

Computer Science

Chair: Dr. John Harris

The Computer Science field is an exciting and rapidly changing one in which new platforms and applications regularly replace old ones. In order to prepare oneself for a career where major changes are expected as a matter of course students should learn skills and concepts that are fundamental to the discipline. The Computer Science program at Saint Francis emphasizes both skills and concepts that are fundamental to the discipline today and in the future as well as gaining experience with platforms and applications that are widely used today.

There are five concentrations available in the Computer Science curriculum at Saint Francis University: Software Development, Web Development, Information and Network Security, Information Technology and a General concentration. The Software Development and Web Development concentrations deal primarily with software development and place an emphasis on programming and problem-solving skills. Information and Network Security and Information Technology are designed to prepare one for a career as an Administrator. The Information and Network Security concentration places a heavy emphasis on issues related to Computer Security while the Information Technology concentration places an emphasis on the management of computer resources. The Computer Science curriculum at Saint Francis is designed to give students ample opportunities to satisfy the requirements of more than one of the aforementioned concentrations allowing students a large amount of breadth as well as depth in their studies.

Information and Network Security: This concentration is a preparation for a career in IT with an emphasis on system/network administration with particular attention paid to issues related to security. Students who successfully complete the requirements of this concentration will be prepared for a position as a network administrator or related career.

Software Development: This concentration is a preparation for a career as a programmer or software engineer. An emphasis is placed on issues related to knowing how to use all the features of modern programming languages, the design and implementation of algorithms, and the process of developing and maintaining software.

Web Application Development: This concentration is a preparation for a career as a programmer or software engineer. It is similar to the Software Development track, but with greater emphasis placed on the development of applications specifically designed for the world wide web and less emphasis placed on algorithm design.

Information Technology: This concentration is a preparation for a career as a specialist in Information Technology (IT). There is less emphasis on programming and mathematics and a greater emphasis on system/network administration, communication and management than is present in the other Computer Science tracks.

General: This concentration is for the student who wishes to choose a set of courses from the upper-level Computer Science electives and select MIS upper-level offerings in a way as to determine his or her own specialization within the field.

Two minors are also available to complement science, business, or other majors: Computer Science and Management Information Systems. Emphasis is placed on the integration of computers within the human organization. Students make use of networked personal computers in the computer laboratories for programming exercises, the use of applications packages, and connection to campus and world-wide networks.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

MAJOR REQUIREMENTS

Computer Science 121, 122, 209, 492; Mathematics 121, 130; Physics 121, 122; completion of one of the following concentration areas.

General Concentration: Twenty-one additional Computer Science credits from 211, 205, 342, 345 or any 400 level Computer Science elective; Mathematics 122, 304.

Information and Network Security Concentration: Computer Science 211, 422, 430, 431, 433, 435, 437; Mathematics 122, 304, 322. Computer Science 205 is highly recommended.

Software Development Concentration: Computer Science 211, 345, 401, 410, 420 plus six credits chosen from Computer Science 402, 409 or 445; Mathematics 122, 304; Computer Science 205 and 240-245 are highly recommended.

Web Application Development Concentration: Computer Science 211, 345, 409, 410, 431, 445 plus three credits chosen from Computer Science 401 or 420; Mathematics 122, 304.

Information Technology Concentration: Computer Science 345, 422, 431, 433; Management Information Systems 102, 343, 406; English 208; Management 101.

Minor in Computer Science Requirements: Computer Science 121, 122 and 209 and two other courses of which at least one is three credits, from Computer Science 211, 240-245, 345, 409, 422, 430, 431 and 433.

Minor in Management Information Systems Requirements: Computer Science 101; Management Information Systems 102, 342,343; Management 101; and one of the following: Computer Science 121 or Management Information Systems 110.

COMPUTER SCIENCE — COURSE DESCRIPTIONS

101. Introduction to Computer Systems (3 credits)

Introduction to the basic concepts and techniques of how computers are used to help solve problems with emphasis on quantitative reasoning applications in science, business and other areas of life; discussion of components of a complete computer system, including equipment, programs, data, procedures, and personnel; applications packages, online and web resources. No prior exposure to computers is assumed. *Fall, Spring, Summer.*

102. Management Information Systems (same as MIS 102) (3 credits)

Systems theory, quality, decision-making and the organizational role of information systems are introduced. Information technology including computing and telecommunications systems are stressed. Concepts of organization and information systems growth and re-engineering are introduced. This course emphasizes management considerations, as well as structured system techniques and technological factors. *Prerequisite: CPSC 101. Fall.*

110. Computer Programming with Business Applications (same as MIS 110) (3 credits)

Introduction to the basic principles of computer programming and the application of programming solving business-oriented problems. Topics include algorithm development, basic control structures, procedures, arrays, records, graphic user interface design, and file processing. Applications in Visual basic will be included. No prior exposure to computer programming is assumed. *Fall, Spring.*

121. Introduction to Programming (4 credits)

Introduction to algorithm design and other aspects of programming using the Java programming language along with a brief introduction to Computer Science concepts such as hardware, assembly language, programming language and compilation. *Three lecture periods and one 2-hour laboratory. Fall.*

122. Intermediate Programming (4 credits)

Further coverage of Java along with an emphasis placed on algorithm design techniques, object-oriented design, along with an introduction to basic data structures, software engineering concepts, and design patterns. *Three lecture periods and one 2-hour laboratory. Prerequisite: Computer Science 121. Spring.*

205. C++ Programming (1 credit)

An introduction to programming in C++ specifically geared toward non-computer science applications. Emphasis is on coding programs in C++ while contrasting it with other higher-level languages. *Prerequisite: Computer Science 121. Fall.*

209. Introduction to Web Applications (3 credits)

An introduction to the development of web applications using Java servlets and JavaServer Pages (JSP). Students will learn the essentials of server setup and configuration, scripting, forms, CGI, cookies, XML, other technologies for web application development, and the MVC architecture. *Prerequisite: Computer Science 122. Fall.*

211. Advanced Programming Topics (3 credits)

A project-based continuation of CPSC 209 that uses the Struts framework to develop Java EE web applications. *Prerequisites: Computer Science 209. Spring.*

240 – 245. Applied Programming Languages (1-3 credits)

This course is a vehicle for teaching the basics of various programming languages. Each time the course is taught it is devoted to a particular programming language. Among the languages that may be taught in this course are Python, Perl, PHP, C#, Ruby, Scheme, ML, Haskell, JavaScript, or Smalltalk. *Prerequisite: Computer Science 122. As Needed.*

310. Numerical Analysis (same as Mathematics 310) (3 credits)

Programmable algorithms, with error analysis, for: solving non-linear equations, systems of linear equations, matrix calculations, polynomial interpolation, least squares approximation, and numerical integration. Programming assignments. *Prerequisites: Computer Science 121, 205, or 210, Mathematics 221. Spring, even-numbered years.*

342. E-Commerce (same as MIS 342) (3 credits)

Introduction to the use of computer networks as a medium for commercial activity. Topics include technological infrastructure, Internet retailing and advertisement, business-to-business commerce, consumer behavior, corporate strategy, and the legal and societal issues of electronic commerce. *Prerequisite: CPSC 101. Fall.*

343. System Analysis and Design
(same as MIS 343)
(3 credits)

This course examines the system development and modification process. It emphasizes the factors for effective communication and integration with users and user systems. It encourages interpersonal skill development with clients, users, team members, and others associated with development, operation and maintenance of the system. Structured and object oriented analysis and design, use of modeling tools, adherence to methodological life cycle and project management standards. *Prerequisite: CPSC 102. Spring.*

345. Data Base Management
(same as MIS 345)
(3 credits)

Students analyze techniques for organizing, storing, and retrieving large amounts of related data. Conceptual analysis as well as practical applications on computers are presented. Emphasis is placed on management control practices concerning security, privacy, integrity, and the maintenance of the data. *Prerequisites: Computer Science 110, 343; Management 101. Fall.*

398-399. Computer Science Internship
(3-15 credits)

The integration of classroom theory with practical work experience under which students have specific periods of attendance at college and specific periods of employment, either full- or part-time, with or without pay. Credit may vary from three to 15 credits, but no more than four credits may be counted toward major requirements, with additional credits counted as free electives. Open only to Computer Science majors with approval of the department chair and the Provost. *Fall, Spring, Summer.*

401. Data Structures
(3 credits)

Advanced data structures, concepts, and algorithms and their application to information storage and retrieval and list processing are discussed. *Prerequisite: Computer Science 211. Fall, even-numbered years.*

402. Algorithm Design and Analysis
(3 credits)

Design and analysis of algorithms with an emphasis on problems involving strings, sequences and trees. The problems are generally taken from the domain of Computational Biology. There will be coverage of algorithm design techniques, the basics of asymptotic analysis of algorithms, NP-Completeness. *Prerequisites: Computer Science 401. Spring, odd-numbered years.*

409. Web Application Architectures
(3 credits)

Building upon the introductory course on web application development, the key concepts, principles and technologies of web application development are covered. A particular platform of the instructor's choosing will be used throughout the course in order to develop various web applications. *Prerequisites: Computer Science 209. Fall, odd-numbered years.*

410. Software Engineering
(3 credits)

Introduction to the models and issues concerned with the development of high-quality software. Application of software engineering methodology to the planning, specification, design, development, testing, and delivery of a large software project. *Prerequisite: Computer Science 211. Fall, even-numbered years.*

420. Programming Languages
(3 credits)

Introduction to the general concepts of programming language design and implementation; underlying principles of various types of languages are discussed; exposure to various programming languages not used in other courses. *Prerequisite: Computer Science 211. Spring, odd-numbered years.*

422. Introduction to Systems Administration
(3 credits)

Students learn the fundamental tasks involved in system administration as well as how to install, configure, and administer network services such as DNS, Sendmail, Apache, Samba, in a Linux environment. *Prerequisites: Computer Science 209. Fall, odd-numbered years.*

**430. Computer Organization and Operating Systems
(3 credits)**

An introduction to the fundamental concepts of Operating Systems and Computer Organization including coverage of process and memory management, device management, the operating system API, internal data representation, computer arithmetic, instruction set architecture, I/O, pipelining and the memory hierarchy. Prerequisites: Computer Science 122. Fall, even-numbered years.

**431. Networks and Data Communications
(3 credits)**

Introduction to underlying concepts and principles of computer networks; network topology, communication protocols (ISO/OSI, TCP/IP), LANs and WANs applications such as e-mail and the World Wide Web. Pre-requisite: Computer Science 211. Fall, odd-numbered years.

**433. Fundamentals of Computer Security
(3 credits)**

The fundamentals of network and host security are covered in this course including the CIA triad, risk analysis, access control, general principles and practices, incident response, the basics of cryptography, firewalls, security audits, securing network services, securing Windows and Linux machines, various types of attacks, as well as hands-on use of popular security tools. Prerequisites: Computer Science 431. Spring, even-numbered years.

**435. Intrusion Detection Systems and Forensics
(3 credits)**

This course covers the fundamental concepts of Intrusion Detection Systems and Computer Forensics. This is an applied course where students will obtain hands-on experience with Intrusion Detection software as well as with software that is used in Computer Forensics. Prerequisites: Computer Science 431 and 433. Spring, even-numbered years.

**437. Cryptography
(3 credits)**

An introduction to cryptography and its uses, including coverage of foundations, protocols, hashing, digital signatures, public key and symmetric cryptography, key management. Prerequisites: Computer Science 122, Mathematics 130. Spring, odd-numbered years.

**440. Computer Graphics
(3 credits)**

The display of images to a computer's output device is discussed; students are introduced to the basic principles and algorithms of graphics with particular emphasis on 3-D imaging; illumination and animation are discussed. Prerequisite: Computer Science 211. As needed.

**445. Advanced Database Management
(3 credits)**

An advanced course on databases that covers topics such as web applications that use databases, XML query, distributed databases, database security, data warehouses, and data mining. Prerequisites: Computer Science/ Management Information Systems 345, Mathematics 304. Spring, odd-numbered years.

**491. Seminar: Special Problems
(1-3 credits)**

Open to qualified students with special areas of interest. As needed.

**492. Computer Science Seminar
(1 credit)**

Selection of an acceptable computer science topic, research, and presentation of the research findings in written and oral form. Prerequisite: Computer Science 122. Spring.

**501. Independent Study in Computer Science
(1-8 credits)**