CS2210 B - Data Structures and Algorithms
Course Outline – Winter 2024

1. Course Information

Course Information

CS2210 B - Data Structures and Algorithms
Winter 2024

Section 1
Instructor: Roopa Bose
Lectures: Monday 3:30 pm - 5:30 pm and Wednesday 3:30 pm - 4:30 pm at SEB-1200

Section 2
Instructor: Marios-Stavros Grigoriou
Lectures: Tuesday 7:00 pm – 10:00 pm at NCB-113

List of Prerequisites

A list of the prerequisites for the course.
1. Either
Either Computer Science 1027A/B, Computer Science 1037A/B, the former Computer Science 2101A/B, Computer Science 2121A/B or Digital Humanities 2221A/B in each case with at least 65%, and 1.0 course with at least 60% in each from: Applied Mathematics 1201A/B, Numerical and Mathematical Methods 1411A/B, Numerical and Mathematical Methods 1412A/B, Calculus 1000A/B, Calculus 1301A/B, Calculus 1500A/B, Calculus 1501A/B, Mathematics 1600A/B, the former Applied Mathematics 1411A/B, the former Applied Mathematics 1412A/B, the former Applied Mathematics 1414A/B, the former Applied Mathematics 1413; or Integrated Science 1001X with at least 60%.

2. Knowledge of Java. If you do not know Java, you must be aware that you will need to spend extra time learning this language as all programming assignments are in Java.

Students who have been admitted to this course without the normal prerequisite of Computer Science 1027 or 1037 may not have been exposed to the background material expected for this course; it is the responsibility of these students to gain familiarity with this material on their own.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Office Hours
Marios-Stavros Grigoriou (Course Coordinator)	mgrigori@uwo.ca	MC 215	3:30 pm to 5:30 pm on Thursday via Zoom
Roopa Bose	rbose4@uwo.ca	MC 28C	1:00 pm to 3:00 pm on Tuesday via Zoom

TA Consulting Hours (To be posted in OWL)

Students must use their Western (@uwo.ca) email addresses when contacting their instructors. Use course number – CS2210B in the subject line.

3. Course Syllabus, Schedule, Delivery Mode

Course Description

The purpose of this course is to provide the students with solid foundations in the basic concepts of programming: Data structures and algorithms. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter. This course is also about showing the correctness of algorithms and studying their computational complexities. This course offers the students a mixture of theoretical knowledge and practical experience.

The study of data structures and algorithms is carried out within an object-oriented framework. When implementations are considered, the Java programming language is used. Topics covered in this course include:

- Design and analysis of algorithms
- Time complexity and asymptotic notation
- Dictionaries and hash tables
- Trees, binary search trees, AVL trees, multi-way search trees, (2,4)-trees, and B-trees
- Graphs, graph traversals, and graph algorithms

Course Learning Outcomes

- Compute the time and space complexity of an algorithm to predict the amount of time and memory that it will need when executed on a computer.
- Compare different data structures and algorithms to select the most appropriate one for a particular application.
- Design algorithms that correctly solve a problem
- Use hash tables, trees, and graphs to model and solve computational problems.
- Implement algorithms and data structures as Java programs.

Tentative lecture schedule

Week	Topic
Week1 (Jan 8 to 12)	Linear search and Binary search algorithms.
Week 2 (Jan 15 to 19)	Algorithm Design & Analysis, including the notion of complexity function and the asymptotic notation
Week 3 (Jan 22 to 26)	Recursive algorithms and how to compute their time complexity
Week 4 (Jan 29 to Feb 2)	Dictionary ADT and Hash tables
Week 5 (Feb 5 to 9)	Trees and simple tree algorithms
Week 6 (Feb 12 to 16)	Ordered dictionary ADT and Binary Search Trees
Spring Reading week (Feb 19 to 23)	-------
Week 7 (Feb 26 to Mar 1)	Binary Search Trees continued and AVL Trees
Week 8 (Mar 4 to 8)	Multiway Trees
Week 9 (Mar 11 to 15)	Multiway Trees continued
Week 10 (Mar 18 to 22)	Introduction to graphs
Week 11 (Mar 25 to 29)	Graph traversal algorithms
Week 12 (Apr 1 to 5)	Advanced graph algorithms

Contingency Plan for Pivoting to 100% Online Learning
Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

If the course needs to be moved online, any remaining exams will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

4. Course Materials

OWL
All course material will be posted to OWL: (http://owl.uwo.ca).

Students are responsible for checking the course OWL site on a regular basis for course material, assignments, news, and updates. This is the primary method by which information will be disseminated to all students outside the classroom.

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Textbook
Data Structures and Algorithms in Java, sixth edition. Michael T. Goodrich, Roberto Tamassia, and Michael Goldwasser. John Wiley & Sons Inc., 2014.

Textbook is **not** required, but students are encouraged to try to get a copy as it provides complementary material to that presented in class.

Lecture Notes
Lecture notes will be available in OWL.

Technical Requirements to take this course

- A computer or tablet able to run a recent version of a web browser, Java, and a Java Integrated Development Environment,
- A webcam and microphone in case the course delivery needs to be moved online, and
- Reliable high-speed internet connection

In addition to the technology requirements associated with this course, you should also possess a set of computer skills that include: installing software, security, and virus protection on your computer, managing files/folders on your computer, using the internet, using a web browser, write, compile, debug, and execute programs in Java.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Concept Assignments (2)	6%	(3% each)
Programming Assignments (3)	36%	(12% each)
Midterm Test (1)	24%	
Final Exam (1)	34%	

This course is an important prerequisite for CS 2212a/b and most third year Computer Science courses. The following rules are designed to ensure that students progressing in honors programs, and those planning to take further CS courses, meet certain minimum standards:

- To be eligible to receive an overall passing grade of 50%, a student must receive a weighted average of at least 45% on the midterm and final exams, and a weighted average of at least 45% on the assignments. If these conditions are not met, the maximum mark that you will receive is 48%.
- To be eligible to receive an overall grade of 60% or higher in the course, a student must receive a weighted average of at least 55% on the midterm and final exams, and a weighted average at least 55% on the assignments. If these conditions are not met, the maximum mark that you will receive is 58%.

If for any reason the assignment schedule given below cannot be adhered to, the assignment marks will be pro-rated. The assignments are worth 42% of the overall mark for the course. If an assignment must be canceled for any reason, the remaining assignment weights will be prorated to add up to 42%. If for any reason the midterm examination must be canceled, the final exam will be worth 58% of the final mark.

Schedule (*Tentative, some of these dates might change*)
All assignments are due through OWL at 11:55pm on the date indicated.

- Assignment 1 (concept) due on **January 26**, 2024
- Assignment 2 (programming) due on **February 16**, 2024
- Assignment 3 (concept) due on **March 1,** 2024
- Assignment 4 (programming) due on **March 22**, 2024
- Assignment 5 (programming) due on **April** 5, 2024
- A 2-hour midterm exam TBD (Tentatively between March 4, 2024, and March 8, 2024)
- A 3-hour final exam will be scheduled by the Registrar's Office. (TBD)

There will be no makeup Midterm Exam, except for students requesting a Special Midterm Exam for religious reasons. These students must have notified the course instructor and filed documentation with their Dean's office at least 2 weeks prior to the Midterm Exam.

If you miss the midterm exam for any other reason, follow the procedure for Academic Accommodation for Medical Illness given below. If accommodation is approved by your Dean's office, your final exam mark will be re-weighted to include the weight of the midterm exam.

Concept Assignments
Two concept assignments will be assigned in this course. Each assignment consists of a set of exercises related to the material covered in class. The solutions for the exercises should be neatly written or typed.

All programming assignments must be submitted through OWL. Students are responsible for checking their e-mail and the course's OWL site on a regular basis.

Programming Assignments
The programming assignments require you to write Java programs related to the data structures and algorithms discussed in lectures.

To be eligible for full marks, your programming assignments must run on the departmental computing equipment. You may develop assignments on your home computer, but you must allow for the amount of time it will take to get the final programs working on Computer Science's machines.

All programming assignments must be submitted through OWL. Students are responsible for checking their e-mail on a regular basis.

Late Policy
Concept assignments must be handed in by the due dates. **No late concept assignments will be accepted.**

The late penalty for programming assignments is $[2.5^i]$ (2.5 to the i-th power, rounded to the nearest integer), where $i > 0$ is the number of days you are late. So, if you hand in your assignment 1 day late,

you will be penalized 3%, a delay of 2 days will decrease your grade by 6%, 3 days is penalized 16% and 4 days takes 39% off your grade. You cannot be more than 4 days late.

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Appeals of Assignment Marks
Appeals of assignment marks must be **addressed first to the T.A**. who marked your work. If you and the T.A. cannot agree, then please discuss the situation with the instructor.
Appeals **must occur within 1 week** from the first day that the marked assignments were made available to students. After that 1-week period has gone by, no more appeals will be considered.

Ethical Conduct
Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf
Students must write their assignments in their own words. Whenever students take an idea, or a passage from another author (including an AI bot), they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

All assignments are individual assignments. You may discuss approaches to problems among yourselves; however, the actual details of the work (assignment coding, answers to concept questions, etc.) must be an individual effort. Assignments that are judged to be the result of academic dishonesty will be penalized and the Department of Computer Science and the Dean's office will be informed of this offence. Notice that the Department or the Dean's office might impose additional penalties. You are responsible for reading and respecting the Computer Science Department's policy on Scholastic Offences and Rules of Ethical Conduct
https://www.csd.uwo.ca/undergraduate/current/policies/ethical_conduct.html

We will use the plagiarism checking software called MOSS to compare student program submissions.

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Email Contact and OWL
Students should check the course's OWL site on a regular basis for news and updates. This site is the primary method by which information will be disseminated to all students outside the classroom. **Students are responsible** for checking OWL and their email messages on a regular basis.

Email messages will be sent to the UWO email address assigned to students by Information Technology Services (ITS), i.e., your email address @uwo.ca. It is each student's responsibility to read this email on a frequent and regular basis, or to have it forwarded to an alternative email address if preferred. See the ITS website for directions on forwarding email. However, you should note that email at ITS (your UWO account) and other email providers such as hotmail.com or yahoo.com may have quotas or limits on the amount of space they can use. If you let your email accumulate there, your mailbox may fill up and you may lose important email from your instructors. Losing email that you have forwarded to an alternative email address is not an excuse for not knowing about the information that was sent.

Students must use their Western (@uwo.ca) email addresses when contacting the instructor. If you send email to the instructor from a commercial account, send a carbon copy (cc) to your UWO email address. The instructors will respond to your UWO address.

In accordance with university policy, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that email received from the University at his/her official university address is attended to in a timely manner.

6. Student Absences

Academic Consideration for Student Absences
Students who experience an extenuating circumstance (like illness or injury) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration. You must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf
The Student Medical Certificate is available at
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences must be submitted to the Academic Counselling office of a student's Home Faculty.

If a student receives academic accommodation, depending on the circumstances the instructor will determine whether the missed components will be excused (so that the completed components will be re-weighted) or if deadlines will be extended for submitting the missing academic work. Accommodation for any work missed must be requested to the student's Dean's Office/Academic Counselling unit.

Note: missed work can only be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is not sufficient on its own.

Absences from Final Examinations
If you miss the final exam, please contact your Faculty's Academic Counselling Office as soon as you can do so. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup final exam). You may also be eligible to write the Special Exam if you are in a multiple exam situation (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

6. Accommodation and Accessibility

Religious Accommodation
When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

7. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

No electronic devices will be allowed during the exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.