

**Western University**  
**Faculty of Engineering**  
**Department of Electrical and Computer Engineering**

**SE2205A: Algorithms and Data Structures for Object Oriented Design**

**Course Outline 2021-22 (Fall 2021: September 08, 2021 to December 08, 2021)**

*No classes/Labs on October 11 (Monday/Thanksgiving) and from November 1 until November 7, 2021 (Fall reading week)*

**Description:**

This Course surveys of important computer algorithms and related data structures used in object-oriented software engineering. Design, performance analysis and implementation of such algorithms, stressing their practical use and performance certification of large software applications. Understand how to "seal" designs to guarantee performance goals and ensure that all error conditions are caught.

**Instructor:** Dr. Quazi M. Rahman, P.Eng., SMIEEE  
TEB 263, 519-661-2111 ext. 81399, UWO  
Email address: [qrahman3@uwo.ca](mailto:qrahman3@uwo.ca)

Consultation hours over zoom (Registration required): Tuesdays and Fridays: 10 am – 11.30 am. Other times: by appointment please. [Note: based on the COVIT-19 scenario, it may change into in-person meeting, which will be notified via OWL course-site]

**Academic Calendar Copy:** (<https://www.westerncalendar.uwo.ca/AllCourses.cfm>) Survey of important computer algorithms and related data structures used in object-oriented software engineering. Design, performance analysis and implementation of such algorithms, stressing their practical use and performance certification of large software applications. Understand how to "seal" designs to guarantee performance goals and ensure that all error conditions are caught.

**Contact Hours:** 3 lecture hours, 2 laboratory hours, 0.5 course.

**Antirequisite:** Computer Science 2210A/B

**Prerequisites:** Computer Science 1026A/B or Engineering Science 1036A/B.

**Co-requisite:**

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.

**CEAB Academic Units:** Engineering Science 75%, Engineering Design 25%.

**Recommended References:**

1. Frank M. Carrano and Timothy M. Henry, Data Structures and Abstractions with Java, Prentice Hall, 5th Edition, 2019, ISBN 10: 0-13-483169-1 ISBN 13: 978-0-13-483169-5
2. Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser, Data structures and algorithms in Java, John Wiley & Sons, 6th Ed., 2014 (ISBN: 978-1-118-77133-4).
3. Gayle Laakmann McDowell. Cracking the Coding Interview, Career Cup, 6th Edition, 2015, ISBN: 978-0-9847828-5-7.
4. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, Modern Java in Action: Lambdas, streams, functional and reactive programming (ISBN 9781617293566)  
(<https://www.manning.com/books/modern-java-in-action?query=modern%20java> )

### General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	2/2	Use of Engineering Tools	2/2	Impact on Society and the Environment	
Problem Analysis	3/2	Individual and Team Work		Ethics and Equity	
Investigation		Communication Skills		Economics and Project Management	
Design		Professionalism		Life-Long Learning	

Notation:  $x/y$ , where  $x$  is the cognitive level (1: Remember, 2: Understand, 3: Apply) at which the attribute is assessed and  $y$  is the academic level (1: Beginner, 2: Intermediate, 3: Advanced) at which the attribute is assessed.

### Topics and Specific Learning Objectives

Course Topics and Specific Learning Objectives	CEAB Graduate Attributes Indicators
<b>1. Object-Oriented Principles (OPP) Revisited</b> At the end of this section, students will be able to:	
a. Explain the Object-Oriented Principles.	KB 3
b. Identify the implementations of OOP in Java.	KB 4
c. Apply OOP in their programming with Java.	ET 2
<b>2. More Java Features</b> At the end of this section, students will be able to:	
a. Identify some Adapter-features of Java programming including Composition, Aggregation	ET 1, ET 2
b. Recognize the benefits of Generics.	KB 4
c. Working with Exception handing, Recursions and the likes	ET 1, ET 2
<b>3. Fundamental Data Structures</b> At the end of this section, students will be able to:	
a. Identify, implement and use basic data structures including arrays, lists and linked lists.	KB3, ET1, ET2
b. Identify, implement and use queues and stack data structures.	KB3, ET1, ET2

c. Identify, implement and use tree and graph data structures.	KB3, ET1, ET2
d. Identify, implement and use Maps and Hash Tables.	KB3, ET1, ET2
e. Recognize and work with Java Collections framework.	ET 1, ET 2
f. Recognize and work with Java Streams framework.	ET 1, ET 2
<b>4. Algorithm Analysis</b> At the end of this section, students will be able to:	
a. Recognize the concepts of algorithms analysis.	KB 3, PA 1
b. Perform Asymptotic analysis on any given algorithm.	KB 3, PA 1, PA 2, PA 3
<b>5. Fundamental Algorithms</b> At the end of this section, students will be able to:	
a. Recognize and implement the main search algorithms.	KB 3, PA 1, PA 2, PA 3
b. Recognize and implement the main selection algorithms.	KB 3, PA 1, PA 2, PA 3
c. Recognize and implement the main sorting algorithms.	KB 3, PA 1, PA 2, PA 3
d. Recognize and implement the main tree algorithms.	KB 3, PA 1, PA 2, PA 3
e. Recognize and implement the main graph algorithms	KB 3, PA 1, PA 2, PA 3

## Evaluation

Course Component	Weight
Lab Assignments (Maximum 5)	25%
Midterm 1	10%
Midterm 2	15%
Midterm 3	20%
Final Examination	27%
Attendance	3%
Bonus (Quizzes and Lab exercises: Maximum 10)	5%

**Note:** A maximum-recorded mark for this course will be 100%, even if someone receives more than 100% mark after adding the bonus.

**Lab Assignments:** A maximum of 5 assignments will be available. Late submission will be open for three days after the due date with 10% late penalty for each day. No submission will be accepted after that date.

**Lab exercises and Quizzes (Bonus 5%):** To help the students follow with the material there will be a quiz and lab exercise in every week beginning from week 2. The associated grades of these labs and quizzes will be added as bonus grade. Strick deadline will be maintained on these bonus components.

**Midterm Test:** There will be three midterms:

Midterm 1: 3<sup>rd</sup> week of the program

Midterm 2: 6<sup>th</sup> week of the program

Midterm 3: 9<sup>th</sup> week of the program.

Mode: Online-in-person exam OR paper-based in-person exam (TBD)

Time: During class time

**Final Examination:**

Mode: Online-in-person exam OR paper-based in-person exam (TBD)

Time: Examination will take place during the regular examination period

**Attendance:**

Class attendance will be recorded and a grade of maximum 3% will be assigned based on the following breakdown:

Percentage of Attendance	Bonus Grade (Out of 3)
1 – 49	0
50 – 69	1
70 – 89	2
90 and above	3

**Lab Attendance:**

In-person Lab Attendance will be required for getting any help from the TAs. In this case, the TAs should be communicated via email so that they can be there in the lab for the students who may have some questions. (The TAs will observe the lab hours as office hours, when they will expect any student in the lab).

Since the on-line components will be used in the exam, completion of this course will require you to have a reliable device that meets the technical requirements for this service.

**Use of English:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Attendance:** Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been

given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

**Absence Due to Illness or Other Circumstances:** Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf)

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

**Missed Midterm Examinations:** If a student misses a midterm examination, she or he must follow the Instructions for Students Unable to Write Tests and provide documentation to Undergraduate Services Office within 24 hours of the missed test. If accommodation is granted, the department will decide whether to provide a make-up test or allow reweighting of the test, where reweighting means the marks normally allotted for the midterm will be added to the final exam. If no reasonable justification for missing the test can be found, then the student will receive a mark of zero for the test.

If a student is going to miss the midterm examination for religious reasons, they must inform the instructor in writing within 48 hours of the announcement of the exam date or they will be required to write the exam.

**Cheating and Plagiarism:** Students must write their essays and 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. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

### **Use of Electronic Devices:**

### **Use of Personal Response Devices (“Clickers”):**

**Policy on Repeating All Components of a Course:** Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted by the student for grading in subsequent years.

**Internet and Electronic Mail:** Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) and making themselves aware of any information that is posted about the course.

**Accessibility:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

**Support Services:** Office of the Registrar, <http://www.registrar.uwo.ca/>  
Student Development Centre, <http://www.sdc.uwo.ca/>  
Engineering Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>  
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, [http://www.health.uwo.ca/mental\\_health/](http://www.health.uwo.ca/mental_health/), for a complete list of options about how to obtain help.

### **Class Schedule:**

## SE 2205A - ALGORITHMS & DATA STRUCTURE

**Course Description:** Survey of important computer algorithms and related data structures used in object-oriented software engineering. Design, pe of large software applications. Understand how to "seal" designs to guarantee performance goals and insure that all error conditions are caught. Ant

Section	Component	Class Nbr	Days	Start Time	End Time	Location					
001	LEC	8765	<table border="1"><tr><td></td><td></td><td>W</td><td></td><td></td></tr></table>			W			10:30 AM	12:30 PM	WSC-55
		W									
001	LEC	8765	<table border="1"><tr><td></td><td></td><td></td><td>Th</td><td></td></tr></table>				Th		1:30 PM	2:30 PM	SEB-2200
			Th								
002	LAB	8766	<table border="1"><tr><td></td><td></td><td></td><td>Th</td><td></td></tr></table>				Th		10:30 AM	12:30 PM	ACEB-4435
			Th								
003	LAB	10244	<table border="1"><tr><td></td><td>Tu</td><td></td><td></td><td></td></tr></table>		Tu				1:30 PM	3:30 PM	ACEB-4435
	Tu										
004	LAB	8767	<table border="1"><tr><td>M</td><td></td><td></td><td></td><td></td></tr></table>	M					2:30 PM	4:30 PM	ACEB-4435
M											
005	LAB	8768	<table border="1"><tr><td></td><td></td><td></td><td>Th</td><td></td></tr></table>				Th		4:30 PM	6:30 PM	ACEB-4435
			Th								