MOUNT ROYAL UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTING

COMP 2503 – PROGRAMMING III: DATA STRUCTURES

Fall 2023

TERRITORY ACKNOLWEGEMENT

Mount Royal University is located within the traditional territories of the Niitsitapi (Blackfoot) and the people of the Treaty 7 region in Southern Alberta, which includes the Siksika, the Piikani, the Kainai, the Tsuu t'ina, and the Iyarhe Nakoda. We are situated on land where the Bow River meets the Elbow River, and the traditional Blackfoot name of this place is "Mohkinstsis," which we now call the City of Calgary. The City of Calgary is also home to the Métis Nation.

CALENDAR DESCRIPTION:

Data structures important to computing such as basic linear structures, trees, heaps and hash tables will be studied. Additionally, searching and sorting methods will be covered. The representation, uses, and algorithms for manipulating these data structures will be examined. The emphasis is on using these structures to solve problems.

CREDITS: 3, Format: 3 hours lecture, 1 hour tutorial per week

PREREQUISITE: COMP 1502 with a minimum grade of C-

INSTRUCTOR: Maryam Elahi

Office: B175K
Phone: 403440 6935
E-mail: melahi@mtroyal.ca

Virtual Office hours: Tuesdays 13:30-14:20, or by appointment
Meet link: https://meet.google.com/huu-ript-dbx

*Note: The office hours are held online via Google Meet. Students are welcome to drop in during virtual office hours, or contact the instructor via email to set up an appointment.

IMPORTANT DATES

September 15, 2023:	Last Day to Adjust Registration (Add/Drop)
November 17, 2023:	Last Day to Withdraw from Courses with a W-grade
December 13-23, 2023:	Final Exam Period

Other important dates can be found here:
http://www.mtroyal.ca/academics/StudentRegistrationRecords/CriticalDates/index.php

CLASS MEETING TIMES:

Lectures:	001	Wednesday and Friday	11:30 – 12:50	B222
Tutorials:	401	Tuesday	11:00 – 11:50	B215
	402	Tuesday	12:00 – 12:50	B215

TEXTBOOKS: (optional) Drozdek, A. (2013). Data Structures and Algorithms in Java

OTHER RESOURCES:

Free online textbook: http://opendatastructures.org/

Additional readings may be assigned or recommended during the course on the course D2L site.

COURSE CONTENT:

COMP 2503 builds on the skills obtained in COMP 1501 and 1502: Java programming and object-oriented design.

Almost all programs require the management of some data. As the requirements get more complex and the amount of data being handled grows, more sophisticated ways to work with data are needed. Over the years, many standard *data structures* have been developed, such as lists, trees, and hash tables, that can be used to solve a variety of problems. A program designer and implementer must be able to select an appropriate data structure, understand its efficiency, strengths and weaknesses, and know when and how to modify it for the application at hand.

Searching for and sorting of data are fundamental computing techniques, so using searching and sorting effectively is a vital tool for program developers. Selecting the correct sorting or searching technique requires an understanding of the underlying data structures and an understanding of the efficiency of the algorithm being used.

LEARNING OUTCOMES:

At the end of the course, the student will be able to:

1. Programming Skills
    a. Design and code recursive algorithms over lists and/or trees.
    b. Design and implement algorithms using pointers.
    c. item Understand and implement programs using generics.
2. Data Structures
    a. Know the characteristics of the following data structures and to choose the appropriate one to solve a given problem:
        i. lists
        ii. stacks
        iii. queues
        iv. trees
        v. hash tables

b. Design and implement applications using the data structures above.
c. Understand various ways that data structures can be implemented.
d. Describe and compare the efficiency of selected algorithms, including several searching and sorting algorithms.

3. Software Libraries
   a. Explain the use of inheritance and its relation to using existing libraries
   b. Implement programs using data structures provided in Java libraries.

METHODS OF INSTRUCTION

There are four hours of instruction per week: three hours of lectures and one hour of tutorial. Attendance of all classes including tutorials is expected and is essential to success in the course. New concepts will be formally presented in lectures. Tutorials will be time to reinforce the learning by providing an opportunity to practice those concepts, both on the computer and on paper. Completion of all exercises is required.

Outside of class time, students are expected to study the assigned readings and review questions regularly, and be prepared for group discussions and class activities. The course will follow the course text. It is advisable to read the appropriate sections before class. Students are expected to attend the tutorials and complete the assigned exercises during the tutorial time. They are also expected to complete the assignments and quizzes by the assigned deadline. More details will be provided later in the course.

The instructor will use e-mail to send messages about the course. The D2L page for the course will be used for posting announcements, lecture notes, tutorial instructions, assignments, quizzes, and other course materials. Students must check these regularly.

TECHNOLOGY REQUIREMENTS

To successfully complete this course, students need access to a computer with the following software. Lab computers are equipped with these software.

1. A current and updated web browser: Students need a web browser to access the course material, submit their exercises, complete the online review quizzes, and access their grades via D2L. For online office hours, Google Meet will be used. Google Meet can be accessed via many web browsers but will work best with Google Chrome, and therefore, working with Google Chrome is strongly recommended. If unsure how to use D2L, Google Meet, or any other MRU resource, students should consult the instructor or an instructional assistant (IA).
2. Java SDK and Development Environment: For lab exercises and assignments, the Java programming language will be used. The recommended development environment is the latest version of OpenJDK + Eclipse.

ASSESSMENT:

Students will achieve the course learning outcomes by regularly participating in class activities and completing the assigned readings, quizzes, and assignments. Assessment will take place regularly throughout the course, as well as in cumulative and summative form on exams. Assessment will be carried out in a variety of formats:

Midterm Exam	20%
Final Exam	35%
Assignments	30%
Lab Exercises and Participation	10%
Quizzes	5%

All assessments will follow the MRU standard conversion as shown below. Final grades in all courses will be represented by a letter grade corresponding to the percentage equivalents, regardless of the program. A minimum grade of C- is required in this course in order to use it as a prerequisite for subsequent computer courses and graduation. Percentage grades will be converted to letter grades as follows:

95 – 100	**A+**	77 – 79	**B+**	67 – 69	**C+**	55 – 59	**D+**
85 – 94	**A**	73 – 76	**B**	63 – 66	**C**	50 – 54	**D**
80 – 84	**A–**	70 – 72	**B–**	60 – 62	**C–**	< 50	**F**

EXAMINATIONS:

The midterm exam is tentatively scheduled for **Friday, October 27, for 75 minutes during lecture hours**. If a change in this date is necessary, students will be notified by e-mail well in advance. The midterm exam will cover material from the preceding weeks.

The final examination will be held between December 13-23 (inclusive). The final exam will be comprehensive, with a greater focus on the second half of the course. The tentative exam duration is 3 hours. The exact date and time will be set by the University Registrar and will be announced later in the semester. Students must be available to write the final examination at the scheduled time during this period.

All material covered in lectures, tutorials, assignments, and readings may appear on the exams.

Students will not normally be permitted to write a missed midterm at a later date. A student seeking alternative arrangements must contact the instructor at least two weeks before the exam date. Students must familiarize themselves with Mount Royal's full examination policy, as described in the calendar.

EXERCISES:

Students are responsible for completing tutorial exercises in the class time provided, or as assigned homework. Periodically throughout the semester, students will be required to hand in these solutions at the end of the class for credit. Performance on exercises will be used to assign the exercises mark for the course. Students who regularly miss class should expect a low grade in this category, regardless of their marks in other course components.

ASSIGNMENTS:

There will be four assignments (7.5% each) on the following topics:

1. Java Refresher and Comparators
2. Generics and Linked Lists
3. Queues, Iterators and Trees
4. TreeMaps and Hashing

QUIZZES:

Online review quizzes will be assigned throughout the semester at the end of each topic. The purpose of the quizzes is to provide feedback to the student and the instructor on how well the material is being understood.

LATE POLICIES

Unless specified otherwise, assigned work must be electronically submitted before 11:59 pm on the due date specified. **Late submissions will not be accepted.**

COURSE AND UNIVERSITY POLICIES:

- Students are responsible for being familiar with the course policies stated throughout this course outline.

- Students must familiarize themselves with University policies, including the academic regulations described in the Calendar, and the Student Community Standards. See: https://www.mtroyal.ca/CampusServices/CampusResources/StudentCommunityStandards

- It is each student's responsibility to be aware of what constitutes plagiarism.

- Students must familiarize themselves with the other important University dates (e.g. registration and fee deadline dates) listed in the Calendar.

- The instructor will frequently use University e-mail to communicate with the class. It is the student's responsibility to read these messages in a timely fashion.

ACADEMIC ACCOMMODATION AND STUDENTS WITH DISABILITIES

Disability-Related Accommodations

If you are a student experiencing a disability who may require academic accommodation and have not yet registered with Access and Inclusion Services, please contact that office at 403-440-6868 or accessibility@mtroyal.ca. You must be registered with Accessibility Services to access academic accommodations. It is a student's responsibility to request academic accommodation. More information is available at:

http://mtroyal.ca/AcademicSupport/ResourcesServices/AccessibilityServices

Non-Disability-Related Accommodations

Students requiring non-disability-related academic accommodations (as related to the protected grounds in Human Rights Legislation) are encouraged to contact Access and Inclusion Services to explore what academic accommodations may be available to assist them in order to participate fully in their academic studies. Students can also contact the Office of Safe Disclosure to find out more about their rights and responsibilities related to human rights, harassment and accommodations. More information is available at:

https://www.mtroyal.ca/OfficeOfSafeDisclosure/index.htm

STUDENT RESOURCES

While MRU is transitioning back to in-person delivery, many areas are providing both on-campus and online support and services during office hours on weekdays. Connect directly with each department at the following:

Academic Advising
Early support
Career Services
INKSIM Center
Library access and resources
Office of the Registrar and Student Awards and Financial Aid
Recruitment

STUDENT LEARNING SERVICES

Learning Strategists can help you with writing, math learning, time management, planning a presentation, academic reading strategies, exam preparation strategies, organizing ideas, editing techniques, and more. Appointments are free of charge and can be booked online (through MyMRU), by phone, or in person. Workshops are also offered for a variety of popular topics.

Consider being a mentor: Academic and Personal Success (MAPS) peer mentorship programs provide first-year students with mentorship from senior peers in their program of study. These peer mentors help their mentees transition into their first year

of university life by providing them guidance and support on an academic and a personal level. More information is available at:

http://mtroyal.ca/AcademicSupport/ResourcesServices/StudentLearningServices

SAFETY AND WELLNESS

For information about wellness, mental health, counselling and related services, see: http://mtroyal.ca/CampusServices/WellnessServices

For information and assistance related to human rights, equity, inclusion, discrimination, harassment, sexual violence, and related services, see: https://www.mtroyal.ca/EquityDiversityInclusion/index.htm