

torontoeschool

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ICS4U Computer Science Grade 12

Course Outline

Course Title: Computer Science, Grade 12, University Preparation

Course Code: ICS4U

Grade: 12

Course Type: University Preparation

Credit Value: 1.0

Prerequisite: : [ICS3U, Introduction to Computer Science, Grade 11](#)

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

Course Developer: Toronto eSchool

Department: Computer Studies

Department Head: Paul Rogers, B.Sc., B.Ed., OCT

Developed Date: 2016

Most Recent Revised Date: 2022

Course Description

Computer Science 12 – ICS4U 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.

Course Contents:

Unit	Titles and Descriptions	Time
Unit 1	<p>Programming Concepts and Skills</p> <p>Students will demonstrate the ability to use different data types and expressions when creating computer programs; describe and use modular programming concepts and principles in the creation of computer programs; design and write algorithms and subprograms to solve a variety of problems; use proper code maintenance techniques when creating computer programs.</p>	28 hours
Unit 2	<p>Software Development</p> <p>Students will demonstrate the ability to manage the software development process effectively, through all of its stages - planning, development, production, and closing; apply standard project management techniques in the context of a student-managed team project.</p>	22 hours
Unit 3	<p>Designing Modular Programs</p> <p>Students will demonstrate the ability to apply modular design concepts in computer programs; analyze algorithms for their effectiveness in solving a problem.</p>	28 hours
Unit 4	<p>Topics in Computer Science & Independent Project</p> <p>Student will complete two independent projects in this unit. Furthermore, students will assess strategies and initiatives that promote environmental stewardship with respect to the use of computers and related technologies; analyze ethical issues and propose strategies to encourage ethical practices related to the use of computers; analyze the impact of emerging computer technologies on society and the economy; research and report on different areas of research in computer science, and careers related to computer science.</p>	18 hours
	<p>Final Evaluation Final Evaluation for this course is based on a Final Cumulative Project, which is worth 20% of the overall course marks, and a Multiple Choice exam, which worth 10% of the overall course marks. The Project will be evaluated using a marking scheme and a rubric.</p>	14 hours
	Total	110 hours

All course material is online, no textbook purchase required. Resources and references for course materials will be provided on course webpage. Students are expected to watch and read all lecture videos and reading materials provided, and complete relevant exercises at student's time of convenience.

Overall Expectations: ICS4U

By the end of this course, students will:

Strand	Overall Expectations
Programming Concepts and Skills	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.
Software Development	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.
Designing Modular Programs	C1. demonstrate the ability to apply modular design concepts in computer programs; C2. analyze algorithms for their effectiveness in solving a problem.
Topics In Computer Science	D1. assess strategies and initiatives that promote environmental stewardship with respect to the use of computers and related technologies; D2. analyze ethical issues and propose strategies to encourage ethical practices related to the use of computers; D3. analyze 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.

Teaching / Learning Strategies

As in a conventional classroom, instructors employ a range of strategies for teaching a course:

- Clear writing that explains new concepts to students
- Examples of full solutions in various contexts and opportunities to practice
- Direct instruction and coaching on student work by the teacher

In addition, teachers and students have at their disposal a number of tools that are unique to electronic learning environments:

- Electronic simulation activities
- Video presentations
- Discussion boards and email
- Assessments with real-time feedback
- Interactive activities that engage both the student and teacher in the subject
- Peer review and assessment
- Internet Instructional Videos

The aim of this course is to introduce students to computer programming. Students are given a lesson and then work independently to apply what they have learned in different contexts to solve problems.

Assessment and Evaluation of Student Achievement

The purpose of assessment and evaluation is to improve student learning. Assessment and evaluation is based on the provincial curriculum expectations and the achievement levels outlined in the curriculum document. In order to ensure that assessment and evaluation are valid and reliable, and that they lead to the improvement of student learning, teachers use a variety of strategies throughout the course, including: providing students with feedback about their work (known as assessment for learning), helping to set learning goals and monitor their own progress (known as assessment as learning), and evaluation and reporting of progress in the form of grades and marks (known as assessment of learning).

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for the discipline. A credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade for this course will be determined as follows:

- 70% of the grade will be based upon evaluations conducted throughout the course. This portion of the grade will 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 assessment task that occurs at or near the end of the course. In the case of this course, this final assessment task will take in two parts, a major comprehensive programming project and a final exam to be completed online under the supervision of a pre-approved proctor. Each of the two parts worth 15%, a total of 30% of the student's final mark in the course.

The Achievement Chart for this Course of Study will be employed to guide students in assessing their own learning and planning strategies for improvement. Students will have the opportunity to complete the Ministry of Education exemplar projects or their equivalents for this Course of Study.

Overall and specific expectations will be assessed and evaluated based upon the following criteria:

. Knowledge and Understanding	25%
. Thinking Skills:	25%
. Communication Skills:	20%
. Application / Making Connections:	30%

A Summary Description of Achievement in Each Percentage Grade Range and Corresponding Level of Achievement		
Percentage Grade Range	Achievement Level	Summary Description
80-100%	Level 4	A very high to outstanding level of achievement. Achievement is <i>above</i> the provincial standard.
70-79%	Level 3	A high level of achievement. Achievement is <i>at</i> the provincial standard.
60-69%	Level 2	A moderate level of achievement. Achievement is <i>below</i> , but <i>approaching</i> , the provincial standard.
50-59%	Level 1	A passable level of achievement. Achievement is <i>below</i> the provincial standard.
below 50%	Level R	Insufficient achievement of curriculum expectations. A credit will not be granted.

The Final Grade

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning.

The percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for this discipline.

A credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade for this course will be determined as follows:

I. Term Work:	70%
. Lesson Assignments	20%
. Unit Assignments	30%
. Communication and Discussion	20%
II. Final Evaluation:	30%
. Final Assignment	20%
. Final Exam	10%

The Report Card

Two official report cards are issued - midterm and final. Each report card will focus on two distinct but related aspects of student achievement. First, the achievement of curriculum expectations is reported as a percentage grade. Additionally, the course median is reported as a percentage. The teacher will also provide written comments concerning the student's strengths, areas for improvement and next steps. Second, the learning skills are reported as a letter grade, representing one of four levels of accomplishment. The report cards contain separate sections for the reporting of these two aspects. The report card also indicates whether an OSSD credit has been earned.

Resources Required by the Students

- Access to ICS4U online course of study
- Access to a scanner or digital camera
- Access to a spreadsheet and word-processing software
- Access to an online graphing calculator
- Access to YouTube

Note: This course is entirely online and does not require or rely on any textbook.

Achievement Chart – Computer Studies, Grades 9–12

Categories	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Knowledge and Understanding - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
The student:				
Knowledge of content (e.g., facts, technical terminology, definitions, procedures, standards)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
understanding of content (e.g., concepts, principles, methodologies, use of tools)	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content
Thinking - The use of critical and creative thinking skills and/or processes				
The student:				
use of planning skills (e.g., focusing research, gathering information, selecting strategies, organizing a project)	uses planning skills with limited effectiveness	uses planning skills with moderate effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
use of processing skills (e.g., analysing, interpreting, assessing, reasoning, evaluating, integrating, synthesizing)	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
use of critical/creative thinking processes (e.g., evaluation of computer solutions, problem solving, decision making, detecting and correcting flaws, research)	uses critical / creative thinking processes with limited effectiveness	uses critical / creative thinking processes with some effectiveness	uses critical / creative thinking processes with considerable effectiveness	uses critical / creative thinking processes with a high degree of effectiveness
Communication - The conveying of meaning through various forms				
The student:				
Expression and organization of ideas and information (e.g., clear expression, logical organization) in oral, visual, and written forms, including electronic forms (e.g., presentations, charts, graphs, tables, maps, models, web pages, reports)	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
communication for different audiences (e.g., peers, computer users, company supervisor) and purposes (e.g., to inform, to persuade) in oral, visual, and written forms, including electronic forms	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness

use of conventions, vocabulary, and terminology of the discipline in oral, visual, and written forms, including electronic forms	uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	uses conventions, vocabulary, and terminology of the discipline with some effectiveness	uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
Application - The use of knowledge and skills to make connections within and between various contexts				
	The student:			
application of knowledge and skills (e.g., concepts, procedures, processes, use of tools) in familiar contexts	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
transfer of knowledge and skills (e.g., choice of tools and software, ethical standards, concepts, procedures, technologies) to new contexts	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness
making connections within and between various contexts (e.g., between computer studies and personal experiences, opportunities, social and global challenges and perspectives; between subjects and disciplines)	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness

Late and Missed Assignments:

Students are expected to:

- be responsible for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher, and in a form approved by the teacher
- understand that there will be consequences for not completing assignments for evaluation and/or for submitting those assignments late
- use time productively, both online and offline

All submissions will be online and should be completed within given time frame. Late assignments will be assessed a penalty of 10% per a day, until day 10, in which no submission will be allowed.

Late or missed work accompanied by a doctor's note will receive no penalty.

Academic Responsibility and Integrity:

Practice is a crucial part for Computer Science. Students are expected to use all resources provided online, complete all exercises provided prior to solutions posted. Additionally, students are highly encouraged to go to our online discussion forum to ask questions and discuss course materials. Please do not post solutions to assignment questions on forum before due dates to avoid committing plagiarism.

It is essential for both educational and ethical reasons that each person does his/her own work. There is a distinction between getting help and copying. Learning tasks that students complete, as well as all assignments, tests and exams which students submit for evaluation must be their own work. Plagiarism, including electronic theft and misrepresentation of original work, cheating, theft of evaluation instruments, use of unauthorized aids and false representation of identity will result in appropriate consequences. Penalty for each plagiarized work is a 10% reduction in the final grade.

Program Planning Considerations for Computer Studies

Teachers who are planning a program in this subject will make an effort to take into account considerations for program planning that align with the Ontario Ministry of Education policy and initiatives in a number of important areas:

1. Education for students with special education needs
2. Environmental education
3. Equity and inclusive education
4. Financial literacy education
5. Ontario First Nations, Metis, and Inuit education
6. Role of information and communications technology
7. English language learners
8. Career education
9. Cooperative education and other workplace experiences
10. Health and safety

1. Education for Students with Special Education Needs:

Torontoeschool is committed to ensuring that all students are provided with the learning opportunities and supports they require to gain the knowledge, skills, and confidence they need to succeed in a rapidly changing society. The context of special education and the provision of special education programs and services for exceptional students in Ontario are constantly evolving. Provisions included in the Canadian Charter of Rights and Freedoms and the Ontario Human Rights Code have driven some of these changes. Others have resulted from the evolution and sharing of best practices related to the teaching and assessment of students with special educational needs.

The provision of special education programs and services for students at Torontoeschool rests within a legal framework. The Education Act and the regulations related to it set out the legal responsibilities pertaining to special education. They provide comprehensive procedures for the identification of exceptional pupils, for the placement of those pupils in educational settings where the special education programs and services appropriate to their needs can be delivered, and for the review of the identification of exceptional pupils and their placement.

Teachers will take into account the needs of exceptional students as set out in the students' Individual Education Plan. The online courses offer a vast array of opportunities for students with special education needs to acquire the knowledge and skills required for our evolving society. Students who use alternative techniques for communication may find a venue to use these special skills in these courses. There are a number of technical and learning aids that can assist in meeting the needs of exceptional students as set out in their Individual Education Plan. In the process of taking their online course, students may use a personal amplification system, tela-typewriter (via Bell relay service), an oral or a sign-language interpreter, a scribe, specialized computer programs, time extensions, ability to change font size, oral readers, etc.

2. Environmental Education:

Environmental education teaches students about how the planet's physical and biological systems work, and how we can create a more sustainable future. Good curriculum design allows environmental issues and topics to be woven in and out of the online course content. This ensures that the student will have opportunities to acquire the knowledge, skills, perspectives and practices needed to become an environmentally literate citizen. The online course should provide opportunities for each student to address environmental issues in their home, in their local community, or even at the global level.

3. Equity and Inclusive Education:

Torontoeschool is taking important steps to reduce discrimination and embrace diversity in our online school in order to improve overall student achievement and reduce achievement gaps due to discrimination. The Ontario Equity and Inclusive Education Strategy was launched in April 2009 and states that all members of the Torontoeschool community are to be treated with respect and dignity. This strategy is helping Torontoeschool educators better identify and remove discriminatory biases and systemic barriers to student achievement. These barriers related to racism, sexism, homophobia and other forms of discrimination may prevent some students from reaching their full potential. The strategy supports the Ministry's key education priorities of high student achievement, reduced gaps in student achievement and increased accountability and public confidence in Ontario's schools. Students, regardless of their background or personal circumstances, must be given every opportunity to reach their full potential. Research shows that when students feel welcomed and accepted in their school, they are more likely to succeed academically. Torontoeschool desires to create a culture of high expectations where factors such as race, age, gender, sexual orientation and socio-economic status do not prevent students from achieving ambitious outcomes.

4. Financial Literacy Education:

Financial literacy may be defined as having the knowledge and skills needed to make responsible economic and financial decisions with competence and confidence. Since making financial decisions has become an increasingly complex task in the modern world, students need to have knowledge in various areas and a wide range of skills in order to make informed decisions about financial matters. Students need to be aware of risks that accompany various financial choices. They need to develop an understanding of world economic forces as well as ways in which they themselves can respond to those influences and make informed choices. Torontoeschool considers it essential that financial literacy be considered an important attribute of a well-educated population. In addition to acquiring knowledge in such specific areas as saving, spending, borrowing, and investing, students need to develop skills in problem solving, inquiry, decision making, critical thinking, and critical literacy related to financial and other issues. The goal is to help students acquire the knowledge and skills that will enable them to understand and respond to complex issues regarding their own personal finances and the finances of their families, 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 as consumers. The Ministry of Education and

Torontoeschool are working to embed financial literacy expectations and opportunities in all courses as appropriate, as part of the ongoing curriculum review process.

5. Ontario First Nations, Metis, and Inuit Education:

First Nation, Metis, and Inuit students in Ontario will need to have the knowledge, skills, and confidence they need to successfully complete their elementary and secondary education in order to pursue postsecondary education or training and/or to enter the workforce. They will need to have the traditional and contemporary knowledge, skills, and attitudes required to be socially contributive, politically active, and economically prosperous citizens of the world. All students in Ontario will need to have knowledge and appreciation of contemporary and traditional First Nation, Metis, and Inuit traditions, cultures, and perspectives. Torontoeschool and the Ministry of Education are committed to First Nation, Metis, and Inuit student success. Torontoeschool teachers are committed to (1) developing strategies that will increase the capacity of the education system to respond to the learning and cultural needs of First Nation, Metis, and Inuit students; (2) providing quality programs, services, and resources to help create learning opportunities for First Nation, Metis, and Inuit students that support improved academic achievement and identity building; (3) providing a curriculum that facilitates learning about contemporary and traditional First Nation, Metis, and Inuit cultures, histories, and perspectives among all students where possible; and (4) developing and implementing strategies that facilitate increased participation by First Nation, Metis, and Inuit parents, students, communities, and organizations in working to support the academic success of the student.

6. The Role of Information and Communications Technology in the Curriculum.

Information literacy is the ability to access, select, gather, critically evaluate, and create information. Communication literacy refers to the ability to communicate information and to use the information obtained to solve problems and make decisions. Information and communications technologies are utilized by all Torontoeschool students when the situation is appropriate within their online course. As a result, students will develop transferable skills through their experience with word processing, internet research, presentation software, and telecommunication tools, as would be expected in any other course or any business environment.

7. English Language Learners:

This Torontoeschool online course can provide a wide range of options to address the needs of ESL/ELD students. This online course must be flexible in order to accommodate the needs of students who require instruction in English as a second language or English literacy development. The Torontoeschool teacher considers it to be their responsibility to help students develop their ability to use the English language properly. Appropriate modifications to teaching, learning, and evaluation strategies in this course may be made in order to help students gain proficiency in English, since students taking English as a second language at the secondary level have limited time in which to develop this proficiency. This online course can provide a wide range of options to address the needs of ESL/ELD students. Well written content will aid ESL students in mastering not only the content of this course, but as well, the English language and all of its idiosyncrasies. Torontoeschool has created course content to enrich the student's learning experience. In addition, since many occupations in Canada require employees with capabilities in the English language, many students will learn English language skills which can contribute to their success in the larger world.

8. Career Education:

As the online student progresses through their online course, their teacher is available to help the student prepare for employment in a huge number of diverse areas. With the help of their teacher, students will learn to set and achieve goals and will gain experience in making meaningful decisions concerning their career choices. The skills, knowledge and

creativity that students acquire through this online course are essential for a wide range of careers. Throughout their secondary school education, students will learn about the educational and career opportunities that are available to them; explore and evaluate a variety of those opportunities; relate what they learn in their courses to potential careers in a variety of fields; and learn to make appropriate educational and career choices.

9. Cooperative Education and Other Workplace Experiences:

By applying the skills they have developed, students will readily connect their classroom learning to real-life activities in the world in which they live. Cooperative education and other workplace experiences will broaden their knowledge of employment opportunities in a wide range of fields. In addition, students will increase their understanding of workplace practices and the nature of the employer-employee relationship. Torontoeschool teachers will try to help students link to Ministry programs to ensure that students have information concerning programs and opportunities.

10. Health and Safety:

The major health and safety concerns associated with computer use are musculoskeletal injuries (including repetitive strain injuries) and eye strain. Teachers should not only ensure that workstations are ergonomically arranged but also encourage students to maintain good posture and to take regular breaks to stand and stretch. It is also important to inform students of the mental and emotional health risks associated with social isolation – a familiar condition among heavy computer users.