Fall 2020 -- Department of Computer Science, University of Western Ontario

CS3331 - Foundations of Computer Science

Emergency Remote Teaching

Course description (course web site)

We live during the computer revolution, which is changing fast everything around us. While programming languages change fast, the basic underlying theory does not. This course covers the basic concepts of the theory of computation. To study computation thoroughly, we need models. Ideally, we would like simple models to solve our problems. This is what the theory of computation is about: computational models and their power, with an impressive array of applications. That includes finite state machines, regular expressions, push-down automata, and context-free grammars. A crucial aspect is studying the limits of computations, which involves investigating all powerful models, such as Turing machines. Some problems are intractable, that is, it takes ages to solve them, others are provably impossible to solve even on an infinitely powerful computer. Computability theory sheds light on these issues of fundamental importance to anyone attempting to understand what computers can do for us.

Topics

- Regular Languages
  - Finite State Machines (FSM), Deterministic (DFSM), Nondeterministic (NDFSM), Regular Expressions, Regular Grammars
  - Minimizing DFSM, Conversions between DFSM, NDFSM, Reg. Exp., and Reg. Grammars
  - Proving regularity, Closure properties
  - Proving nonregularity, Pumping theorem, Using closure properties
  - Decision Problems, Membership, Emptiness, Totality, Finiteness, Equivalence, Minimality
- Context-free Languages
  - Pushdown Automata (PDA), Context-free Grammars (CFG)
  - Conversions, PDA ↔ CFG, CFG → Chomsky Normal Form
  - Ambiguity
  - Proving context-freeness, Closure properties
  - Proving noncontext-freeness, Pumping theorem, Using closure properties
  - Decision Problems, Membership, Emptiness, Finiteness
- Turing Machines and Undecidability
  - Turing Machines (TM), Deterministic TM
  - Decidable languages (D), Semidecidable languages (SD)
  - Multi tape TM, Nondeterministic TM
  - Universal TM, Halting Problem
  - D and SD, Enumeration
  - Reduction, Using reduction to prove undecidability
  - Rice's Theorem, Non-SD languages
  - Unrestricted Grammars
  - Non-TM Problems, Post Correspondence Problem (PCP), Context-free language problems

Prerequisites

Computer Science 2214: Discrete Structures for Computing or Mathematics 2155: Discrete Structures I or registration in the third or fourth year of an honors program that combines Computer Science and other mathematical science or SE 2251A/B (251A/B) and registration in the third year of the BESc program in Software Engineering.
Unless you have either the prerequisites for this course or written special permission from your Dean to enrol 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

- Prof. Lucian Ilie, MC378, e-mail: ilie@uwo.ca
  - Office hours: Zoom, TBA

Class time

- Tuesdays, 3:30 - 5:30pm
- Wednesdays, 9:30 - 10:30am
- **Lectures: Zoom, synchronous**

Textbook (required)

- Elaine Rich, *Automata, Computability, and Complexity. Theory and Applications,* © Person Prentice Hall (2008), ISBN 978-0-13-228806-4.
  - The textbook is out of print. A free PDF is available from the author's web site. You can find a hard copy from previous students or from AbeBooks.

Tools

- JFLAP (You are allowed to use JFLAP for assignments.)

Evaluation (tentative due dates - the date in the assignment supersedes this) -- Assignments will be available on **OWL**

- Assignment 1 (10%) -- due Oct. 6
- Assignment 2 (10%) -- due Oct. 20
- Assignment 3 (10%) -- due Nov. 24
- Assignment 4 (10%) -- due Dec. 6
- **Best 3 out of 4 assignments will be considered.**
- **In case of missed assignments, their weight is moved to the exams as follows: assignments 1 and 2 to midterm and assignments 3 and 4 to final. The midterm exam, if missed, has to be retaken; the weight cannot be moved to the final exam.**
- Midterm Exam (31%) -- (covers Regular and Context-free Languages -- see Topics above) -- Tuesday, Oct. 27, 3:30 - 5:30pm (see lecture notes for sample midterm exam)
  - Review sessions by TAs (in additions to in-class review): Will be announced in OWL
- Final Exam (39%) -- (covers Turing Machines and Undecidability -- see Topics above) -- TBA
  - Review sessions by TAs (in additions to in-class review): Will be announced in OWL
- **Both exam are open book and will take place using Proctortrack.**

- **In order to pass the course you MUST PASS THE EXAMS, that is, your weighted average grade for the two exams should be at least 50/100.**

TAs

TBA

TAs office hours

TBA

Assignments

- The assignments will consist 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 on the course web site. The availability of assignments will be announced on class and/or 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 the T.A. will 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.

Computing Facilities

Each student will be given an account on the Computer Science Department senior undergraduate computing facility, GAUL. In accepting the GAUL account, a student agrees to abide by the department's; Rules of Ethical Conduct.

Adherence to Deadlines

There is no penalty for late submissions up to three days. After that the late work is no longer accepted.

Accommodation and Accessibility

Accommodation Policies
Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.
Academic Consideration for Student Absence
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 expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. 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 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.

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:
https://multiculturalcalendar.com/ecal/index.php?s=c-univwo
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).
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 Academic Calendar for details (under Special Examinations).

Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.
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 e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.
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.
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.
All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in 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).
Tests and examinations in this course will be conducted using the remote proctoring service, such as 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/

Tests and examinations in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will not be recorded. (Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.)
More information about the use of Zoom for exam invigilation 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 system requirements for Zoom. Information about the system requirements are available at the following link: https://support.zoom.us/hc/en-us
Tests and examinations in this course will be conducted using both Zoom and the remote proctoring service, such as Proctortrack.
When Zoom is used for exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded. (Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.)
Proctortrack will require you to provide personal information (including some biometric data). The session will be recorded. By taking this course, you are consenting to the use of this software. More information about remote proctoring 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 system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at the following links: https://www.proctortrack.com/tech-requirements/ https://support.zoom.us/hc/en-us

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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 (519) 661-2147 if you have any questions regarding accommodations.
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.health.uwo.ca/mental_health") 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".
