Ontario eSecondary School
Course Outline
2024-2025

Ministry of Education Course Title: Computer Science
Ministry Course Code: ICS4U
Course Type: University
Grade: 12
Credit Value: 1.0
Prerequisite(s): ICS3U: Introduction to Computer Science
Department: Computer Studies

Course developed by: Brad Strassburger	**Date: December 1st, 2024**
Length: One Semester	**Hours:** 110

This course has been developed based on the following Ministry documents:
1. *Technological Education (2009)*
2. *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)*
3. *Learning for All (2013)*

COURSE DESCRIPTION/RATIONALE

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 analyze 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.

OVERALL CURRICULUM EXPECTATIONS

A. Programming Concepts and Skills
By the end of this course, students will:

- A1. demonstrate the ability to use different data types and expressions when creating computer programs;
- A2. describe and use modular programming concepts and principles in the creation of computer programs;
- A3. design and write algorithms and subprograms to solve a variety of problems;
- A4. use proper code maintenance techniques when creating computer programs.

B. Software Development
By the end of this course, students will:
- B1. demonstrate the ability to manage the software development process effectively, through all of its stages – planning, development, production, and closing;
- B2. apply standard project management techniques in the context of a student-managed team project.

C. Designing Modular Programs
By the end of this course, students will:
- C1. demonstrate the ability to apply modular design concepts in computer programs;
- C2. analyse algorithms for their effectiveness in solving a problem.

D. Topics in Computer Science
By the end of this course, students will:
- D1. assess strategies and initiatives that promote environmental stewardship with respect to the use of computers and related technologies;
- D2. analyse ethical issues and propose strategies to encourage ethical practices related to the use of computers;
- D3. analyse the impact of emerging computer technologies on society and the economy;
- D4. research and report on different areas of research in computer science, and careers related to computer science.

COURSE CONTENT

Unit	Length
Unit 0: Welcome and Intro	1 hours
Unit 1: Topics in Computer Science	10 hours
Unit 2: Programming Basics	10 hours
Unit 3: Basics of Object Oriented Programming	10 hours
Unit 4: Advanced Object Oriented Programming	20 hours
Unit 5: GUI's	15 hours
Unit 6: Data	15 hours
Unit 7: Games	15 hours
Unit 8: Culminating and Exam	15 hours
Total	**110 Hours**

UNIT DESCRIPTIONS

Unit 0 - Welcome and Introduction
Students will learn about what the course is about, what they can expect from each unit, and an overview of the major assignments in the course.

Unit 1 - Topics in Computer Science
In this unit you will learn about a number of topics in computer science. You will start by learning about computer security and ethical issues, as well as environmental impacts. From here you will look at options in post-secondary education and have the opportunity to research emerging technologies. Throughout this unit you will have questions to work on and a quiz that acts as checkpoints for your learning, followed by a major report and meeting with your teacher.

Unit 2 - Java Programming Basics
In this unit you will review the basic programming concepts covered in the grade 11 course, but will introduce you to the use of java. You will look at input, output, variables, a variety of math functions, and repetition. In this unit you will find two quizzes that will act as checkpoints as well as two graded assignments.

Unit 3 - Basics of Object Oriented Programming
In this unit you will be introduced to some of the main concepts in object oriented programming (OOP). These concepts can be a little abstract but are fundamental to moving forward in the rest of the course. You will look at the basic elements of OOP such as classes and objects, as well as how to share traits between objects and methods. You will also learn about how to use our "robot" interface which will hopefully help to make the process easier to learn. In this unit there will be two check in activities, one quiz and one small assignment. Your project for this unit will require you to create a robot world and have your robot execute tasks in it.

Unit 4 - Advanced Object Oriented Programming
In this unit you will expand your knowledge of object orientation programming (OOP). These concepts are at the heart of OOP and will allow you to make much more complex programs. We will continue to utilize the robot classes to help make concrete connections to these concepts. In this unit there will be

two checkin quizzes as well as two assignments. You will conclude the unit with another teacher meeting.

Unit 5 - GUI's
In this unit you will learn about the creation and use of GUI's as well as how to implement arrays in Java. These concepts will likely be review from your grade 11 course, it will just be a matter of learning the java syntax. You will have one check in quiz and one major assessment for this unit.

Unit 6 - Data
In this unit you will learn about basic data access and storage using external files. You will also look at sorting methods and how they can be used. Finally you will look at basic statistical methods for data analysis. In this unit there will be one quiz which will act as a check in as well as one major assessment.

Unit 7 - Games
In this unit you will learn about the basics of game development. You will start by learning how to draw primitive shapes on a frame and will then look at planning a game. You will also look at how coding can be made to imitate computer choice and how to implement this in simple games. There will be one final quiz for the course which will act as a check in and will not count towards your final grade. You will then complete a unit project of creating a simple game to play against the computer.

Unit 8 - Culminating Project
In this unit you will complete a final programming project that covers the major concepts learned in the course. You will also have the opportunity to complete exam review prior to making arrangements and completing your exam.

TEACHING AND LEARNING STRATEGIES

In this course, students will experience the following activities.

Presentations with embedded videos are utilized to outline concepts, explain theory with the use of examples and practice questions, and incorporate multi-media opportunities for students to learn more (e.g. online simulations, quizzes, etc.).

Reflection is an opportunity for students to look back at concepts and theories with new eyes, to relate theory to practice, and to align learning with their own values and beliefs.

Discussions with the instructor are facilitated through video conferencing, discussing the concepts and skills being studied. This enables two-way communication between the student and the instructor, to share ideas and ask questions in dialogue. This also helps to build a relationship between the student and instructor.

Practical extension and application of knowledge are integrated throughout the course. The goal is to help students make connections between what they learn in the classroom and how they understand and relate to the world around them and their own lives. Learning becomes a dynamic opportunity for students to be more aware that their learning is all around them and enable them to create more meaning in their lives.

Individual activities/assignments assessments are completed individually at a student's own pace and are intended to expand and consolidate the learning in each lesson. Individual activities allow the teacher to accommodate interests and needs and to assess the progress of individual students. For this reason, students are encouraged to discuss IEPs (Individual Education Plans) with their teacher and to

ask to modify assessments if they have a unique interest that they feel could be pursued in the assessment. The teacher plays an important role in supporting these activities by providing ongoing feedback to students, both orally and in writing.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance. These assessments are not for marks.
- In assessment for learning (AFL), teachers provide students with descriptive feedback and coaching for improvement.
- In assessment as learning (AAL), teachers help students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.

Evaluation: Assessment of Learning (AOL) focuses on evaluation which is the process of making a judgment about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgment.

STRATEGIES FOR ASSESSMENT

Assessments are an important part of the learning process. It is the intention that formative and summative assessments provide students with constructive feedback to help them grow in developing their skills. It is also important that students play an active role in monitoring their own learning and skills development through the use of formative activities. It is also important that students bring their own creativity to the unit summative assessments.

ASSESSMENT ACTIVITIES

- ❑ Diagnostic tests
- ❑ Completed templates and graphic organizers
- ❑ Presentations
- ❑ Programming Projects
- ❑ Quizzes
- ❑ End of unit conversations (Google Meets)
- ❑ Culminating Programming Project

EVALUATION

The final grade will be determined as follows:
- 70% of the grade will be based on evaluation conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration will be given to more recent evidence of achievement.
- 30% of the grade will be based on a final evaluation administered at the end of the course. This evaluation will be based on evidence from a final project and an exam. The final evaluation is an

opportunity for the student to demonstrate comprehensive achievement of the overall expectations for the course.

(*Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of Education Publication, 2010 p.41)

Weight	
Course Work	**70**
Knowledge/Understanding (K)	17.5
Thinking/Inquiry (T)	17.5
Communication (C)	17.5
Application (A)	17.5
Final	**30**
Culminating Project (K5, T5, C5, A5)	20
Final Exam (K2.5, T2.5, C2.5, A2.5)	10

TERM WORK EVALUATIONS (70%)

Evaluation Item	Description	Category	Weight
Unit 1 Future Technology Report	Students will look at emerging technologies and how they can prepare to be part of it.	K, T, C, A	5
Unit 2 Math Part 2 Program	Students will use basic programming functions to solve problems	K, T, C, A	10
Unit 2 Unit 2 Project	Students will complete two programs that require the use of variables and mathematics.	K, T, C, A	
Unit 3 Unit 3 Project	Students will create a program using basic object oriented programming principles.	K, T, C, A	5
Unit 4 Conditional and Predicate Methods Activity	Students will use advanced object oriented programming concepts to write a program for a robot to complete tasks.	K, T, C, A	15
Unit 4 Unit 4 Project	Students will create a program utilizing advanced object oriented programming concepts.	K, T, C, A	
Unit 5 Unit 5 Project	Students will create a program that uses a GUI and arrays to process information.	K, T, C, A	10
Unit 6 Unit 6 Project	Students will create a GUI program that accesses data and performs basic calculations.	K, T, C, A	10
Unit 7 Unit 7 Project	Students will create a scaled down version of connect four.	K, T, C, A	15

FINAL EVALUATIONS (30%)

Evaluation Item	Description	Category	Weight
Final Project	Final Programming Project	K, T, C, A	20
Final Project	Exam	K, T, C, A	10

AAL/AFL/AOL TRACKING SHEET

Unit 1: Topics in Computer Science

AAL	AFL	AOL
Computer Security Questions	Unit 1 Quiz	Future Technology Research
Ethics in Computing Questions	Teacher Meeting	
Emerging Technologies Questions		
Post-Secondary and Career Options Questions		

Unit 2: Java Programming Basics

AAL	AFL	AOL
Output Activity	Boolean Operators Quiz	Math Pt2 Assignment
Math Pt1 Activity	Unit 2 Quiz	Unit 2 Project
Boolean Operators Activity		
Math Pt2 Activity		
Selection Activity		
Repetition Activity		

Unit 3: Basics of Object Oriented Programming

AAL	AFL	AOL
Intro to Robots Activity	Concepts Quiz #1	Unit 3 Project
Inheritance Activity	Creating a Robot World	
Overriding Methods Activity		

Unit 4: Advanced Object Oriented Programming

AAL	AFL	AOL
Instance Variables Activity	Concepts Quiz #2	Conditional Execution and Predicate Methods Assignment
Polymorphism Activity	Concepts Quiz #3	Unit 4 Project
Top Down Design Activity	Teacher Meeting	
Conditional Execution and Predicate Methods Activity		
Recursion Activity		
Iteration Activity		
External Data Activity		

Unit 5: GUI's

AAL	AFL	AOL
Introduction to GUI's Activity	Concepts Quiz #4	Unit 5 Project
Arrays Activity		
2D Arrays Activity		
Canvas and Clearing Objects Activity		

Unit 6: Data

AAL	AFL	AOL
File Access Activity	Concepts Quiz #5	Unit 6 Project
Selection Sort Activity		
Bubble Sort Activity		
Data Analysis Activity		

Unit 7: Games

AAL	AFL	AOL
Introduction to Graphics Activity	Concepts Quiz #6	Unit 7 Project
Developing Simple Games Activity		
AI for Games Activity		

Unit 6: Cumulative Assessments

AAL	AFL	AOL
Exam Review		Culminating Project
		Exam

CONSIDERATION FOR PROGRAM PLANNING

PLANNING PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS
Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal. Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows: All students can succeed. Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Successful instructional practices are founded on evidence-based research, tempered by experience.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS
Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 percent of the students in Ontario's English language schools is a language other than English. Ontario's linguistic heritage includes several Aboriginal languages; many African, Asian, and European languages; and some varieties of English, such as Jamaican Creole. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of

Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

THE ROLE OF TECHNOLOGY IN THE PROGRAM

Information and communications technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' language learning. ICT tools include multimedia resources, databases, Internet websites, digital cameras, and word-processing programs. Tools such as these can help students to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings. Information and communications technologies can also be used to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning.

ACCOMMODATIONS

Accommodations will be based on meeting with parents, teachers, administration and external educational assessment reports. The following three types of accommodations may be provided:

- ❏ **_Instructional accommodations:_** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.

- ❏ **_Assessment accommodations:_** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- ❏ Provide step-by-step instructions.

- ❏ Help students create organizers for planning writing tasks.

- ❏ Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.

- ❏ Permit students a range of options for reading and writing tasks.

- ❏ Where an activity requires reading, provide it in advance.

- ❏ Provide opportunities for enrichment.