

Computer Science

Department Goals

This is an exciting time to be involved in computer science and information technology. Recent developments coupled with the promise of future advances provide strong motivation for engaging the discipline at all levels.

The department fully embraces the College purpose of educating with Christ preeminent and bringing all things captive to Him. All disciplines of study are to be engaged including the study of computation in its many forms and computer science more specifically. Every effort is made to have the students in the program relate their computer science content to their Christian worldview.

To ensure a rigorous academic standard in computer science courses, the current joint curricular guidelines of the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronic Engineers (IEEE) are used in the development of those courses and their content. The current standard implemented is that approved in 2001. A new 2007 standard is under development.

The department goals include:

1. the offering of the major in Computer Science;
2. the offering of minors in Computer Science and Computer Information Systems;
3. the offering of department courses needed by other majors to enhance those programs;
4. the offering of a Unix based server for programs requiring this operating and computing environment. This server configuration is a dual AMD 64 bit dual core system supporting Sun Microsystem's Solaris (Unix) operating system with a substantial disk farm and memory. Majors have access to this server as well as a wealth of other computing tools and resources.

The programs offered provide a balanced consideration of theory and application within the computing sciences. Faculty are genuinely interested in working directly with students to facilitate timely progress in the development of knowledge and skills in the discipline. We invite all who have interest in computer science and related disciplines to inquire.

Requirements for Major in Computer Sciences

The core and distribution requirements for a major in computer science are those listed for baccalaureate degrees on page 24

Core requirements	58
Electives	24

Major Course Requirements

COS 130. Computer Programming Methodology	4
COS 150. Advanced Programming Methodology	4
COS 230. Data Structures and Algorithms	4
COS 250. Introduction to Computer Organization	4
COS 300. Database Systems	4
COS 325. Operating Systems and Network Programming	4
COS 350. Programming Languages	4
COS 375. Software Engineering	4
COS 425. Foundations of Computer Science 'W'	4
COS 492. Senior Integration Seminar and Paper 'S'	4
STA 275. Quantitative Methods for Computer Science	4
Total hours for the major	44
Total degree hours	126

Requirements for Minor in Computer Science

COS 130. Computer Programming Methodology	4
COS 150. Advanced Programming Methodology	4
COS 230. Data Structures and Algorithms	4
COS 300. Database Systems	4
COS 375. Software Engineering	4
Total hours for the minor	20

Requirements for Minor in Computer Information Systems

COS 130. Computer Programming Methodology	4
COS 240. Information Systems for Management	4
COS 300. Database Systems	4
STA 425. Data Mining	4
Total hours for the minor	16

Computer Sciences Courses

Computer Science Courses (COS-prefix)

125. Perspectives on Information Technology

An introductory survey of current information technologies and tools. Emphasis will be on fluency – the student's ability to not only know but also to apply these tools in actual application scenarios. Tools considered will include but will not be limited to tools in the MS Office suite. Students will also address the general content of information technology as well as examine approaches to Christian worldviews regarding technology and the computing sciences. Three hours.

130. Computer Programming Methodology

Designed for majors in computer science and minors in computer science and computer information systems. This course introduces the student to a general methodology for computer programming. Course content includes problem solving techniques, algorithm development, structured and object-oriented programming methodology, pseudo-code, data types, selection, iteration, and arrays. Elementary file structures are also examined. Prerequisite: MAT 141. Four hours.

131. Computing for Engineers

Foundations of computing with an introduction to design and analysis of algorithms and an introduction to design and construction of programs for engineering problem-solving. The MATLAB software will be used as the programming language of choice for pre-engineering students. Prerequisite: MAT 141. Four hours.

150. Advanced Programming Methodology

This course examines programming methods of greater sophistication. Topics include data abstraction, data structures, and simple recursion. Program design issues including commonality and variability analysis, coupling, and cohesion will be examined. Object oriented (OO) techniques such as data hiding and polymorphism will be emphasized. This course provides the necessary foundation for further study in computer science. Prerequisite: COS 130. Four hours.

230. Data Structures and Algorithms

This course provides an in-depth study of data structures and algorithms. Data structure topics include: stacks, lists, queues, trees, and graphs. Algorithms include: various sorts and searches, greed, divide and conquer, Dijkstra, etc. Programming techniques will include multi-way recursion. Big O notation for the analysis of techniques will be emphasized. Prerequisite: COS 150. Four Hours

240. Information Systems for Management

This course examines the role of information systems technology in today's business world. The course is designed for business majors and computer information systems minors interested in developing a basic understanding of the application of computer technology in the business environment. The course addresses the role of information in the business environment; the techniques of information problem identification and analysis; the tools and techniques of structured systems analysis; and overviews of software, hardware and telecommunications systems currently in use. Investigation, analysis, writing, and presentation skills will be developed. Four hours.

250. Introduction to Computer Organization

This course is an introduction to computer organization with an emphasis upon viewing the computer in a hierarchical

fashion, with virtual machines built on top of the features of lower level virtual machines. There will be an emphasis upon interactions among hardware, software, firmware, and operating systems. The basic organization of a computer; its central processing unit, memory, and input/output devices all tied together by a system bus, will be learned in theory, and that theory will be applied in practice to understanding the more important computer architectures of today. Students will also learn to program in C/C++, with those languages being used as a means of communicating many of the ideas in the course. Prerequisite: COS 230. Four hours.

300. Database Systems

A study of the nature and application of database processing. The physical representation of databases, the primary structured models used in organizing a database, commercially available database management systems, and the factors involved in implementing and using a database are covered. Students will design and work with a database using one of the database management systems on the Covenant College computing network. Prerequisite: COS 150. Four hours.

325. Operating Systems and Network Programming

This course will look at issues of concurrency including its two best known applications: operating systems and network programming. The course provides an introduction to operating systems, their function, development, structure, and implementation. A general model of operating systems functions and development will be studied. In addition, an introduction to data communication networks, including the Open Systems Interconnection (OSI) model will be provided. Hands on work will include the use of Interprocess Communication methods (IPC), process and thread creation and management, and Remote Procedure Call (RPC). Prerequisite: COS 250. Four hours.

350. Programming Languages

A survey of the significant features of existing and experimental programming languages with particular emphasis on grammars, syntax, semantics, notation, parsing, and storage arrangements. Selected examples of general purpose and special purpose languages are studied. Prerequisite: COS 250. Four hours.

375. Software Engineering

An overview of the tools, metric techniques, and team-oriented methodologies necessary to support the development of large systems and application software will be given. A group project consists of the study and implementation of a large software system of the type expected in industry. This type of project requires a high degree of interaction and communication among team members, as well as rigorous coding techniques. Prerequisite: COS 150. Four hours.

425. Foundations of Computer Science

Development of the theoretical foundations of programming: algorithms, languages, automata, computability, complexity, data structures; a broad range of fundamental topics are consolidated and extended in preparation for further study. The course includes an introduction to information theory: the understanding of the quantification of data, particularly in regards to its reliability. Implications of these theories will be developed in relation to such topics as artificial intelligence and linguistics. Prerequisite: COS 230. Four hours. 'W'

450. Special Topics

A course offered on a subject of particular interest but unlisted as a regular course offering. The course is open to appropriate students by class standing, background, or interest, depending on the topics. All offerings are at the discretion of the department. The department uses this course to provide majors and other departments and groups with topics of current interest which are timely in the student's development in computer science as well as other disciplines. Possible topics include artificial intelligence, the Internet, neural networks, parallel processing, expert systems, and computer graphics. Prerequisites and credit hours will vary.

492. Senior Integration Seminar and Paper

This course is divided into two parts. The first part is a two-hour seminar on computer science and a Christian worldview. In this part of the seminar the student examines major questions relative to Christianity and the computer science profession. The student writes a paper expressing his/her Christian view as it relates to computer science. The second part of the course is devoted to the study of one's responsibility as a member of the computer science profession. The participants will examine techniques in résumé preparation, interviewing, career goal setting and professional identification. Under normal circumstances, seniors participate in at least one computer industry related employment registry. Prerequisites: COS major and senior standing. Four hours. 'S'

Quantitative Methods Courses (STA-prefix)

STA 251. Elementary Statistical Methods

An introductory course in statistical science used in scientific research investigations. Topics considered include the nature and importance of statistics, quantification, measurement, probability, elementary research design, the collection and scoring of research results, measures of central tendency, the normal distribution, correlational analysis, statistical inference, analysis of variance and the analysis of categories and ranks. Computer applications will be stressed. Prerequisite: MAT 141 or "C" or better in a higher-level mathematics course or placement level three. Four hours.

STA 275. Quantitative Methods for Computer Science

This course examines the empirical analysis methods associated with computer science. Topics include sets, functions, algorithms, combinations, permutations, probability, and descriptive and inferential statistics. Students will also examine basic simulation methods including the bootstrap and jackknife. Prerequisite: MAT 141. Four hours.

STA 364. Special Topics in Advanced Statistical Methods

This course is designed to offer an advanced topic in applied statistical science. Three main topics are offered on a rotating basis: regression analysis, design of experiments and analysis of variance (ANOVA), and survey sampling. Other topics offered on a demand basis include but are not limited to factor analysis, statistical process control (SPC), statistical computing, spreadsheet use in statistical analysis, and multivariate analysis. Prerequisite: STA 251. Four hours.

STA 425. Data Mining

An examination of the empirical methods used to evaluate and extract information from very large corporate and research databases and data sets. Methods considered will include classification trees, predictive modeling, clustering techniques and anomaly detection. Students will gain experience in actual data mining using SAS Enterprise Miner and other data mining tools. Prerequisite: STA 251 or 275; or permission of instructor. Four hours.