

# Computer Science Curriculum and Licensure Guidelines

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## Introduction

Ohio [House Bill 170](#), effective in March 2018, made five significant changes to the Ohio prescribed curriculum. The law:

1. Requires the Ohio Department of Education to create computer science standards and model curriculum for grades K-12 ([ORC 3301.079 \(A\)\(4\)](#)).
2. Provides a state definition for computer science that includes, “logical reasoning, computing systems, networks and the internet, data and analysis, algorithms and programming, impacts of computing and structured problem-solving skills applicable in many contexts from science and engineering to the humanities and business.” ([ORC 3301.012](#))
3. Permits credit in *advanced computer science* to satisfy the Algebra 2/Math 3 or its equivalent mathematics curriculum requirement for high school graduation ([ORC 3313.603 \(C\)\(3\)](#)).
4. Permits credit in *advanced computer science* to satisfy an advanced science (excluding biology or life science) curriculum requirement for high school graduation ([ORC 3313.603 \(C\)\(5\)](#)).
5. Stipulates the requirements for licensure for educators who teach computer science courses ([ORC 3319.236](#)).

Development of the [Ohio Learning Standards and Model Curriculum](#) for Computer Science is complete. The State Board of Education adopted the standards and model curriculum in December 2018 for implementation in the 2019-2020 (FY2020) school year.

The Ohio Learning Standards for Computer Science define what students should know and be able to do, and the Model Curriculum provides clarity to the standards as well as information to help educators plan and implement their local curricula.

The law does not mandate that districts include these standards in any school offering or provide a curriculum that addresses these standards ([ORC 3301.079 \(A\)\(4\)](#)).

## Choosing EMIS Subject Codes

Some computer science course titles and descriptions have been revised to better address district needs. The next EMIS Manual revision will reflect these changes. Districts should select course subject codes based on these new course titles and descriptions.

Districts may use names for courses that are different from the course names shown in EMIS. When recording courses in EMIS, districts must select the subject codes of the courses that match the content of their own courses. Brief descriptions of each course, below, will help districts determine the best matches for the courses they offer.

### K-8 COMPUTER SCIENCE COURSES

The following courses do not earn high school computer science credit. The K-8 content addresses Ohio's Learning Standards for Computer Science instruction and is most effective when integrated with curriculum components from other academic content areas.

#### **Computer Science K-3**

Includes content in the grade K-3 portion of Ohio's Learning Standards for Computer Science.

#### **Computer Science 4-6**

Includes content in the grade 4-6 portion of Ohio's Learning Standards for Computer Science.

#### **Computer Science 7-8**

Includes content in the grade 7-8 portion of Ohio's Learning Standards for Computer Science.

#### **Robotics K-8**

Students engage in a design process to manage and control devices through investigative and exploration activities. Products of student work in robotics may be descriptive and/or functional models of technology applications. Students will apply the knowledge and skills necessary to program and operate robots. The students will learn robotic operations and system configurations. Students will code and debug programs using the robotic programming language. This course can also serve as a computer science course.

### HIGH SCHOOL COMPUTER SCIENCE COURSES

#### **Computer Science (Previously Computer Science Principles)**

In this course, students develop an understanding of how computing is used to solve problems and enable innovation across fields and how these solutions can impact society. Students explore using computational thinking skills and tools to solve problems and create artifacts. Effective communication and collaboration skills are developed as students work individually and in group explorations.

#### **Computer Science Principles with In-Depth Study (Previously Computer Science A)**

This course addresses computer science topics that include problem solving strategies, organization of data, algorithmic thinking and programming, analysis of potential solutions and the impacts of computing. The course provides the opportunity for a more in-depth study of selected computer science content.

#### **Specific Topics in Computer Science (Previously Computer Science AB)**

This course provides a focused examination of specific computer science topics (e.g., cybersecurity, robotics, data science).

## **Networking**

In this course, students understand the concepts and use of network servers and devices (e.g., host, firewall, router, switch). Students understand the advantages and disadvantages of network models (e.g., peer-peer, client-server). Content addresses network design fundamentals including network type (e.g., LAN, WAN, MAN). Students also learn the application of network topologies (e.g., Star, bus, hybrid). At an *advanced* level, students design and build simple networks, understand server virtualization and network security.

## **Computer Service**

This course includes configuration, troubleshooting and repair of network hardware, clients and peripherals. In addition, content should include installation of operating systems including updates, computer security and customer service.

## **Other Computer Science**

A high school level course that addresses content from the 9-12 section of Ohio's Learning Standards for Computer Science and is different in scope from any of the other Subject Codes described above.

## **Computer Science Programming**

This course includes the study and use of programming languages (e.g., C++, C#, Java, Python).

## **Website Development**

This course includes planning, designing and coding webpages to create dynamic, usable websites. Content includes web programming using common design tools, (e.g., HTML, XML, CSS, web-based editors). Students study and use web-based protocols, e.g., SFTP, TCP/IP, HTTP, HTTPS. In addition, content includes using tag elements, working with graphics, hypertext links, graphical tables and accessibility methods including Universal Design.

## **Advanced Website Development**

Course should include advanced Web programming and applications, Universal Design and other accessibility methods.

FY2020 will be the last year for this subject code; it will be deleted prior to FY2021. In its place, schools will use subject code 290160 (Website Development) recorded as *advanced* in the EMIS Course Level Element field (CN080).

## **Robotics**

Application of processes and knowledge in the design, development, and use of systems to manage and control devices. Products of student work in robotics may be descriptive and/or functional models of technology applications across all systems areas.

## **Industrial Computer Applications**

Experiences with computer applications across the technological systems areas. Selected activities covering computer hardware, software, and interface device applications to develop understanding of industrial uses of computers.

## Using EMIS Course Level Element Field

EMIS allows districts to designate up to seven levels for each course. These are levels I-V, Advanced and Intervention. The levels allow districts to use the same subject codes for different course offerings. For example, a district can identify a single computer science course as an intervention, introductory or advanced course. You can find more information on the EMIS Course Level Element field in Course Master Record section [EMIS Manual section 4.2](#).

To be considered an advanced level, a computer science course must:

- Include Ohio's 9-12 *advanced level* standards; and
- Be recorded as *advanced* in the EMIS Course Level Element field (CN080).

## Using a Computer Science Course to Satisfy Ohio Graduation Requirements

[State law](#) permits schools to allow a student to use a computer science course to satisfy credit for mathematics, advanced mathematics or advanced science courses. Courses in computer science provide an alternative way for students to demonstrate what they know and can do. This option also will support students who plan to enter specialized careers that draw on knowledge and skills learned in computer science courses.

Districts can record credits for computer science using the appropriate computer science subject codes in EMIS. Each district is responsible for tracking how students fulfill graduation requirements. Ohio encourages districts to have a system in place for recording transcribed credit(s) in computer science whenever they apply it toward the fulfillment of credit(s) for graduation.

### APPLYING CREDIT IN COMPUTER SCIENCE TO SATISFY A MATHEMATICS CREDIT

Districts may use credit in a computer science course to satisfy a student's mathematics credit. For them to do so, the course must address high school mathematics standards and focus on the study of, or usage of, algorithms for problem solving. A course that focuses only on learning a computer language without application and analysis does not qualify for mathematics credit. The district chooses the content and standards associated with each course and determines whether each course complies with these guidelines. Find additional guidance on the requirements for mathematics courses beyond Geometry/Math 2 in the [Requirements for Mathematics Courses Beyond Geometry/Mathematics 2](#) document.

NOTE: A student may satisfy only two of the four required mathematics graduation credits with credit in computer science.

### APPLYING CREDIT FROM AN ADVANCED COMPUTER SCIENCE COURSE TO SATISFY CREDIT FOR ALGEBRA 2/MATH 3 OR EQUIVALENT

Starting in spring 2018, a student may choose to apply one credit of *advanced computer science* to satisfy one unit of Algebra 2/Math 3 or equivalent. Only credit in an *advanced computer science* course can be used to satisfy the Algebra 2/Math 3 or equivalent graduation requirement in mathematics. An *advanced computer science course* must address standards in the grades 9-12 *advanced section* of Ohio's Learning Standards for Computer Science and must be recorded as *advanced* in the EMIS Course Level Element field (CN080).

NOTE: A single credit in *advanced computer science* may only be used to satisfy one Algebra 2/Math 3 or equivalent, **or** an advanced science (excluding Biology or Life Sciences) credit.

NOTE: When students choose to take advanced computer science in lieu of Algebra 2/Math 3 or equivalent, the school must communicate that some institutions of higher education may require Algebra 2/Math 3 or equivalent for the purpose of college admission. Also, the parent, guardian, or legal custodian of each student who chooses to take advanced computer science in lieu of Algebra 2/Math 3 or equivalent must sign and submit to the school a document containing a statement acknowledging that not taking Algebra 2/Math 3 or equivalent may negatively affect college admission decisions ([ORC 3313.603 \(C\)\(3\)](#)).

The Department will provide an Advanced Computer Science Checklist template for districts to document how they have notified parents, guardians or legal custodians of any adverse effects their students could experience on college admissions, or entry into a program of study, when they use advanced computer science to satisfy Algebra 2/Math 3 or the equivalent.

NOTE: Ohio high school graduates who choose to participate in intercollegiate athletics should refer to the [NCAA rules](#) for details on how using credit in *advanced computer science* to satisfy Algebra 2/Math 3 may affect their eligibility.

### **APPLYING CREDIT FROM AN ADVANCED COMPUTER SCIENCE COURSE TO SATISFY CREDIT FOR AN ADVANCED SCIENCE COURSE**

Starting in spring 2018, a student can choose to apply one credit in *advanced computer science* to satisfy one unit of advanced science (excluding Biology or Life Sciences). An advanced science course builds on the content in Physical Science and Biology in Ohio's Learning Standards for Science. Physical Science and Biology are foundational courses for high school science. Computer science may not replace these courses.

NOTE: The requirement to earn a physical science credit and a life science credit must be met by science courses. A school cannot use computer science courses to satisfy either of these requirements for a student. A school can use an advanced computer science course only to satisfy the requirement that a student earn a third science credit in an advanced science course.

NOTE: A single credit in *advanced computer science* may only be used to satisfy a credit in an advanced science course (excluding Biology or Life Sciences) *or* Algebra 2/Math 3.

NOTE: Only a computer science course addressing *standards in the grades 9-12 advanced section of Ohio's Learning Standards for Computer Science* and recorded as *advanced* in the EMIS Course Level Element field (CN080) *can* satisfy the required credit of an advanced science course.

## Qualifications to Teach Computer Science

Teachers can qualify to teach computer science in several ways ([ORC 3319.236](#)).

The **three most common pathways** are to:

- Hold a full teaching license in computer science;
- Hold a computer technology endorsement and have successfully passed the [computer science Ohio Assessments for Educators \(OAE\) exam](#) (currently OAE #010); or
- Hold a full teaching license in any area and add computer science through a [supplemental pathway](#) ([OAC 3301-24-14](#)) that includes passing the [computer science OAE exam](#).

**Alternative Pathway** - Under the [alternative pathway](#) (which would be considered full licensure), an individual must hold a 2.5 undergraduate GPA, complete an Intensive Pedagogical Training Institute (IPTI) or an approved training institute, and receive a passing score the OAE exam.

There are two additional licenses available to individuals who do not hold a professional or alternative license.

The 12-hour Teaching Permit allows an individual to teach up to 12 hours a week. Applicants must hold at least a baccalaureate, master's or doctoral degree, or show evidence of significant experience, verified by the employing district, in the subject to be taught.

The 40-hour STEM School Teaching Permit allows an individual to teach up to 40 hours a week at a STEM designated school. Applicants must hold at least a baccalaureate, master's or doctoral degree, or show evidence of significant experience, verified by the employing district, in the subject to be taught.

**Teaching Advanced Placement (AP) Computer Science Courses** - To teach an AP computer science course, in addition to holding a proper license, an individual must complete a professional development program endorsed or provided by the organization that creates and administers national advanced placement examinations. For this purpose, the individual may complete the program at any point during the calendar year.