operation of computers. The architecture and assembly language programming of a specific computer are stressed, in addition to general principles of hardware organization and low-level software systems. Lecture and laboratory. Credit given for only one of CSCI-C 335 or H 335.

CSCI-C 343 Data Structures (4 cr.) CASE N&M P: CSCI-C 212. CSCI-C 241. C: CSCI-C 241. Systematic study of data structures encountered in computing problems, structure and use of storage media, methods of representing structured data, and techniques for operating on data structures. Lecture and laboratory. Credit given for only one of CSCI-C 343 or H 343.

CSCI-H 343 Data Structures, Honors (4 cr.) CASE N&M P: CSCI-C 212. CSCI-C 241. C: CSCI-C 241. Honors version of CSCI-C 343. Systematic study of data structures encountered in computing problems, structure and use of storage media, methods of representing structured data, and techniques for operating on data structures. Lecture and laboratory. Credit given for only one of CSCI-C 343 or H 343.

CSCI-B 351 Introduction to Artificial Intelligence and Computer Simulation (3 cr.) CASE N&M P: CSCI-C 211. A survey of techniques for machine intelligence and their relation to human intelligence. Topics include modeling techniques, neural networks and parallel processing systems, problem-solving methods, vision, heuristics, production systems, speech perception, and natural language understanding. Credit given for only one of CSCI-B 351 or COGS-Q 351.

CSCI-B 355 Autonomous Robotics (3 cr.) P: Two semesters of computer programming or consent of instructor. Introduction to the design, construction, and control of autonomous mobile robots. This course covers basic mechanics, electronics and programming for robotics, as well as the applications of robots in cognitive science. Credit given for only one of CSCI-B 355 or COGS-Q 360.

CSCI-Y 390 Undergraduate Independent Study (1-3 cr.) P: Instructor's permission. Independent research based on existing literature or original work. A report, in the style of a departmental technical report, is required. May be repeated for a maximum of 6 credit hours of any combination of CSCI-Y 390, Y 391, Y 399 and Y 499.

CSCI-Y 391 Undergraduate Independent System Development (1-3 cr.) P: Instructor's permission. The student designs, programs, verifies, and documents a project assignment. Prior to enrolling, the student must arrange for an instructor to supervise the course activity. May be repeated for a maximum of 6 credit hours of any combination of CSCI-Y 390, Y 391, Y 399 and Y 499.

CSCI-Y 399 Project in Professional Practice (3 cr.) P: CSCI-C 343 and one other computer science major course of 300 level or above and approval of department. The student designs, programs, verifies, and documents a project assignment selected in consultation with an employer and the department. May be repeated for a maximum of 6 credit hours of any combination of CSCI-Y 390, Y 391, Y 399 and Y 499.

CSCI-B 401 Fundamentals of Computing Theory (3 cr.) CASE N&M P: CSCI-C 241. CSCI-C 212. C: CSCI-C 212. Fundamentals of formal language theory, computation models and computability, the limits of computability and feasibility, and program verification.

CSCI-B 403 Introduction to Algorithm Design and Analysis (3 cr.) CASE N&M P: CSCI-C 241, C 343 and MATH-M 216 or M 212. Algorithm design methodology. General methods for analysis of algorithms. Analysis of the performance of specific algorithms, such as those for searching and sorting.

CSCI-P 415 Introduction to Verification (3 cr.) CASE N&M P: CSCI-C 311. Tools and techniques for rigorous reasoning about software and digital hardware. Safety, reliability, security, and other design-critical applications. Decision algorithms. Projects involving the use of automated reasoning, such as model checkers, theorem provers, and program transformation.

CSCI-P 423 Compilers (4 cr.) CASE N&M P: CSCI-C 311. Compiler design and construction, including lexical analysis, parsing, code generation, and optimization. Extensive laboratory exercises.

CSCI-P 434 Distributed Systems (4 cr.) P: CSCI-C 343. Principles of distributed systems including system design, distributed algorithms, consistency and concurrency, and reliability and availability. The role of these foundational issues in distributed file systems, distributed computing, and data-driven systems.

CSCI-P 436 Introduction to Operating Systems (4 cr.) CASE N&M P: CSCI-C 335 and #C 343. Organization and construction of computer systems that manage computational resources. Topics include specification and implementation of concurrency, process scheduling, storage anagement, device handlers, mechanisms for event coordination. Lecture and laboratory.

CSCI-P 438 Introduction to Computer Networks (4 cr.) P: CSCI-C 335. Foundations of computer networks. Networking hardware technology such as Ethernet, ATM, wireless. Networking protocols (TCP/IP), routing, error correcting. Network services such as DNS, Web servers, virtual private networks (VPN), open SSL. Credit given for only one of CSCI-P 438 or P 538.

CSCI-B 441 Digital Design (4 cr.) CASE N&M P: CSCI-C 335. Organization and logic design of digital systems. Course presents a structured design philosophy, emphasizing hardwired and microprogrammed control. Boolean algebra, hardware building blocks, circuit synthesis, microprogramming. In the laboratory, students build, study, and debug a working minicomputer from elementary hardware components. Lecture and laboratory.

CSCI-P 442 Digital Systems (4 cr.) CASE N&M P: CSCI-B 441. Lab fee. Elements of computer architecture construction of hardware systems, emphasizing a combination of components to form systems, and applications of general principles of computing to digital implementation. Lecture and laboratory.

CSCI-B 443 Introduction to Computer Architecture (3 cr.) CASE N&M P: CSCI-C 335 and C 343. Principles of processors, control units, and storage systems. Registers, buses, microprogramming, virtual storage. Relationship between computer architecture and system software.

CSCI-B 461 Database Concepts (3 cr.) CASE N&M P: CSCI-C 241and C 343. Introduction to database concepts and systems. Topics include database models and systems: hierarchical, network, relational, and object-oriented; database design principles; structures for efficient data access; query languages and processing; database applications development; views; security; concurrency; recovery. Students participate in a project to design, implement, and query a database, using a standard database system. Credit given for only one of CSCI-B 461 or B 561.

CSCI-P 462 Database Application Design and Implementation (3 cr.) P: CSCI-B 461 This course deals with practical issues in the design and implementation of database application systems. Topics include database modeling design, query languages, communication with data, transaction management, concurrency control techniques, security, database design procedures, and some advanced database applications, such as data warehousing, data mining, semi-structured data and semantic web.

CSCI-P 465 Software Engineering for Information Systems I (3 cr.) CASE N&M P: CSCI-C 343. CSCI-B 461. C: CSCI-B 461. Lab fee. Analysis, design, and implementation of information systems. Project specification. Data modeling. Software design methodologies. Software quality assurance. Supervised team development of a real system for a real client.

CSCI-P 466 Software Engineering for Information Systems II (3 cr.) CASE N&M P: CSCI-C 343. CSCI-B 461. C: CSCI-B 461. Lab fee. Analysis, design, and implementation of information systems. Project specification. Data modeling. Software design methodologies. Software quality assurance. Supervised team development of a real system for a real client.

CSCI-B 481 Interactive Graphics (4 cr.) CASE N&M P: CSCI-C 343 and MATH-M 301 or M 303. Computer graphics techniques. Introduction to graphics hardware and software. Two-dimensional graphics methods, transformations, and interactive methods. Three-dimensional graphics, transformations, viewing geometry, object modeling, and interactive manipulation methods. Basic lighting and shading. Video and animation methods. Credit given for only one of #CSCI-B 481 or B 581.

CSCI-B 490 Seminar in Computer Science (1-3-6 cr.) Special topics in computer science. May be repeated for a maximum of 6 credit hours.

CSCI-H 498 Honors Seminar (1-3-6 cr.) P: Junior or senior major in computer science or informatics with a GPA of at least 3.3, or permission of instructor. A survey of faculty research in computer-related fields with different

professors discussing their research each week. May be repeated for a maximum of 6 credit hours.

CSCI-Y 499 Honors Research (1-12 cr.) P: Approval of departmental honors committee. May be repeated for a maximum of 6 credit hours of any combination of CSCI-Y 390, Y 391, Y 399 and Y 499.

Undergraduate Programs

The School of Informatics and Computing offers a Bachelor of Science in Informatics (INFOBS), a Bachelor of Science in Computer Science (CSCIBS), and an Accelerated Master's in Computer Science.

The very nature of these degrees, with the changing technologies and applications, requires that the content of each degree be continuously assessed and revised. Therefore, the faculty of the School of Informatics and Computing will periodically review and revise the curricula to ensure that students are prepared to meet contemporary workplace and intellectual demands. Please contact the School of Informatics and Computing Student Services Office, or refer to our website at www.soic.indiana.edu/.

Academic counseling for each student in the School of Informatics and Computing is provided by an academic advisor prior to each semester's enrollment. Although academic counseling is intended to provide effective guidance, students are responsible for planning their own programs and for meeting the following degree requirements for graduation. Students are advised to read bulletin descriptions of all courses selected, paying careful attention to conditions concerning awarding of credit.

Admissions

- Application Procedures
- Admitted Students
- Financial Aid & Scholarships

Application Procedures

How to Apply

We require that you submit your application online. If you need to submit additional materials by mail, send them to the appropriate address below. (International applicants should submit materials to these addresses, *not* to the Office of International Services.)

Computer Science Degrees
Graduate Admissions
Computer Science Program
Indiana University
150 S. Woodlawn Avenue
Bloomington, IN 47405-7104

Informatics Degrees
Indiana University
Informatics Graduate Programs
Graduate Studies Office
901 E. 10th Street, Room 235
Bloomington, IN 47408

What We Are Looking For

We want to know if your interests and abilities match the program you are applying for and if you seem likely to benefit from an education in the school. If you think it is helpful, you can supplement the required application materials with other information that sheds light on your capabilities. A resume or curriculum vitae is ideal for including citations or links to any published work, hardware artifacts, or software artifacts you have produced.

Items that are important in the evaluation process include:

EDUCATIONAL BACKGROUND

We do not require a bachelor's degree in computer science, informatics, or a related field, but we are looking for background in key areas. For example, for computer science degrees, you should have had courses in data structures, machine organization and assembly language, and discrete structures.

LETTERS OF REFERENCE

Except in special cases, references should be from academic faculty, including at least some in informatics and computing. We ask for three letters but you may submit more. If you have experience as a teaching assistant, a letter from your teaching supervisor attesting to your teaching abilities could help your application for aid.

GRE SCORES

We require GRE scores for all applicants and cannot process your application until we receive them. We do not have cut-offs for GRE scores, preferring instead to use the full information available in your application to evaluate. IU's institution code for reporting your GRE scores is 1324, and the department code is 0402 for computer science degrees, 0404 for informatics degrees.

STATEMENT OF PURPOSE

The most important information to include in your statement of purpose concerns your academic goals. Tell us which research areas you are interested in and which Indiana University faculty you would like to work with. You may also use your statement of purpose to explain any anomalies in your record.

TRANSCRIPTS

You must submit a transcript from each previous undergraduate or graduate institution other than Indiana University that you have attended. We are most interested in the grades you received in courses that are relevant to our graduate programs.

Computer Science Applicants

Applicants to the computer science programs must complete a supplemental form.

International Applicants

If you are not a citizen or permanent resident of the United States, you must submit the following with your application for admission:

1. Financial documentation proving that you have the resources to support yourself and any dependents during your first year of study here. Download IU's financial documentation form (PDF) and submit it with your application. Your admission cannot be finalized, and your immigration document cannot be issued, without this information.

2. Test of English as a Foreign Language (TOEFL) or IELTS scores. All applicants who are not native speakers of English or who did not receive an undergraduate or graduate degree from a university in the United States must submit these scores. IU's institution code for reporting TOEFL scores is 1324, and the department code is 78 for computer science degrees and 99 for informatics degrees. We normally expect a minimum TOEFL score of 100 on the Internet-based test, 250 on the computer-based test, or approximately 600 on the paper-based test, or a score of 6.5 on the IELTS. We may make exceptions when there is other evidence of English ability.

Do not worry if some of your materials, such as your GRE scores or a recommendation letter, have not reached us by the international priority deadline below. We encourage you to get them in as soon as possible, though.

Master's Students Interested in a Ph.D. Program

When applying to one of our Ph.D. programs, current School of Informatics and Computing master's students should contact Graduate Student Services for application procedures. Applicants must fill out the online application for the Ph.D. degree, but other procedures are different. You can reach us by e-mail at graduate@soic.indiana.edu.

Recent Applicants

If you applied here in the last two years and are applying again, contact us for instructions.

Deadlines

Fall Semester Priority Deadline for Admission and Financial Aid

- PhD student applications: December 1
- Master's student applications: January 1

Spring Semester Priority Deadline for Admission and Financial Aid

- Master of Science in Security Informatics (only program which accepts spring applications): October 1

Admission Status and Notification

We evaluate applications for fall semester after the priority deadlines. We will let you know as soon as we have reached a decision, generally by March 15.

Occasionally students who are not admitted contact us for an explanation. Unfortunately, we receive several hundred applications per year, and we do not have the staff to explain admissions decisions on a case-by-case basis.

Dual Master's Program

Students who are concurrently enrolled in two schools may qualify for two master's degrees under a provision that allows credit earned to satisfy the major requirements of one program to count as elective credit in a second program. Any area of substantial overlap in the two courses of study will be negotiated by the graduate advisor. A student must be formally admitted by both programs. All requirements for both degrees must be met. All course work must be completed within a period of six years.

Admitted Students

Congratulations on your admittance to the School of Informatics and Computing. We're eager for you to join our close-knit community.

We have an orientation for new graduate students each fall, when we'll tell you what you need to know to start off on the right foot.

International students will also attend international orientation, which covers a wide range of topics about studying and living in the United States. IU's Office of International Services can answer any questions you have about visas and other paperwork. This office will be a resource for you throughout your IU career, helping you adjust to U.S. culture, meet your academic goals, complete required paperwork, make good financial choices, and more.

Deferring Admission

You can defer your start date up to one year, but you need to get approval from the program to which you were admitted.

Financial Aid & Scholarships

Tuition & Fees

Indiana University is committed to keeping its degrees affordable for in-state and out-of-state students, both through low costs and generous financial aid.

The Office of Student Financial Assistance has information about current costs of attendance for full-time, domestic graduate students. Costs for international students are slightly different and include mandatory health insurance.

Master's and doctoral students have access to a wide range of financial aid and scholarships from the school, Indiana University, and outside sources such as the federal government.

We offer a variety of assistantships to our Ph.D. students, as well as a limited number of fellowships. In addition, IU offers a number of diversity-building fellowships.

You can learn more about financial aid opportunities from the Office of Student Financial Assistance and the University Graduate School Funding and Fees pages.

International Students

The Office of International Services has information about financial aid and employment for international students. See the information about financial aid for prospective graduate students, employment for F-1 students and J-1 students, and other money matters.

Degree Programs

- M.S. and Accelerated Master's Program in Computer Science
- M.S. in Bioinformatics
- M.S. in Human-Computer Interaction Design
- M.S. in Security Informatics
- Information and Library Science
- Ph.D. in Computer Science (offered through the University Graduate School)

- Ph.D. in Informatics (offered through the University Graduate School)

Computer Science

- M.S. in Computer Science
- Accelerated Master's Program in Computer Science

About the Program

What imagination makes possible, computer science makes real.

Robots were once science fiction. Today, they build cars, take photos on Mars, disarm bombs, and vacuum our living rooms. While there may be no limit to what technology can accomplish—from space travel to curing cancer—none of it is possible without key breakthroughs in computing theory, programming, artificial intelligence, data analysis, and systems and application design.

As a graduate student in computer science, you'll develop a deep understanding of computing theory and applications that will serve as a springboard to new discoveries. Our cross-disciplinary approach to computer science exposes you not only to the latest research in high-performance computing, data and search, artificial intelligence, and computer security—but also gives you the opportunity to apply those insights to real-world problems such as controlling pandemic disease and tracking the effects of climate change on polar ice.

Major research concentrations on campus include:

- Formal methods for system design, hardware, and robotics
- Foundations: Theory of computing, algorithms, and applied logic
- High-performance computing
- Cybersecurity
- Graphics and visualization
- Programming languages and compilers
- Artificial intelligence and cognitive science
- Distributed and parallel systems
- Database and information systems
- Computer networks and security

Degrees

M.S. in Computer Science

- A two-year, multidisciplinary program that provides broad insights in computing theory, data and search, networks, systems, applications and programming, and their practical applications in solving problems

Accelerated Master's Program in Computer Science

- A five-year combined B.S. and M.S. in computer science for highly focused students who want a head start on their careers

Ph.D. in Computer Science

(See University Graduate School Bulletin, http://www.indiana.edu/~bulletin/iu/gradschool/2012-2013/index.shtml)

M.S. in Computer Science

M.S. Requirements

The Master of Science in Computer Science program includes a minimum of 30 credit hours of course work in the foundations of computer science, programming, systems, and applications.

CURRICULUM

Most of the Computer Science Program's courses at the 500-level and above are classified into these areas:

- Foundations (middle digit 0 or 1, e.g., B 501, B 502, B 503, B 510)
- Programming Languages (middle digit 2, e.g., B 521, B 522, P 523, B 524)
- Systems (middle digit 3 or 4, e.g., P 536, B 538, B 541, P 542, B 543)
- Applications (middle digit 5, 6, 7 or 8, e.g., B 551, B 552, B 553, B 561, P 565-566, P 573, B 581, B 582)

General courses not associated with a specific area are numbered with a middle digit 9. Courses that involve a major programming project are designated as "programming-in-the-large," and carry a course number with letter designation P.

Required Computer Science Courses (18 cr.)

- 6 courses in computer science listings at the 500-level or higher
  - With prior written permission from the director of Master's studies, one course may be selected from:
    - CSCI-B 401 Fundamentals of Computing Theory (3 cr.)
    - CSCI-B 403 Introduction to Algorithm Design and Analysis (3 cr.)
    - CSCI-P 436 Introduction to Operating Systems (4 cr.)
    - CSCI-B 443 Introduction to Computer Architecture (3 cr.)
    - MATH-M 471 Numerical Analysis I (3 cr.)
    - MATH-M 472 Numerical Analysis II (3 cr.)
  - One course must be a CSCI P-course (3 cr.)
  - One course must be a CSCI Foundations course (3 cr.)
  - Two of the three areas (Programming, Systems, Applications) must be represented

Computer Science Electives (3–6 cr.)

Creativity Requirement (6–9 cr.)

Students have a choice among five options to fulfill their creativity requirement.

- C: Computer science concentration.
- Three graduate-level courses (minimum of 9 credit hours) from computer science, including an additional P-level graduate course beyond the core requirements. One graduate-levell independent studet course (CSCI-Y 790 or Y 791 for a maximum of 3 credit hours).
- R: Master's research project.

- Two graduate-level independent study courses (CSCI-Y 790 or Y 791 for a maximum of 6 credit hours), consisting of a survey or original research at a level appropriate for publication as a departmental technical report or conference presentation.

- S: Master's software project.
- Two graduate-level independent study courses (CSCI-Y 791 for a maximum of 6 credit hours), consisting of substantial individual input into a major software research and development project, documented in the public domain.

- TH: Master's thesis.
- Two graduate-level independent study courses (CSCI-Y 792 or Y 793 for a maximum of 6 credit hours), consisting of a formal master's thesis as prescribed by the University Graduate School.

- A: Interdisciplinary application of computer science.
- Three or more courses (minimum of 9 credit hours) in a program that applies computer science to another discipline. These courses must be approved in advance by the graduate faculty and may affect the total number of credit hours you take in order to fulfill your computer science requirements.

Accelerated Master's Program in Computer Science

The Accelerated Master's Program combines the Computer Science B.S. and M.S. degrees to enable highly focused and motivated students to organize their studies so as to earn the two degrees in five years from the time of matriculation to the university.

The program's overall course requirements add up to as much as nine fewer credit hours than the sum total of the B.S. and M.S. taken individually.

Admission and Status

- For admission to the Accelerated Master's Program, students must have completed at least 26 CSCI major hours towards a Computer Science B.S. degree. Students must have earned a major GPA of at least 3.0 at the time of admission to the program.
- Students in the program are normally classified as undergraduates until the end of the first semester in which 120 or more hours of credit toward graduation have been earned. During this semester, students in good standing, defined as a major GPA of at least 3.0, must submit the standard application to the University Graduate School and initiate the transition to graduate status. If the transition to graduate status is delayed beyond this time, Accelerated Master's status will normally revert to undergraduate B.S. status. Students are advised to check on the effect that transition to graduate status may have on existing undergraduate funding; the possibility of graduate funding is conditional upon transition to graduate status. Those not in good standing at this time are dropped from the program and reclassified as undergraduate B.S. students.
- Students in the Accelerated Master's Program must complete at least 15 hours of coursework while registered in graduate status. Normally, this would encompass no fewer than two semesters.
- Students need to begin graduate-level courses in the senior year, while in undergraduate status. Otherwise, the program will not be completed in five years. Students should consult with the graduate advisor regarding appropriate graduate-level courses. Permission to enroll in graduate-level courses must be obtained from the course instructor and the Graduate Studies office.
- The B.S. and M.S. degrees may be taken either sequentially or simultaneously. To be taken sequentially, the student must apply to graduate with the Undergraduate Recorder for the B.S. while still in undegraduate status.
- Students should be aware that the requirements for the Bachelor's degree must be completed to be eligible for the Master's degree.

Academic Requirements

- A minimum of 143 credit hours
- Major GPA of at least 3.0; Cumulative GPA for graduate courses of at least 3.0
- All Computer Science B.S. requirements
- At least 21 Computer Science credit hours beyond the requirements for the B.S. at the 500 level or above. At most 6 combined credit hours may be CSCI-Y 790, Y 791, Y 792 or Y 793. Note that 0 credit hours may be CSCI-Y 890.
- M.S. creativity requirement (may include courses from above)

M.S. in Bioinformatics

M.S. Requirements

The M.S. in Bioinformatics is a two-year professional program that emphasizes computation and informatics but also integrates knowledge from biology, mathematics, and related areas. It prepares students to pursue a bioinformatics career or admission to a Ph.D. program.

PREREQUISITES

Our M.S. students are expected—but not required—to have at least introductory knowledge of both informatics and biology, including:

- Approximately 6 credit hours of undergraduate course work in biology, covering molecular biology, genetics, and evolution
- Approximately 6 credit hours of undergraduate course work in computer science or informatics, covering programming, discrete structures, and data structures

If you have not completed these prerequisites, you will be required to take one of the following courses:

- INFO-I 500 Fundamental Computer Concepts for Informatics (3 cr.), for students without computer science training
- BIOL-L 504 Genome Biology for Physical Scientists (3 cr.), for students without biology training

COURSES

Students are required to complete 36 credit hours of graduate-level course work, including the following courses:

- INFO-I 519 Introduction to Bioinformatics (3 cr.)
- INFO-I 529 Machine Learning in Bioinformatics (3 cr.)

Students must also complete a yearlong, 6 credit hour capstone research project, including an oral presentation to the public and submission of a written report, which is usually 15 to 30 pages long. These projects are typically supervised by one of the core bioinformatics faculty members, but we encourage students to work with a supervisor in a related discipline—such as biology, chemistry, or medical sciences—and choose a co-supervisor among the bioinformatics core faculty.

All other courses can be selected from topics and seminars in bioinformatics and courses in related disciplines.

M.S. in Human-Computer Interaction (design emphasis)

M.S. Requirements

The Master of Science in HCI (design emphasis) is an intensive, two-year program that teaches students to shape new media, interactive tools, artifacts, and systems in ways that enhance usability, augment learning, facilitate communication, and enrich the lives of the people using them. The program culminates in a one-semester 6 credit hour capstone project.

Download the HCID MS Program handbook here: http://eli.informatics.indiana.edu/HCIDProgramHandbook20132014-V1.0.pdf and HCID MS Capstone Thesis Handbook here: http://eli.informatics.indiana.edu/Capstone-Version-V1.0-2013.pdf.

CURRICULUM

A total of 36 credit hours is required for this degree. There are some required courses and there is some choice as described below.

Year 1 Fall

- INFO-I 541 Interaction Design Practice (6 cr.)
- INFO-I 590 Topic: Foundations of HCI (3 cr.)

Year 1 Spring

- INFO-I 543 Interaction Design Methods (3 cr.)
- INFO-I 542 Foundations of HCI (3 cr.)
- INFO-I 561 Meaning and Form in HCI (3 cr.)

Year 2 Fall

- INFO-I 590 Topic: Prototyping (3 cr.)

Recommended Electives* (select two):

- INFO-I 604 Human Computer Interaction Design Theory (3 cr.)
- INFO-I 590 Topic: Rapid Design for Slow Change (3 cr.)
- FINA-S 552 Graphic Design (3 cr.) or similar course

Year 2 Spring

- INFO-I 694 Thesis/Project in Human-Computer Interaction (6 cr.)

Recommended Electives* (select one):

- INFO-I 590 Topic: TBA (3 cr.)
- INFO-I 590 Topic: Interaction Culture (3 cr.)

***Electives and Recommended Electives**

The recommended electives detailed above are the elective classes that students most typically select and the classes which they can select without additional approval from the program director. It is possible for students to tailor their particular program by selecting with approval of the director alternative graudate classes from within the University. Independent Study or Internship credits are sometimes possible as an additonal alternative, as described in the HCI/d MS Handbook. Electives can be from any school at Indiana University with courses related to the student's area of concentration, including other areas in Informatics and Computing and ILS. Courses that have appealed to our students can be found in the School of Fine Arts, the Department of Communication and Culture, the Department of Telecommunications, and the Kelley School of Business. Please note that other schools are not required to allow HCI/d students to participate in their courses.

M.S. in Security Informatics

M.S. Requirements

The M.S. in Security Informatics (MSSI) offers an interdisciplinary focus that combines coursework in mathematics, protocol analysis, and system and network security, with business and economics, social engineering, human-computer interaction, and other disciplines.
In addition, MSSI students choose a concentration in financial risk, psychology, organizational theory or a particular focus area is computer science like embedded systems.

CURRICULUM

A total of 36 credit hours is required for this degree. Individual program choices will vary. The program can be understood as consisting of four elements:

1. Security foundations
2. Professional practice
3. Computing networks
4. Concentrations in an area of interest

Courses

- INFO-I 591 Graduate Internship (6 cr.)

Required Security Informatics Courses (12 cr.)

- INFO-I 520 Security for Networked Systems (3 cr.)
- INFO-I 525 Organizational Informatics and Economic Security (3 cr.)
- INFO-I 533 Systems and Protocol Security and Information Assurance (3 cr.)
- INFO-I 536 Foundational Mathematics of Cybersecurity (3 cr.)

Computer Networking Electives (9 - 12 cr.)

Electives or Concentration (6 - 9 cr.)

Concentration electives (9 cr.)
Concentration electives can be from any school or college at Indiana University with courses related to the student's area of interest. The Kelley School of Business teaches graduate courses on management of technology and information systems in organizations. The School of Public and Environmental Affairs teaches courses on risk behavior, policy, and decision-making. The Department

of Telecommunications also offers courses in information economics, media studies, and information policy.

Suggested courses and concentrations:

- Complex Systems
  - ILS-Z 604 Topic: Information Networks (3 cr.)
  - INFO-I 586 Artificial Life (3 cr.)
  - INFO-I 590 Topic: The Simplicity of Complexity (3 cr.)
  - INFO-I 601 Introduction to Complex Systems (3 cr.)
- Embedded Systems Concentration
  - CSCI-B 441 Digital Design (4 cr.)
  - CSCI-C 335 Computer Structures (4 cr.)
  - CSCI-P 415 Introduction to Verification (3 cr.)
  - CSCI-P 442 Digital Systems (4 cr.)
  - CSCI-P 545 Embedded and Real-Time Systems (3 cr.)
- Social Informatics
  - INFO-I 504 Social Dimensions of Science Informatics (3 cr.)
  - INFO-I 506 Globalization and Information (3 cr.)
  - INFO-I 651 Ethnography of Information (3 cr.)
- Music Informatics
  - INFO-I 545 Music Information Representation, Search and Retrieval (3 cr.)
  - INFO-I 547 Music Information Processing: Audio (3 cr.)
  - MUS-K 503 Electronic Studio Resources 1 (3 cr.)
- Business Concentration
  - BUS-F 421 Derivative Securities and Corporate Risk Management (3 cr.)
  - BUS-F 525 Corporate Financial Risk Management (1.5 cr.)
  - BUS-K 490 Independent Study in Decision Sciences (1–3 cr.)
  - SPEA-V 541 Benefit-Cost Analysis of Public and Environmental Policies (3 cr.)
- SPEA Concentration
  - SPEA-E 560 Environmental Risk Analysis (3 cr.)
  - SPEA-V 507 Data Analysis and Modeling for Public Affairs (3 cr.)
  - SPEA-V 673 Public Policy Analysis and Management Science/Operations Research (3 cr.)
- Criminal Justice Concentration
  - CJUS-P 430 Law and the Legal System (3 cr.)
  - CJUS-P 595 Data Analysis in Criminal Justice I (3 cr.)
  - CJUS-P 596 Data Analysis in Criminal Justice II (3 cr.)
- Psychology Concentration
  - PSY-P 533 Introduction to Bayesian Data Analysis I (3 cr.)
  - PSY-P 647 Decision Making under Uncertainty (3 cr.)
  - PSY-P 651 Perception/Action (3 cr.)
  - PSY-P 654 Multivariate Analysis (3 cr.)
  - PSY-P 820 Social Perception (3 cr.)
- Information and Library Science Concentration
  - ILS-Z 514 Social Aspects of Information Technology (3 cr.)
  - ILS-Z 532 Information Architecture for the Web (3 cr.)
  - ILS-Z 636 Semantic Web (3 cr.)
  - ILS-Z 642 Content Analysis for the Web (3 cr.)
  - ILS-Z 643 The Information Industry (1–3 cr.)
  - ILS-Z 671 School Media (3 cr.)
  - ILS-Z 680 The Book to 1450 (3 cr.)
- Telecommunications Concentration
  - TEL-T 504 Introduction to Telecommunications Policy Studies (3 cr.)
  - TEL-T 512 Communication and Politics (3 cr.)
  - TEL-T 532 Economics of the Media Industries (3 cr.)
  - TEL-T 575 Directed Group New Media Design Project (3 cr.)
  - TEL-T 610 The Networked Society (3 cr.)
  - TEL-T 650 Telecommunications and the Constitution (3 cr.)

Concentrations can also be regional or cultural. Indiana University is home to exemplary centers and institutes for geographical and regional studies. Any of the cultural and regional studies can be combined with the study of network security; given the inherently global nature of the challenges. Some examples include:

- African Studies Program
- Center for Languages of the Central Asian Region
- Center for Latin American and Caribbean Studies
- Center for the Study of Global Change
- East Asian Studies Center
- European Union Center
- India Studies Program
- Inner Asian and Uralic National Resource Center
- Jewish Studies Program
- Middle Eastern and Islamic Studies Program
- Russian and East European Institute
- West European Studies

Courses

Computer Science

Informatics

Key to Course Codes

AAAD	African American and African Diaspora Studies (COLL)
AFRI	African Studies (COLL)
AMID	Apparel Merchandising and Interior Design (COLL)
AMST	American Studies Program (COLL)
ANAT	Anatomy (Medical Sciences Program)

ANTH	Anthropology (COLL)
AST	Astronomy (COLL)
BIOL	Biology (COLL)
BUS	Kelley School of Business
CEUS	Central Eurasian Studies (COLL)
CHEM	Chemistry (COLL)
CLAS	Classical Studies (COLL)
COLL	College of Arts and Sciences
COGS	Cognitive Science Programs (COLL)
CMCL	Communication and Culture (COLL)
CMLT	Comparative Literature (COLL)
CJUS	Criminal Justice (COLL)
CSCI	Computer Science (School of Informatics and Computing)
EALC	East Asian Languages and Cultures (COLL)
ECON	Economics (COLL)
EDUC	School of Education
ENG	English (COLL)
FINA	Fine Arts (COLL)
FOLK	Folklore and Ethnomusicology (COLL)
FRIT	French and Italian (COLL)
GEOG	Geography (COLL)
GEOL	Geological Sciences (COLL)
GER	German Studies (COLL)
GNDR	Gender Studies (COLL)
HISP	Spanish and Portuguese (COLL)
HIST	History (COLL)
HPER	School of Health, Physical Education, and Recreation
HPSC	History and Philosophy of Science (COLL)
HON	Honors (COLL)
HUBI	Human Biology (COLL)
INFO	School of Informatics and Computing
INTL	International Studies Program (COLL)
JOUR	School of Journalism
JSTU	Jewish Studies (COLL)
LAMP	Liberal Arts and Management Program (COLL)
LING	Linguistics (COLL)
LTAM	Latin American and Caribbean Studies (COLL)
MATH	Mathematics (COLL)
MUS	School of Music
NELC	Near Eastern Languages and Cultures (COLL)
NURS	School of Nursing
PHIL	Philosophy (COLL)
PHSL	Physiology (Medical Sciences Program)
PHYS	Physics (COLL)
POLS	Political Science (COLL)
PSY	Psychological and Brain Sciences (COLL)
REL	Religious Studies (COLL)
SLAV	Slavic Languages and Literatures (COLL)
SLIS	School of Library and Information Science
SOC	Sociology (COLL)
SPEA	School of Public and Environmental Affairs
SPHS	Speech and Hearing Sciences (COLL)
STAT	Statistics (COLL)
TEL	Telecommunications (COLL)
THTR	Theatre and Drama (COLL)
WEUR	West European Studies (COLL)

CSCI-A 504 Introductory C++ Programming (2 cr.) P: Programming experience. Topics include aspects of C++ that are not object-oriented, basic data structures, standard libraries, and Unix tools for project management. Credit not given for both CSCI-A 504 and either CSCI-A 304, A 597, A 592, C 212 or BUS-K 201.

CSCI-A 506 Object-Oriented Programming in C++ (2 cr.) P: CSCI-A 201, A 304, A 504, or A 597. Topics include objects, classes, encapsulation, inheritance, polymorphism, templates and exceptions. Credit not given for both CSCI-A 506 and either CSCI-A 306, A 202, A 592, A 598 or C 212.

CSCI-A 521 Computing Tools for Scientific Research (3 cr.) C: MATH-M 118 or higher required; MATH-M 211 recommended. Introduction to computer-based tools useful for analysis and understanding of scientific data. Basic methods of computation, data processing, and display systems such at Matlab combined with elementary practical C/C++ programming. Techniques to support customized scientific research tasks, with particular emphasis on biological, neural, and behavioral sciences. Lecture and laboratory.

CSCI-A 538 Network Technologies and Systems Administration (3 cr.) P: CSCI-A 110, EDUC W200, or equivalent computer literacy. Introduction to network principles and current network technology, both hardware and software. Network administration tools and techniques. Laboratory provides practical experience. Credit not given for CSCI-A 547 and A 538.

CSCI-A 546 User-Interface Programming (3 cr.) P: CSCI-A 201, A 202, A 306, C 212, A 506, A 597, A 598, or equivalent experience. Learn to prototype and build graphical user interfaces for computer applications. Contemporary software design methodology. Students design and implement prototype interfaces to applications provided by the instructor. Extensive use will be made of

both commercial and experimental software tools. Credit not given for both CSCI-A 546 and A 346.

CSCI-A 548 Mastering the World-Wide Web (3 cr.) P: Two semesters of programming experience or equivalent, and some knowledge of operating systems. Project-oriented course leading to ability to maintain a web site with full functionality. Topics include background on internet network protocols and programming, web server administration, advanced web design and authoring, web protocols, interfacing services into the web. Credit not given for both CSCI-A 548 and A 348.

CSCI-A 590 Topics in Programming (1-2-6 cr.) Eight-week courses designed to provide foundations for using modern programming tools for applications and web development. Lecture and lab.

CSCI-A 591 Introduction to Computer Science (3 cr.) A first course in computer science for those intending to take advanced computer science courses. Introduction to programming and to algorithm design and analysis. Using the Scheme programming language, the course covers several programming paradigms. Lecture and laboratory. Credit not given for both CSCI-A 591 and C 211.

CSCI-A 592 Introduction to Software Systems (3 cr.) P: Programming experience. Design of computer software systems and introduction to programming. Topics include the Java programming language and its data structure facilities; building and maintaining large projects; shell tools and system calls. Introduction to object-oriented programming. Lecture and laboratory. Credit not given for both CSCI-A 592 and C 212.

CSCI-A 593 Computer Structures (3 cr.) P: CSCI-A 592. Lab fee. Structure and internal operation of computers. The architecture and assembly language programming of a specific computer are stressed, in addition to general principles of hardware organization and low-level software systems. Lecture and laboratory. Credit not given for both CSCI-A 593 and C 335. May be applied toward the Ph.D. minor.

CSCI-A 594 Data Structures (3 cr.) P: CSCI-A 592. C: CSCI-C 241 and A 593. Systematic study of data structures encountered in computing problems; structure and use of storage media; methods of representing structured data; and techniques for operating on data structures. Lecture and laboratory. Credit not given for both CSCI-A 594 and C 343. May be applied toward the Ph.D. minor.

CSCI-A 595 Fundamentals of Computing Theory (3 cr.) P: CSCI-C 241 C: CSCI-C 212. Fundamentals of formal language theory, computation models and computability, the limits of computability and feasibility, and program verification. Credit not given for bothCSCI-A 595 and B 401. May be applied toward the Ph.D. minor, graduate credit available for CS M.S. candidates with special permission.

CSCI-A 596 Programming Languages (3 cr.) P: CSCI-A 593 C: CSCI-A 594. Systematic approach to programming languages. Relationships among languages, properties and features of languages, and the computer environment necessary to use languages. Lecture and laboratory. Credit not given for both CSCI-A 596 and C 311. May be applied toward the Ph.D. minor.

CSCI-A 597 Introduction to Programming I (3 cr.) Fundamental programming constructs, including loops, arrays, classes, and files. General problem-solving techniques. Emphasis on modular programming, user-interface design, and developing good programming style. Credit not given for both CSCI-A 597 and A 201. Not intended for computer science majors.

CSCI-A 598 Introduction to Programming II (3 cr.) P: CSCI-A 597, A 201, A 504, or A 304. Advanced programming techniques: user-defined functions and types, recursion versus iteration, parameter-passing mechanisms. Classic abstract data types and algorithms. Programming style. Object-oriented programming. Credit not given for both CSCI-A 598 and A 202. Not intended for computer science majors.

CSCI-B 501 Theory of Computing (3 cr.) P: CSCI-C 241. Deterministic and nondeterministic automata, regular expressions, pumping lemmas; context-free languages, parsing, pushdown automata, context-sensitive languages, LBA, LR(k) languages, closure and decidability of language classes. Turing machines, random access machines, grammars, general recursive functions, equivalence of computation models, universal machines, relative computing. Unsolvability, semi-recursive sets, Rice's Theorem. Space and time complexity, NP completeness.

CSCI-B 502 Computational Complexity (3 cr.) P: CSCI-B 501. Study of computational complexity classes, their intrinsic properties, and relations between them. Topics include time and space computational complexity. Reducibility and completeness of problems within complexity classes. Complexity of optimization problems. Complexity hierarchies. Relativization of the P =? NP conjecture. Parallel computation models and the class NC.

CSCI-B 503 Algorithms Design and Analysis (3 cr.) P: MATH-M 216 and CSCI-C 343. Models, algorithms, recurrences, summations, growth rates. Probabilistic tools, upper and lower bounds; worst-case and average-case analysis, amortized analysis, dynamization. Comparison-based algorithms: search, selection, sorting, hashing. Information extraction algorithms (graphs, databases). Graphs algorithms: spanning trees, shortest paths, connectivity, depth-first search, breadth-first search. Credit not given for both CSCI-B 503 and B 403.

CSCI-B 510 Introduction to Applied Logic (3 cr.) Structures: relations between structures, term structures. Description: notation and meaning, substitution operations, first order formulas, database languages, program verification conditions, semantics valuation, normal forms, quantifier reduction, axiomatic theories. Proof: resolution, sequential calculi, natural deduction, automated theorem proving, semantic completeness. Limits of formalization: compactness, undecidability of truth, undecidability of canonical theories, non-formalizability of database theory.

CSCI-B 521 Programming Language Principles (3 cr.) Systematic approach to programming languages. Relationships among languages, properties and features of languages, the computer environment necessary to support language execution. Credit not given for both CSCI-B 521 and either CSCI-C-311 or A 596.

CSCI-B 522 Programming Language Foundations (3 cr.) P: CSCI-C 311 or B 521 and B 510 Introduction to denotational, operational, and axiomatic approaches to programming language semantics. Semantic analysis of major programming language features. Logics of programs.

CSCI-B 524 Parallelism in Programming Languages and Systems (3 cr.) P: CSCI-P436 or P 536, and either CSCI-C 311 or B 521 or C 343. Fundamentals of parallel computation, with an emphasis on parallel programming methodology and programming languages. Topics include: Parallel algorithms. Major paradigms for parallel software construction: data parallelism, task/thread parallelism and CSP. Compiling programs for parallel computers.

CSCI-B 534 Distributed Systems (3 cr.) P: CSCI-P 436 or P 536. Principles of distributed systems including naming, consistency, concurrency, and security and their role in distributed file systems and file sharing systems. Includes study of and current best practices in distributed computing models: peer-to-peer, grid computing, and distributed object model.

CSCI-B 541 Hardware System Design I (3 cr.) P: CSCI-C 335 and C-343. Lab fee. Structured approach to hardware design, emphasizing hardwired and microprogrammed control. Boolean algebra, hardware building blocks, architecture and control, implementation issues. In the laboratory, students build a working computer using hardware prototyping technologies. Basic training in the use of design and simulation software. Lecture and laboratory. Credit not given for both CSCI-B 541 and B 441.

CSCI-B 543 Computer Architecture (3 cr.) P: CSCI-C 335 and C 343. Fundamentals of computer design, instruction processing and performance analysis. Architecture of single-processor systems, focusing on pipelining, memory and memory hierarchies, and interconnect technology. Exploration of architecture classes such as high-performance multiprocessors, massively parallel computers, embedded systems. Credit not given for both CSCI-B 543 and B 443.

CSCI-B 551 Elements of Artificial Intelligence (3 cr.) P: CSCI-C 343 or good knowledge of LISP or Scheme. Introduction to major issues and approaches in artificial intelligence. Principles of reactive, goal-based, and utility-based agents. Problem-solving and search. Knowledge representation and design of representational vocabularies. Inference and theorem proving, reasoning under uncertainty, and planning. Overview of machine learning.

CSCI-B 552 Knowledge Based Artificial Intelligence (3 cr.) P: CSCI-B 551. Knowledge-based methods for artificial intelligence systems: knowledge representation, organization, and application. Typical content includes: Principles of memory organization, indexing and retrieval. Memory-based, analogical, and case-based reasoning. Applications to understanding, explanation, planning, and advisory systems.

CSCI-B 553 Neural and Genetic Approaches to Artificial Intelligence (3 cr.) P: CSCI-B 551. Approaches to the design of intelligent systems inspired by nervous systems, evolution, and animal behavior. Distributed and perceptually grounded representations. Temporal processing. Perception and action. Genetic search. Unsupervised and reinforcement learning. Comparison of symbolic, subsymbolic, and hybrid approaches to intelligence.

CSCI-B 555 Machine Learning (3 cr.) Theory and practice of constructing algorithms that learn functions and choose optimal decisions from data and knowledge. Topics include: mathematical/probabilistic foundations, MAP classification/regression, linear and logistic regression, neural networks, support vector machines, Bayesian networks, tree models, committee machines, kernel functions, EM, density estimation, accuracy estimation, normalization, model selection.

CSCI-B 561 Advanced Database Concepts (3 cr.) P: CSCI-C 241, C 335, and C 343. Database models and systems: especially relational and object-oriented; relational database design theory; structures for efficient data access; query languages and processing; database applications development; views. Transaction management: concurrency and recovery. Credit not given for both CSCI-B 461 and B 561.

CSCI-B 565 Data Mining (3 cr.) Algorithmic and practical aspects of discovering patterns and relationships in large databases. The course also provides hands-on experience in data analysis, clustering and prediction. Topics include: data preprocessing and exploration, data warehousing, association rule mining, classification and regression, clustering, anomaly detection, human factors and social issues in data mining.

CSCI-B 581 Advanced Computer Graphics (3 cr.) P: CSCI-C 343, MATH-M 301 or M 303 or equivalent experience. Lab fee. Introduction to graphics hardware and software. Two-dimensional graphics methods, transformations, and interactive methods. Three-dimensional graphics, transformations, viewing geometry, object modeling and interactive manipulation methods. Basic lighting and shading. Video and animation methods. Credit not given for both CSCI-B 581 and B 481.

CSCI-B 582 Image Synthesis (3 cr.) P: CSCI-B 581 and MATH-M 215. Lab fee. Raster image display: color theory, gamma correction, and filtering. Advanced shading methods: local illumination models, global illumination models. Surface display, including ray tracing and Z-buffering. Solid modeling; spline surfaces, CSG, superquadrics, and deformations. Scientific visualization: isosurfaces and volume rendering.

CSCI-B 599 Teaching in Computer Science (1 cr.) General principles of teaching and practical experiences that relate to teaching computer science. An important feature of the course is the micro-teaching, in which each participant prepares and delivers short lectures to the seminar participants. Each presentation is followed by critical analysis and discussion.

CSCI-B 603 Advanced Algorithms Analysis (3 cr.) P: CSCI-B 503. Advanced topics in analysis of algorithms, including fast algorithms for classical problems, lower bounds results, and statistical behavior.

CSCI-B 607 Philosophy of Computation (3 cr.) P: Permission of instructor. Critical examination of the conceptual foundations of computing. Several different views assessed with respect to conceptual, explanatory,

and empirical criteria. Primary focus on formal symbol manipulation, recursive function theory, effective computability, computational complexity, digitality, and information processing. Some non-standard approaches also considered: connectionism, dynamics, and artificial life.

CSCI--B 609 Topics in Algorithms and Computing Theory (1-6 cr.) P: Permission of instructor. Special topics in algorithms and computing theory. May be repeated for credit with permission.

CSCI-B 619 Topics in Applied Logic (1-6 cr.) P: Permission of instructor. Special topics in applied logic. May be repeated for credit with permission.

CSCI-B 621 Advanced Concepts in Programming Languages (3 cr.) P: CSCI-C 311 or B 521. C: CSCI-P 423 or P 523. Discussion of current issues in the design of programming languages. Modularity, abstraction, and static analysis. Applicative and nonapplicative models. Single and multiple processing.

CSCI-B 622 Programming Language Type Systems (3 cr.) P: CSCI-C 311 or B 521. Theoretical foundations and engineering techniques for modern type systems, focusing on polymorphism and subtyping in typed lambda-calculi; applications, including type systems for objects, abstract data types, and modules; issues in type checker implementation and polymorphic type inference.

CSCI-B 629 Topics in Programming Languages (1-6 cr.) P: CSCI-C 311 or B 521 and permission of instructor. Special topics in programming languages. May be repeated for credit with permission.

CSCI-B 639 Topics in Software (1-6 cr.) P: Permission of instructor. Special topics in software systems. May be repeated 2 times for a maximum of 12 credit hours.

CSCI-B 644 Very Large Scale Integration (3 cr.) P: CSCI-B 441 or B 541. Lab fee. Basic theory and practice required to convert hardware algorithms and architecture to silicon structures. Use of state-of-the-art design tools for integrated circuits.

CSCI-B 649 Topics in Systems (1-6 cr.) P: Permission of instructor. Special topics in systems. May be repeated for credit with permission.

CSCI-B 651 Natural Language Processing (3 cr.) P: CSCI-B 551. CSCI-B 552 or B 553 recommended Theory and methods for natural language processing. Algorithms for sentence parsing and generation. Context-free and unification grammars. Question-and-answer systems. Analysis of narratives. Finite-state approaches to computational phonology and morphology. Machine translation. Machine learning of natural language. Speech recognition. Neural-network and statistical alternatives to symbolic approaches.

CSCI-B 652 Computer Models of Symbolic Learning (3 cr.) P: CSCI-B 552. Symbolic artificial intelligence methods for learning. Inductive and explanation-based generalization. Failure-driven learning. Case-based learning. Typical content includes: Operationality of explanations and utility of learning. Goal-driven learning. Criteria for when, what, and how to learn. Learning in integrated architectures.

CSCI-B 656 Web Mining (3 cr.) Machine learning techniques to mine the Web and other unstructured/ semistructured, hypertextual, distributed information repositories. Crawling, indexing, ranking and filtering algorithms using text and link analysis. Applications to search, classification, tracking, monitoring, and Web intelligence. Group project on one of the topics covered in class.

CSCI-B 657 Computer Vision (3 cr.) P: CSCI-C 463 or B 551. Concepts and methods of machine vision as a branch of artificial intelligence. Basics of digital image processing. Local and global tools for deriving information from image data. Model-based object recognition and scene understanding.

CSCI-B 659 Topics in Artificial Intelligence (1-6 cr.) P: Permission of instructor. Special topics in artificial intelligence. May be repeated for credit with permission.

CSCI-B 661 Database Theory and Systems Design (3 cr.) P: CSCI-B 461 or B 561. Database models: relational, deductive, complex-object, object-oriented. Query languages: relational algebra and calculus, datalog, fixpoint logics, object-oriented query languages. Transaction management theory: concurrency control, recovery, distribution. Post-relational and object-oriented database systems.

CSCI-B 662 Database Systems and Internal Design (3 cr.) P: CSCI-B 561 This course deals with database management systems and their modern applications. We will discuss various issues to be considered and design decisions to be made in these systems. Topics include storage management, access methods, query processing and optimization strategies, concurrently control techniques, data warehousing, data mining, semi-structured data management, etc.

CSCI-B 665 Software Engineering Management I (3 cr.) P: CSCI-B 561 or BUS-S 560. Topics include: the high cost of software, the software life cycle, understanding programming teams, and methodologies for controlling development. Presentation of readings and supervision of programming teams producing software products required.

CSCI-B 666 Software Management Implementation II (1-3 cr.) P: CSCI-B 665. Continuation of projects from CSCI-B 665. Periodic reports and a final paper required. If taken for two or more credits, an additional project or paper is required.

CSCI-B 669 Topics in Database and Information Systems (1-6 cr.) P: Permission of instructor. Special topics in database and information systems. May be repeated for credit with permission.

CSCI-B 673 Advanced Scientific Computing (3 cr.) P: CSCI-P 573 and MATH-M 471. Multiprocessor organization: vectorization, memory organization, processor topologies and architectures. Models of parallelism. Programming language and systems for scientific and high performance computing. Environments for interactive scientific experiments and databases. Distributed programming tools. Parallelism in scientific problems: Parallel algorithmic techniques, parallel algorithms and models, parallel performance analysis and debugging.

CSCI-B 679 Topics in Scientific Computing (1-6 cr.) P: Permission of instructor. Special topics in scientific computing. May be repeated for credit with permission.

CSCI-B 689 Topics in Graphics and Human Computer Interaction (1-6 cr.) P: Permission of instructor. Special topics in graphics and human computer interaction. May be repeated for credit with permission.

CSCI-P 515 Specification and Verification (3 cr.) P: CSCI-C 311. Tools and techniques for rigorous reasoning about software and digital hardware. Safety, reliability, security, and other design-critical applications. Decision algorithms. Projects involving the use of automated reasoning, such as model checkers, theorem provers, and program transformation. Credit not given for both CSCI-P 415 and P 515.

CSCI-P 523 Programming Language Implementation (3 cr.) P: CSCI-B 521 or C 311. Implementation of traditional and nontraditional computer programming languages. Compilation, including lexical analysis, parsing, optimization, code generation, and testing. Run-time support, including run-time libraries, storage management, input-output. Comparison of implementation techniques. Extensive laboratory exercises. Credit not given for both CSCI-P 523 and P 423.

CSCI-P 532 Object-Oriented Software Development (3 cr.) P: Proficiency in Java. This course will help turn motivated students into superior contributors to any small- to mid-sized commercial or open-source software project. It takes a hands-on, learning-by-doing approach. Students are introduced to design patterns, tools, and teamwork strategies from the first assignment to the last project.

CSCI-P 535 Pervasive Computing (3 cr.) P: Object oriented programming. Lab fee. Topics in pervasive computing, such as: sensors, mobility, tangibles, ambient displays, middleware, location and context-awareness. User-centered design methods, such as: requirements gathering, design, prototyping and evaluation. Labs cover current technologies, such as sensors and mobile devices. Lecture and laboratory.

CSCI-P 536 Advanced Operating Systems (3 cr.) P: CSCI-C 335 and C 343. Advanced topics in operating systems, such as: multi-tasking, synchronization mechanisms, distributed system architecture, client-server models, distributed mutual exclusion and concurrency control, agreement protocols, load balancing, failure recovery, fault tolerance, cryptography, multiprocessor operating systems. Credit not given for both CSCI-P 536 and P 436.

CSCI-P 538 Computer Networks (3 cr.) P: Operating systems or networking course. Layered TCP/IP architecture. LAN technologies (Ethernet, wireless, token ring). Switching. Internet addressing (IPv4, IPv6). Routing protocols. Congestion control (TCP, UDP). Applications (DNS, HTTP, peer-to-peer networks). Selection of topics including DHCP, ICMP, VPNs, multicast, security. Credit given for only one of CSCI-P 438 and P 538.

CSCI-P 542 Hardware System Design II (3 cr.) P: CSCI-B 541 or B 441. Lab fee. Depending on instructor, a selection of topics in system-level design, such as simulation, logic synthesis, high-level synthesis, codesign, embedded software, verification, test, requirements specification, and others. Projects in system-level design. Computer-aided design tools. Lecture and laboratory. Credit not given for both CSCI-P 542 and P 442.

CSCI-P 545 Embedded and Real-Time Systems (3 cr.) P: Any 400-level "systems" course (middle digit 3 or 4). Design and implementation of purpose-specific, locally distributed software systems. Models and methods for time-critical applications. Real-time operating systems. Testing, validation, and verification. Safety-critical design. Related topics, such as resiliency, synchronization, sensor fusion, etc. Lecture and laboratory.

CSCI-P 565 Software Engineering I (3 cr.) P: CSCI-C 343, B 461 previously or B 561 concurrently. Analysis, design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development processes. Credit not given for both CSCI-P 465-P 466 and CSCI-P 565-P 566.

CSCI-P 566 Software Engineering II (3 cr.) P: CSCI-C 343, B 461 previously or B 561 concurrently. Analysis, design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development processes. Credit not given for both CSCI-P 465-P 466 and CSCI-P 565-P 566.

CSCI-P 573 Scientific Computing (3 cr.) P: MATH-M 303 or M 301, M 343 and CSCI-C 212. For students from all scientific, engineering, and mathematical disciplines, this course provides an overview of computer hardware, software, and numerical methods that are useful on scientific workstations and supercomputers. Topics include high-performance computer architectures, software tools and packages, characteristics of numerical methods in common use, graphical presentation of results, and performance analysis and improvement.

CSCI-P 632 Object-Oriented Software Management (3 cr.) P: Permission of instructor. This course will help turn motivated students into superior managers of any small- to mid-sized commercial or open-source software project. It takes a hands-on, learning-by-doing approach. Students are introduced to the main management concerns of managing smallish design and development teams.

CSCI-Y 790 Graduate Independent Study (1-6 cr.) Independent study under the direction of a faculty member, culminating in a written report. R grade not allowed. The different departmental options for independent study are: Research and Reading, Software System Development, Master's Research Project, Master's Software Project, and a University Master's Thesis. May be repeated for credit.

CSCI-Y 791 Graduate Independent System Development (1-6 cr.) System development culminating in written report and a publicly available system. R grade not allowed. May be repeated for credit.

CSCI-Y 792 Master's Thesis (1-6 cr.) Readings and research under the supervision of the master's thesis advisor, leading to a thesis at a level admissible as a departmental technical report. R grade not allowed. May

be repeated for a maximum of 6 credit hours of CSCI-Y 792 and Y 793.

CSCI-Y 793 Master's Software Thesis (1-6 cr.) A major software development project, possibly performed jointly with other students, documented in the public domain and with final approval by three graduate faculty. R grade not allowed. May be repeated for a maximum of 6 credit hours of CSCI-Y 792 and Y 793.

CSCI-Y 798 Professional Practicum/Internship (0 cr.) P: Current enrollment in graduate degree program in computer science. Provides for participation in graduate level professional training and internship experience.

CSCI-Y 799 Computer Science Colloquium (1 cr.) A series of talks by researchers in computer science and closely related areas presenting their recent research. A minimum of 75% attendance and course work in the form of a written report based on the talk by any colloquium speaker are required for credit. May be repeated for a maximum of 3 credit hours.

CSCI-Y 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation.

CSCI-G 901 Advanced Research (6 cr.) Ph.D. dissertation research after the completion of all course requirements.

Informatics

INFO-I 500 Fundamental Computer Concepts for Informatics (3 cr.)
An Introduction to fundamental principles of computer concepts for Informatics study, including an overview of computer architecture, computer algorithms, fundamentals of operating systems, data structure, file organization and database concepts. INFO I500 is expected to impart the required level of competency in computer science. This course may be waived in lieu of six undergraduate credit hours of computer science or informatics coursework, covering areas of programming, discrete structures, and data structures.

INFO-I 501 Introduction to Informatics (3 cr.)
P: Calculus I or Linear Algebra I and introductory undergraduate statistics or probability course. This course serves as an intensive introduction to the most central technical tools of Informatics, most importantly, Probability and Statistics, Linear Algebra and Numerical Optimization. The course weaves in computation, using R, as a uniting theme, while including numerous examples and applications of the techniques presented.

INFO-I 502 Human-Centered Research Methods in Informatics (3 cr.) This course surveys a broad range of research methods employed in Informatics, exploring their meta-theoretical underpinnings and exemplifying their application to specific research questions. This course is intended for students in Informatics graduate programs, especially Ph.D. students, who need a grounding in research methods.

INFO-I 504 Social Dimensions of Science Informatics (3 cr.) Examines ethical, legal, and social issues surrounding contemporary research and practice in science informatics. Topics include the nature of science and technology, the ramifications of recent advances in science informatics, and relevant science policy and research ethics. General knowledge of science informatics is assumed.

INFO-I 506 Globalization and Information (3 cr.)
Explores the processes that promote and impede movement of human action and informational activities to the most general levels, e.g., the level of the world as a whole. Surveys diverse theories of globalization to identify the best approaches for professional informatics career planning and making information globally accessible.

INFO-I 519 Introduction to Bioinformatics (3 cr.) P: One semester programming course or equivalent. Sequence alignment and assembly; RNA structure, protein and molecular modeling; genomics and protenomics; gene prediction; phylogenic analysis; information and machine learning; visual and graphical analysis bioinformatics; worldwide biologic databases; experimental design and data collection techniques; scientific and statistical data analysis; database and data mining methods; and network and Internet methods.

INFO-I 520 Security for Networked Systems (3 cr.)
This course is an extensive survey of system and network security. Course materials cover the threats to information confidentiality, integrity and availability and the defense mechanisms that control such threats. The course provides the foundation for more advanced security courses and hands-on experiences through course projects.

INFO-I 521 Malware Epidemic: Threat and Defense (3 cr.) P: One semester programming course or equivalent. This course is designed to be research and hands-on oriented. Students are required to read and present research papers that reflect the state of the art in malware-related research and participate in course projects that expose them to the cutting-edge technologies on malware defense.

INFO-I 525 Organizational Informatics and Economics of Security (3 cr.) Security technologies make explicit organizational choices that allocate power. Security implementations allocate risk, determine authority, reify or alter relationships, and determine trust extended to organizational participants. The course begins with an introduction to relevant definitions (security, privacy, trust) and then moves to a series of timely case studies of security technologies.

INFO-I 529 Machine Learning in Bioinformatics (3 cr.)
P: INFO-I 519 or equivalent knowledge. The course covers advanced topics in Bioinformatics with a focus on machine learning. The course will review existing techniques such as hidden Markov models, artificial neural networks, decision trees, stochastic grammars, and kernel methods. Examine application of these techniques to current bioinformatics problems including: genome annotation and comparison, gene finding, RNA secondary structure prediction, protein structure prediction, gene expression analysis, proteonmics, and integrative functional genomics.

INFO-I 531 Seminar in Health Informatics (1-3 cr.)
Variable topic. Emphasis is on advanced topics and

research in health informatics. May be repeated with different topics, subject to approval of the Dean.

INFO-I 532 Seminar in Bioinformatics (1-3 cr.) Variable topic. Emphasis is on advanced topics and research in bioinformatics. May be repeated with different topics, subject to approval of the Dean.

INFO-I 533 Systems and Protocol Security and Information Assurance (3 cr.) This course looks at systems and protocols, how to design threat models for them and how to use a large number of current security technologies and concepts to block specific vulnerabilities. Students will use a large number of systems and programming security tools in the laboratories.

INFO-I 534 Seminar in Human-Computer Interaction (1-3 cr.) Variable topic. Emphasis is on advanced topics and research in human-computer interaction. May be repeated once with a different topic, subject to approval of the program director.

INFO-I 536 Foundational Mathematics of Cyber Security (3 cr.) Students will learn mathematical tools necessary to understand modern cyber security. The course will cover introductory mathematical material from a number of disparate fields including probability theory, computational theory, complexity theory, group theory, and information theory.

INFO-I 537 Legal and Social Informatics of Security (3 cr.) Security technologies make explicit organizational choices that allocate power. Security implementations allocate risk, determine authority, reify or alter relationships, and determine trust extended to organizational participants. The course begins with an introduction to relevant definitions (security, privacy, trust) and then moves to a series of timely case studies of security technologies. This course may be taken as an alternative INFO-I 525. The course also requires a project, including a work plan, a timeline, peer evaluations, and professional presentations.

INFO-I 538 Introduction to Cryptography (3 cr.) This class considers issues of network security, treating in depth the topics covered in INFO-I 536. In particular, the class involves adversarial modeling, a detailed treatment of security primitives, and methods for analysis of security. It spans the ethics and technology of security, with examples drawn both from deployed and proposed protocols. Topics to be covered include studies of rational and malicious cheating, symmetric and asymmetric cryptography, security reductions and heuristics.

INFO-I 539 Cryptographic Protocols (3 cr.) This class will cover current and timely topics in the field of Security Informatics. Topics will vary from year to year. Examples of topics that could have been covered in recent years include phishing and cyberfraud, trusted computing basis, electronic voting, and digital rights management systems.

INFO-I 541 Interaction Design Practice (3-6 cr.) Human-Computer Interaction Design (HCID) describes the way a person or group accomplishes tasks with a computer—what the individual or group does and how the computer responds; what the computer does and how the individual or group responds. Sometimes known as "interface design," HCID becomes increasingly important as computing intelligence and connectivity spread ubiquitously to home, work, and play environments. This course will be organized around a collection of readings and three design projects concerned with applying human-computer interaction principles to the design, selection, and evaluation of interactive systems.

INFO-I 542 Foundations of HCI (3 cr.) "Foundations of HCI" offers a survey overview of the field of Human-Computer Interaction Design. It introduces the main themes of HCI set generally in a historical context. Themes include interaction design, cognitive modeling, distributed cognition, computer-supported cooperative work, data visualization, ubiquitous computing, affective computing, and domestic computing, among others.

INFO-I 543 Interaction Design Methods (3 cr.) Students will learn basic concepts and methods for usability studies and evaluation of interactive systems as well as apply those methods to actual system design evaluations. This course is not only for understanding the basics and traditional approaches in this area, but also for exploring new ways of evaluating the usability of state-of-the-art technology-based systems such as systems in ubiquitous computing, CSCW, tangible and social computing areas.

INFO-I 544 Experience Design (3 cr.) Accompanying its move from workplace productivity into culture-at-large, HCI is increasingly concerned with designing engaging user experiences. "Experience Design" is an interdisciplinary course that brings anthropological, philosophical, design, and technological perspectives together to explore novel ways to research, design, and evaluate qualities of user experience.

INFO-I 545 Music Information Representation, Search, and Retrieval (3 cr.) A comprehensive, comparative study of computer-based representation schemes for music, including those oriented toward music notation, music performance, and music analysis. Overview of musical metadata. Techniques and tools for search and retrieval of music information. Credit not given for both INFO-I 545 and MUS-N 564.

INFO-I 546 Music Information Processing: Symbolic (3 cr.) This course deals with both methodology and specific applications that attempt to algorithmically annotate, understand, recognize, and categorize music in symbolic (score like) form. Particular applications will include key finding, harmonic analysis, note spelling, rhythm recognition, meter induction, piano fingering, and various classification problems such as genre or composer identification. The methodology we will employ will be probabilistic and will include ideas from Machine Learning such as optimal classifiers, hidden Markov models, and Bayesian networks. Students will have computing assignments, present papers, and be expected to implement solutions to problems using a high-level language such as R or Matlab.

INFO-I 547 Music Information Processing: Audio (3 cr.) This course deals with various music analysis and processing problems that use sampled audio as the primary data representation. We discuss digital signal processing, including filtering and its relationship to Fourier techniques. Topics include synthesis, effects processing, score following, and blind music recognition, and accompaniment systems.

INFO-I 548 Introduction to Music Informatics (3 cr.) History, issues, and applications in music information technology. Survey of various types of musical information. Introduction to digital musical media, including data standards and processing; database structure and organization standards and processing; database structure and organization of audio-, score-, and text file objects; and discussion of copyright issues.

INFO-I 552 Ind Study in Bioinformatics (1-3 cr.) P: Permission of instructor and completion of at least one 500-level informatics course. Independent readings and research under the direction of a faculty member culminating in a written report. May be repeated for a maximum of 3 times and 9 credit hours.

INFO-I 553 Ind Study in Chem Informatics (1-3 cr.) P: Permission of instructor and completion of at least one 500-level informatics course. Independent readings and research under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 3 times and 9 credit hours.

INFO-I 554 Ind St Human Computer Interaction (1-3 cr.) P: Permission of instructor and completion of at least one 500-level informatics course. Independent readings and research under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 3 times and 9 credit hours.

INFO-I 561 Meaning and Form in HCI (3 cr.) P: INFO-I 541. This course is a continuation of Human-Computer Interaction Design I, emphasizing the justification of design effectiveness.

INFO-I 571 Chemical Information Technology (3 cr.) Overview of chemical informatics techniques, including chemical structure coding, chemical data representation, chemical database and search systems, molecular visualization and modeling techniques, and the development of chemical informatics software.

INFO-I 572 Computational Chemistry and Molecular Modeling (3 cr.) This course has two main objectives. 1) To give you a thorough introduction to computational chemisty and modern methods of electronic structure theory that form the basis of molecular modeling today. Mainly, we will concentrate on quantum mechanical methods and pay special attention to Density Functional Theory. Instead of digging deep into the mathematics of quantum chemistry, we will concentrate on practical aspects and examine in detail how computational chemistry can be used to explain chemical reactions and electronic properties. 2) To get your ‘Hands Dirty’ and conduct real and original research designed to allow you to see the knowledge obrained from the first part of the course in action and apply a wide range of state-of-the-art methods to solve a specific chemcial research problem at a high level of scientific rigor.

INFO-I 573 Programming for Science Informatics (3 cr.) Students will receive a thorough understanding of software development for chem- and bioinformatics, and broaden experience of working in a scientific computing group. Topics include programming for the web, depiction of chemical and biological structures in 2D and 3D, science informatics tool kits, software APIS, AI and machine-learning algorithm development, high performance computing, database management, managing a small software development group, and design and usability of science informatics software.

INFO-I 585 Bioinspired Computing (3 cr.) Biologically-inspired computing is an interdisciplinary field devoted to computational methods modeled after natural design principles. The goal is to produce informatics tools with enhanced robustness, scalability, flexibility and natural human-machine interaction. Topics include: Self-organization, Evolutionary Systems, Cellular Automata, Boolean Networks, L-Systems, Collective and Swarm Behavior, Artificial Immune Systems, Complex Networks.

INFO-I 586 Artificial Life (3 cr.) Artificial life is a broad discipline encompassing the origins, modeling, and synthesis of natural and artificial living entities and systems. Artificial intelligence, as a discipline, tries to model and understand intelligent systems and behavior, typically at the human level.

INFO-I 590 Topics in Informatics (3 cr.) Variable topic. Emphasis is on new developments and research in informatics. May be repeated with different topics, subject to approval of the Dean.

INFO-I 591 Graduate Internship (0-6 cr.) P: Approval required. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in Informatics course work. May be repeated for a maximum of 6 credit hours.

INFO-G 599 Thesis Research (0 cr.) Master's students who have enrolled in 30 or more hours of graduate course work applicable to the degree and who have completed all other requirements of the degree except the thesis of final project of performance may enroll in INFO-G 599. Requires section authorization.

INFO-I 601 Introduction to Complex Systems (3 cr.) The course will cover fractals, emergent behavior, chaos theory, cooperative phenomena, and complex networks. Students will learn how to think differently about complexitalities, finding ways to understand their complexity and addressing the problems they pose.

INFO-I 602 Music Info Processing: Audio (3 cr.) This course deals with various music analysis and processing problems that use sampled audio as the primary data representation. Digital signal processing including filtering and its relationship to Fourier techniques. Focus on applications including score following, automatic music transcription and annotation from audio,musical accompaniment systems, as well as some useful audio effects.

INFO-I 604 Human Computer Interaction Design Theory (3 cr.) The course will explore, analyze, and criticize underlying assumptions and the rational behind some of the most influential theoretical attempts in HC and related fields. The purpose of the course is to make students aware of how theories can influence practice and to develop critical thinking around the role, purpose, and function for theories.

INFO-I 605 Social Foundations of Informatics (3 cr.) Topics include the economics of information businesses and information societies, legal and regulatory factors that shape information and information technology use, the relationship between organization cultures and their use of

information and information technology, and ownership of intellectual property.

INFO-I 609 Advanced Seminar I in Informatics (3 cr.) Contemporary Informatics approaches and related theories. This Ph.D. seminar will be held as reading and discussion courses, divided into sections. This means that the courses will to a large extent be self- and/or group-study oriented with support from faculty.

INFO-I 611 Mathematical and Logical Foundations of Informatics (3 cr.) P: Basic discrete mathematics equivalent to MATH-M 118, or consent of instructor. An introduction to mathematical methods for information modeling, analysis, and manipulation. The topics include proof methods in mathematics, models or computation, counting techniques and discrete probability, optimization, statistical inference and ore advanced topics that include but are not limited to Markov chains and random walks, random graphs, and Fourier analysis.

INFO-I 617 Informatics in Life Sciences and Chemistry (3 cr.) Introduces the fundamental notions in genome and proteome informatics and chemical informatics focusing on the design and organizing issues in information systems used in those areas. The course is designed for students with no biology or chemistry background, but some knowledge in informatics, who want to learn basic topics in bioinformatics and chemical informatics.

INFO-I 619 Structural Bioinformatics (3 cr.) The course will cover informatics approaches, based on the sequence and 3D structure of biological macromolecules, whose objective is to improve our understanding of the function of these molecules.

INFO-I 621 Computational Techniques in Comparative Genomics (3 cr.) Summarizes computational techniques for comparing genomes on the DNA and protein sequence levels. Topics include state of the art computational techniques and their applications: understanding of hereditary diseases and cancer, genetic mobile elements, genome rearrangements, genome evolution, and the identification of potential drug targets in microbial genomes.

INFO-I 651 Ethnography of Information (3 cr.) Introduces ethnography as a social science methodology and way of knowing with which to study information and its social contexts. Places ethnography in the Informatics knowledge base. Trains students in the use of a broad range of ethnographic techniques relevant to study of automated information technology in use. Designed to be open to students from other programs with sufficient methodological and substantive background.

INFO-I 667 Seminar in Health Informatics I (3 cr.) P: INFO-I 531. Advanced graduate seminar in health informatics, designed to complement INFO-I 531. This seminar is intended for graduate students enrolled in the Health Informatics track in the Informatics Doctoral Program.

INFO-I 690 Topics in Informatics (1-3 cr.) Variable topic. Emphasis on new developments and research in informatics. Course is intended for Ph.D. students in the school of Informatics. May be repeated with different topics, subject to approval of the Dean.

INFO-I 692 Thesis/Project Bioinformatics (1-6 cr.) P: Graduate standing and approval of the Dean. The student prepares and presents thesis or project in an area of bioinformatics. The product is substantial, typically a multi-chapter paper or carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between student and sponsoring faculty member. May be repeated for a maximum of 6 credit hours.

INFO-I 693 Thesis/Project in Chemical Informatics (1-6 cr.) P: Graduate standing and approval of the Dean. The student prepares and presents a thesis or project in an area of chemical informatics. The product is substantial, typically multi-chapter paper, or a carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member. May be repeated for a maximum of 6 credit hours.

INFO-I 694 Thesis/Project in Human-Computer Interaction (1-6 cr.) P: Graduate standing and approval of the Dean. The student prepares and presents a thesis or project in an area of human-computer interaction. The product is substantial, typically multi-chapter paper, or a carefully designed and evaluated application, based on well-planned research or scholarly project. Details are worked out between the student and sponsoring faculty member. May be repeated for a maximum of 6 credit hours.

INFO-I 698 Research in Informatics (1-30 cr.) Research not dissertation related under the direction of a member of the graduate faculty. May be repeated for a maximum of 30 credit hours.

INFO-I 699 Independent Study in Informatics (1-3-12 cr.) Independent readings and research for Ph.D. students under the direction of a faculty member, culminating in a written report. May be repeated for a maximum of 12 credit hours.

INFO-I 709 Advanced Seminar II in Informatics (3 cr.) Topic: Contemporary Informatics approaches and related theories. This Ph.D. seminar will be held as reading and discussion courses, divided into sections. This means that the courses will to a large extent be self- and/or group-study oriented with support from faculty. More advanced readings and discussion than INFO-I 609.

INFO-I 790 Informatics Research Rotation (3 cr.) Working with faculty to investigate research opportunities. May be repeated for a maximum of 6 credit hours.

INFO-I 798 Professional Practicum/Internship (0 cr.) P: Current enrollment in the graduate degree program in Informatics. Participation in graduate level professional training and internship experience.

INFO-I 890 Thesis Readings and Research (1-12-30 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation. May be repeated for a maximum of 30 credit hours.

INFO-G 901 Advanced Research (6 cr.) Ph.D. dissertation research after the completion of all course requirements.

Computer Science

CSCI-A courses are non-major courses and are listed first regardless of the course level.

CSCI-A 504 Introductory C++ Programming (2 cr.) P: Programming experience. Topics include aspects of C++ that are not object-oriented, basic data structures, standard libraries, and Unix tools for project management. Credit not given for both CSCI-A 504 and either CSCI-A 304, A 597, A 592, C 212 or BUS-K 201.

CSCI-A 506 Object-Oriented Programming in C++ (2 cr.) P: CSCI-A 201, A 304, A 504, or A 597. Topics include objects, classes, encapsulation, inheritance, polymorphism, templates and exceptions. Credit not given for both CSCI-A 506 and either CSCI-A 306, A 202, A 592, A 598 or C 212.

CSCI-A 521 Computing Tools for Scientific Research (3 cr.) C: MATH-M 118 or higher required; MATH-M 211 recommended. Introduction to computer-based tools useful for analysis and understanding of scientific data. Basic methods of computation, data processing, and display systems such at Matlab combined with elementary practical C/C++ programming. Techniques to support customized scientific research tasks, with particular emphasis on biological, neural, and behavioral sciences. Lecture and laboratory.

CSCI-A 538 Network Technologies and Systems Administration (3 cr.) P: CSCI-A 110, EDUC W200, or equivalent computer literacy. Introduction to network principles and current network technology, both hardware and software. Network administration tools and techniques. Laboratory provides practical experience. Credit not given for CSCI-A 547 and A 538.

CSCI-A 546 User-Interface Programming (3 cr.) P: CSCI-A 201, A 202, A 306, C 212, A 506, A 597, A 598, or equivalent experience. Learn to prototype and build graphical user interfaces for computer applications. Contemporary software design methodology. Students design and implement prototype interfaces to applications provided by the instructor. Extensive use will be made of both commercial and experimental software tools. Credit not given for both CSCI-A 546 and A 346.

CSCI-A 548 Mastering the World-Wide Web (3 cr.) P: Two semesters of programming experience or equivalent, and some knowledge of operating systems. Project-oriented course leading to ability to maintain a web site with full functionality. Topics include background on internet network protocols and programming, web server administration, advanced web design and authoring, web protocols, interfacing services into the web. Credit not given for both CSCI-A 548 and A 348.

CSCI-A 590 Topics in Programming (1-2-6 cr.) Eight-week courses designed to provide foundations for using modern programming tools for applications and web development. Lecture and lab.

CSCI-A 591 Introduction to Computer Science (3 cr.) A first course in computer science for those intending to take advanced computer science courses. Introduction to programming and to algorithm design and analysis. Using the Scheme programming language, the course covers several programming paradigms. Lecture and laboratory. Credit not given for both CSCI-A 591 and C 211.

CSCI-A 592 Introduction to Software Systems (3 cr.) P: Programming experience. Design of computer software systems and introduction to programming. Topics include the Java programming language and its data structure facilities; building and maintaining large projects; shell tools and system calls. Introduction to object-oriented programming. Lecture and laboratory. Credit not given for both CSCI-A 592 and C 212.

CSCI-A 593 Computer Structures (3 cr.) P: CSCI-A 592. Lab fee. Structure and internal operation of computers. The architecture and assembly language programming of a specific computer are stressed, in addition to general principles of hardware organization and low-level software systems. Lecture and laboratory. Credit not given for both CSCI-A 593 and C 335. May be applied toward the Ph.D. minor.

CSCI-A 594 Data Structures (3 cr.) P: CSCI-A 592. C: CSCI-C 241 and A 593. Systematic study of data structures encountered in computing problems; structure and use of storage media; methods of representing structured data; and techniques for operating on data structures. Lecture and laboratory. Credit not given for both CSCI-A 594 and C 343. May be applied toward the Ph.D. minor.

CSCI-A 595 Fundamentals of Computing Theory (3 cr.) P: CSCI-C 241 C: CSCI-C 212. Fundamentals of formal language theory, computation models and computability, the limits of computability and feasibility, and program verification. Credit not given for bothCSCI-A 595 and B 401. May be applied toward the Ph.D. minor, graduate credit available for CS M.S. candidates with special permission.

CSCI-A 596 Programming Languages (3 cr.) P: CSCI-A 593 C: CSCI-A 594. Systematic approach to programming languages. Relationships among languages, properties and features of languages, and the computer environment necessary to use languages. Lecture and laboratory. Credit not given for both CSCI-A 596 and C 311. May be applied toward the Ph.D. minor.

CSCI-A 597 Introduction to Programming I (3 cr.) Fundamental programming constructs, including loops, arrays, classes, and files. General problem-solving techniques. Emphasis on modular programming, user-interface design, and developing good programming style. Credit not given for both CSCI-A 597 and A 201. Not intended for computer science majors.

CSCI-A 598 Introduction to Programming II (3 cr.) P: CSCI-A 597, A 201, A 504, or A 304. Advanced programming techniques: user-defined functions and types, recursion versus iteration, parameter-passing mechanisms. Classic abstract data types and algorithms. Programming style. Object-oriented programming. Credit not given for both CSCI-A 598 and A 202. Not intended for computer science majors.

CSCI-B 501 Theory of Computing (3 cr.) P: CSCI-C 241. Deterministic and nondeterministic automata, regular expressions, pumping lemmas; context-free languages, parsing, pushdown automata, context-sensitive languages, LBA, LR(k) languages, closure and

decidability of language classes. Turing machines, random access machines, grammars, general recursive functions, equivalence of computation models, universal machines, relative computing. Unsolvability, semi-recursive sets, Rice's Theorem. Space and time complexity, NP completeness.

CSCI-B 502 Computational Complexity (3 cr.) P: CSCI-B 501. Study of computational complexity classes, their intrinsic properties, and relations between them. Topics include time and space computational complexity. Reducibility and completeness of problems within complexity classes. Complexity of optimization problems. Complexity hierarchies. Relativization of the P =? NP conjecture. Parallel computation models and the class NC.

CSCI-B 503 Algorithms Design and Analysis (3 cr.) P: MATH-M 216 and CSCI-C 343. Models, algorithms, recurrences, summations, growth rates. Probabilistic tools, upper and lower bounds; worst-case and average-case analysis, amortized analysis, dynamization. Comparison-based algorithms: search, selection, sorting, hashing. Information extraction algorithms (graphs, databases). Graphs algorithms: spanning trees, shortest paths, connectivity, depth-first search, breadth-first search. Credit not given for both CSCI-B 503 and B 403.

CSCI-B 510 Introduction to Applied Logic (3 cr.) Structures: relations between structures, term structures. Description: notation and meaning, substitution operations, first order formulas, database languages, program verification conditions, semantics valuation, normal forms, quantifier reduction, axiomatic theories. Proof: resolution, sequential calculi, natural deduction, automated theorem proving, semantic completeness. Limits of formalization: compactness, undecidability of truth, undecidability of canonical theories, non-formalizability of database theory.

CSCI-B 521 Programming Language Principles (3 cr.) Systematic approach to programming languages. Relationships among languages, properties and features of languages, the computer environment necessary to support language execution. Credit not given for both CSCI-B 521 and either CSCI-C-311 or A 596.

CSCI-B 522 Programming Language Foundations (3 cr.) P: CSCI-C 311 or B 521 and B 510 Introduction to denotational, operational, and axiomatic approaches to programming language semantics. Semantic analysis of major programming language features. Logics of programs.

CSCI-B 524 Parallelism in Programming Languages and Systems (3 cr.) P: CSCI-P436 or P 536, and either CSCI-C 311 or B 521 or C 343. Fundamentals of parallel computation, with an emphasis on parallel programming methodology and programming languages. Topics include: Parallel algorithms. Major paradigms for parallel software construction: data parallelism, task/thread parallelism and CSP. Compiling programs for parallel computers.

CSCI-B 534 Distributed Systems (3 cr.) P: CSCI-P 436 or P 536. Principles of distributed systems including naming, consistency, concurrency, and security and their role in distributed file systems and file sharing systems. Includes study of and current best practices in distributed computing models: peer-to-peer, grid computing, and distributed object model.

CSCI-B 541 Hardware System Design I (3 cr.) P: CSCI-C 335 and C-343. Lab fee. Structured approach to hardware design, emphasizing hardwired and microprogrammed control. Boolean algebra, hardware building blocks, architecture and control, implementation issues. In the laboratory, students build a working computer using hardware prototyping technologies. Basic training in the use of design and simulation software. Lecture and laboratory. Credit not given for both CSCI-B 541 and B 441.

CSCI-B 543 Computer Architecture (3 cr.) P: CSCI-C 335 and C 343. Fundamentals of computer design, instruction processing and performance analysis. Architecture of single-processor systems, focusing on pipelining, memory and memory hierarchies, and interconnect technology. Exploration of architecture classes such as high-performance multiprocessors, massively parallel computers, embedded systems. Credit not given for both CSCI-B 543 and B 443.

CSCI-B 551 Elements of Artificial Intelligence (3 cr.) P: CSCI-C 343 or good knowledge of LISP or Scheme. Introduction to major issues and approaches in artificial intelligence. Principles of reactive, goal-based, and utility-based agents. Problem-solving and search. Knowledge representation and design of representational vocabularies. Inference and theorem proving, reasoning under uncertainty, and planning. Overview of machine learning.

CSCI-B 552 Knowledge Based Artificial Intelligence (3 cr.) P: CSCI-B 551. Knowledge-based methods for artificial intelligence systems: knowledge representation, organization, and application. Typical content includes: Principles of memory organization, indexing and retrieval. Memory-based, analogical, and case-based reasoning. Applications to understanding, explanation, planning, and advisory systems.

CSCI-B 553 Neural and Genetic Approaches to Artificial Intelligence (3 cr.) P: CSCI-B 551. Approaches to the design of intelligent systems inspired by nervous systems, evolution, and animal behavior. Distributed and perceptually grounded representations. Temporal processing. Perception and action. Genetic search. Unsupervised and reinforcement learning. Comparison of symbolic, subsymbolic, and hybrid approaches to intelligence.

CSCI-B 555 Machine Learning (3 cr.) Theory and practice of constructing algorithms that learn functions and choose optimal decisions from data and knowledge. Topics include: mathematical/probabilistic foundations, MAP classification/regression, linear and logistic regression, neural networks, support vector machines, Bayesian networks, tree models, committee machines, kernel functions, EM, density estimation, accuracy estimation, normalization, model selection.

CSCI-B 561 Advanced Database Concepts (3 cr.) P: CSCI-C 241, C 335, and C 343. Database models and systems: especially relational and object-oriented; relational database design theory; structures for efficient data access; query languages and processing; database applications development; views. Transaction

management: concurrency and recovery. Credit not given for both CSCI-B 461 and B 561.

CSCI-B 565 Data Mining (3 cr.) Algorithmic and practical aspects of discovering patterns and relationships in large databases. The course also provides hands-on experience in data analysis, clustering and prediction. Topics include: data preprocessing and exploration, data warehousing, association rule mining, classification and regression, clustering, anomaly detection, human factors and social issues in data mining.

CSCI-B 581 Advanced Computer Graphics (3 cr.) P: CSCI-C 343, MATH-M 301 or M 303 or equivalent experience. Lab fee. Introduction to graphics hardware and software. Two-dimensional graphics methods, transformations, and interactive methods. Three-dimensional graphics, transformations, viewing geometry, object modeling and interactive manipulation methods. Basic lighting and shading. Video and animation methods. Credit not given for both CSCI-B 581 and B 481.

CSCI-B 582 Image Synthesis (3 cr.) P: CSCI-B 581 and MATH-M 215. Lab fee. Raster image display: color theory, gamma correction, and filtering. Advanced shading methods: local illumination models, global illumination models. Surface display, including ray tracing and Z-buffering. Solid modeling; spline surfaces, CSG, superquadrics, and deformations. Scientific visualization: isosurfaces and volume rendering.

CSCI-B 599 Teaching in Computer Science (1 cr.) General principles of teaching and practical experiences that relate to teaching computer science. An important feature of the course is the micro-teaching, in which each participant prepares and delivers short lectures to the seminar participants. Each presentation is followed by critical analysis and discussion.

CSCI-B 603 Advanced Algorithms Analysis (3 cr.) P: CSCI-B 503. Advanced topics in analysis of algorithms, including fast algorithms for classical problems, lower bounds results, and statistical behavior.

CSCI-B 607 Philosophy of Computation (3 cr.) P: Permission of instructor. Critical examination of the conceptual foundations of computing. Several different views assessed with respect to conceptual, explanatory, and empirical criteria. Primary focus on formal symbol manipulation, recursive function theory, effective computability, computational complexity, digitality, and information processing. Some non-standard approaches also considered: connectionism, dynamics, and artificial life.

CSCI--B 609 Topics in Algorithms and Computing Theory (1-6 cr.) P: Permission of instructor. Special topics in algorithms and computing theory. May be repeated for credit with permission.

CSCI-B 619 Topics in Applied Logic (1-6 cr.) P: Permission of instructor. Special topics in applied logic. May be repeated for credit with permission.

CSCI-B 621 Advanced Concepts in Programming Languages (3 cr.) P: CSCI-C 311 or B 521. C: CSCI-P 423 or P 523. Discussion of current issues in the design of programming languages. Modularity, abstraction, and static analysis. Applicative and nonapplicative models. Single and multiple processing.

CSCI-B 622 Programming Language Type Systems (3 cr.) P: CSCI-C 311 or B 521. Theoretical foundations and engineering techniques for modern type systems, focusing on polymorphism and subtyping in typed lambda-calculi; applications, including type systems for objects, abstract data types, and modules; issues in type checker implementation and polymorphic type inference.

CSCI-B 629 Topics in Programming Languages (1-6 cr.) P: CSCI-C 311 or B 521 and permission of instructor. Special topics in programming languages. May be repeated for credit with permission.

CSCI-B 639 Topics in Software (1-6 cr.) P: Permission of instructor. Special topics in software systems. May be repeated 2 times for a maximum of 12 credit hours.

CSCI-B 644 Very Large Scale Integration (3 cr.) P: CSCI-B 441 or B 541. Lab fee. Basic theory and practice required to convert hardware algorithms and architecture to silicon structures. Use of state-of-the-art design tools for integrated circuits.

CSCI-B 649 Topics in Systems (1-6 cr.) P: Permission of instructor. Special topics in systems. May be repeated for credit with permission.

CSCI-B 651 Natural Language Processing (3 cr.) P: CSCI-B 551. CSCI-B 552 or B 553 recommended Theory and methods for natural language processing. Algorithms for sentence parsing and generation. Context-free and unification grammars. Question-and-answer systems. Analysis of narratives. Finite-state approaches to computational phonology and morphology. Machine translation. Machine learning of natural language. Speech recognition. Neural-network and statistical alternatives to symbolic approaches.

CSCI-B 652 Computer Models of Symbolic Learning (3 cr.) P: CSCI-B 552. Symbolic artificial intelligence methods for learning. Inductive and explanation-based generalization. Failure-driven learning. Case-based learning. Typical content includes: Operationality of explanations and utility of learning. Goal-driven learning. Criteria for when, what, and how to learn. Learning in integrated architectures.

CSCI-B 656 Web Mining (3 cr.) Machine learning techniques to mine the Web and other unstructured/ semistructured, hypertextual, distributed information repositories. Crawling, indexing, ranking and filtering algorithms using text and link analysis. Applications to search, classification, tracking, monitoring, and Web intelligence. Group project on one of the topics covered in class.

CSCI-B 657 Computer Vision (3 cr.) P: CSCI-C 463 or B 551. Concepts and methods of machine vision as a branch of artificial intelligence. Basics of digital image processing. Local and global tools for deriving information from image data. Model-based object recognition and scene understanding.

CSCI-B 659 Topics in Artificial Intelligence (1-6 cr.) P: Permission of instructor. Special topics in artificial intelligence. May be repeated for credit with permission.

CSCI-B 661 Database Theory and Systems Design (3 cr.) P: CSCI-B 461 or B 561. Database models: relational, deductive, complex-object, object-oriented. Query languages: relational algebra and calculus, datalog, fixpoint logics, object-oriented query languages. Transaction management theory: concurrency control, recovery, distribution. Post-relational and object-oriented database systems.

CSCI-B 662 Database Systems and Internal Design (3 cr.) P: CSCI-B 561 This course deals with database management systems and their modern applications. We will discuss various issues to be considered and design decisions to be made in these systems. Topics include storage management, access methods, query processing and optimization strategies, concurrently control techniques, data warehousing, data mining, semi-structured data management, etc.

CSCI-B 665 Software Engineering Management I (3 cr.) P: CSCI-B 561 or BUS-S 560. Topics include: the high cost of software, the software life cycle, understanding programming teams, and methodologies for controlling development. Presentation of readings and supervision of programming teams producing software products required.

CSCI-B 666 Software Management Implementation II (1-3 cr.) P: CSCI-B 665. Continuation of projects from CSCI-B 665. Periodic reports and a final paper required. If taken for two or more credits, an additional project or paper is required.

CSCI-B 669 Topics in Database and Information Systems (1-6 cr.) P: Permission of instructor. Special topics in database and information systems. May be repeated for credit with permission.

CSCI-B 673 Advanced Scientific Computing (3 cr.) P: CSCI-P 573 and MATH-M 471. Multiprocessor organization: vectorization, memory organization, processor topologies and architectures. Models of parallelism. Programming language and systems for scientific and high performance computing. Environments for interactive scientific experiments and databases. Distributed programming tools. Parallelism in scientific problems: Parallel algorithmic techniques, parallel algorithms and models, parallel performance analysis and debugging.

CSCI-B 679 Topics in Scientific Computing (1-6 cr.) P: Permission of instructor. Special topics in scientific computing. May be repeated for credit with permission.

CSCI-B 689 Topics in Graphics and Human Computer Interaction (1-6 cr.) P: Permission of instructor. Special topics in graphics and human computer interaction. May be repeated for credit with permission.

CSCI-P 515 Specification and Verification (3 cr.) P: CSCI-C 311. Tools and techniques for rigorous reasoning about software and digital hardware. Safety, reliability, security, and other design-critical applications. Decision algorithms. Projects involving the use of automated reasoning, such as model checkers, theorem provers, and program transformation. Credit not given for both CSCI-P 415 and P 515.

CSCI-P 523 Programming Language Implementation (3 cr.) P: CSCI-B 521 or C 311. Implementation of traditional and nontraditional computer programming languages. Compilation, including lexical analysis, parsing, optimization, code generation, and testing. Run-time support, including run-time libraries, storage management, input-output. Comparison of implementation techniques. Extensive laboratory exercises. Credit not given for both CSCI-P 523 and P 423.

CSCI-P 532 Object-Oriented Software Development (3 cr.) P: Proficiency in Java. This course will help turn motivated students into superior contributors to any small- to mid-sized commercial or open-source software project. It takes a hands-on, learning-by-doing approach. Students are introduced to design patterns, tools, and teamwork strategies from the first assignment to the last project.

CSCI-P 535 Pervasive Computing (3 cr.) P: Object oriented programming. Lab fee. Topics in pervasive computing, such as: sensors, mobility, tangibles, ambient displays, middleware, location and context-awareness. User-centered design methods, such as: requirements gathering, design, prototyping and evaluation. Labs cover current technologies, such as sensors and mobile devices. Lecture and laboratory.

CSCI-P 536 Advanced Operating Systems (3 cr.) P: CSCI-C 335 and C 343. Advanced topics in operating systems, such as: multi-tasking, synchronization mechanisms, distributed system architecture, client-server models, distributed mutual exclusion and concurrency control, agreement protocols, load balancing, failure recovery, fault tolerance, cryptography, multiprocessor operating systems. Credit not given for both CSCI-P 536 and P 436.

CSCI-P 538 Computer Networks (3 cr.) P: Operating systems or networking course. Layered TCP/IP architecture. LAN technologies (Ethernet, wireless, token ring). Switching. Internet addressing (IPv4, IPv6). Routing protocols. Congestion control (TCP, UDP). Applications (DNS, HTTP, peer-to-peer networks). Selection of topics including DHCP, ICMP, VPNs, multicast, security. Credit given for only one of CSCI-P 438 and P 538.

CSCI-P 542 Hardware System Design II (3 cr.) P: CSCI-B 541 or B 441. Lab fee. Depending on instructor, a selection of topics in system-level design, such as simulation, logic synthesis, high-level synthesis, codesign, embedded software, verification, test, requirements specification, and others. Projects in system-level design. Computer-aided design tools. Lecture and laboratory. Credit not given for both CSCI-P 542 and P 442.

CSCI-P 545 Embedded and Real-Time Systems (3 cr.) P: Any 400-level “systems” course (middle digit 3 or 4). Design and implementation of purpose-specific, locally distributed software systems. Models and methods for time-critical applications. Real-time operating systems. Testing, validation, and verification. Safety-critical design. Related topics, such as resiliency, synchronization, sensor fusion, etc. Lecture and laboratory.

CSCI-P 565 Software Engineering I (3 cr.) P: CSCI-C 343, B 461 previously or B 561 concurrently. Analysis, design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development

processes. Credit not given for both CSCI-P 465-P 466 and CSCI-P 565-P 566.

CSCI-P 566 Software Engineering II (3 cr.) P: CSCI-C 343, B 461 previously or B 561 concurrently. Analysis, design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development processes. Credit not given for both CSCI-P 465-P 466 and CSCI-P 565-P 566.

CSCI-P 573 Scientific Computing (3 cr.) P: MATH-M 303 or M 301, M 343 and CSCI-C 212. For students from all scientific, engineering, and mathematical disciplines, this course provides an overview of computer hardware, software, and numerical methods that are useful on scientific workstations and supercomputers. Topics include high-performance computer architectures, software tools and packages, characteristics of numerical methods in common use, graphical presentation of results, and performance analysis and improvement.

CSCI-P 632 Object-Oriented Software Management (3 cr.) P: Permission of instructor. This course will help turn motivated students into superior managers of any small- to mid-sized commercial or open-source software project. It takes a hands-on, learning-by-doing approach. Students are introduced to the main management concerns of managing smallish design and development teams.

CSCI-Y 790 Graduate Independent Study (1-6 cr.) Independent study under the direction of a faculty member, culminating in a written report. R grade not allowed. The different departmental options for independent study are: Research and Reading, Software System Development, Master's Research Project, Master's Software Project, and a University Master's Thesis. May be repeated for credit.

CSCI-Y 791 Graduate Independent System Development (1-6 cr.) System development culminating in written report and a publicly available system. R grade not allowed. May be repeated for credit.

CSCI-Y 792 Master's Thesis (1-6 cr.) Readings and research under the supervision of the master's thesis advisor, leading to a thesis at a level admissible as a departmental technical report. R grade not allowed. May be repeated for a maximum of 6 credit hours of CSCI-Y 792 and Y 793.

CSCI-Y 793 Master's Software Thesis (1-6 cr.) A major software development project, possibly performed jointly with other students, documented in the public domain and with final approval by three graduate faculty. R grade not allowed. May be repeated for a maximum of 6 credit hours of CSCI-Y 792 and Y 793.

CSCI-Y 798 Professional Practicum/Internship (0 cr.) P: Current enrollment in graduate degree program in computer science. Provides for participation in graduate level professional training and internship experience.

CSCI-Y 799 Computer Science Colloquium (1 cr.) A series of talks by researchers in computer science and closely related areas presenting their recent research. A minimum of 75% attendance and course work in the form of a written report based on the talk by any colloquium speaker are required for credit. May be repeated for a maximum of 3 credit hours.

CSCI-Y 890 Thesis Readings and Research (1-12 cr.) Research under the direction of a member of the graduate faculty leading to a Ph.D. dissertation.

CSCI-G 901 Advanced Research (6 cr.) Ph.D. dissertation research after the completion of all course requirements.

Graduate

Thirty (30) credit hours are required for the M.S. (some majors require more than 30), all of which may be taken in a single department; at least 20 of these credit hours must be earned in the major field. A minimum of 9 credit hours of course work or at least three courses in the major field (excluding thesis) must be numbered 500 or above.

Academic Policies and Procedures

Academic policies and procedures have been developed and approved by faculty to govern and facilitate student academic progress. These policies and procedures exist for undergraduate and graduate students.

Undergraduate

Academic Regulations

- Absences
- Academic Probation
- Academic Standing
- Academic Warning
- Credit for Correspondence Courses
- Dean's List
- Degree Application
- Degrees Awarded with Distinction
- Dismissal
- Readmission
- Semester Load
- Statute of Limitations

Absences

From Final Examinations: Students are required to adhere to the policies regarding final examinations, as published in the Enrollment and Student Academic Information Bulletin or the Registration Guide and Academic Information.

From Scheduled Classes: Illness is usually the only acceptable excuse for absence from class. Other absences must be explained to the satisfaction of the instructor, who will decide whether omitted work may be made up.

Academic Probation

Students will be placed on academic probation if their semester grade point average or cumulative grade point average is below 2.0, they have had an academic warning before and/or their cumulative grade point average is below 2.5. Students will be instructed to schedule an appointment at the Student Academic Center for assessment and to meet with their School of Informatics

& Computing advisor. After one probation semester, students who fail to return to good academic standing will be dismissed.

Academic Standing
A student is in good academic standing for an Indiana University bachelor's degree when his or her semester grade point average is a minimum of 2.0 (C) for the last semester's course work and when his or her cumulative grade point average is at least 2.0 (C).

Class Standing
Class standing is based on the number of credit hours completed:

- Freshman, fewer than 26 credits
- Sophomore, 26 to 55 credits
- Junior, 56 to 85 credits
- Senior, 86 or more credits

Academic Warning
Students will receive an academic warning letter if their semester grade point average is below 2.0, but their cumulative grade point average is above 2.5. Students will receive only one academic warning, any future semester of a gpa below 2.0 will result in academic probation or dismissal.

Credit for Correspondence Courses
With prior permission from the dean, the School of Informatics and Computing will accept a maximum of 2 courses by correspondence study. These courses may only count as general electives.

Dean's List
The School of Informatics and Computing recognizes exceptional academic performance in baccalaureate degree programs. The Dean's List contains the names of students who have achieved a semester gpa of 3.5 or higher during any semester in which the student completes 12 or more graded credit hours.

Degree Application
Candidates for graduation must file an application with the school by October 1 for December graduation and by March 1 for May or August graduation to be included in the graduation ceremony program.

Degrees Awarded with Distinction
The School of Informatics and Computing awards bachelor's degrees with three levels of distinction: Distinction (3.5 GPA); High Distinction (3.75 GPA); and Highest Distinction (3.9 GPA). Students must have taken 60 graded credit hours at Indiana University.

The level of distinction is printed on both the final transcript and the diploma.

Dismissal
Students will be dismissed if they fail to return to good academic standing after one semester on probation. Students will be notified in writing that they have been dismissed and will be withdrawn from classes for which they have registered.

Readmission
Dismissed students must petition the dean of the School of Informatics and Computing for readmission. A Petition for Readmission must be filed by July 15 for fall, November 15 for spring, and April 15 for summer readmission. A student who has been dismissed is eligible to return to school after being out of school for one regular semester (summer sessions do not count) and having petitioned successfully. A third dismissal is final. Dismissed students whose petitions are denied will not be allowed to register.

Semester Load
A typical full-time academic load is 12 to 17 credit hours per semester, with the average load being approximately 15 credit hours. Students who expect to carry more than 17 credit hours a semester should have a cumulative grade point average of at least 3.0 (B) and have approval from an academic advisor or dean.

Statute of Limitations
Candidates for the bachelor's degree in the School of Informatics and Computing have the right to complete the degree requirements specified by the bulletin in effect at the time they entered Indiana University, provided that the required courses are available and that no more than eight calendar years have elapsed since the date of entry.

Grading Policies
The School of Informatics and Computing follows the official grading system of Indiana University, which is as follows:

A+	= 4.00	C+	= 2.30
A	= 4.00	C	= 2.00
A-	= 3.70	C-	= 1.70
B+	= 3.30	D+	= 1.30
B	= 3.00	D	= 1.00
B-	= 2.70	D-	= 0.70
		F	= 0.00

The following grades carry no grade points: I (Incomplete), NC (No Credit), NR (No Report Filed by Instructor), P (Passing), R (Deferred), S (Satisfactory), W (Withdrawal).

- Change of Grade
- Extended-X Option
- Grade Point Average
- Incomplete Courses
- Pass/Fail Option
- R Grade
- Withdrawals

Change of Grade
A student desiring a change of grade should discuss the situation with the instructor. A change of grade must be justified. If the instructor agrees, the faculty member will file a Grade Change Authorization Form. If the instructor and student do not agree on a changed grade, or if the instructor cannot be located, the student should discuss the matter with the chairperson or director of the department offering the course. Appeals unresolved at this level may be referred to the academic deans. Appeals of grades or requests for other actions will not be considered after one calendar year from the end of the semester in which the course in question was taken.

Extended-X Option
The School of Informatics and Computing does not recognize Extended-X grades for internal purposes

and degree requirements. Grades of FX calculate as grades of F (D-X grades as grades of D-, DX grades as grades of D, etc.). This calculation will apply to all categories of academic standing (good standing, probation, and dismissal); class rank; and all grade point average requirements in the degree, including cumulative, semester, and major concentrations.

A student may exercise this option for no more than 3 courses, totaling no more than 10 credit hours. A student may use the Extended-X option on the transcript only once for a given course.

Only courses attempted during or after the fall 2001 term will be eligible for replacement under the Extended-X policy. The following grades cannot be replaced under the Extended-X policy: S, P, W, I, R, NC.

Grade Point Average

The cumulative grade point average is computed by dividing the total number of grade points earned by the total number of credit hours completed in which grades of A through F are assigned. Credit earned at another institution may be applied toward degree requirements, but the grades earned at other institutions will not be calculated in the Indiana University cumulative grade point average.

Incomplete Courses

A temporary grade of Incomplete (I) on the transcript indicates that the course work is mostly completed, generally 75 to 80 percent, and of passing quality.

It is the student's responsibility to contact the instructor to have a grade of Incomplete assigned. The instructor specifies the work to be done to remove the grade of Incomplete and the period of time allowed for completion. If the student fails to remove the Incomplete within one calendar year, the Office of the Registrar will change the grade to an F. The dean (or instructor) authorizes adjustments of this period in exceptional circumstances. A student who has received a grade of Incomplete should not register for the course a second time but should arrange with the instructor to have the grade changed to a letter grade upon completion of requirements, provided that it is done within the year.

Pass/Fail Option

Students in the School of Informatics and Computing may elect to take a maximum of 12 credit hours total under the Pass/Fail option. The procedure for declaring this option can be found in the Enrollment and Student Academic Information Bulletin. Special regulations affecting the Pass/Fail option for School of Informatics and Computing students are as follows:

- Only one course per semester or one course per summer session can be taken under the Pass/Fail option.
- School of Informatics and Computing students may take only university elective courses or general elective courses on a Pass/Fail basis. The Pass/Fail option may not be used for any course that satisfies the requirements for a minor or certificate.
- A grade of P is not counted in the grade point average; a grade of F is included. Grades of P cannot be changed to any other letter grade.
- Pass/Fail forms are availble from your advisor.

R Grade

The R grade (Deferred) on the final report indicates that the nature of the course is such that the work of the student can be evaluated only after two or more terms. Courses in which an R grade is assigned will be announced as deferred grade courses in the online enrollment system.

Withdrawals

A grade of W (Withdrawal) is given automatically to the student who withdraws from courses during the automatic withdrawal period as specified in the Enrollment and Student Academic Information Bulletin. After the automatic withdrawal period, a student may withdraw only with the permission of the dean. This approval is given only for urgent reasons related to extended illness or equivalent distress. The desire to avoid a low grade is not an acceptable reason for withdrawal from a course.

A grade of W does not affect the overall grade point average. A grade of F will be recorded on the official transcript if a student stops attending but does not officially withdraw from class. Students who alter their schedules, whether at their own initiative or by departmental directive, must follow withdrawal procedures. Students who do not assume this responsibility are jeopardizing their records because they will incur a failing grade in a course not properly dropped and will not receive credit for work done in a course not properly added.

Students who wish to cancel their Bloomington campus registrations for a future semester must notify the Office of the Registrar in writing prior to the first day of classes.

Students who are forced to discontinue all studies during the semester (even if enrolled in only one course) and withdraw from the university must contact the Student Advocates Office in Eigenmann Hall West 229 to complete the withdrawal process.

At IUB, if a student withdraws after the first week of classes, the courses in which the student was enrolled will be retained on the student's record with a grade of W or F (as appropriate) and a notation of the date of withdrawal. To qualify for a grade of W after the deadline, a student must be passing the course(s) on the date of withdrawal. If the student is failing, the grade on the date of withdrawal will be F.

Academic Misconduct

Cheating

Cheating is dishonesty of any kind with respect to course assignments, alteration of records, or examinations. It is the student's responsibility not only to abstain from cheating, but also to avoid the appearance of cheating and to guard against making it possible for others to cheat. Any student who helps another student cheat is as guilty of cheating as the student assisted. The student also should do everything possible to induce respect for the examining process and for honesty in the performance of assigned tasks in or out of class.

Plagiarism

Plagiarism is assuming credit for someone else's work, words, or ideas—whether or not the ideas are expressed in the borrower's own words. Honesty requires that any ideas or materials taken from another source for either written or oral use must be fully acknowledged. Plagiarism

includes language or ideas taken from isolated formulas, sentences, or paragraphs; entire articles copied from books, periodicals, or speeches; the writings or created works of other students; and materials assembled or collected by others in projects or collections without acknowledgment.

A faculty member who has evidence that a student is guilty of cheating or plagiarism will initiate the process of determining the student's guilt or innocence. No penalty will be imposed until the student has been informed of the charge and of the evidence on which it is based, and has been given an opportunity to present a defense. If the faculty member finds the student guilty, the faculty member assesses a penalty within the course and promptly reports the case in writing to the dean of the school or comparable head of the academic unit. The report should include the names of any other students who may be involved in the incident and recommendations for further action. The dean, in consultation with the faculty member if the latter so desires, will initiate any further disciplinary proceedings and inform the faculty member of any action taken. In every case, a record of the offenses remains on file.
For further regulations, please refer to the *IU Code of Student Rights, Responsibilities, and Conduct.*

Student Grievance Procedures

All academic personnel (faculty, part-time instructors, and advisors) are expected to conform to the Code of Student Rights, Responsibilities and Conduct (http://www.indiana.edu/~registra/misconduct.shtml). Students who feel that they have been treated unfairly by a faculty member may lodge a complaint by following these steps:

1. Discuss the matter with the faculty member or instructor.
2. If step 1 fails to resolve the situation, discuss the matter with the chairperson of the department or the coordinator of the program in which the faculty member is employed. The departmental chairperson will discuss it with the faculty member and seek some resolution.
3. If step 2 fails, the student may discuss the matter or file a written, signed complaint with the dean. Anonymous complaints will not be entertained. A copy of any written complaint will be forwarded to the faculty member, who may respond in writing.
4. When warranted, the dean may refer a written complaint and the faculty member's response to the Faculty Affairs Committee for further investigation and review.
5. The Faculty Affairs Committee will evaluate the complaint on the basis of university policy and may recommend to the dean that the instructor be sanctioned. If the committee finds the complaint to be unfounded, a letter to that effect may be placed in the student's file.

Graduate

For forms, please visit the School of Informatics and Computing website.

- Academic Integrity
- Academic Standing
- Course Waivers
- Credit Earned in Non-Degree Status
- Degree Conferral
- Grading System
- Intercampus Transfer
- Student Grievance
- Time Requirements
- Transfer of Credit

Academic Integrity

Academic integrity requires that students take credit only for their own ideas and efforts. Misconduct, including cheating, fabrication, plagiarism, interference, or facilitating academic dishonesty, is prohibited because it undermines the bonds of trust and cooperation among members of this community and between us and those who may depend on our knowledge and integrity. Complete details are contained in the Indiana University

Academic Misconduct

Cheating

Cheating is dishonesty of any kind with respect to course assignments, alteration of records, or examinations. It is the student's responsibility not only to abstain from cheating, but also to avoid the appearance of cheating and to guard against making it possible for others to cheat. Any student who helps another student cheat is as guilty of cheating as the student assisted. The student also should do everything possible to induce respect for the examining process and for honesty in the performance of assigned tasks in or out of class.

Plagiarism

Plagiarism is assuming credit for someone else's work, words, or ideas—whether or not the ideas are expressed in the borrower's own words. Honesty requires that any ideas or materials taken from another source for either written or oral use must be fully acknowledged. Plagiarism includes language or ideas taken from isolated formulas, sentences, or paragraphs; entire articles copied from books, periodicals, or speeches; the writings or created works of other students; and materials assembled or collected by others in projects or collections without acknowledgment.

A faculty member who has evidence that a student is guilty of cheating or plagiarism will initiate the process of determining the student's guilt or innocence. No penalty will be imposed until the student has been informed of the charge and of the evidence on which it is based, and has been given an opportunity to present a defense. If the faculty member finds the student guilty, the faculty member assesses a penalty within the course and promptly reports the case in writing to the dean of the school or comparable head of the academic unit. The report should include the names of any other students who may be involved in the incident and recommendations for further action. The dean, in consultation with the faculty member if the latter so desires, will initiate any further disciplinary proceedings and inform the faculty member of any action taken. In every case, a record of the offenses remains on file.
For further regulations, please refer to the *IU Code of Student Rights, Responsibilities, and Conduct.*

Academic Standing

Students are considered to be in good standing during any semester in which their academic grade point average is at least 3.0 (B) for both their last semester's course work and for the cumulative average of all course work completed. Only courses with grades of C (2.0) or above may be counted toward degree requirements. However, grades below C are used in computing the cumulative grade point average, even if a course is repeated and a higher grade is earned.

Academic Probation

Students are placed on probation following a semester in which their graduate cumulative or semester grade point average falls below 3.0. Students on probation are required to attain an average of at least 3.0 for all graduate course work completed by the end of the next semester of full-time enrollment or its equivalent (9 credit hours). Failure to do so is cause for dismissal.

Course Waivers

Requests for waiver of specific courses or requirements on the basis of previous course work are to be submitted in writing to the dean.

Credit Earned in Non-Degree Status

Not more than 9 hours of graduate credit completed as a non-degree student may be credited toward a School of Informatics graduate degree. Deficiency courses do not apply to the 9 credit hours.

Degree Conferral

For all students seeking a master's degree, an application for the degree must be filed with the School of Informatics at least 60 days before the date anticipated for degree conferral. All degree requirements must be completed at least 30 days prior to the date of expected degree conferral, including submission of the bound copies of the master's thesis (if required for degree).

Grading System

The official grading system is as follows:

Grade	Quality of Achieveme	Points Per Credit Hour		Grade	Quality of Achieveme	Points Per Credit Hour
A+	Highest passing grade	4.0		D-	Lowest passing grade	0.7
A		4.0		P	Passing	-
A-		3.7		S	Satisfactory	-
B+		3.3		F	Failure	0.0
B		3.0		W	Withdrawn	-
B-		2.7		I	Incomplete	-
C+		2.3		R	Deferred Grade	-
C		2.0		NC	No Credit	-
C-		1.7		NR	No grade received	-
D+		1.3		NY	Signifies enrollment in a special program for which credit earned will be recorded when completed.	

A minimum of a B (3.0) average in graduate work is required for continuance in graduate study. Courses completed with grades below C (2.0) are not counted toward degree requirements, but such grades will be counted in calculating a student's grade point average. Note that no work may be transferred from another institution unless the grade is B (3.0) or higher.

Incomplete Grades

A grade of Incomplete may be given only if the completed portion of a student's work is of passing quality. It is the responsibility of the student to satisfy the requirements of that course within one calendar year from the date on which the Incomplete is recorded. The student is expected to finish all necessary work in time for the instructor to assign a regular grade before the expiration of this time period. If the student is unable to do so, it is the student's responsibility to notify the instructor of the course and the graduate advisor within the year to request an extension of time. Every overdue Incomplete will be changed to a grade of F after one calendar year.

A student who has received a grade of Incomplete (I) should not register for the course a second time, but should arrange with the instructor to have the Incomplete (I) changed to a letter grade upon completion of all requirements.

Withdrawals

Because deadlines for withdrawal from courses may vary by campus and/or school, students should check with the current campus *Schedule of Classes* to verify deadlines and procedures.

Intercampus Transfer

Students enrolled in the School of Informatics at any campus of Indiana University may transfer to the School of Informatics on another campus, provided they are in good standing.

Student Grievance

All academic personnel (faculty, part-time instructors, and advisors) are expected to conform to the Code of Student Rights, Responsibilities and Conduct. Students who feel that they have been treated unfairly by a faculty member may lodge a complaint by following these steps:

1. Discuss the matter with the faculty member or instructor.
2. If step 1 fails to resolve the situation, discuss the matter with the chairperson of the department or the coordinator of the program in which the faculty member is employed. The departmental chairperson will discuss it with the faculty member and seek some resolution.
3. If step 2 fails, the student may discuss the matter or file a written, signed complaint with the dean. Anonymous complaints will not be entertained. A

copy of any written complaint will be forwarded to the faculty member, who may respond in writing.

4. When warranted, the dean may refer a written complaint and the faculty member's response to the Faculty Affairs Committee for further investigation and review.
5. The Faculty Affairs Committee will evaluate the complaint on the basis of university policy and may recommend to the dean that the instructor be sanctioned. If the committee finds the complaint to be unfounded, a letter to that effect may be placed in the student's file.

Time Requirements

All requirements for the M.S. degrees must be met within five consecutive calendar years from the date of completion of the first credited (i.e., nondeficiency) course.

Revalidation of Courses

Normally, a course may not be counted toward degree requirements if it has been completed more than five years prior to the awarding of the degree for master's students. The advisor may recommend to the dean that course work taken prior to the deadline be revalidated if it can be demonstrated that the knowledge contained in the course(s) remains current. Currency of knowledge may be demonstrated by (a) passing an examination specifically on the material covered by the course; (b) passing a more advanced course in the same subject area; (c) passing a comprehensive examination in which the student demonstrates substantial knowledge of the content of the course; or (d) publishing scholarly research demonstrating knowledge of the content of the course.

Courses taken while an undergraduate and counted toward the requirements of a baccalaureate degree may not also be counted toward a graduate degree.

Transfer of Credit

A maximum of 8 credit hours (9 credit hours at IUPUI) of graduate course work with grades of B (3.0) or higher may be transferred from other accredited colleges and universities and applied to the School of Informatics degree programs. The transfer must be approved by the dean and is not an automatic occurrence. (See Revalidation of Courses for more information.)

Faculty

Core Faculty

- Ahn, Yong-Yeol, Ph.D. *(KAIST, 2008)*, *Assistant Professor of Informatics and Computing*
- Bardzell, Jeffrey, Ph.D. *(Indiana University, 2004), Associate Professor of Informatics*
- Bardzell, Shaowen, Ph.D. *(Indiana University, 2004), Associate Professor of Informatics*
- Beer, Randall, Ph.D. *(Case Western Reserve University, 1989), Professor of Cognitive Science, Computer Science and Informatics*
- Blevis, Eli, Ph.D. *(Queen's University at Kingston, 1990), Associate Professor of Informatics and Cognitive Science*
- Bollen, Johan, Ph.D. (University of Brussels, 2001), *Associate Professor of Informatics*
- Bramley, Randall, Ph.D. *(University of Illinois at Urbana-Champaign, 1989), Professor of Computer Science*
- Brendel, Volker, Ph.D. *(Weizmann Institute of Science, Israel, 1986), Professor of Biology and Computer Science*
- Brown, Geoffrey, Ph.D. *(University of Texas at Austin, 1987), Professor of Computer Science*
- Camp, L. Jean, Ph.D. *(Carnegie Mellon University, 1996), Professor of Informatics and Computer Science; Adjunct Professor of Telecommunications; Associate Director, Center for Applied Cybersecurity Research*
- Chauhan, Arun, Ph.D. *(Rice University, 2003), Assistant Professor of Computer Science*
- Connelly, Kay, Ph.D. *(University of Illinois, 2003), Associate Professor of Computer Science; Associate Director of the Center for Applied Cybersecurity Research*
- Crandall, David, Ph.D. *(Cornell University, 2008), Assistant Professor of Informatics*
- Dalkilic, Mehmet, Ph.D. *(Indiana University, 2000), Associate Professor of Informatics and Computer Science; Coordinator Life Sciences; Associate Center For Genomics and Bioinformatics*
- Ensmenger, Nathan, Ph.D. *(University of Pennsylvania, 2001), Associate Professor of Informatics*
- Ergun, Funda, Ph.D. *(Cornell University, 1998), Associate Professor of Computer Science*
- Flammini, Alessandro, Ph.D. *(International School for Advanced Studies, 1996), Associate Professor of Informatics; Adjunct Associate Professor of Physics; Affiliated Researcher in the Biocomplexity Institute*
- Fox, Geoffrey C., Ph.D. *(Cambridge University [United Kingdom], 1967), Distinguished Scientist, Community Grids Laboratory; Distinguished Professor of Computer Science, Physics and Informatics; Associate Dean of Graduate Studies and Research*
- Friedman, Daniel P., Ph.D. *(The University of Texas at Austin, 1973), Professor of Computer Science*
- Groth, Dennis, Ph.D. *(Indiana University, 2002), Associate Professor of Informatics, Computer Science and Cognitive Science; Interim Vice Provost for Undergraduate Education*
- Gupta, Minaxi, Ph.D. *(Georgia Institute of Technology, 2004), Associate Professor of Computer Science*
- Haghverdi, Esfandiar, Ph.D. *(University of Ottawa, 2000), Associate Dean for Undergraduate Studies*; *Associate Professor of Computer Science; Adjunct Associate Professor of Mathematics*
- Hahn, Matthew, Ph.D. *(Duke University, 2003), Associate Professor of Informatics and Biology*
- Hakken, David, Ph.D. *(American University, Washington D.C., 1978), Professor of Informatics; Adjunct Professor of Anthropology*
- Hauser, Kris, Ph.D. *(Stanford University, 2008), Assistant Professor of Computer Science*
- Hill, Raquel, Ph.D. *(Harvard University, 2002) Associate Professor of Computer Science and Informatics*

- Hofstadter, Douglas, Ph.D. *(University of Oregon, 1975), Distinguished Professor; College Professor of Cognitive Science and Computer Science; Adjunct Professor of Comparative Literature; Director, Center for Research on Concepts and Cognition*
- Kapadia, Apu, Ph.D. *(University of Illinois at Urbana-Champaign, 2005), Assistant Professor of Computer Science and Informatics*
- Leake, David, Ph.D. *(Yale University, 1990), Executive Associate Dean, School of Informatics and Computing; Professor of Computer Science*
- Leivant, Daniel, Ph.D. *(University of Amsterdam [Netherlands], 1975), Professor of Computer Science; Adjunct Professor of Philosophy and Mathematics*
- Lumsdaine, Andrew, Ph.D. *(Massachusetts Institute of Technology, 1992), Professor of Computer Science*
- McRobbie, Michael A., Ph.D. *(Australian National University, 1979), President of Indiana University; Professor of Computer Technology, Purdue School of Engineering and Technology, Computer Science, Informatics and Philosophy; Adjunct Professor of Information Science and Cognitive Science*
- Medina, Eden Miller, Ph.D. *(Massachusetts Institute of Technology, 2005), Associate Professor of Informatics; Adjunct Associate Professor of History*
- Menczer, Filippo, Ph.D. *(University of California at San Diego, 1998), Professor of Informatics, Computer Science and Cognitive Science; Adjunct Professor of Physics*
- Mills, Jonathan W., Ph.D. *(Arizona State University, 1988), Associate Professor of Computer Science*
- Myers, Steven, Ph.D. *(University of Toronto [Canada], 2004), Associate Professor of Informatics and Computer Science; Research Affiliate, Center for Applied Cybersecurity Research*
- Newton, Ryan, Ph.D. *(Massachusetts Institute of Technology, 2009), Assistant Professor of Computer Science*
- Paolillo, John, Ph.D. *(Stanford University, 1992), Associate Professor of Informatics and Information Science; Adjunct Associate Professor of Linguistics*
- Plale, Beth, Ph.D. *(State University of New York at Binghamton, 1998), Professor of Computer Science*
- Purdom, Paul W., Ph.D. *(California Institute of Technology, 1966), Professor of Computer Science*
- Qiu, Judy, Ph.D. *(Syracuse University, 2005), Assistant Professor of Informatics*
- Radivojac, Predrag, Ph.D. *(Temple University 2003), Associate Professor of Computer Sicence and Informatics*
- Raphael, Christopher, Ph.D. *(Brown University, 1991), Professor of Informatics and Cognitive Science; Adjunct Professor of Music Theory*
- Rawlins, Gregory J.E., Ph.D. *(University of Waterloo [Canada], 1987), Associate Professor of Computer Science and Informatics*
- Rocha, Luis Mateus, Ph.D. *(State University of New York at Binghamton, 1997), Professor of Informatics, Computer Science and Cognitive Science*
- Sabanovic, Selma, Ph.D. *(Rensselaer Polytechnic Institute, 2007), Assistant Professor of Informatics*
- Sabry, Amr, Ph.D. *(Rice University, 1994), Professor of Computer Science*
- Sahinalp, S. Cenk, Ph.D. *(University of Maryland at College Park, 1997), Professor of Computer Science*
- Schnabel, Robert, Ph.D. *(Cornell University, 1977), Dean, School of Informatics and Computing; Professor of Computer Science and Informatics*
- Shan, Chung-Chein (Ken), Ph.D. *(Harvard University, 2005), Assistant Professor of Computer Science*
- Siegel, Martin A., Ph.D. *(University of Illinois, 1973), Professor of Informatics, Cognitive Science and Instructional Systems Technology*
- Sterling, Thomas, Ph.D. (*Massachusetts Institute of Technology,* 1984), *Professor of Informatics and Computing*
- Stolterman, Erik, Ph.D. *(Umea University [Sweden], 1991), Professor of Informatics*
- Swany, Martin, Ph.D. *(University of California, Santa Barbara, 2003), Associate Professor of Computer Science*
- Tang, Haixu, Ph.D. *(Shanghai Institute of Biochemistry [China], 1998), Associate Professor of Informatics and Computer Science; Affiliated Researcher in the Center for Genomics and Bioinformatics*
- Todd, Peter M., Ph.D. *(Stanford University, 1992), Professor of Informatics, Cognitive Science and Psychological and Brain Sciences*
- Van Gucht, Dirk, Ph.D. *(Vanderbilt University, 1985), Professor of Computer Science*
- Vespignani, Alessandro, Ph.D. *(University of Rome [Italy], 1993), Professor of Informatics and Cognitive Science; Adjunct Professor of Physics and Statistics; Affiliated Researcher, Biocomplexity Institute*
- Wang, XiaoFeng, Ph.D. *(Carnegie Mellon University, 2004), Associate Professor of Informatics and Computer Science; Affiliated Researcher in the Center for Applied Cybersecurity Research*
- Wild, David, Ph.D. *(Sheffield University [United Kingdom], 1994), Associate Professor of Informatics*
- Wu, Yuqing, Ph.D. *(University of Michigan, Ann Arbor, 2004), Associate Professor of Computer Science*
- Ye, Yuzhen, Ph.D. *(Shanghai Institute of Biochemistry, China, 2001), Associate Professor of Informatics and Computer Science*
- Zhang, Qin, Ph.D. *(Hong Kong University of Science and Technology, China, 2010) Assistant Professor of Computer Science*

Special Faculty

- Antolovic, Danko, Ph.D. (J*ohns Hopkins University, 1983), Adjunct Lecturer of Informatics and Computing*
- Barnard, John, Ph.D. *(University of Sheffield [United Kingdom], 1983), Adjunct Professor of Informatics and Computing*
- Beggs, John, Ph.D. *(Yale University, 1998), Adjunct Associate Professor of Informatics*
- Börner, Katy, Ph.D. *(University of Kaiserslautern [Germany], 1997), Adjunct Professor of Informatics; Core Member of Cognitive Science Program; Assistant Professor of Information Science*

- Byrd, Donald, Ph.D. *(Indiana University, 1984), Adjunct Associate Professor of Informatics and Computing*
- Cate, Fred, JD. *(Stanford University, 1987), Adjunct Professor of Informatics and Computing*
- Cherbas, Peter, Ph.D. *(Harvard University, 1973), Professor of Biology; Senior Fellow, Institute for Molecular and Cellular Biology; Adjunct Professor of Computer Science*
- Clemmer, David, Ph.D. *(University of Utah, 1992), Adjunct Professor of Informatics and Computing*
- Dickinson, Markus, Ph.D. *(Ohio State University, 2005), Adjunct Assistant Professor of Informatics and Computing*
- Doman, Thompson, Ph.D. *(University of Louisville, 1990), Adjunct Associate Professor of Informatics and Computing*
- Gasteiger, Johann, Ph.D. *(University of Munich, 1971), Adjunct Professor of Informatics and Computing, Founder, Molecular Newtworks GmbH*
- Gilbert, Kevin, Ph.D. *(Massachusetts Institute of Technology, 1974), Adjunct Lecturer of Informatics and Computing*
- Guha, Rajarshi, Ph.D. *(Penn State University, 2005), Adjunct Assistant Professor of Informatics and Computing*
- Gyssens, Marc, Ph.D. *(University of Antwerp [Belgium], 1985), Adjunct Professor of Informatics and Computing*
- Isaacson, Eric, Ph.D. *(Indiana University, 1992), Adjunct Associate Professor of Informatics and Computing*
- Jakobsson, Markus, Ph.D. *(University of California-San Diego, 1997), Adjunct Assistant Professor of Informatics and Computing*
- Kuebler, Sandra, Ph.D. *(University of Tubinger, 2003), Adjunct Assistant Professor of Informatics and Computing*
- Lajiness, Michael, *Adjunct Professor of Informatics and Computing*
- Leykin, Oleksandr, Ph.D. *(Indiana University, 2007), Adjunct Lecturer of Informatics and Computing*
- Lynch, Michael, Ph.D. *(University of Minnesota, 1977), Adjunct Professor of Informatics and Computing*
- Moss, Lawrence, Ph.D. *(University of California at Los Angeles, 1984), Professor of Mathematics; Adjunct Associated Professor of Computer Science, Linguistics, and Philosophy; Adjunct Assistant Professor of Informatics and Computing; Director of Logic Program, College of Arts and Sciences*
- Ortiz, Gerardo, Ph.D. *(Ecole Polytech, 1992), Adjunct Professor of Informatics and Computing*
- Rogers, Yvonne, Ph.D. *(University of Wales, 1988), Adjunct Professor of Informatics and Computing*
- Ruffo, Giancarlo, Ph.D. *(University of Turin, 2000), Adjunct Senior Lecturer of Informatics and Computing*
- Scheutz, Mattias, Ph.D. *(University of Vienna, 1995; Indiana University, 1999), Adjunct Associate Professor of Informatics and Computing*
- Sporns, Olaf, Ph.D. *(Rockefeller University, 1990), Adjunct Professor of Informatics*
- Stewart, Craig, Ph.D. *(Indiana University, 1988), Adjunct Associate Professor of Informatics and Computing*
- Trosset, Michael, Ph.D. *(University of California-Berkeley, 1983), Adjunct Professor of Informatics and Computing*
- Wallace, Steven, *Adjunct Lecturer of Informatics and Computing*
- Wernert, Eric, Ph.D. *(Indiana University, 2000), Adjunct Assistant Professor of Informatics and Computing*
- Yu, Chen, Ph.D. *(Princeton University, 2002), Adjunct Associate Professor of Informatics and Computing*

Lecturers

- Duncan, John, Ph.D. *(Indiana University, 2011), Lecturer of Informatics*
- German, Dan-Adrian, M.S. *(Indiana University, 1994), Senior Lecturer of Computer Science*
- Hottell, Mathew, M.S. *(Indiana University, 2003), Senior Lecturer of Informatics*
- Menzel, Suzanne, M.S. *(Rutgers University, 1983), Senior Lecturer of Computer Science*
- Onesti, Nina, M.S. *(Indiana University, 2008), Lecturer of Informatics*
- Pope, Charles E., B.S. *(Ambassador University, 1993), CSCI A110 Course Coordinator; Senior Lecturer of Computer Science*
- Richert, Daniel, M.S. *(Indiana University, 2012), Lecturer of Informatics*
- Whitmer, Jeffrey M., M.A. *(Indiana University, 1986), Senior Lecturer of Computer Science*

Emeriti Faculty

- Dunn, J. Michael, Ph.D. *(University of Pittsburgh, 1966), Former Dean, School of Informatics; Emeritus Oscar R. Ewing Professor of Philosophy; Emeritus Professor of Informatics and Computer Science; Founding Member, Cognitive Science Program*
- Gannon, Dennis, Ph.D. *(University of California, Davis, 1974; University of Illinois, 1980), Professor of Computer Science*
- Gasser, Michael E., Ph.D. *(University of California at Los Angeles, 1988), Associate Professor Emeritus of Computer Science and Cognitive Science; Adjunct Associate Professor Emeritus of Linguistics*
- Hagstrom, Stanley A., Ph.D. *(Iowa State University, 1957), Professor Emeritus of Physics and Computer Science*
- Hanson, Andrew J., Ph.D. *(Massachusetts Institute of Technology, 1971), Professor Emeritus of Computer Science*
- Haynes, Christopher T., Ph.D. *(University of Iowa, 1982), Associate Professor Emeritus of Computer Science and Informatics*
- Johnson, Steven D., Ph.D. *(Indiana University, 1983), Professor Emeritus of Computer Science*
- Ogan, Christine, Ph.D. *(University of North Carolina, 1976), Professor Emeritus of Informatics and Journalism*
- Prosser, Franklin, Ph.D. *(Pennsylvania State University, 1961), Professor Emeritus of Computer Science*

- Robertson, Edward L., Ph.D. *(University of Wisconsin - Madison, 1970), Professor Emeritus of Computer Science and Informatics*
- Springer, George, Ph.D. *(Harvard, 1949), Professor Emeritus of Computer Science and Mathematics*
- Wiggins, Gary D., Ph.D. *(Indiana University, 1985), Director of Chemical Informatics Program; Interim Director of Bioinformatics Program; Professor Emeritus of Informatics*
- Winkel, David E., Ph.D. *(Iowa State University, 1957), Professor Emeritus of Computer Science*
- Wise, David S., Ph.D. *(University of Wisconsin—Madison, 1971), Professor Emeritus of Computer Science*

Student Organizations & Services

The following student groups are available for students to participate in:

- BUILT - Building Understanding in Leadership and Technology
- CS - Computer Science Club
- ICCA - Informatics and Computing Consulting Association
- ICSA - Informatics and Computing Student Association
- ITECC - Informatics, Technology, Entrepreneurship and Computing Club
- SoIC Summer Camp Counselors
- STARS Ambassadors
- Student Interns
- Tutors
- uWIC - Undergraduate Women in Informatics and Computing

Other information on Student Groups may be found at http://www.soic.indiana.edu/community/groups.shtml.