The Computer Science program at Siena features excellent facilities, full-time dedicated faculty and a wide variety of educational and career opportunities. The program is oriented towards “hands on” computing in a small class environment. Laboratory experiences are an essential component of many courses, so that students can work closely with our faculty. Beginning with the first course, students develop their abilities to solve problems, analyze, synthesize, think critically and communicate. Many courses require group projects and intensive teamwork.

The Computer Science major at Siena requires a minimum of 30 hours of coursework in Computer Science and 14 hours of coursework in Mathematics. Most students participate in a senior year capstone experience by enrolling in Software Engineering I and II, and by involvement in a well-established internship program. There are also opportunities for research with a professor in a one-on-one situation.

A minor in another field is not required, but one may be chosen from any that the college supports. Frequently chosen minors for Computer Science majors at Siena are Business, Mathematics or Physics. A Computer Science

# Administrative leave, 2007-2008
‡ Sabbatical leave, Spring 2008
A Computer Science major opting for a minor in Business would take the following courses: ACCT—200, ACCT—205, ECON—101 or ECON—102, FINC—301, MKMG—211, and MKMG—212. A Computer Science major opting for a minor in Mathematics would take the following courses: MATH—110, MATH—120, MATH—250, MATH—350 and 2 upper level math courses. A Computer Science major opting for a minor in Physics would take the following courses: PHYS—130, PHYS—140, PHYS—210 or PHYS—212, PHYS—220 or PHYS—222, PHYS—230 and PHYS—240.

For students interested in engineering, the Computer Science Department participates in a 3-2 program with Rensselaer Polytechnic Institute, Clarkson University, Catholic University, SUNY-Binghamton and Manhattan College. Such students will receive a Bachelor of Science in Computer Science from Siena and a Bachelor of Science in Engineering from the cooperating institution.

Certificate Programs in Computer Science and in Information Systems are available for students not wishing to complete all B.S. requirements or who already have a bachelor's degree in another field. The department also offers minors in Computer Science and in Information Systems.

The Computer Science program is based on the suggested curriculum of the SIGCSE (Special Interest Group Computer Science Education) of the ACM (Association for Computing Machinery).

Facilities: The Computer Science Department has its own networked computing facility for laboratory work using Linux servers, and Windows PCs and a variety of other hardware and software. There are 4 instructional labs and one open lab, with over 100 PCs managed by five servers with several terabytes of disk space. Students also access Siena’s campus-wide academic computing network. (See the “Information and Technology Services” section of the catalog for a complete description of the Academic Computing facilities).

Students have access to several programming languages including C, C++, Scheme, Java, Visual Basic, Prolog, Visual C++, and Perl. Application packages for word processing, spreadsheet modeling, and database management are also available for student use. Additional software available for use in courses and on student projects includes the Statistical Package for the Social Sciences (SPSSX), Oracle, and various Computer Aided Software Engineering (CASE) tools, Macromedia Studio, Mathematica and Rational Rose.

Requirements for the Major: A student is required to take at least 30 credits in Computer Science, including Introduction to Computer Science (CSIS—110), Introduction to Programming (CSIS—120), Data Structures (CSIS—210), Assembly Language and Computer Architecture (CSIS—220), Object-Oriented Design and Programming (CSIS—225), Analysis of Algorithms
(CSIS—385) and four upper-level Computer Science electives numbered 300 or higher. The student must take 14 hours in Mathematics: Calculus I and II (MATH—110 and MATH—120), and Discrete Mathematics I and II (MATH—250, MATH—350).

Requirements for the Minor in Computer Science: The minor in Computer Science will consist of six courses (at least 18 credit hours) in Computer Science. At least three of the courses must be at the CSIS—120 level or above. Students are responsible for understanding prerequisites and ensuring they can complete the minor in a timely fashion.

Requirements for the Minor in Information Systems:
At least 18 credit hours (the equivalent of 6 courses) as follows:

- Introduction to Computer Applications (CSIS—010) or any 3 credits in Computer Science.
- Introduction to Computer Science (CSIS—110)
- Database Design and Applications for Business (CSIS—112) or Database Management (CSIS—350)
- Management Information Systems (CSIS—114)
- Survey of Information Technology (CSIS—116)
- Any one of: Accounting Systems and Data Processing (ACCT—470), Topics in Computer Science (CSIS—200), Topics in Computer Science with Laboratory (CSIS—201), Introduction to Programming (CSIC—120), Data Structures (CSIS—210)

Students are responsible for understanding prerequisites and ensuring they can complete the minor in a timely fashion.

Requirements for a Certificate in Computer Science: A student must take 18 hours in Computer Science, including Introduction to Computer Science (CSIS—110), Introduction to Programming (CSIS—120), Data Structures (CSIS—210), Assembly Language and Computer Architecture (CSIS—220), Object-Oriented Design and Programming (CSIS—225) and Advanced Algorithms (CSIS—385). The student must also take 11 hours of Mathematics, including Calculus I and II (MATH—110 and MATH—120) and Discrete Structures (MATH—250). (Discrete Structures is not required for Mathematics majors who wish to earn this certificate.) At least four of the courses and at least three of the Computer Science courses must be completed at Siena College. The Computer Science courses may not be taken with the pass/fail option. Students are responsible for understanding prerequisites and ensuring they can complete the certificate in a timely fashion. A minimum grade of C- is required for all Computer Science courses, and the minimum GPA to earn the certificate is a 2.0 average for all the certificate courses.

Requirements for a Certificate in Information Systems: Introduction to Computer Science (CSIS—110), Database Design and Applications for Business (CSIS—112), Management Information Systems (CSIS—114),
Survey of Information Technology (CSIS—116), Introduction to Programming (CSIS—120), Data Structures (CSIS—210), and any two of the following courses: Topics in Computer Science (CSIS—200, with appropriate topic), Topics in Computer Science with Laboratory (CSIS—201, with appropriate topic), Assembly Language and Computer Architecture (CSIS—220), Object-Oriented Design and Programming (CSIS—225), Data Base Management (CSIS—350), Advanced Topics in Computer Science (CSIS—400, with appropriate topic), Advanced Topics in Computer Science with Laboratory (CSIS—401, with appropriate topic), Software Engineering I (CSIS—410), Software Engineering II (CSIS—415), and Mathematical Statistics I (MATH—270) or Business Statistics I (QBUS—200) (but not both). At least four of the courses must be completed at Siena College. The Computer Science courses may not be taken with the pass/fail option. Students are responsible for understanding prerequisites and ensuring they can complete the certificate in a timely fashion. A minimum grade of C— is required for all Computer Sciences courses, and the minimum GPA to earn the certificate is a 2.0 average for all the certificate courses.

Cooperative Engineering Program: Students pursuing the 3-2 Program in Computer Science and Engineering must satisfy all the requirements for the major and the core requirements. The student’s advisor and the coordinator of the 3-2 Program will help the student in planning a program so that the requirements for the B.S. in Computer Science from Siena will be completed at the end of the fourth year and the B.S.E. from the engineering school at the end of the fifth year. Each student should consult with the 3-2 Engineering Coordinator at least once a semester.

CSIS—SSX. Spreadsheet Exam  0 credits

This course will be awarded to School of Business students passing the department’s spreadsheet exam during orientation. No registration is required. This is one of three ways to satisfy the School of Business spreadsheet requirement; the others are completion of CSIS—010 or CSIS—011. Similarly, this serves as one possible prerequisite to certain CSIS and Business courses, but CSIS—010 or CSIS—011 can be used instead.

CSIS—010. Introduction to Computer Applications (2 hours lecture, 2 hours laboratory)  3 credits

An introduction to computers and applications using both character and graphical user interfaces. Topics will include hardware components; application software including word processing, spreadsheets, graphics, and database management; data communications; issues in information systems such as privacy and security; computer operations; and networking. This course should be a first course in computing for non-science majors. Computer Science majors cannot apply this course to the major. Laboratory fee. No prerequisites. (ATTR: ARTS)
CSIS—011. Problem Solving with Spreadsheets 1 credit

A lab-based introduction to problems, problem-solving, and the kinds of problems amenable to spreadsheet solutions. Provides a foundation for analyzing business and decision support problems using spreadsheet technology. Typical techniques studied may include absolute and relative addressing, macros, and conditionals. Students will be expected to apply their skills to various business scenarios and cases. May not be taken concurrently with or subsequent to CSIS—010. No prerequisites. Lab fee.

CSIS—013. Computer Ethics 1 credit

This course is a survey of the ethical issues involved in computing. Topics studied will include data access, privacy, security, hacking, copyright and intellectual property issues, email, etc. The focus will be on identifying and analyzing ethical problems related to computing, as well as on ways to foster ethical decision-making in computing-centered situations. No prerequisites.

CSIS—019. Computer Science Seminar 1 credit

This course will be offered with emphasis on different topics. The content will be designated by subtitle. Students may take the course more than once with different content. Potential topics include: History of Computing, Computing and Film, Information Presentation, etc. No prerequisites.

CSIS—030. Introduction to Computing with SPSS 3 credits

An introduction to the Statistical Package for the Social Sciences, a step by step instruction of the procedures used and an understanding of the printed output. Data preparation for the input of variables, format statements, system and program output, correlation coefficients, data plots, chi-square and distribution tests, analysis of variance and covariance are some of the subjects studied. Prerequisite: ATDV—110 or QBUS—200 or permission of instructor. Computer Science majors may not apply this course to the major but may take it only as computer science elective credit. Computer use fee. (ATTR: ARTS)

CSIS—110. Introduction to Computer Science (2 hours lecture, 2 hours laboratory) 3 credits

An introduction to Computer Science with an emphasis on problem solving, algorithm development, and design and testing of solutions using a programming language. In particular, the course will emphasize techniques for modular design and testing of programs, including techniques for reducing a large problem to smaller one. Other topics include general computer organization, information representation, efficiency of solutions, and a brief introduction to declarative programming techniques. No prerequisites. Lab fee. (ATTR: ARTS, CAQ)

CSIS—112. Database Design and Applications for Business 3 credits

This course introduces the concepts and practices of database design and use from a business perspective. Topics to be covered include data models (object, entity-relationship, and relational, for example), database design
techniques, data dictionaries, query language (e.g. SQL, QBE), requirements
analysis, legacy systems, databases for decision support, presentation tech-
niques (forms, web pages, etc.) and basic information on database use in a
business setting. The course includes hands-on use of a common business
database management system to illustrate and emphasize the concepts.
Prerequisite: CSIS—010 or CSIS—110. Computer use fee.

CSIS—114. Management Information Systems  (2 hours
lecture, 2 hours laboratory)  3 credits

An introduction to fundamental management issues and information
system principles involved in the analysis, design, and implementation of
management information systems. Topics include business information sys-
Butm planning, technology architecture, database design, systems develop-
ment, decision support systems, internal control, and computer security and
disaster planning. In order to provide an opportunity for students to develop
a facility for applying the knowledge gained in the course, case studies will
be used extensively. Prerequisite: CSIS—010 or CSIS—011 or CSIS—
SSX. Lab fee. (ATTR:ARTS)

CSIS—116. Survey of Information Technology (2 hours
lecture, 2 hours laboratory)  3 credits

This course completes the Management Information Systems
sequence. Students will continue their study of programming and databases,
while gaining hands-on experience in the application of these skills in a
management setting. Topics may include electronic commerce, decision
support systems, executive information systems, and other current aspects of
information technology. Prerequisites: either (1) CSIS—112 and CSIS—
114 or (2) CSIS—350. Lab fee. (ATTR:ARTS)

CSIS—120. Introduction to Programming  (2 hours
lecture, 2 hours laboratory)  3 credits

An introduction to the procedural design paradigm with an emphasis
on problem solving, algorithm development, and implementation of algo-
rithms in computer programs in a procedural language, such as C or C++.
Other topics will include hardware organization, data representation, sys-
tem software, programming style, program testing and analysis of algo-
rithms. Prerequisite: CSIS—110. Lab fee. (ATTR:ARTS, CAQ)

CSIS—200. Topics in Computer Science  3 credits

This course will use an area of research, theory or practice to apply and
extend basic principles of Computer Science. The course may be taken
more than once with different topics. Possible topics include web design,
emerging programming languages, computer graphics, computer security,
and e-commerce. Prerequisite: permission of the instructor. (ATTR:ARTS)

CSIS—201. Topics in Computer Science with Laboratory
(2 hours lecture, 2 hours laboratory  3 credits

This course will use an area of research, theory or practice to apply and
extend basic principles of Computer Science. The course may be taken
more than once with different topics. Possible topics include web design,
emerging programming languages, computer graphics, computer security, and e-commerce. The laboratory includes such things as hands-on exploration and experimentation with concepts, software tools, computer systems, or computer languages designed to confirm or extend the principles developed in lecture. Prerequisite: permission of the instructor. Laboratory fee. (ATTR: ARTS)

CSIS—210. Data Structures (2 hours lecture, 2 hours laboratory) 3 credits
This course continues the study of algorithm design and implementation with an emphasis on the use and implementation of data structures such as records, stacks, queues, linked lists, trees and graphs. Students will continue development of programming skills using modular and structured programming techniques in a programming language. Prerequisite: CSIS—120. Lab fee. (ATTR: ARTS)

CSIS—220. Assembly Language and Computer Architecture (3 hours lecture, 2 hours laboratory) 4 credits
An introduction to assembly language programming using a specific assembly language (for example, VAX, Intel, or MIPS assembly language). Addressing techniques, internal computer components, machine language, subroutines, and parameter passing will be discussed. The course also covers topics in computer architecture including memory systems organization, interfacing and communication, functional organization, and multiprocessing architectures. Prerequisite: CSIS—120. Lab fee. (ATTR: ARTS, ISCE)

CSIS—225. Object-Oriented Design and Programming (2 hours lecture, 2 hours laboratory) 3 credits
This course continues previous work in using an object-oriented language in problem solving, and will consist of two parallel strands: the development of students’ expertise in advanced features of the language, and the introduction of object-oriented design methodologies. The two strands will be developed in the context of a large-scale semester project implemented by teams of from three to six students. Prerequisite: CSIS—210. Lab fee. (ATTR: ARTS, ISCE)

CSIS—310. Numerical Methods 3 credits
Course objectives are to survey and develop numerical methods for solving scientific problems. Topics covered are roots of linear and nonlinear systems, numerical integration, approximation, interpolation, and ordinary differential equations. The course will emphasize efficient computer implementation of numerical algorithms. Prerequisites: CSIS—120 and MATH—120. Computer use fee. (ATTR: ARTS)

***CSIS—325. Computer Organization 3 credits
This course provides a foundation in computer hardware organization including: a brief survey of historical developments in computer hardware,***

***Offered when there is sufficient student interest.***
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a contrast of computer architectures and their implementation, and numbering systems. Also covered are fundamentals of logic design with application to the design of basic computer elements such as counters, adders, decoders, design of instruction timing sequences, register structure, addressing techniques and microcomputers. Prerequisites: CSIS—220, PHYS—070 and PHYS—240. (ATTR: ARTS)

CSIS—330. Operating Systems (3 hours lecture, 3 hours laboratory) 4 credits
A study of processor, memory, device, and information management of contemporary computer systems. Emphasis is placed on the models and algorithms for multi-programming computer operating systems. Discussion will include classic problems such as the concurrency problems of mutual exclusion, deadlock and synchronization, and memory management concepts such as paging, working set and segmentation. The laboratory includes an introduction to using the UNIX operating system, an introduction to programming in the C language and experiments designed to confirm or extend the principles developed in lecture. Prerequisite: CSIS—210. Laboratory fee. (ATTR: ARTS)

CSIS—340. Programming Languages 3 credits
A study of the organization and structure of modern programming language paradigms with an emphasis on semantic issues. Topics include formal language theory, syntax, semantics, calling protocols, and conventional and abstract data types. This course will include comparison studies of languages such as LISP, C, Ada, Prolog, C++, Pascal, FORTRAN, and APL. Prerequisite: CSIS—225. Computer use fee. (ATTR: ARTS)

CSIS—350. Data Base Management 3 credits
A study of Data Base Management Systems, including the relational, hierarchical, and network models. Topics will include the storage structures, data representations, access methods, and query languages. Problems such as security, privacy, and maintaining the integrity of the data stored will be discussed. Prerequisite: CSIS—210. (ATTR: ARTS, ISCE)

CSIS—355. Advanced Database 3 credits
This course has two major themes: (1) An introduction to the principles of database management system implementation (as opposed to use), with an emphasis on current relational implementation technology; and (2) a study of the emerging Object-Oriented database technology from the standpoint of a database user/administrator. Topics in both themes will include query processing, concurrency control, language design, data modeling, and distributed systems. Prerequisite: CSIS—350 or instructor permission. Computer use fee. (ATTR: ARTS)

CSIS—365. Communications & Networks 3 credits
A survey of data communication and networks. Topics to be covered include techniques of transmission, protocols for line control, error detection
and correction, communication software, various types of network systems, distributed applications, and performance evaluation. Prerequisite: CSIS—220. (ATTR: ARTS)

CSIS—375. Introduction to Artificial Intelligence 3 credits
Fundamental concepts used in machine implementation of processes which imitate human cognition. Topics include knowledge representation, logical deduction and problem solving, natural language understanding and semantic representation. Current literature and research will be discussed. Students will complete several programming projects in the areas of game trees, backtracking, theorem proving, and rule-based systems. Prerequisite: CSIS—210. Computer use fee. (ATTR: ARTS)

CSIS—380. Computer Graphics 3 credits
This course is an introduction to the mathematical and algorithmic principles of computer graphics as well as graphical applications programming. Topics covered include two and three-dimensional transformations, three-dimensional viewing, shading models, curves and surfaces, ray tracing, texture mapping, and algorithmic issues. In the laboratory these topics will be explored using graphics software tools and through programming using graphics libraries. Standard lab fee (2 hrs); no computer use fee. Prerequisites: CSIS—210 and MATH—120. (ATTR: ARTS, CMLS, LCSL)

CSIS—385. Analysis of Algorithms 3 credits
This course continues previous work in the design and analysis of algorithms. Data structures considered may include, for example, binary trees, AVL trees, B-trees, hash tables, and multi-dimensional trees. Algorithms for searching, inserting into, and deleting from these structures will be discussed. A variety of sorting algorithms (possibly including radix sort, heapsort, mergesort and quicksort) will be studied. Algorithms for other problems such as k-selection, minimum cost spanning trees, connectivity, and shortest paths will be analyzed. NP-complete problems will be introduced. Prerequisites: CSIS—210, MATH—250. (ATTR: ARTS)

CSIS—400. Advanced Topics in Computer Science 3 credits
This course will use an areas of research, theory or practice to apply and extend basic principles of Computer Science. The course may be taken more than once with different topics. Possible topics include: web design, computer graphics, system administration, advanced AI, computer security, systems programming, cryptography, data warehousing, etc. Prerequisite: permission of the instructor. (ATTR: ARTS)

CSIS—401. Advanced Topics in Computer Science with Laboratory (2 hours lecture, 2 hours laboratory) 3 credits
This course will use an area of research, theory or practice to apply and extend basic principles of Computer Science. The course may be taken more than once with different topics. Possible topics include computer graphics, systems administration, web design, Advanced AI, Systems Programming,
Computer Security, Data Warehousing, or Cryptography. The laboratory includes such things as hands-on exploration and experimentation with concepts, software tools, computer systems, or languages designed to confirm or extend the principles developed in lecture. Prerequisite: Permission of the instructor. NOTE: The lab fee will be calculated using the standard lab fee formula with two hours. Because there is a lab fee, the computer use fee will be eliminated. (ATTR: ARTS)

CSIS—410. Software Engineering I 3 credits

Introduces the concepts of structured system analysis. Presents principles of software engineering including techniques for planning, specification, and system design. Specifications for an actual system will be developed. Prerequisite: CSIS—225. Recommended for all senior-level Computer Science majors. (ATTR: ARTS, ISCE)

CSIS—415. Software Engineering II 3 credits

Implementation of a software engineering methodology. Complete design, testing, and verification of a system developed using a programming team concept. Structured design and documentation. Prerequisite: CSIS—410. Computer use fee. (ATTR: ARTS, ISCE)

CSIS—499. Independent Study 1 - 3 credits

A qualified student, with the consent of the Head of the Computer Science Department, may pursue further research and study in some specific aspect of computer science. The student will be directed by a member of the Computer Science Department with whom he/she will hold periodic discussion. The student will be expected to comply with all School of Science guidelines concerning such projects. The number of credits to be awarded (1 - 3) will be determined by the Head of the Computer Science Department and the directing faculty member. Computer use fee. This course is arranged by mutual consent of the faculty member and student. (ATTR: ARTS)