NORTHWESTERN POLYTECHNIC

DEPARTMENT OF SCIENCE

COURSE OUTLINE – WINTER 2023

CS 1150 (A3): Elementary Data Structures 3 (3-0-3) 6 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR:	Franco Carlacci	**PHONE:**	780-539-2091
OFFICE:	C422	**E-MAIL:**	fcarlacci@nwpolytech.ca
OFFICE HOURS:	By Appointment		

CALENDAR DESCRIPTION:

The course provides a review of programming principles (specification, implementation and testing), and an extension of object-oriented concepts from CS1140 including data abstraction, modular program construction and program reuse. The emphasis is on dynamic data structures (eg. lists, string, stacks, queues), and their associated algorithms (eg. recursion, traversal, sorting, searching, hashing).

PREREQUISITE(S)/COREQUISITE: CS1140

REQUIRED TEXT/RESOURCE MATERIALS:

Introduction to Java Programming by D. Liang. ISBN 10th Edition 0-13-376131-2.
Please make good use of the on-line and library resources related to data structures also. See the **CS1150 course** page for additional materials.

DELIVERY MODE(S):

This course includes 3-hours of lecture per week and a 3-hour of lab per week

COURSE OBJECTIVES:

This course introduces students to:

- Object oriented analysis and design: specification, implementation and testing.
- Fundamental data structures: arrays, stacks, queues, lists, trees, heaps, sets, dictionaries and graphs.
- Algorithms associated with data structures: recursion, traversal, sorting, searching, hashing.
- Asymptotic complexity analysis of algorithms

LEARNING OUTCOMES:

By taking this course, students will gain the ability to:

- Analyze problems, design algorithms and data structures to implement computational solutions to problems using an object oriented computer language.
- Design and implement object oriented classes, using inheritance and polymorphism.
- Design and implement array based and linked data structures like: strings, stacks, queues, lists, trees, heaps, sets, dictionaries and graphs.
- Describe and implement common algorithms related to searching, sorting, traversals, and hashing.

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.ca.

** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability**

EVALUATIONS:

Assignments	25%
Quizzes (2-4)	15%
MidTerm Exam	25%
Final Exam (1)	35%

GRADING CRITERIA: (The following criteria may be changed to suite the particular course/instructor)

Please note that most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

Alpha Grade	4-point Equivalent	Percentage Guidelines		Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100		C+	2.3	67-69
A	4.0	85-89		C	2.0	63-66

A-	3.7	80-84		C-	1.7	60-62
B+	3.3	77-79		D+	1.3	55-59
B	3.0	73-76		D	1.0	50-54
B-	2.7	70-72		F	0.0	00-49

COURSE SCHEDULE/TENTATIVE TIMELINE:

Sequence	Topic
Week 1	**Objects and Classes: Chapter 9** • Defining Classes & Creating Objects • Constructors, Static Variables and Methods • Visibility Modifiers, Data Fields Encapsulation • Array of Objects and Scope of Variables
Week 2	**Object Oriented Thinking: Chapter 10** • Class Abstraction & Encapsulation • Objects and Class Relationships • Primitive Types and Wrapper Class Types • String Class
Week 3,4	**Quiz 1** **Inheritance and Polymorphism: Chapter 11** • Superclasses and Subclasses • Overriding and Overloading • Polymorphism • Dynamic Binding • Protected Data and Methods • Preventing Extending and Overriding
Week 5	**Exception Handling : Chapter 12** • Exception Types • Use of Exceptions • Re-throwing Exceptions and Chained Exceptions • Custom Exception Classes
Week 6	**Abstract Classes and Interfaces: Chapter 13** • Abstract Classes • Interfaces • Class Design Guidelines

Week 7	**Generics: Chapter 19** • Defining Generic Classes and Interfaces • Generic Methods • Raw Types and Backward Compatibility • Wildcard Generic Types • Restriction in Generics
Week 8	**Review + Midterm**
Week 9	**Developing Efficient Algorithms: Chapter 22** • Algorithm Efficiency and Big O Notation • Analyzing Algorithm Time Complexity • Determining Big O • Introduction to Dynamic Programming
Week 10,11	**Linked Lists, Stack and Queues: Chapter 24** • Common Operations for Lists • Array Lists • Linked Lists • Stack and Queues • Priority Queues **Quiz 2**
Week 12,13	**Recursion, Searching and Sorting: Chapter 18, 23, 25** • Recursion • Insertion Sort, Bubble sort, Merge Sort, Quick Sort and Heap Sort • Binary Search Trees
Week 14,15	**Introduction to Hashing and Graphs: Chapter 27 and Chapter 28**

STUDENT RESPONSIBILITIES:

Assignments are to be handed in and/or demonstrated in the scheduled lab on the due-date. Late assignments will **not** be accepted.

Important Note: Students will be eligible for a passing grade only, if they obtain **40%** out of a possible 80% marks (on written exams).

STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Calendar at http://www.nwpolytech.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at https://www.nwpolytech.ca/about/administration/policies

**Note: all Academic and Administrative policies are available on the same page.