



CST8284

Object Oriented Programming (Java)

Course Outline

2022-2023

Pre-requisite(s)	CST8116
Co-requisite(s)	N/A
Prepared by	Sandra Iroakazi
Approved by	Sandra Brancatelli, M.Eng., P.Eng., Academic Chair, ICT-Applications & Programming
Normative hours	70.00
Grading system	A+ Through F
Experiential Learning	No

Applicable Program(s)	Level	Core/Elective
0336X01FWO - Computer Programming	2	Core
0336X03FWO - Computer Programming	2	Core
0336X07PAO - Computer Programming	2	Core
0336X09FAO - Computer Programming	2	Core
1561X01FWO - Computer Programming and Analysis	2	Core
1561X03FWO - Computer Programming and Analysis	2	Core

Course Description

Working in the field of information technology as a programmer requires a firm understanding of Object-Oriented Programming (OOP) concepts. Students explore object-oriented programming methodology using the Java programming language. Object oriented concepts, such as encapsulation, inheritance, abstraction and polymorphism are covered and reinforced with practical applications. Students explore the basics of data structures and algorithms as well as basic Graphical User Interface (GUI) programming.

Vocational Learning Outcomes

This course provides the opportunity for you to achieve the following outcomes:

0336X01FWO - Computer Programming

VLO 1	Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
VLO 2	Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
VLO 3	Implement and maintain secure computing environments. (T, A)
VLO 4	Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X03FWO - Computer Programming

VLO 1	Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
VLO 2	Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
VLO 3	Implement and maintain secure computing environments. (T, A)
VLO 4	Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X07PAO - Computer Programming

VLO 1	Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
VLO 2	Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
VLO 3	Implement and maintain secure computing environments. (T, A)
VLO 4	Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X09FAO - Computer Programming

VLO 1	Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
VLO 2	Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
VLO 3	Implement and maintain secure computing environments. (T, A)

VLO 4 Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

1561X01FWO - Computer Programming and Analysis

1561X03FWO - Computer Programming and Analysis

Assessment Levels —T: Taught A: Assessed CP: Culminating Performance

Essential Employability Skills

This course contributes to your program by helping you achieve the following Essential Employability Skills:

- EES 1 Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience. (A)
- EES 3 Execute mathematical operations accurately. (A)
- EES 4 Apply a systematic approach to solve problems. (T, A)
- EES 5 Use a variety of thinking skills to anticipate and solve problems. (T, A)
- EES 6 Locate, select, organize and document information using appropriate technology and information systems. (T, A)
- EES 7 Analyze, evaluate and apply relevant information from a variety of sources. (T, A)
- EES 10 Manage the use of time and other resources to complete projects. (A)

Assessment Levels —T: Taught A: Assessed CP: Culminating Performance

Course Learning Requirements / Embedded Knowledge and Skills

When you have earned credit for this course, you will have demonstrated the ability to:

1. Install and use the Java Development and Runtime Environment and documentation libraries.

- Install the Java development and runtime environment.
- Compile and execute Java programs consisting of multiple classes.

2. Install and use the Eclipse integrated development environment.

- Install and configure the Eclipse integrated development environment.
- Use the Eclipse integrated development environment to develop Java programs.

3. Write Java program code to solve a problem, based on a description of the problem context, including UML diagrams, using object-oriented techniques.

- Identify object attributes (which ultimately become instance variables that maintain state). Identify object behaviours (which ultimately become methods that can be invoked to implement the behaviours).
- Create classes with instance variables and the following categories of methods: constructor , accessor , mutator , service , etc. Instance variables and methods must follow the prescribed naming conventions based on UML class diagram specifications.
- Decompose complex objects into component parts and identify the composition relationships between those components.
- Define and document the user interface based on the processing requirements.
- Implement non-polymorphic behaviors with Object methods.
- Produce appropriate outputs, including: reports, screens, messages, files.

4. Explain and use basic data structures.

- Implement arrays of primitive types.
- Implement arrays of references to Java objects.
- Explain how Interface specifications (e.g. Collection , List , Set , etc.) are used to support alternate concrete implementations (e.g. ArrayList , LinkedList , TreeSet , HashSet , etc.). Implement Java code to demonstrate this capability.
- Implement and manage lists of objects using Java's ArrayList .
- Use common Big-O notations such as O(1), O(log n), O(n), O(n log n), O(n2) to make informed choices from the Java Collections framework.

5. Apply inheritance and polymorphism in program implementation.

- Implement inheritance hierarchy and polymorphism where derived classes implement specialized behavior using polymorphic methods.

6. Use existing simple generic classes to manage objects.

- Explain the underlying nature of object management and the role of the compiler in handling generic syntax.
- Use selected Collection classes.
- Use generic Interface reference-to variables to manage concrete generic Collection objects.

7. Write java code to implement exception handling.

- Use of keywords throw, throws, try, catch, and finally.
- Checked and unchecked expetions. Write code that deals with both checked and unchecked exceptions.
- Write custom exception classes by extending base exception classes from the API.
- Code using try-with-resources

8. Implement program Input/Output operations.

- Explain the difference between binary , text , and object streams.
- Implement Serializable interface to support file I/O (object stream). Implement code to support text streams.

9. Produce tested code that executes correctly and consistently.

- Install and use the JUnit testing framework to implement test classes.
- Perform iterative testing to locate and eliminate logic problems until results match expectations enunciated in the test plan.

- Develop a comprehensive test plan with the associated test data.
- Ensure that all user messages and help messages correctly reflect program state and expected user actions.
- Use junit assertions to test the pre-conditions and post-conditions that have been expressed in the Test Plan.

10. Test procedures using valid data only, invalid data only, and a combination both valid and invalid data.

- Use a mixture of data including valid, invalid, and a combination of both in testing procedures.

11. Prepare program documentation using prescribed program specifications.

- Use JavaDoc tagging to generate formatted documentation conforming to Oracle Java coding standards.
- Create basic UML static class diagrams to represent classes and their structural relationships.

12. Debug program problems using manual methods and computerized tools in an appropriate manner.

- Trace program execution through the debugger, using breakpoints , step-in , step-over . Inspect variables, being able to follow the reference-object relationships at run-time.
- Describe the differences between the runtime allocation of stack -oriented and heap -oriented variables.

13. Identify appropriate strategies for solving a problem.

- Define a problem; identify sources of help; identify various strategies for problem solving; use technical reference manuals and /or on-line help where applicable.

14. Introduce Swing for building a Graphical User Interfaces (GUI) using Java Foundation Classes.

- Build a basic UI using containers such as a JFrame
- Add Components such as Panels, Buttons, and TextFields.
- Specify GUI layouts using Layout Managers.
- Respond to user interaction by implementing Event Handling classes.

15. Use local and remote Git repositories to perform version control of a Java program.

- Review and demonstrate the use of Git commands on a local repository: git init, git add, git commit, git status, and git log.
- Use a remote Git repository to demonstrate the use of Git commands: git push, git pull, git remote.
- Use Git commands at a command prompt, and within an Integrated Development Environment (IDE).
- Explain the benefits of using a private versus a public, remote Git repository for version control.

Learning Resources

Required Textbooks:

- *Big Java Early Objects, 7/E. Author: Horstmann, C. Wiley. ISBN: eText: 978-1-119-49909-1 or loose-leaf paper: 978-1-119-74020-9.*

Recommended Online Resources

- **Samples:** Open Java Development Kit (OpenJDK) version 17 or later
For windows: use Windows x64 JDK link:<https://docs.aws.amazon.com/corretto/latest/corretto-17-ug/downloads-list.html>

Required Hardware: This course is part of the mobile (laptop) program initiative at Algonquin College. Students are required to have a functioning laptop at all lecture and lab classes. The specifications for the required laptop and additional information about the mobile program initiative can be found at <http://www.algonquincollege.com/mllearning>.

Required Software

Java Platform (JDK) - Java (Amazon Corretto) -17

Learning Activities

Samples of learning activities include:

- classroom lectures
- software demonstrations
- online lectures
- online software demonstrations
- individual and/or paired laboratory work
- practical and reading assignments
- research of course-related material

This course has 2 hours lecture, 1-hour hybrid, 2 hours lab per week. You will probably need to spend an additional 5 hours per week, on average, of your own time for assignments and study.

Lectures

Pre-defined Evaluation / Earning Credit

The following list provides evidence of this course's learning achievements and the outcomes they validate:

Final Exam (20%)

Validates Outcomes: CLR 3, CLR 4, CLR 5, CLR 6, CLR 7, CLR 8, CLR 11, CLR 12, CLR 13, CLR 14, CLR 15, EES 1, EES 3, EES 4, EES 5, EES 7

Midterm Exam(s) (15%)

Validates Outcomes: CLR 3, CLR 4, CLR 5, CLR 6, CLR 13, EES 1, EES 3, EES 4, EES 5, EES 7

Quiz(zes)/Test(s) (10%)

Validates Outcomes: CLR 3, CLR 4, CLR 5, CLR 13, EES 4, EES 5

Assignment(s) (25%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 5, CLR 6, CLR 7, CLR 8, CLR 9, CLR 11, CLR 12, CLR 13, CLR 14, CLR 15, EES 1, EES 3, EES 4, EES 5, EES 6, EES 7, EES 10

Lab Activity(ies) (20%)

Validates Outcomes: CLR 1, CLR 3, CLR 4, CLR 5, CLR 7, CLR 9, CLR 10, CLR 12, CLR 14, CLR 15, EES 4, EES 5, EES 7

Hybrid Assignment(s) (10%)

Validates Outcomes: CLR 5, CLR 7, CLR 8, CLR 13, CLR 14, CLR 15, EES 3, EES 4, EES 5, EES 7

Prior Learning Assessment and Recognition

Students who wish to apply for Prior Learning Assessment and Recognition (PLAR) need to demonstrate competency at a post-secondary level in all outlined course learning requirements. Evidence of learning achievement for PLAR candidates includes:

- Portfolio
- Challenge Exam
- Project/Assignment
- Other: The nature of a PLAR assessment will vary depending on the documented background of the student. The Challenge Exam may be oral or written, depending on the characteristics of the Porfolio presented by the student.

Other Information

Grade Scheme

Final Grade	Mark Equivalent	Numeric Value	Final Grade	Mark Equivalent	Numeric Value
A+	90% - 100%	4.0	A	85% - 89%	3.8
A-	80% - 84%	3.6	B+	77% - 79%	3.3
B	73% - 76%	3.0	B-	70% - 72%	2.7
C+	67% - 69%	2.3	C	63% - 66%	2.0
C-	60% - 62%	1.7	D+	57% - 59%	1.4
D	53% - 56%	1.2	D-	50% - 52%	1.0
F	0% - 49%	0	FSP	0	0

Course Related Information

In order to pass the course, the student must have a grade of at least 50% (or “D-”) on both the theory component as well as in the applied component. The theory component is composed of the Hybrid test(s), Quiz(zes), Midterm Exam, and Final Exam. The applied component is composed of Lab exercises and assignments.

Even if your combined grade exceeds 50% for the entire course, if you fail either the theory component or the applied component you will not achieve a passing grade in the course.

Please refer to the Course Section Information (CSI) / weekly schedule for specific course-related information as provided by your professor.

Department Information

STUDENT ACADEMIC RESPONSIBILITIES

- Each student is responsible for:
- Knowing the due dates for marked out-of-class assignments.
 - Attending all classes and knowing the dates of in-class marked assignments and exercises.
 - Maintaining a folder of all work done in the course during the semester for validation claims in cases of disagreement with faculty.
 - Keeping both paper and electronic copies of all assignments, marked and unmarked, in case papers are lost or go missing.
 - Regularly checking both Brightspace announcements as well as one's Algonquin e-mail account for important messages from both professors and college administration.
 - Participating in on-line and classroom exercises and activities as required.
 - Retaining course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Department Grading Policy - For all courses that have both a theory and practical (lab) component, students must have a grade of at least 50% (or “D-”) on both the theory component as well as in the practical (i.e. lab) component in order to achieve a passing grade in the course. i.e. Even if your combined grade exceeds 50% for the entire course, if you fail either the theory component or the practical component, you will not achieve a passing grade in the course.

Lab/Practical Assessment Demonstration "Demo" Requirements - Certain courses require students to demo their work after it has been submitted. These will be scheduled by the professor and involve 1-2 rudimentary questions to assure the professor that the work submitted by the student is their own. Demos are not graded items - the work submitted is graded. However, where demos are required, if a student does not demo their work, the work will not be graded (i.e. grade of 0 on the lab or practical assessment).

Department Academic Dishonesty Policy - Academic Integrity is very important to all of our faculty and administrative staff and as such, measures have been put into place to detect all forms of academic dishonesty, including plagiarism of code. If plagiarism is detected by a professor, the incident will be reported and investigated. If the findings of the investigation are that a student has submitted plagiarized work as their own, they will be subject to the following policy:

1. The first offence will result in the plagiarized assessment being assigned a grade of 0.
2. The second offence will result in the assignment of a grade of F for the course.
3. The third offence will result in removal of a student from the program of study.

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether involving a professor and a student or amongst students, will not be tolerated on the college premises. Action taken will start with a formal warning and proceed to the full disciplinary actions as outlined in Algonquin College Policies - HR22 and SA07. Harassment means one or a series of vexatious comment(s) (whether done verbally or through electronic means), or conduct related to one or more of the prohibited grounds that is known or ought reasonably to be known to be unwelcome/unwanted, offensive, intimidating, derogatory or hostile. This may include, but is not limited to: gestures, remarks, jokes, taunting, innuendo, display of offensive materials, offensive

graffiti, threats, verbal or physical assault, stalking, slurs, shunning or exclusion related to the prohibited grounds.

For further information, a copy of the official policy statement can be obtained from the Student Association.

Violation of the Copyright Act

General – The Copyright Act makes it an offence to reproduce or distribute, in whatever format, any part of a publication without the prior written permission of the publisher. For complete details, see the Government of Canada website at <http://laws.justice.gc.ca/en/C-42> . Make sure you give it due consideration, before deciding not to purchase a textbook or material required for your course.

Software Piracy - The Copyright Act has been updated to include software products. Be sure to carefully read the licensing agreement of any product you purchase or download, and understand the terms and conditions covering its use, installation and distribution (where applicable). Any infringement of licensing agreement makes you liable under the law.

Disruptive Behaviour is any conduct, or threatened conduct, that is disruptive to the learning process or that interferes with the well being of other members of the College community. It will not be tolerated. Members of the College community, both students and staff, have the right to learn and work in a secure and productive environment. The College will make every effort to protect that right. Incidents of disruptive behaviour must be reported in writing to the departmental Chair as quickly as possible. The Chair will hold a hearing to review available information and determine any sanctions that will be imposed. Disciplinary hearings can result in penalties ranging from a written warning to expulsion.

For further details, consult the Algonquin College Policies AA32, SA07 and IT01 in your Instaguide.

College Related Information

Algonquin College's policies have been developed to ensure the health, safety and security of all students, faculty and staff, and the proper and fair operation of the College as an academic institution and employer. Please refer to the Algonquin College Policies website for the most current policy information available at <http://www.algonquincollege.com/policies/>.

Students are especially encouraged to be aware of the following College expectations

Academic Integrity

Algonquin College is committed to the highest standards of academic integrity, and students are expected to uphold these standards as part of the learning process. Any academic work submitted by a student is expected to be their own work, unless designated otherwise and all sources must be attributed. All students should be familiar with the Algonquin College policy [AA48: Academic Integrity](#) which outlines student's roles and responsibilities and what represents academic dishonesty. In some courses, online proctoring may be used to prevent academic dishonesty. Additional information can be found at [Academic Integrity - Student Survival Guide - Subject Guides at Algonquin College \(libguides.com\)](#) and via [Academic Integrity Student Resources](#). Students with any questions about the course expectations regarding academic integrity are encouraged to speak to their professor and the College's academic integrity team at acaio@algonquincollege.com

Centre for Accessible Learning

Students with visible and/or non-visible disabilities are encouraged to register with the [Centre for Accessible Learning \(CAL\)](#) in order to be eligible for appropriate learning supports and/or accommodations. Students are strongly encouraged to make an appointment with the Centre for Accessible Learning as early as possible when starting a program. Once your needs are identified, a Letter of Accommodation (LOA) will be issued which you can share with your professors. If you are a returning student, please ensure that professors are given a copy of your LOA each semester.

College Email

Students at Algonquin College are provided with a college email account. This is the address that will be used when the College, your professors, or your fellow students communicate important information about your program or course activities. Your network credentials can be found in the [ACSIS portal](#) and you are expected to check your Algonquin email regularly and to use it to send and receive college-related email. Support is available through the college Information Technology Service (ITS) at: <https://www.algonquincollege.com/its/>

Retroactive Accommodations

Students are expected to meet evaluation and completion deadlines as stated in course outline and course section information documents. In circumstances where evaluation and/or completion deadlines are missed or student performance has been affected by a temporary or permanent disability (including mental health), interim or retroactive accommodations may be considered. In such instances, please consult your course faculty member. For other situations where deferral of evaluations may be warranted, please consult Algonquin College Policy [AA21: Deferred Evaluation](#).

Student Course Feedback

Algonquin College invites students to share their course experience by completing a student course feedback survey for each course they take. For further details consult Algonquin College Policy [AA25: Student Course Feedback](#).

Use of Mobile Devices in Class

With the proliferation of small, personal mobile devices used for communications and data storage, Algonquin College believes there is a need to address their use during classes and examinations. During classes, the use of such devices unless authorized by your professor can be disruptive and disrespectful to others. During examinations, the use of such devices is generally prohibited unless authorized by your professor. Otherwise use is considered academic dishonesty in the form of cheating. For further details consult Algonquin College Policy [AA32: Use of Mobile Devices in Class](#).

Technology Requirements

Students are required to have access to a computer and to the internet. There may also be additional technology-related resources required to participate in a course that are not included in the course materials fee, such as headphones, webcams, specialized software, etc. Details on these requirements can be found in the Course Section Information of the course outline for each course available on Brightspace.

Transfer of Credit

It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Safe Harbour

In the event of an unexpected major event (pandemic, etc.), your course may have changes that are not reflected in the Course Outline. Should this happen, the Course Section Information document will have updated information about your course.