

Computer Science, Grade 12, University Preparation

Course Title: Computer Science

Course Code: ICS4U

Grade: 12

Course Type: University Preparation

Credit Value: 1.0

Prerequisites: ICS3U

Curriculum Document: [Computer Studies, The Ontario Curriculum, Grades 10 to 12, 2008 \(Revised\)](#)

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Teacher(s):

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Course Description:

This course enables students to further develop knowledge and skills in computer science. Students will use modular design principles to create complex and fully documented programs, according to industry standards. Student teams will manage a large software development project, from planning through to project review. Students will also analyse algorithms for effectiveness. They will investigate ethical issues in computing and further explore environmental issues, emerging technologies, areas of research in computer science, and careers in the field.

Unit Title and Description	Time Allocated
Java Review In this unit students will set up the Eclipse Integrated Development Environment, review basic programming theories and Java programming concepts covered in ICS3U. Students will also study environmental stewardship and ethical issues related to computers and technology.	8 Hours
One-Dimensional Arrays	10 Hours

<p>In this unit students will study and implement programming concepts pertaining to one-dimensional arrays. Students will also compare the different careers and fields related to Computer Science.</p>	
<p>Sorting</p> <p>In this unit students will study and implement sorting algorithms such as Bubble Sort and Selection Sort. Students will also investigate several emerging technologies and their expected impact on society such as Energy Harvesting, Vehicular Communication, and Machine Learning.</p>	12 Hours
<p>Object-Oriented Programming</p> <p>In this unit students will study and implement programming theories related to Object Oriented Programming such as Polymorphism, Method Overloading and Overriding, Superclasses and Subclasses, Abstract Classes, Stacks and Queues. Students will also begin to investigate concepts pertaining to software development such as the Software Development Life-Cycle and Software Development Models.</p>	14 Hours
<p>Two-Dimensional Arrays</p> <p>In this unit students will expand their knowledge of one-dimensional arrays to two-dimensional arrays. Students will also study and practice the first stage of Software Development: Requirements Analysis.</p>	14 Hours
<p>Graphical User Interface</p> <p>In this unit students will expand their knowledge of one-dimensional arrays to two-dimensional arrays. Students will also study and practice the first stage of Software Development: Requirements Analysis.</p>	15 Hours
<p>Dynamic Lists</p> <p>In this unit students will learn about basic Graph Theory and Linked Lists, they will expand these concepts to implement an arbitrarily sized list in Java using the ArrayList class. Students will also study and practice the third stage of Software Development: Implementation & Testing.</p>	12 Hours
<p>Advanced Topics</p> <p>In this unit students will study and implement advanced topics such as Recursion, Binary Search, and Algorithm Complexity Analysis. Students will also study and practice the last stage of Software Development: Deployment and Maintenance.</p>	14 hours
<p>Final Assessment</p>	11 Hours

This course includes a final project worth 15% of the final grade. Working independently, students will create a robust Java program by following the Software Development Life-Cycle. Students will also complete a 3 hour proctored exam worth 15% of the final grade.

Overall Curriculum Expectations

Programming Concepts and Skills

1. Demonstrate the ability to use different data types, including one-dimensional arrays, in computer programs;
2. Demonstrate the ability to use control structures and simple algorithms in computer programs;
3. Demonstrate the ability to use the subprograms within computer programs;
4. Use proper code maintenance techniques and conventions when creating computer programs

Software Development

1. Demonstrate the ability to manage the software development process effectively, through all of its stages – planning, development, production, and closing;
2. Apply standard project management techniques in the context of a student-managed team project

Designing Modular Programs

1. Demonstrate the ability to apply modular design concepts in computer programs;
2. Analyse algorithms for their effectiveness in solving a problem

Topics in Computer Science

1. Assess strategies and initiatives that promote environmental stewardship with respect to the use of computers and related technologies;
2. Analyse ethical issues and propose strategies to encourage ethical practices related to the use of computers;
3. Analyse the impact of emerging computer technologies on society and the economy;
4. Research and report on different areas of research in computer science, and careers related to computer science

Resources Required:

This course is entirely online and does not require nor rely on any textbook. The following software is required and is currently not supported on mobile devices like tablets and Chromebooks.

- Java Development Kit (JDK) from Oracle® (A link to download this software for free is provided in the course)
- Eclipse® IDE (A link to download this free software for Mac® or Windows® is provided in the course)

Teaching and Learning Strategies:

The aim of this course is to introduce students to computer programming. In order to achieve this goal, a wide variety of instructional strategies are used to provide learning opportunities to accommodate a variety of learning styles, interests, and ability levels. The following are used throughout the course as strategies for teaching and learning the concepts presented:

- *Communicating:* Through the use of discussions, this course offers students the opportunity to share their understanding both in oral as well as written form.
- *Problem Solving:* This course scaffolds learning by providing students with the basic knowledge needed to understand computer science and building off of this knowledge as they progress through the course. The course guides students toward recognizing opportunities to apply knowledge they have gained to solve problems.
- *Connecting:* This course connects the concepts taught to real-world applications (e.g. students will write programs that can read and write files).
- *Representing:* Through the use of examples, practice problems, and sample code, the course models various coding practices, poses questions that require students to use different representations as they are working at each level of conceptual development - concrete, visual or symbolic, and allows individual students the time they need to solidify their understanding at each conceptual stage.
- *Guided Exploration:* The course and teacher guide students through the exploration of a variety of coding practices and procedures necessary to be successful in computer science.

Assessment and Evaluation Strategies

Every student attending Christian Virtual School is unique. We believe each student must have the opportunities to achieve success according to their own interests, abilities, and goals. Like the Ministry of Education, we have defined high expectations and standards for graduation, while introducing a range of options that allow students to learn in ways that suit them best and enable them to earn their diplomas. Christian Virtual School's Assessment, Evaluation, and Reporting Policy is based on seven fundamental principles, as

outlined in the [Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools](#) document.

When these seven principles are fully understood and observed by all teachers, they guide the collection of meaningful information that helps inform instructional decisions, promote student engagement, and improve student learning. At Christian Virtual School, teachers use practices and procedures that:

- are fair, transparent, and equitable for all students;
- support all students, including those with special education needs, those who are learning English, and those who are First Nation, Métis, or Inuit;
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents or guardians at the beginning of the school year or course and at other appropriate points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement; and
- develop students' self-assessment skills to enable them to access their own learning, set specific goals, and plan next steps for their learning.

For more information on Christian Virtual School's assessment and evaluation strategies, you can refer to our [Assessment, Evaluation, and Reporting Policy](#).

First and foremost, they are designed as opportunities for students to improve their learning. Assessment for the purpose of improving student learning is seen as both “assessment for learning” and “assessment as learning,” according to *Growing Success*. As part of assessment for learning, teachers provide students with descriptive feedback and coaching for improvement. Teachers engage in assessment as learning by helping all students develop their capacity to be independent, autonomous learners who can set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning. Examples of these types of assessments in this course include:

Assessment for Learning	Assessment as Learning
Class discussion activities	Self-directed exercises
Practice activities	

Second, we focus on a balance between assessing students' acquisition of knowledge as well as their skills of thinking, communication, and application of subject-specific material. In this course, you can expect assessment to be divided into the following balance:

Percentage	Skill
20	Knowledge and Understanding: Subject-specific content acquired and the comprehension of its meaning and significance
30	Thinking/Inquiry: The use of critical and creative thinking skills and/or processes
30	Communication: The conveying of meaning through various forms
20	Application: The use of knowledge and skills to make connections within and between various contexts

Lastly, the assessments are designed so that teachers have an opportunity to gain an understanding of a student's learning through direct observation of students, one-on-one conversations with students, and evaluating products that students submit. Examples of these methods in this course include:

Observation	Conversation	Product
Peer-to-peer discussion activities	Interaction through emails	Unit tests
Practice assignments	Teacher-student discussions	

Program Planning Considerations

Each of our courses have been designed by a team of educators to create an environment infused with creativity, flexibility, choice, and variety, with the goal to help every student succeed. We also take into consideration several topics that span disciplines and ensure we incorporate these into each of our courses.

Program Planning Considerations

Students with Special Needs

Christian Virtual School is committed to ensuring that all students are provided with the learning opportunities and supports they require to succeed. Our courses are made to offer flexible, personalized learning experiences. By maintaining an asynchronous model, students can move through their courses at their own pace, ensuring they are able to take the time they need to understand concepts or work with their teacher if they hit roadblocks. Christian Virtual School courses also incorporate choice, allowing students to submit work in a variety of mediums or formats to communicate their ideas.

In addition to the flexibility built into the courses, Christian Virtual School will implement the accommodations that are listed in a student's Individual Education Plan (IEP) that are applicable to the online learning environment. In these cases, the learning expectations will be the same as or similar to the expectations outlined in the curriculum document but supports will be provided to

help students achieve those expectations. Common accommodations in the environment are reducing the workload, simplifying tasks and materials, providing extra time for tests and exams, allowing scribing or the use of specialized equipment, and not deducting marks for spelling.

English Language Learners

Although all our courses are only offered in English at this time, Christian Virtual School welcomes students learning the English language. Students do need to meet a baseline proficiency level to access the content, but Christian Virtual School teachers are responsible for helping students develop their English literacy skills no matter the course they are enrolled in.

Upon enrollment, students are asked if they would like to provide information about their English language background, and this information is used by our teachers to help them adjust their instruction and suggest accommodations within the courses. English language learners are encouraged to reach out to their teacher or the Christian Virtual School administration to talk about the accommodation options in their courses so that the appropriate opportunities are given to everyone.

Environmental Education

Christian Virtual School operates with 5 core values: responsibility, perseverance, integrity, compassion, and community. These core values determine our business operations, as well as exemplify what we, as educators, want to instill in our students. Environmental education, among other causes, are important to us as a school and we strive to promote learning about these issues and solutions within our courses. We work to educate students on the environment, its threats, and the importance of sustainability. We also work to inspire students to make an impact within their community and identify an alignment between their passions and the local, or global, needs.

Environmental education is woven throughout our course content, across all disciplines. Depending on the course and subject matter, this education can be subtle or explicit, but the goal is to ensure that students have the opportunity to acquire the knowledge, skills, perspective and practices needed to become an environmentally literate citizen.

Equity and Inclusive Education

Christian Virtual School stands on the belief that every person is unique and, regardless of ancestry, culture, ethnicity, sex, physical or intellectual ability, race, religion, sexual orientation, socio-economic status, or other similar factor, they are to be welcomed, included, accepted, treated fairly, and respected. As a school, we teach students about multiple worldviews, how to identify and acknowledge similarities and differences, and how to communicate with others in an inclusive, kind, loving, and compassionate way.

Diversity is valued at Christian Virtual School, and it is our goal to ensure all members of the community feel safe, comfortable, and accepted. Our courses are written to draw attention to the contributions of men and woman alike, the different perspectives of various cultural, religious, and racial communities, and the beliefs and practices of First Nations, Métis, and Inuit peoples, to

showcase a wide range of backgrounds and allow all of our students to see themselves reflected in the curriculum.

As a school, we see and recognize the diversity of families, children, and people in the world in need of Christ's love. We work every day to spread the love and acceptance of Christ.

Financial Literacy Education

Whenever possible, Christian Virtual School emphasizes the importance of financial literacy. Making financial decisions has become an increasingly complex task, and students need to have knowledge in many areas and a wide range of skills in order to make informed decisions about financial matters. In addition to the concrete skills of numeracy and finances from a mathematical point of view, students need to develop an understanding of the economic forces and ways in which they can respond to those influences.

Lessons that promote skill building in problem solving, inquiry, research, decision making, reflection, and critical thinking are present throughout Christian Virtual School courses. The goal is to help students acquire the knowledge and skills required to understand their own finances, as well as to develop an understanding of local and global effects of world economic forces and the social, environmental, and ethical implications of their own choices.

The Role of Information and Communication Technology

Technology is rapidly changing, and the requirements for literacy in technology is growing just as quickly. Students entering the workforce are expected to have a firm grasp of information and communication technologies and be skilled their use.

Due to the nature of Christian Virtual School courses, students are exposed to a wide range of technologies to both facilitate and communicate their learning. As a result, students will develop transferable skills through their experience with word processing, information processing, internet research, presentation software, communication tools, and more.

Career Education

Opportunities are present throughout Christian Virtual School courses to explore careers related to the different disciplines and subject areas. Students are exposed to a wide variety of modern careers, fields of study, and employment opportunities.

In addition, teachers are available to help the student prepare for employment in a number of diverse areas. With the help of teachers, students will learn to set and achieve goals and gain experience in making meaningful decisions concerning career choices. The skills, knowledge, and creativity that students acquire through our course are essential for a wide range of careers.

Health and Safety

In order to provide a suitable learning environment for the Christian Virtual School staff and students, it is critical that the courses and the learning environment complies with relevant federal, provincial, and municipal health and safety legislation and by-laws, including, but not limited to, the Workplace Safety and Insurance Act, the Workplace Hazardous Materials Information System (WHMIS), the Food and Drug Act, the Health Protection and Promotion Act, the Ontario Building Code, and the Occupational Health and Safety Act (OHSA).

Consideration of students' health and safety is taken when planning activities, investigations, and experiments for our courses to ensure that proper safety precautions are communicated to and attainable for students.