The Major in Information Systems

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http://www.cm.u.edu/information-systems/

Information Systems (IS), found within the Dietrich College of Humanities and Social Sciences, is an internationally recognized undergraduate major for students who want to design and implement effective solutions to meet organizational, societal and management needs for information and decision support.

In today's complex, interconnected world, the effective creation, distribution, and use of information via technology is central to daily life. Computer based information systems facilitate, enable and often define the relationships between corporations and consumers, buyers and suppliers, businesses of all sizes, social networks, and citizens and their governments. Understanding these relationships and effectively addressing the collection, flow, and distribution of information is vital to running a modern organization, enterprise or government agency.

Information Systems involves the effective design, delivery, use and impact of information and communications technologies in organizations and society. The importance of information technology and information systems to organizations and the need for well-educated professionals in the field is the basis for the Information Systems curriculum at Carnegie Mellon. Whether implementing applications, providing management or decision support, managing complex systems projects, or helping organizations design business processes or cope with rapid change, IS professionals fill an essential need across all sectors of society.

Information systems students at Carnegie Mellon learn to use, manage and design information technologies to address real problems or opportunities. They develop a solid foundation in computing, communications, as well as software development principles, languages, and methods. Since Information Systems generally operate within organizations, IS students study social sciences and organizational theory. IS students learn how to resolve information technology solutions to meet real-world economic and organizational constraints. Information system students also learn, through hands-on experience, the importance of professional communications, project management, critical thinking and teamwork. Building on the multi-disciplinary strengths of the university and the Dietrich College of Humanities and Social Sciences, graduates in Information Systems are ideally suited to take a leading role in shaping our information-based future.

The flexible nature of the program encourages students to explore their own interests through program electives, study in a contemporary content area or through optional second majors and minors.

IS students are well prepared to pursue graduate work in a wide range of fields. For students interested in master's degree graduate work at Carnegie Mellon, there are many possibilities, including accelerated Masters degree programs in Information Systems Management, Human Computer Interaction, Information Security Policy and Management, Engineering Technology and Innovation Management, and Business Administration.

IS graduates continue to be in high demand in the information-age workplace. There has been a strong job market for IS students in recent years, and national trends indicate that this is likely to continue. IS majors often take jobs in consulting companies, major software firms, large corporations, and start-up companies. Internship opportunities closely parallel the job market.

In addition to the Dietrich College General Education Requirements and basic prerequisites in Mathematics, Statistics and Computer Science, IS students must complete the Professional Core, the Disciplinary Core and a Focused Content Area. In the Professional Core (consisting of six courses), students learn the basic skills necessary to analyze, design, implement and test high-quality, cost effective information systems. Two of the Professional Core courses are project-based experiences in which small teams of students develop and deliver solutions to real information problems.

In the Disciplinary Core (consisting of three courses), students study key areas fundamental to understanding and solving problems in information systems: professional communications; quantitative analysis and research methods; and organizations, policy, and social science.

IS students also complete three courses within one Content Area. The content areas are designed to provide students an opportunity to gain additional depth in a focused area. Currently, twelve content areas are available: (1) Business / Enterprise Systems, (2) Computing and Information Systems & Technology, (3) Social and Global Systems, (4) Quantitative methods; and organizations, policy, and social science.

Study Abroad Options in Information Systems

Given the importance of globalization, we encourage students to consider expanding their international experience by spending a semester studying abroad. The IS program is very flexible in allowing students to pursue these opportunities. With careful planning, study abroad is possible during most semesters. Students interested in study abroad should talk with the IS Academic Advisor to help plan an appropriate course of study. With prior approval, study abroad courses may be applied to major requirements.

Information Systems as Additional Major or Minor

Information Systems is not available as either an additional major or minor.

Curriculum

The Information Systems major is offered only as a Bachelor of Science (B.S.) degree. In addition to major requirements outlined below, all Information Systems students must fulfill the General Education requirements for the Dietrich College of Humanities and Social Sciences. A total of 360 units is required for the degree.

Requirements are subject to revision. Advisor approval is required for each student’s major curriculum plan. Any proposed course substitutions to courses required for the IS major must be approved in advance by the IS Academic Advisor.

Prerequisites

Information Systems requires completion of prerequisite courses in Mathematics, Statistics and Computer Science. All prerequisites must be successfully completed prior to the start of Fall semester, junior year.

Mathematics and Statistics

Complete one of the following calculus sequences:

- 21-111 Differential Calculus
- 21-112 Integral Calculus

OR

- 21-120 Differential and Integral Calculus (Required for advanced business courses)
- 21-256 Multivariate Analysis

OR

- 21-120 Differential and Integral Calculus (Required for advanced computer science courses)
- 21-122 Integration and Approximation

AND also complete:

- 36-201 Statistical Reasoning and Practice

Computer Science

Three Computer Science courses are required. To maintain normal progress toward the Information Systems degree, students must complete 15-121 Introduction to Data Structures prior to the start of Spring Semester, sophomore year.

Students entering the program as freshmen will have the option to complete a Computer Science Placement Test. Depending on appropriate Advanced Placement credit and/or results of the Computer Science Placement Test, entering students may place directly into 15-112 or 15-121. 15-110 is taken as the first Computer Science prerequisite unless a student places
directly into 15-112 or 15-121. Most students entering the program will begin the sequence with 15-110.

15-110 Principles of Computing  
15-112 Fundamentals of Programming and Computer Science  
15-121 Introduction to Data Structures  

Note: Students cannot receive credit for both 15-104 Introduction to Computing for Creative Practice and 15-110 Principles of Computing.

Professional Core

The Professional Core consists of six courses (five core courses and one core elective). Complete all five of these courses:

- 67-250 The Information Systems Milieux (Spring Semester Only)  
- 67-262 Database Design and Development (Offered Annually)  
- 67-272 Application Design and Development (Offered Annually)  
- 67-373 Software Development Project (Spring Semester Only)  
- 67-475 Innovation in Information Systems (Fall Semester Only)

Note: Students transferring into Information Systems as sophomores or juniors substitute 67-344 Organizational Intelligence in the Information Age (or other pre-approved courses) 67-250 The Information Systems Milieux.

Professional Core Elective

Plus, complete 6 to 12 units chosen from the following options:

- 19-402 Telecommunications Technology, Policy & Management  
- 19-403 Policies of Wireless Systems  
- 67-240 Mobile Web Design & Development  
- 67-279 Introduction to Geographical Information Systems  
- 67-306 Special Topics: Management of Computer and Information Systems  
- 67-308 Innovation Studio: Health Care Information Systems  
- 67-319-67-331 Global Technology Consulting Groundwork - Technology Consulting in the Global Community

Note: These two courses are taken sequentially.

- 67-324 Accelerating Innovation and Entrepreneurship  
- 67-327 Web Application Security  
- 67-328 Mobile to Cloud: Building Distributed Applications  
- 67-329 Contemporary Themes in Global Systems  
- 67-344 Organizational Intelligence in the Information Age  
- 67-353 IT & Environmental Sustainability  
- 67-364 Practical Data Science  
- 67-442 Mobile Application Development in iOS  
- 88-223 Decision Analysis  
- 88-275 Bubbles: Big Data for Human Minds

OR Any Computer Science course above 15-121 with prerequisite of 15-112 or higher.

OR Any Human-Computer Interaction course (05-xxx).

OR other pre-approved 67-3xx or 67-4xx which may be offered from time to time. Students wishing to apply such courses to their Professional Core requirement must complete a course substitution application through the IS Academic Advisor.

OR other pre-approved courses offered by the Engineering & Public Policy Department (19-xxx).

NOTE: 67-1xx and 67-2xx courses may not be applied to this requirement.

Disciplinary Core

Complete one course (9 units) from each of the three Disciplinary Core categories.

Professional Communications

Information systems professionals communicate with a wide range of people in most organizations and often facilitate communications between diverse groups of stakeholders. Consequently, the most successful professionals typically are those with strong communication skills. These courses help students see that the structure and presentation of information affects how well (and how easily) it can be understood and used.

Complete one course (9 units). It is recommended that this requirement be completed by the end of junior year:

- 05-341 Organizational Communication  
- 36-315 Statistical Graphics and Visualization  
- 51-261 Communication Design Fundamentals: Design for Interactions for Communications  
- 70-321 Negotiation and Conflict Resolution  
- 70-340 Business Communications  
- 70-341 Organizational Communication  
- 70-342 Managing Across Cultures  
- 76-270 Writing for the Professions  
- 76-272 Language in Design  
- 88/70-65-341 Organizational Communication

Quantitative Analysis and Research Methods

This area focuses on decision making and data analysis — essential to development of useful information systems. this area exposes students to analytic methods in the social sciences and quantitative methods for approaching complex methods.

Complete one course (9 units). It is recommended that this requirement be completed in the sophomore year:

- 21-257 Models and Methods for Optimization  
- 21-325 Probability  
- 36-202 Methods for Statistics and Data Science  
- 36/70-208 Regression Analysis  
- 36-217 Probability Theory and Random Processes  
- 36-225 Introduction to Probability Theory  
- 36-303 Sampling, Survey and Society  
- 36-309 Experimental Design for Behavioral and Social Sciences  
- 67-364 Practical Data Science  
- 80-305 Choices, Decisions, and Games  
- 80-405 Game Theory  
- 88-223 Decision Analysis  
- 88-251 Empirical Research Methods  
- 88-275 Bubbles: Big Data for Human Minds

Organizations, Policy, and Social Science

The focus of this area is on how organizations function in modern social and economic environments. Students will develop a greater understanding of how social policy and technology influence organizations and how they operate.

Complete one course (9 units):

- 08-200/19-211 Ethics and Policy Issues in Computing  
- 15-390/70-421 Entrepreneurship for Computer Science  
- 19-402 Telecommunications Technology, Policy & Management  
- 19-403 Policies of Wireless Systems  
- 19-411 Global Competitiveness: Firms, Nations and Technological Change  
- 67-308 Innovation Studio: Firms, Nations and Technological Change  
- 67-321 Social Informatics
This content area broadens a student's knowledge in the business, economics and policy aspects of large scale information systems.

Business/Enterprise Systems

This content area avails students to key themes in globalization and global systems - management, policy, international business, and technology.

Social and Global Systems

This content area avails students to key themes in globalization and global systems - management, policy, international business, and technology.

Quantitative Analysis

Students will learn to apply analytic and quantitative methods for approaching complex, ambiguous problems.
Integrative Design, Arts, and Technology (IDeATe) Content Areas:

An IDeATe content area consists of a minimum of 27 units which may include one Portal Course (other than 15-104 Introduction to Computing for Creative Practice) plus 2 courses from one of the areas below.

Game Design (IDeATe)
In this content area, students will learn both theory and skill in the key areas of games: dramatic narrative and character development, visual and sound synthesis, special effects and performance capture, programming and engine development, interface and interaction architecture development, game assessment and redesign. Please visit the Game Design website (http://www.cmu.edu/ideate/concentrations-and-minors/game-design.html) for information about available courses.

Animation and Special Effects (IDeATe)
The interconnected components of performance capture, rendering, 3D and 2D animation, and special effects will be covered in this content area.
Course information can be found at the Animation and Special Effects website (http://www.cmu.edu/ideate/concentrations-and-minors/animation-and-special-effects.html).

Media Design (IDeATe)
The digital mediation of experiences content area explores the interconnected development of technology and content in new media systems and the meaning that arises from the resulting forms. Students learn to design mediated experiences across different platforms, from mobile to large-scale installations. Course information can be found on the Media Design website (http://www.cmu.edu/ideate/concentrations-and-minors/media-design.html).

Learning Media (IDeATe)
Students in this content area will combine their diverse skills for the design of effective new media systems for learning; from games for learning to tangible learning tool kits and remote learning systems. They will leverage new technologies, media arts knowledge, and learning science principles to create engaging experiences with measurable real world impact. For course information, please visit the Learning Media website (http://www.cmu.edu/ideate/concentrations-and-minors/learning-media.html).

Sound Design (IDeATe)
This content area will explore the processes and products of digital sound and music. Students will receive basic training in key areas: principles of computer music, hybrid instrument building, concepts in sound design. 62-150 IDeATe: Introduction to Media Synthesis and Analysis (10 units) is the required portal course for this content area and will serve as one of the courses for this content area. Course information can be found at the Sound Design website. (http://www.cmu.edu/ideate/concentrations-and-minors/sound-design.html)

innovation and Entrepreneurship (IDeATe)
Students in this content area will develop the knowledge and skills to lead and innovate in creative industries. Their interdisciplinary, hands-on coursework will emphasize the conceptualization of innovative products and the structuring of innovation processes. Courses and additional information can be found at the Innovation and Entrepreneurship website (http://www.cmu.edu/ideate/concentrations-and-minors/entrepreneurship-for-creative-industries.html).

Intelligent Environments (IDeATe)
The focus of this content area is on spaces that support efficiency and high quality of experience, addressing both the integrated development of such environments and the resulting experience. The required portal course for this content area is 62-150 IDeATe: Introduction to Media Synthesis and Analysis (10 units) or 16-223/60-223 IDeATe: Introduction to Physical Computing (10 units) and will serve as one of the courses for this content area. Course information can be found at the Intelligent Environments website (http://www.cmu.edu/ideate/concentrations-and-minors/intelligent-environments.html).

Physical Computing (IDeATe)
The barriers between computing devices and their users have slowly dissolved. The physical world is becoming a key interface for computing and the internet of things is becoming the next generation of connectivity. Students in this content area will explore the technical, experiential, and semantic issues of this evolution. Course information can be found on the Physical Computing website (http://www.cmu.edu/ideate/concentrations-and-minors/physical-computing.html).

Sample Curriculum

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<th>Sophomore</th>
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<td>Fall</td>
<td>Spring</td>
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<td>67-100 Information Systems Freshman Workshop</td>
<td>67-250 The Information Systems Milestone</td>
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<td>21-111 Differential Calculus</td>
<td>21-112 Integral Calculus</td>
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<td>36-201 Statistical Reasoning and Practice</td>
<td>76-101 Interpretation and Argument</td>
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<td>Freshman Seminar</td>
<td>79-104 Global Histories</td>
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<tr>
<th>Junior</th>
<th>Senior</th>
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<td>Fall</td>
<td>Spring</td>
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<tr>
<td>99-101 Computing @ Carnegie Mellon</td>
<td>99-102 Computing @ Carnegie Mellon</td>
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<td>Elective Course</td>
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Academic Policies

Transfer into Information Systems
Most IS students are admitted directly into Information Systems as incoming freshmen. Only Information Systems major students are permitted to enroll in the Professional Core courses (67-250 and above), and IS students have enrollment priority in IS electives.

Students in high academic standing may apply to be admitted to the Information Systems major as transfer students. Transfers into Information Systems will always be subject to availability of space in the major. Applications will be considered based on the following criteria:

- Strong record of academic performance at Carnegie Mellon (minimum GPA of 3.4)
- Relevance and clarity of personal statement
- Interview with IS Academic Advisor. Current Dietrich students must also interview with their Academic Advisory Center (AAC) advisor while non-Dietrich students will only be required to meet with the IS Academic Advisor.
- Relevance of courses completed to date
- Completion of 15-112 Fundamentals of Programming and Computer Science with final grade of 'A' or 'B'
Application materials must be submitted no later than the last day of classes of the fall or spring semester. Current Dietrich students will submit materials to the Academic Advisory Center while non-Dietrich students will submit all materials directly to Information Systems in PH 222.

Students accepted as transfers to the IS program would normally be expected to complete the usual prerequisites and begin the Professional Core courses during the next available semester.

Students interested in applying for transfer to the Information Systems major should contact the IS Academic Advisor for information regarding availability, application procedures and deadlines. Potential applicants to the IS major should be working toward a sensible alternative major, so that their success at Carnegie Mellon is not predicated on admission to the IS program.

**Double Counting of Courses**

“Double Counting” refers to instances when a course taken to fulfill one requirement counts simultaneously toward a requirement in another major or minor program. Double Counting is permitted in the Dietrich College on a very limited basis. Information Systems students may double count no more than two courses used to fulfill any Information Systems major requirement (beyond the Dietrich College General Education requirements and Prerequisite courses) with any combination of dual degrees, additional majors, minors or graduate degree programs. Only one course may double count with any minor. No course can count for more than one requirement within the major. Students must also adhere to any policy restrictions on double counting enforced by the academic department of the student’s additional major or minor.

**Course Repeats**

Per university policy, when a course is repeated, all grades will be recorded on the official academic transcript and will be calculated in the student’s GPA. This is the case regardless if the first grade for the course is a passing or failing grade.

Undergraduate students who wish to repeat a course already passed must obtain approval from the student’s Dean or Department Head. When a student takes a course s/he has already passed, only one set of units will count towards graduation requirements.

**Faculty**

C.F. LARRY HEIMANN, Teaching Professor – Ph.D., Washington University (St. Louis); Carnegie Mellon, 1998–.

JOSEPH S. MERTZ, Teaching Professor (Joint Appointment with Heinz College) – Ph.D., Carnegie Mellon University; Carnegie Mellon, 1997–.

SARA MOUSSAWI, Assistant Teaching Professor – Ph.D., City University of New York; Carnegie Mellon, 2016–.

JERIA QUESENBERRY, Associate Teaching Professor – Ph.D., Pennsylvania State University; Carnegie Mellon, 2007–.

RAJA SOORIAMURTHI, Teaching Professor – Ph.D., Indiana University; Carnegie Mellon, 2007–.

RANDY S. WEINBERG, Teaching Professor; Program Director, Information Systems – Ph.D., University of Minnesota; Carnegie Mellon, 1998–.

CHADI AOUN, Associate Teaching Professor – Carnegie Mellon - Qatar - Ph.D., University of New South Wales; Carnegie Mellon, 2015–.

ANIS CHARFI, Associate Teaching Professor – Carnegie Mellon - Qatar - Dr.Ing., Technische Universität Darmstadt; Carnegie Mellon, 2015–.

DIVAKARAN LIGINLAL, Teaching Professor – Carnegie Mellon - Qatar - Ph.D., University of Arizona - Tucson; Carnegie Mellon, 2009–.

SELMA LIMAM MANSAR, Teaching Professor – Carnegie Mellon - Qatar - Ph.D., National Polytechnic Institute of Grenoble; Carnegie Mellon, 2007–.

DANIEL PHELPS, Associate Teaching Professor – Carnegie Mellon - Qatar - Ph.D., Florida State University; Carnegie Mellon, 2007–.