## Admission to Computer Science Major

The student must have completed 30 credits and have the approval of the Dean of the College. In addition, the student must have completed:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>3450:208</td>
<td>Introduction to Discrete Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>3460:209</td>
<td>Computer Science I</td>
<td>4</td>
</tr>
<tr>
<td>3460:210</td>
<td>Computer Science II</td>
<td>4</td>
</tr>
<tr>
<td>3450:221</td>
<td>Analytic Geometry-Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

- Computer Science, Certificate ([link](https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/computer-science/computer-science-certificate/))
- Computer Science, Management, BSCS ([link](https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/computer-science/computer-science-management-bscs/))
- Computer Science, Minor ([link](https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/computer-science/computer-science-minor/))
- Computer Science, Systems, BSCS ([link](https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/computer-science/computer-science-systems-bscs/))

## Computer Science (3460)

### 3460:101 Essentials of Computer Science (3 Credits)

Explore major topics in Computer Science - computing systems, data representation, hardware, programming topics, and important applications such as networks, robotics, databases, and gaming.

### 3460:125 Descriptive Computer Science (2 Credits)

Computer literacy: terminology; methods, media for data representation, storage; elements of a computing system; data organization.

### 3460:126 Introduction to Visual Basic Programming (3 Credits)

Windows GUI and Microsoft's Visual BASIC programming environment. Design of user interfaces, event-driven programming, basic control structures, simple variables, arrays, and sequential files.

### 3460:200 Programming for Data Science (4 Credits)

Prerequisite: 3450:145 or 3450:149. Introductory programming for data-intensive applications including data collection, pre-processing/cleansing, analysis, and visualization, using libraries for processing of large data sets. Designed as a first programming course for non-majors in the sciences.

### 3460:209 Computer Science I (4 Credits)

Prerequisite: Completion of 3450:145 or 3450:149 with a grade of C- or better or equivalent. Introduction to problem-solving methods and algorithms. Programming in a high-level language including how to design, code, debug and document programs with good programming style.

### 3460:210 Computer Science II (4 Credits)

Prerequisites: 3460:209 and 3450:208 with a grade of C- or better. Dynamic memory allocation methods, elementary data structures, internal representations, and associated algorithms. Topics include lists, stacks, queues, trees, and sorting methods.

### 3460:289 Selected Topics in Computer Science (1-3 Credits)

Prerequisite: Permission. Selected topics of interest in computer science.

### 3460:306 Assembly and System Programming (4 Credits)

Prerequisite: Completion of 3460:210 or equivalent with a grade of C- or better. Basic computer organization, digital logic, and data representation. Programming in assembly and C languages on a typical digital computer.

### 3460:307 Internet Systems Programming (3 Credits)

Prerequisite: Completion of 3460:210 or equivalent with a grade of C- or better. Overview of current programming languages, tool and scripting technologies for the Internet and World Wide Web.

### 3460:316 Data Structures (3 Credits)

Prerequisites: 3460:210 and [3450:221 or 3450:210] with grades of C- or better. A continuation of topics in 3460:210. Topics include: graphs and graph algorithms, external sorting, hashing, advanced tree and file structures.

### 3460:389 Intermediate Topics in Computer Science (1-3 Credits)

Prerequisite: Permission of instructor. Selected topics of interest in computer science at an intermediate level.

### 3460:395 Internship in Computer Science (1-12 Credits)

Prerequisites: Completion of 3460:209 and 3460:210 with grades of C- or better, and permission of a faculty supervisor. Placement in industry for experience related to computer science. (May be repeated to a maximum of 12 credit hours. No more than three credits may be applied towards a computer science major.)

### 3460:406 Introduction to C & UNIX (3 Credits)

Prerequisite: Completion of 3460:208 or 3460:210 or 3460:406 with a grade of C- or better or permission. Introduction to a number of structures in algebra of particular interest. Programming in assembly and C languages on a typical digital computer.

### 3460:407 Operating Systems (3 Credits)

Prerequisites: Completion of 3460:307 and 3460:210 with grades of C- or better. An introduction to important concepts of modern operating systems: types; storage management; process and resource control; interacting process synchronization.

### 3460:408 Windows Programming (3 Credits)

Prerequisites: Completion of 3460:208 or 3460:210 or 3460:406 with a grade of C- or better or permission. Windows operating systems, integrated development environment, event-driven programming, graphical user interface design, object libraries, component object model, object linking, embedding, client-server objects.

### 3460:411 Human-Computer Interaction (3 Credits)

Prerequisite: 3460:316. This course introduces the basic concepts and technologies of Human-Computer Interaction (HCI). Students will learn how to design and implement systems for human to interact with computers. Topics include: Categories of HCI, CLI, GUI, NUI, Design, Implementation and Evaluation of HCI, HCI Devices, Virtual Device Drive, HCI Toolkits, HCI Standards, Categories of Interactive Tasks, EDP and Multi-Threading in HCI, VR/AR/MR/IXR in HCI, APP HCI, 3D Printing.

### 3460:418 Introduction to Discrete Structures (3 Credits)

Prerequisite: Completion of 3460:210 with a grade of C- or better or permission. Introduction to a number of structures in algebra of particular use to student in computer science. Topics include algorithms and flow chart language, graphs and digraphs, trees, lattices, codes.

### 3460:421 Object-Oriented Programming (3 Credits)

Prerequisite: Completion of 3460:210 with a grade of C- or better. Object-oriented design, analysis, and programming using different development models. Comparison with other programming paradigms.

### 3460:426 Operating Systems (3 Credits)

Prerequisites: Completion of 3460:316 and 4450:320 or equivalents with grades of C- or better. Introduction to aspects of all modern operating systems: types; storage management; process and resource control; interacting process synchronization.
3460:428 UNIX System Programming (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better and knowledge of C. An overview of the UNIX operating system. Shell programming. Process management, processor management, storage management, scheduling algorithms, resource protection, and system programming.

3460:430 Theory of Programming Languages (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better. Advanced concepts underlying programming languages and their applications, formal definitions of programming languages, Backus Normal Form, semantics. Alternative programming paradigms including functional programming.

3460:435 Algorithms (3 Credits)
Prerequisite: Completion of 3460:316 with a grade of C- or better. Design and analysis of efficient algorithms for random access machines; derivation of pattern classification algorithms.

3460:436 Applied Machine Learning (3 Credits)
Prerequisite: 3460:210 with a grade of C- or higher. Machine learning studies algorithms and models that enable computers to complete task without explicit instructions. These algorithms rely on rules, associations, and patterns presented in large data sets gathered or generated through self-learning. This course will introduce students the fundamentals of machine learning, and concepts of deep learning. Topics include machine learning concepts, tasks, and workflow; supervised learning methods for classification and prediction; unsupervised learning methods for pattern recognition; concepts of advanced supervised learning methods including deep learning algorithms such as neural networks and convolutional neural networks. The main focus of the course is the application of industry-leading machine learning algorithms and the enabling techniques that make the implementation of the algorithms practical.

3460:438 Interactive Game & Game Engine Design (3 Credits)
Prerequisite: 3460:316. This course will introduce the basic concepts and techniques of game and game engine design. Students will learn how to design and implement interactive computer games and game engines. Topics include: Interactive Animation, Game Engines, EDP in Game Development, Procedural Animation and Physics Engine, Decision Making and AI Games, Surface & Volume Representation, VR, AR, MR, APP Games, Game Engine Development, and Voxel-Engine.

3460:440 Compiler Design (3 Credits)
Prerequisites: Completion of 3460:210 and (4450:320 or 3460:306), with a grade of C- or better. Techniques used in constructing compilers, including lexical and syntactic analysis, parsing techniques, object code generation and optimization. Course requires a compiler implementation project.

3460:445 Introduction to Bioinformatics (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better or permission. Introduce major themes in bioinformatics. Topics include concepts of molecular genetics, biological databases, database searching, sequence alignments, phylogenetic trees, structure prediction, and microarray data analysis.

3460:453 Computer Security (3 Credits)
Prerequisites: Completion of 3460:210 with a grade of C- or better. Principles of computer security -- cryptography, authentications, secure network protocols, intrusion detection and countermeasures.

3460:455 Data Communication & Computer Networks (3 Credits)
Prerequisites: Completion of 3460:210 with a grade of C- or better. ISO-OSI, TCP/IP, SNA data switching, protocols, flow and error control, routing, topology, Network trends, network taxonomies, and socket-based programming.

3460:457 Computer Graphics (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better. Topics in vector and raster graphics, interactive graphics languages, scan conversion, clipping, geometric transformation, projection, shading, animation and virtual reality.

3460:460 Artificial Intelligence & Heuristic Programming (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better. Study of various programs which have displayed some intelligent behavior. Exploration of level at which computers can display intelligence.

3460:463 Pervasive Computing (3 Credits)
Prerequisites: Completion of 3460:210 with a grade of C- or better. Computing from a wireless perspective. Topics include protocols, algorithms, security and sensor networks.

3460:465 Computer Architecture (3 Credits)
Prerequisite: Completion of 3460:210 and (4450:320 or 3460:306), with a grade of C- or better. An introduction to the hardware organization of the computer at the register, processor and systems level. In-depth study of the architecture of a particular computer system family.

3460:468 Mobile Robotics (3 Credits)
Prerequisites: Completion of 3460:210 with a grade of C- or better. Introduction to history, hardware and software components, and design of autonomous mobile robots. Multiple projects involving both physical robots and software emulation.

3460:475 Database Management (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better. Fundamentals of database organization, data manipulations and representation, data integrity, privacy.

3460:476 Introduction to NoSQL Data Management (3 Credits)
Prerequisite: 3460:210. The widespread emergence of big data storage needs has driven the development and adoption of a new class of non-relational databases commonly referred to as NoSQL databases. This course will explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems. Core concepts of NoSQL databases will be presented, followed by an exploration of how different database technologies implement these core concepts. We will take a closer look at 1-2 databases from each of the four main NoSQL data models (key-value, column family, document, and graph), highlighting the business needs that drive the development and use of each database. Finally, we will present criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

3460:477 Introduction to Parallel Processing (3 Credits)
Prerequisites: Completion of 3460:316 with a grade of C- or better and knowledge of C. Commercial processors: past and present. Parallel languages, models of parallel computation, parallel algorithm design and performance evaluation. Parallel paradigms with relation to real world applications.

3460:480 Software Engineering (3 Credits)
Prerequisite: Completion of 3460:210 with a grade of C- or better. Introduction to formal software specification and validation. Introduction of methodologies and tools of design, development and validation, and maintenance.
3460:489 Topics in Computer Science (1-3 Credits)
Prerequisite: Permission of instructor. Selected topics in computer science at an advanced level.

3460:490 Senior Seminar in Computer Science (3 Credits)
Prerequisites: Must have completed at least 30 hours of 3460 (computer science) courses. Corequisites: 3460:435 and [3460:426 or 4450:325]. Professional software development, surviving 'Mission Impossible' projects, computer ethics, intellectual property rights (patents and copyrights), and other current topics.

3460:497 Individual Study in Computer Science (1-3 Credits)
(May be repeated. Can apply to degree, minor or certificate only with department approval.) Prerequisite: Permission. Directed studies designed as introduction to research problems under guidance of designated faculty member.

3460:498 Senior Honors Project: Computer Science (1-3 Credits)
Prerequisites: 3460:497 and Senior student in Honors Program. Directed study for senior student in the Honors Program who has completed 3460:497. An introduction to research problems in the computer science under the guidance of selected faculty.