Computer Science

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(Csci) http://www.cs.und.edu

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The underlying goal of the Department of Computer Science is to provide up-to-date, quality instruction in its undergraduate and graduate programs. In support of this goal, a curriculum has been developed which encourages a formal, abstract, theoretical approach to the study of computer science while providing students with experience on state-of-the-art equipment. The degree programs are designed to provide a background of professional education for careers in business, science, government, and industry, and to furnish a strong foundation for graduate study in computer science.

The department offers a Bachelor of Science in Computer Science through the John D. Odegard School of Aerospace Sciences and a Bachelor of Arts with a Major in Computer Science through the College of Arts and Sciences. A minor in computer science is also available.

The B.S. program provides the strongest mathematical and scientific background. It is recommended for students who intend to pursue graduate studies or to seek employment involving technical or scientific applications of computing. The B.S. degree is accredited by the Computing Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700.

The B.A. program offers more flexibility with fewer requirements relating to science and mathematics, but with additional requirements for courses in the humanities. This degree program is recommended for students pursuing a broader-based liberal arts education.

Optional specializations in Network and Operating Systems Analysis, Software Engineering, Game Development and Computer Animation, and Information Technology are available in conjunction with the degree programs.

In addition to the majors and minor, several courses are offered to provide basic knowledge of computer technology and programming for students wishing to use the computer as a tool in other disciplines.

John D. Odegard School of Aerospace Sciences

B.S. IN COMPUTER SCIENCE

Required 125 credits (36 of which must be numbered 300 or above, and 60 of which must be from a 4-year institution) including:

I. Essential Studies Requirements (see University ES listing).

II. Requirements of the Odegard School of Aerospace Sciences. See College listing.

III. Courses from computer science as follows:

- CSci 160........Computer Science I.................................(4)
- CSci 161........Computer Science II................................(4)
- CSci 230........Systems Programming.............................(3)
- CSci 242........Algorithms and Data Structures..............(3)
- CSci 289........Social Implications of Computer Technology (3)
- CSci 363........User Interface Design...............................(3)
- CSci 365........Organization of Programming Languages(3)
- CSci 370........Computer Architecture............................(4)
- CSci 435........Formal Languages and Automata............(3)
- CSci 451........Operating Systems I.................................(3)
- CSci Electives* ..........................................................(12)

* All Computer Science electives must be at or above the 200 level. A combined total of at most 6 credits from Csci 260, 297, 397 or 494 may be applied toward these electives.

IV. Courses from other departments as follows:

- Comm 110...Fundamentals of Public Speaking..............(3)
- EE 201......Introduction to Digital Electronics............(2)
EE 202. Electrical Engineering Laboratory (1)
Math 208. Discrete Mathematics (3)
Math 165, 166. Calculus I and II (8)
Approved math elective (3)
Approved probability/statistics elective (3)
Approved 2-semester laboratory science sequence (8)
2 approved courses in science or quantitative methods (6-8)

College of Arts and Sciences

B.A. WITH MAJOR IN COMPUTER SCIENCE
Required 125 hours (36 of which must be numbered 300 or above, and 60 of which must be from a 4-year institution) including:

I. Essential Studies Requirements (see University ES listing).

II. College of Arts and Sciences Requirements. See College listing.

III. Courses from Computer Science as follows:
- CSci 160. Computer Science I (4)
- CSci 161. Computer Science II (4)
- CSci 230. Systems Programming (3)
- CSci 242. Algorithms and Data Structures (3)
- CSci 365. Organization of Programming Languages (3)
- CSci 370. Computer Architecture (4)
- CSci 435. Formal Languages and Automata (3)
- CSci 451. Operating Systems I (3)
- CSci 465. Principles of Translation (3)
- CSci Electives* (12)

*Electives may be selected from CSci 260 (at most 3 hours), CSci 289, CSci 297 or CSci 397 (at most 3 hours) and any other Computer Science courses numbered 300 or above.

IV. Courses from other departments as follows:
- Level II proficiency in a language other than English (Level IV recommended)
- Engl 209. Introduction to Linguistics (3)
- EE 201. Introduction to Digital Electronics (2)
- EE 202. Electrical Engineering Laboratory (1)
- Math 208. Discrete Mathematics (3)
- Phil 350. Symbolic Logic (3)
- Econ 210. Introduction to Business and Economic Statistics (3)

MINOR IN COMPUTER SCIENCE
Courses from Computer Science as follows:
- CSci 160. Computer Science I (4)
  or
- CSci 130. Introduction to Scientific Programming (4)
- CSci 161. Computer Science II (4)
- CSci Electives* (12)

*All 12 credits hours of Computer Science electives must be 200 level or above.

OPTIONAL SPECIALIZATIONS
A student’s coursework in either the B.S. program, the B.A. program, or the Minor program above may be designed to complete one or more of the following three specializations. Each specialization completed will be noted on the student’s academic record.

I. Network and Operating Systems Analysis
Coursework must include:
- CSci 327. Data Communications (3)
- CSci 370. Computer Architecture (4)
- CSci 389. Computer Security (3)
- CSci 451. Operating Systems I (3)
  and two courses from the following list:
- CSci 260. Advanced Programming Languages: PERL (3)
- CSci 427. Advanced Data Communications (3)
- CSci 452. Operating Systems II (3)
II. Software Engineering

Coursework must include:
CSci 230.....Systems Programming.........................(3)
CSci 242 .....Algorithms and Data Structures ..........(3)
CSci 363 .....User Interface Design .......................(3)
CSci 365 .....Organization of Programming Languages (3)
CSci 463 .....Software Engineering ........................(3)

and one course from the following list:
CSci 465 .....Principles of Translation ....................(3)
CSci 562 .....Formal Specification Methods .............(3)
CSci 565 .....Advanced Software Engineering ..........(3)

III. Information Technology

Coursework must include:
CSci 363 .....User Interface Design .......................(3)
CSci 389 .....Computer and Network Security ............(3)
CSci 455 .....Database Management Systems ............(3)
CSci 457 .....E-Commerce Systems ........................(3)

and two courses from the following list:
CSci 260 .....Advanced Programming Languages: PERL (3)
CSci 327 .....Data Communications ........................(3)
CSci 399 .....Handheld Computing ...........................(3)
CSci 513 .....Advanced Database Systems ...............(3)

A student’s coursework in the B.S. program may be designed to complete the following specialization. This specialization will be noted on the student’s academic record.

IV. Game Development and Computer Animation

Elective coursework must include:
CSci 384 .Artificial Intelligence .........................(3)
CSci 463 .Software Engineering ...........................(3)
CSci 446 .Computer Graphics I ............................(3)
CSci 448 .Computer Graphics II ...........................(3)
Art 110 .Introduction to the Visual Arts ...............(3)
Art 112 .Basic Design ......................................(3)

Approved 2-semester laboratory science sequence must include:
Phys 251 .University Physics I .............................(4)
Phys 252 .University Physics II ...........................(4)

Approved math elective must include:
Math 327 Linear Algebra ....................................(3)

Courses

101. Introduction to Computers.  3 credits. Recommended corequisite: CSci 101T. An overview of the fundamental concepts and applications of computer science. Topics include data storage, hardware, operating systems, and programming principles. F,S,SS

101T. Software Applications Tutorial. 1 credit. Recommended corequisite: CSci 101. An introductory tutorial course to complement CSci 101. Activities will include hands-on experience with operating systems and application software (including word processors, spreadsheets, and databases). S/U grading only. F,S,SS

120. Computer Programming I.  4 credits. An introduction to computer programming in a high-level language, with emphasis on problem solving and logical thinking. Students learn to design, implement, test, and debug programs for small-scale problems using elementary data types and control structures. Includes laboratory. F,S,SS

130. Introduction to Scientific Programming. 4 credits. An introduction to scientific computing, with problem solving, algorithm development, and structured programming in a high-level language with an engineering and mathematical focus. Emphasis on learning how to design, code, debug, and document programs, using techniques of good programming style. Includes laboratory. F,S,SS
150. Introduction to Computer Science. 3 credits. This is an introductory course for prospective computer science majors as well as offering an introduction to computing for non-computer science majors. Students will receive a broad introduction to the discipline of computer science without the immersion into a programming language. Students will learn to write interactive Web-based programs. No previous computing or programming experience is assumed. F,S

160. Computer Science I. 4 credits. An introduction to computer science, with problem solving, algorithm development, and structured programming in a high-level language. Emphasis on learning how to design, code, debug, and document programs, using techniques of good programming style. Includes laboratory. F,S,SS

161. Computer Science II. 4 credits. Prerequisites: CSci 130 or CSci 160 and either Math 103 or Math 107. Concurrent enrollment in Math 208 is recommended. A broadening of foundations for computer science with advanced concepts in computer programming. Includes an introduction to data structures, analysis of algorithms, and the theory of computation. Includes laboratory. F,S,SS

170. Computer Programming II. 4 credits. Prerequisite: CSci 120. Advanced techniques in computer programming using a high-level language. Topics include the use of recursion, pointers, and fundamental data structures in developing small to medium-scale programs. Includes laboratory. S

199. Topics in Computing. 1-3 credits, repeatable to 6 credits. Selected introductory-level topics in computing for students of all majors. Course may be repeated for different topics. On Demand.

230. Systems Programming. 3 credits. Prerequisites: CSci 130 or CSci 160. Focus on low level programming. Topics covered include pointers, memory management, code optimization, compiling and linking, and library management. F

242. Algorithms and Data Structures. 3 credits. Prerequisites: CSci 161 and Math 208. Object-oriented implementations of complex data structures including lists, sets, trees, and graphs. Time and space analysis and classification of algorithms using upper bounds (big Oh), lower bounds (big Omega), and exact bounds (big Theta). Techniques for analysis of recursive algorithms including use of the “Master Theorem” for divide-and-conquer recurrences. S

260. Advanced Programming Languages. 3 credits. Prerequisite: CSci 161 or consent of instructor. Programming in a specific high-level language for students who are already proficient at programming in another high-level language. Course may be repeated for different languages. A student may not receive credit for both CSci 260 and a 100-level programming course in the same language. F,S

289. Social Implications of Computer Technology. 3 credits. An introduction to the effects of computer technology on society and individuals and to ethical problems faced by computer professionals. Topics covered include privacy, the nature of work, centralization versus decentralization and the need for human factors analysis in the development of a new computer system. F

297. Experiential Learning. 1-3 credits, repeatable to 6. Prerequisite: CSci 161. A practical experience in which students offer their proficiency in computing as a resource or service for others. The experience may involve software development, software consulting and assistance, system administration, or instruction. S/U grading only. F,S, SS

299. Topics in Computer Science. 1-3 credits, repeatable to 6 credits. Prerequisite: Consent of Instructor. Selected intermediate-level topics in computer science for students with some experience or previous coursework in computing. Course may be repeated for different topics. On Demand.

327. Data Communications. 3 credits. Prerequisites: CSci 230 and Math 208. An introduction to the concepts of data transmission, communication hardware and protocols, communication software and the design, performance and management of computer networks. F

363. User Interface Design. 3 credits. Prerequisite: CSci 161. A study of the design and implementation of user interfaces for software applications. Students will apply principles of interface design to build applications using a toolkit of graphical interface components. Required coursework includes a team project. F

365. Organization of Programming Languages. 3 credits. Prerequisite: CSci 242. Compile and run time requirements of programming languages, parameter passing and value binding techniques. Vector and stack processing. S

370. Computer Architecture. 4 credits. Prerequisite: CSci 230, EE 201, 202. Computer structure, machine presentation of numbers and characters, instruction codes and assembly systems. Introduction to hardware methodologies and software extensions to hardware in computers. Some topics on hardware and software selection will be discussed. F

384. Artificial Intelligence. 3 credits. Prerequisite: CSci 242. A survey of the applications and techniques of artificial intelligence. Topics include problem solving paradigms, tree searching, rule-based systems, theorem proving, knowledge representation, natural language processing, image processing, and computer learning. F

389. Computer and Network Security. 3 credits. Prerequisite: CSci 161. This course introduces techniques for achieving security
in multi-user standalone computer systems and distributed computer systems. Coverage includes host-based security topics (cryptography, intrusion detection, secure operating systems), network-based security topics (authentication and identification schemes, denial-of-service attacks, worms, firewalls), risk assessment and security policies.

397. **Cooperative Education.** 1-3 credits repeatable to 6. Prerequisite: 15 completed credits in CSci including CSci 161, in addition to standard co-op requirements. A practical work experience with an employer closely associated with the student’s academic area. Arranged by mutual agreement among student, department, and employer. S-U grading only. F,S,SS

399. **Topics in Computer Science.** 1-3 credits, repeatable to 12. Prerequisite: Consent of instructor. Selected topics in Computer Science which allow students to study specialized subjects. F,S

427. **Advanced Data Communications.** 3 credits. Prerequisite: CSci 327. Analysis of existing and future data communications technologies and protocols, including the modeling of realistic networked environments and the analysis of their performance. S/2

435. **Formal Languages and Automata.** 3 credits. Prerequisite: CSci 242. A study of automata, grammars, and Turing machines as specifications for formal languages. Computation is defined in terms of deciding properties of formal languages, and the fundamental results of computability and decidability are derived. F

445. **Mathematical Modeling and Simulation.** 3 credits. Prerequisites: CSci 161 or 170, Math 166 and a statistics course. A study of various mathematical applications for digital computers, including the modeling, simulation and interpretation of the solution of complex systems. F/2

446. **Computer Graphics I.** 3 credits. Prerequisites: CSci 242, CSci 363, and Math 166. Introduction to computer graphics. Topics include display technology, light and color, 2D and 3D representations, image processing, ray-tracing, and computer animation. F/2

448. **Computer Graphics II.** 3 credits. Prerequisite: CSci 446. A continuation of CSci 446, topics covered include: history of games, game taxonomies, game design theory, computer game development, XNA and C#, physics engines and AI engines S/2

451. **Operating Systems I.** 3 credits. Prerequisite: CSci 242 and 370. Introduction to operating system theory and fundamentals. Topics include: multiprogramming, CPU scheduling, memory management methods, file systems, interprocess communication, and a survey of modern operating systems. S

452. **Operating Systems II.** 3 credits. Prerequisite: CSci 451. A study of the implementation of operating systems and parts of operating systems, and development of system software. S/2

455. **Database Management Systems.** 3 credits. Prerequisite: CSci 242. Database concepts, database administration, database design, and database performance, including the partial design of a DBMS application. S

457. **Electronic Commerce Systems.** 3 credits. Prerequisite: CSci 260 (.NET). A study of electronic commerce system architecture and electronic commerce content design and implementation. Topics include Internet basics, business issues, Web markup languages, static and dynamic Web programming, e-commerce content design and construction, and databases and host languages with embedded SQL such as JDBC. S/2

463. **Software Engineering.** 3 credits. Prerequisites: CSci 242 and CSci 363. This course teaches software engineering principles and techniques used in the specification, design, implementation, verification and maintenance of large-scale software systems. Major software development methodologies are reviewed. As development team members, students participate in a group project involving the production or revision of a complex software product. S

465. **Principles of Translation.** 3 credits. Prerequisite: CSci 365 and CSci 370. Techniques for automatic translation of high-level languages to executable code. F/2

491. **Seminars in Computer Science.** 1 credit. May be repeated (3 credits maximum). Prerequisite: consent of instructor. A course for advanced students. S-U grading only. F,S

494. **Special Projects in Computer Science.** 1-3 credits varying with the choice of project. May be repeated (6 credits maximum). Prerequisite: consent of instructor. A course for advanced students. F,S