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Western University
Department of Computer Science
CS 2210 – Data Structures and Algorithms
Course Outline – Fall 2020

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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:

- Analysis of algorithms
- Dictionaries, hash tables
- Trees, binary search trees, AVL trees, multi-way search trees, (2,4)-trees, B-trees
- Graphs, graph traversals, graph algorithms
- Sorting.

OWL

Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis. All course material will be posted to OWL: http://owl.uwo.ca.

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.

Minimum Technical Requirements to Take this Course

- A computer or tablet able to run a recent version of a web browser such as Chrome, FireFox, or Safari,
- A webcam and microphone, 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, and using the interned using a web browser.

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 or algorithms to select the most appropriate ones 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

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Prerequisites

1. Either
   - Computer Science 1027A/B, Computer Science 1037A/B, 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, Applied Mathematics 1413, Calculus 1000A/B, Calculus 1301A/B, Calculus 1500A/B, Calculus 1501A/B, Mathematics 1600A/B; 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.

Instructor Information

Dr. Roberto Solis-Oba
Office: MC417
Email: solis@csd.uwo.ca
Office hours through Zoom: Tuesday 2:30 pm - 3:30 pm, Thursday 2:30pm - 3:30 pm
Drop-in sessions through Zoom: Tuesday 1:30 pm - 2:30 pm

Lectures

This is an online course. Video lectures and lecture notes will be posted at the beginning of each week in OWL. It is your responsibility to study the video lectures and reading material every week. Every week there is an ungraded self-assessment for you to evaluate the mastery of the material studied.

Synchronous drop-in sessions will be held every week on Tuesday from 1:30 pm to 2:30 pm, starting in the second week of the term. In this sessions the instructor will present additional examples of material covered in the previous week that most students found challenging.

TA Consulting Hours (To be posted in course's website)

Supplementary Textbook

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

Lecture Notes and Video Lectures

Lecture notes and video lectures will be available in OWL.

Student Evaluation

Grades will be based on:
- 2 concept assignments, each worth 4% of the final mark
- 3 programming assignments, each worth 12% of the final mark
- a midterm exam, worth 21% of the final mark
- a final exam, worth 35% of the final mark

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 honours programs, and those planning to take further CS courses, meet certain minimum standards:

- To be eligible to pass the course, 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.
- 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 of at least 55% on the assignments.

If for any reason the assignment schedule given below cannot be adhered to, the assignment marks will be pro-rated. The assignments are worth 44% of the overall mark for the course. If an assignment has to be cancelled for any reason, the remaining assignment weights will be prorated to add up to 44%. If for any reason the midterm examination has to be cancelled, the final exam will be worth 56% of the final mark.

Every effort will be made to have assignments marked and handed back within 2 weeks of the hand in date. Midterm exam marks will be available within 2 weeks of the exam.

Schedule *(Tentative, some of these dates might change)*

All assignments are due at 11:59pm on the date indicated.

- Assignment 1 (concept) due on September 27.
- Assignment 2 (programming) due on October 18.
- Assignment 3 (concept) due on October 25.
- Assignment 4 (programming) due on November 20.
- Assignment 5 (programming) due on December 8.
- A 2-hour midterm exam will be scheduled by the Registrar's Office.
- A 3-hour final exam will be scheduled by the Registrar's Office.

It is Faculty of Science policy that a student who chooses to write a test or exam deems themselves fit enough to do so, and the student must accept the mark obtained. Claims of medical, physical, or emotional distress after the fact will not be considered.

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 assignments will be made available in OWL. The availability of assignments will be announced via e-mail. Students are responsible for checking their e-mail 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 using an alternative version of Java, 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 handed in using electronic submission procedures, to be described in class.

All assignments will be made availablein OWL. The availability of assignments will be announced via e-mail. Students are responsible for checking their e-mail on a regular basis.

Appeals of Assignment Marks

Appeals of assignment marks should be addressed to the T.A. first. If you and the T.A. cannot agree, then please discuss the situation with the lecturer.

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.

Late Policy

For each assignment it is indicated above when it is due, and for each assignment we will give details on how to hand in the work. Concept assignments must be handed in on the due date. **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.

Extensions will be granted only by the course instructor. If you have serious medical or compassionate grounds for an extension, you should take supporting documentation to the office of the Dean of your faculty, who will contact the instructor.

Accommodation and Accessibility

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are met:

- if the student uses the Self-Reported Absence to request accommodation for an assignment, the student will be granted a 48 hours extension on the deadline
- if the student uses the Self-Reported Absence to request accommodation for the midterm exam, the weight of the midterm exam will be added to the weight of the final exam.

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

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 that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

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

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.

If you miss the final exam, please contact your faculty's Academic Counselling Office as soon as you are able to 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. See

http://www.registrar.uwo.ca/examinations/exam_schedule.html

Recording of Learning Sessions and Exams

Tests and examinations in this course will be conducted using the remote proctoring service Proctortrack. 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. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link:

https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf

Completion of this course will require you to have a reliable Internet connection and a device that meets the technical requirements for this service. Information about the technical requirements are available at the following link:

https://www.proctortrack.com/tech-requirements/

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are **NOT** permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

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, 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 given a mark of zero 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

http://www.csd.uwo.ca/current_students/undergraduate_students/scholastic_offences.html

and Rules of Ethical Conduct

http://www.csd.uwo.ca/current_students/undergraduate_students/rules_of_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 OWL (http://owl.uwo.ca) on a regular basis for news and updates. This site and email are the primary methods by which information will be disseminated to all students in the class. **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 policy, http://www.uwo.ca/its/identity/activatenonstudent.html, 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.

Support Services

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

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 Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations. The policy on Accommodation for Students with Disabilities can be found here:

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

The policy on Accommodation for Religious Holidays can be found here:

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

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.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.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.

Students who are in emotional/mental distress should refer to Mental Health@Western

http://www.uwo.ca/uwocom/mentalhealth

for a complete list of options about how to obtain help. Additional student-run support services are offered by the USC,

http://westernusc.ca/services.

Please consult the Web site for Registrarial Services

http://www.registrar.uwo.ca

and for USC

http://westernusc.ca/services

for a list of student support services and programs.