Course Information.

Instructor: Shahin Kamali
Lectures: 9:30 am - 10:20 am, Mondays, Wednesdays, and Fridays in EITC E2-110
Office: E2-586
Office hours: 1:00–2:00 pm Monday and 10:30–11:30 am Tuesday, in E2 586 or by appointment
Email: shahin.kamali@umanitoba.ca (allow 24 hours for response)

Piazza: We will be using Piazza for class discussion. The system is highly catered to
getting you help fast and efficiently from classmates and the instructor. Rather than
emailing questions, I encourage you to post your questions on Piazza (this can be done
anonymously).
Find our class page at: https://piazza.com/class/jq4fpwagftw1b3

Prerequisites. COMP 1020 - Introductory Computer Science 2. Students are
expected to be familiar with intermediate topics in features of a procedural language,
elements of programming.

Course Goals and Intended Learning Outcomes. This course exposes
students to elementary data structure and their applications. By the end of this course,
students are expected to be able to:

- Describe common data structures and mathematically analyze them
- Use object oriented programs (particularly in Java) to implement various data
  structures and their related algorithms.
- Design data structures to objectify abstract data types and ultimately solving
  computational problems
- Understand and quantify why one data structure and its related algorithmic
  solution is better than another

Textbook. All materials from the class will be posted in the course webpage. The
slides will be the main source for assignments and exams. The following free book is
recommended as the reference for the materials covered in the class.

- Open Data Structures (in Java), Pat Morin (http://opendatastructures.org/ods-
  java/)
Course Overview. COMP 2140 is a second-year course on data structures. Students will learn problem solving with the help of data structure and using Java programming. Topics to be covered include:

Abstract data types

Java Programming (review)
  object-oriented design & classes
  private, public, protected methods

Algorithm Analysis
  measuring the time complexity
  big Oh, big Omega, Theta

Stacks and Queues
  push, pop, enqueue, dequeue
  implementation as an array
  implementation as a linked list

Recursion
  iteration vs recursion
  Fibonacci numbers
  tail recursion

Binary Trees
  insertion, deletion, searching
  height, depth
  children, parents, leaves, ancestry

Tree traversal
  dynamic structure implementation
  array implementation
  binary search trees

Heaps
  reheapUp, reheapDown, buildHeap
  priority queues: insert, extractMax
  binomial trees and their merging

B-Trees
  2-3-4 trees
  insertion in a B-tree

Sorting
  insertion sort
  mergesort
  quicksort
  heapsort
  in-place sorting

Hash Tables
  dictionary abstract data type
  hash functions
  chaining vs. open addressing

Graph Theory
  adjacency list vs. adjacency matrix
  minimum spanning tree (MST’s)
  Prim’s algorithm
  Kruskal’s algorithm
  graph colouring
  graph isomorphism
Grading. All students will be required to complete five assignments, two quizzes, a midterm exam, and a final exam. Grades will be calculated according to the following table:

- assignments 20%
- labs 10%
- quizzes 10%
- midterm exam 20%
- final exam 40%

Assignments. Assignments will be distributed in class during the term. Solutions must be submitted on Desire2Learn (UMLearn) by the posted deadline. To permit the prompt distribution of solutions and return of marked assignments, late assignments will not be accepted. Please include your name and student number on all submitted material.

Examinations. A typical quiz will last 20 minutes and will consist of two or three problems similar to those from recent assignments. There will be a midterm exam held in class (for its whole duration) and a final exam held during the April exam period. Exams and quizzes will be closed book.

Tentative allocation of final mark

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<th>letter grade</th>
<th>percent grade</th>
<th>grade point</th>
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Important Dates

- January 7 first class
- January 23 assignment 1 due
- January 30 quiz
- February 8 assignment 2 due
- February 18 assignment 3 due
- February 19-22 midterm break - no class
- March 2 midterm exam
- March 14 Pi (π or pie) day
- March 20 voluntary withdrawal deadline
- March 22 assignment 4 due
- March 29 quiz
- April 5 assignment 5 due
- April 9 last class
- April 9-23 exam period
**Academic Integrity.** The Faculty of Science takes academic integrity very seriously. Any evidence of academic dishonesty on assignments, labs and/or tests will be forwarded to the appropriate authorities for potential disciplinary actions. The University Student Discipline By-Law may be accessed at: [http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html](http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html). Information from the Faculty of Science regarding Cheating and Plagiarism can be found at [http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html](http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html).

Students are encouraged to discuss course concepts and the general interpretation of homework problems with other students in the class. No written record should be taken from such discussions. Each student must work on the final solution of assignment problems independently. On a cover page, each student must list the names of people with whom he or she has discussed the assignment solution. Submitting the work of another person as your own constitutes academic misconduct. Any collaboration that does not follow these guidelines will be considered plagiarism and will be reported to the Faculty of Science. Students are to abide by the university’s policies regarding academic dishonesty which can be found on this web site: [http://umanitoba.ca/student/resource/student_advocacy/academicintegrity/students](http://umanitoba.ca/student/resource/student_advocacy/academicintegrity/students).

**Class Communication.** All announcements for the class will be posted on the webpage of the course as well as on the course Piazza page. The piazza page will also be the central place for class discussions and for any questions about the lectures and assignments.

Please note that all communication between the instructor and you as a student must comply with the electronic communication with student policy ([http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html](http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html)). You are required to obtain and use your U of M email account for all communication between yourself and the university.

Updated January 6, 2019.