Algonquin College

CST8288
Object Oriented Programming with Design Patterns
Course Outline

2022-2023

Pre-requisite(s)	CST8215 and CST8284
Co-requisite(s)	N/A
Prepared by	Reg Dyer
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	3	Core
0336X03FWO - Computer Programming	3	Core
0336X07PAO - Computer Programming	3	Core
0336X09FAO - Computer Programming	3	Core
1561X01FWO - Computer Programming and Analysis	3	Core
1561X03FWO - Computer Programming and Analysis	3	Core

Course Description

Design patterns are programming architecture solutions to common challenges faced in software implementation. Students implement best practices of object-oriented program development with software design patterns. Students also apply Unified Modeling Language (UML) program specifications in the Java programming language. SQL through JDBC technology is used embedded for developing and using "data access objects". Course topics include refactoring, domain modelling, JDBC and multithreaded servlet programming. Students develop proficiency in creating, testing, debugging, deploying and documenting programs and servlets through practical application.

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)

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

VLO 5 Communicate and collaborate with team members and stakeholders to ensure effective working relationships. (T)

VLO 8 Adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of computing solutions and systems. (T)

0336X03FWO - Computer Programming

VLO 1 Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T)

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

VLO 5 Communicate and collaborate with team members and stakeholders to ensure effective working relationships. (T)

VLO 8 Adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of computing solutions and systems. (T)

0336X07PAO - Computer Programming

VLO 1 Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T)

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

VLO 5 Communicate and collaborate with team members and stakeholders to ensure effective working relationships. (T)

VLO 8 Adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of computing solutions and systems. (T)

0336X09FAO - Computer Programming

VLO 1 Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T)

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

VLO 5 Communicate and collaborate with team members and stakeholders to ensure effective working relationships. (T)

VLO 8 Adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of computing solutions and systems. (T)

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 3 Execute mathematical operations accurately. (A)

EES 4 Apply a systematic approach to solve problems. (A)

EES 5 Use a variety of thinking skills to anticipate and solve problems. (A)

EES 7 Analyze, evaluate and apply relevant information from a variety of sources. (T, A)

EES 9 Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. (T, A)

EES 10 Manage the use of time and other resources to complete projects. (A)

EES 11 Take responsibility for one's own actions, decisions and consequences. (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. Implement an objected-oriented program design incorporating the use of best practice design patterns using the JAVA programming language.

- Implement UML documented specifications in the JAVA language.
- Decompose specifications into UML diagrams showing a hierarchy of packages, classes, and methods showing both static and dynamic relationships (inheritance, object interactions), object compostion and behavior.
- Model processing sequences using UML object diagrams.
- Select and/or extend appropriate built-in classes.
- Write both class and interface definitions as required.
- Apply thru practical application the following design patterns/strategies: Singleton (including a thread-safe singleton), Simple Factory, Builder, Telescoping Constructors, Delegate, Observer, MVC, Get/Set, Adapter, Value Object, Dependent Object, Command Patterns.

2. Explain multithreading concepts related to thread-safe Java Servlet programming.

- Develop a Java application using server side technology which consists of thread-safe Java Servlet(s).
- Apply thread-safe programming concepts within the context of Java Servlet programming.

3. Develop an application thru the use of refactoring steps using Model-View-Controller or modified Model-View-Controller design pattern.

- Use oop concepts introduced to optimise and organize the application
- Implement provided UML class and/or sequence diagrams which progress thru the refactoring steps to gradually separate the various types of program logic into more cohesive manageable classes, each of which has a well defined role in the application.

4. Develop web applications using Java

- Design a web based Java application using both sever-side and client-side programming.
- Design and implement Java code which uses the servlet interface and the servlet life cycle.
- Set up a standalone version of the Apache Tomcat servlet engine.

5. Design, develop and implement the domain layer software components in the Java programming language.

- Develop UML use case diagrams, class diagrams, and sequence diagrams depicting the design of the case study domain layer.
- Design your domain layer such that it includes a minimum of four established design patterns in addition to the Builder design pattern.
- Provide in the design the necessary links/connections to both the presentation layer and data management layers.
- Apply a "controller class" to manage communication and processing between the presentation, domain, and data management layers in the case study design.
- Implement the design in the Java programming language using both Java classes and Java interfaces.

6. Design, develop and implement a Java application designed with multiple layers and tiers utilizing the minimum of a Web Browser presentation layer, Java Servlet server-side objects, and a database server component.

- Develop a multi-tiered architectue and associated components in the design and implementation of a Java based application using bother client and server side technologies.
- Develop a UML class diagram and deployment diagram depicting the design of the multi-tiered Java application.
- Develop multi-tiered Java code which utilize multi-threading concepts within Java Servlets that implements your design.
- Develop Java code that may extend a framework for implementing the data access object design pattern. Code must manipulate a database (Oracle, MySQL, or other main stream database management system) using JDBC and the DAO Command Bean design pattern or industry acceptable Data Access Object design pattern.
- Develop or extend Java code which uses Java database drivers and driver types, database connections, database meta data, database features, supported SQL statement types, and result sets as supported by JDBC.

Learning Resources

Recommended Textbook:
Java How to Program, 11th Edition, by Deitel and Deitel, Published by Pearson Education Inc. in 2018 ISBN: 9780134743356
(Available in Safari by O'Reilly through school library)

Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides. (1994). *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison-Wesley Professional. ISBN-13: 978-0-201-63361-0
(Available in Safari by O'Reilly through school library)

James W. Cooper. (2000). Java(TM) *Design Patterns: A Tutorial*. Addison-Wesley Professional. ISBN-13: 978-0-201-48539-4
(Available in Safari by O'Reily through school library)

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://mlearning.algonquincollege.com.

Learning Activities

This course consists of 2 hours of lecture, and 2 hours of lab each week.
It may also include:

- Classroom Lectures
- Lab exercises
- Assignments
- Team Projects
- Practical and reading assignments
- Research of course-related material

Pre-defined Evaluation / Earning Credit

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

Midterm Exam(s) (20%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 6, EES 3, EES 4, EES 5

Final Exam (30%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 5, CLR 6, EES 3, EES 4, EES 5

Lab Activity(ies) (20%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 6, EES 2, EES 3, EES 4, EES 5, EES 7, EES 10, EES 11

Project(s) (30%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 5, CLR 6, EES 2, EES 3, EES 4, EES 5, EES 7, EES 9, EES 10, EES 11

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 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 (i.e. lab) component.
i.e. 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's 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 CollegePolicy 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.