

DISTRIBUTED COMPUTING

COMP 4001 (August 31, 2022)

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1 DELIVERY METHOD

Lectures will be held in RB 2200. Homework, assignments and other activities will be completed outside of class and submitted in Brifgtospace. Students are expected to be available during class times.

2 CONTACTS

- Evangelos Kranakis, Office 5360 HP,
Office hrs Tue & Thu 1-2 pm (via Zoom Link)
- TA (Email) [Office Hours]
 - Thiago da Silva Gomides (thiogodasilvagomides@cmail.carleton.ca) [TBA]
 - Heli Alpeshkumar Patel (HeliAlpeshkumarPatel@cmail.carleton.ca) [TBA]
 - Gunjan Singh (GunjanSingh@cmail.carleton.ca) [TBA]

3 COURSE DESCRIPTION

This is an introductory course in Distributed Computing. Topics include:

- Computational models, communication complexity,
- Design and analysis of distributed algorithms and protocols,
- Fault-tolerant protocols, synchronous computations.
- Applications may include: communication in data networks, control in distributed system (e.g., election, distributed mutual exclusion), manipulation of distributed data (e.g., ranking).

Prerequisite(s): COMP 1805 (with a minimum grade of C-), COMP 2401 (with a minimum grade of C-) and COMP 2406 or SYSC 4504.

CONTENTS OF LECTURES

1. **Week 01:** Introduction; Overview;
2. **Week 02:** Coloring; Dominating Set; (**Assignment 1**)
3. **Week 03:** ID Selection; Leader Election 1;
4. **Week 04:** Leader Election 2;
5. **Week 05:** Group Search
6. **Week 06:** Connections (**Assignment 2**),
7. **Week 07:** Locality (**Mid-Term**)
 Oct 25-29 Fall Break
8. **Week 08:** Broadcasting;
9. **Week 09:** Trees in DC;
10. **Week 10:** Message Passing; (**Assignment 3**)
11. **Week 11:** Fault Tolerance;
12. **Week 12:** Shared Memory;
13. **Week 13:** Distributed Sorting;

NB: Material covered in lectures may vary slightly depending on time available. Lecture Notes (labeled LEC) and Class Notes (labeled CLA) in PDF are posted in Brifgtspace before and after the lecture, respectively, in a timely manner.

4 ASSESSMENT AND REQUIREMENTS

Following are evaluation details and requirements for the course.

Grading and Course Work

Type of Test	#	% Each	% Total	Where
Assignments	3	10%	30%	Homework
Mid-Term (60 min)	1	30%	30%	TBA
Final (90 min)	1	40%	40%	TBA

Quizzes and Assignments

The purpose of **Exams** is to help you review the material covered in class in a timely manner. Questions are based on everything that we covered in class up to and including the last lecture prior to this exam. You should be familiar with all the material covered from the beginning of the course. Exam questions are generally simpler than assignment questions.

The purpose of **Assignments** is to understand deeper material related to issues discussed in class. Assignments are homework based. From the day an assignment is handed out, you will have about three weeks time to complete and submit them.

Additional Details

- **Assignments**

1. All assignments are compulsory and must be uploaded to the course web site in Brightspace on the due date and time. Submit only in pdf format (DO NOT SUBMIT zip, wordperfect, etc.) It is preferable for the assignments to be typed. Late assignments will not be accepted. Assignments will be submitted through Brightspace's course web site. Missing assignments are worth 0%.
2. You are expected to work on your assignments consistently once they are released. As a result, the instructor does not grant exemptions for the assignments. Under extenuating circumstances, if you are seeking additional accommodations for your assignments (perhaps due to an ongoing medical issue, for instance), you may petition the Associate Dean's office.
3. Plagiarism will not be tolerated. You must always write up the solutions to assignment problems on your own and acknowledge your sources in case you used library material. On the first occasion, plagiarizing an assignment will result in assigning a 0 to all the students involved and continuation of this practice may have severe repercussions for the student(s) involved.
4. Avoid posting code and/or solutions of assignments online on github and other places in the cloud. Other students have found that code and plagiarized their assignments and projects. Students posting their code and/or solutions assignments online are making themselves a potential party to plagiarism.

- **Exams**

1. Make-up exams are not possible. In case you miss an exam the grade will be averaged, but to qualify you must submit a critical analysis (about 20 pages, double-spaced) of all the topics covered (within two weeks from the date the exam was held) for that exam and get a passing grade. (This includes any absences for medical reasons.) Failing to do so you get 0% grade. This rule applies to the mid-term exam.

- **Attendance**

1. Class attendance and participation is encouraged and highly recommended because additional material is being discussed and clarified in class.
2. Office hours are held by the instructor and the TA on a regular basis and students are encouraged to make use of them.

5 USEFUL BOOKS (Not Required)

Your study should be based on the lecture notes (labeled LEC) as well as class notes (labeled CLA) and additional material provided. Although I will not follow any of the

books below you can use them as a guide for supplementary material and further study. Additional material on each topic can also be found on the internet.

1. H. Attiya, J. Welch, Distributed Computing, Wiley, 2E, 2004.
2. F. Bullo, J. Cortes, S. Martinez, Distributed control of robotic networks: a mathematical approach to motion coordination algorithms, Princeton University Press, 2009.
3. D. Gordon, Ant Encounters: Interaction Networks and Colony Behavior, Princeton University Press, 2010.
4. E. Kranakis, D. Krizanc, and E. Markou, The Mobile Agent Rendezvous Problem in the Ring, Morgan-Claypool, 2010.
5. N. Lynch, Distributed Algorithms, Morgan-Kaufmann, 1996.
6. D. Peleg, Distributed Computing A Locality Sensitive Approach, SIAM, 2000.
7. N. Santoro, Design and Analysis of Distributed Algorithms, Wiley, 2007.
8. G. Taubenfeld, Distributed Computing Pearls, Morgan-Claypool, 2018.
9. R. Wattenhoffer, The Science of the Blockchain, 2017.

You can purchase the books either from any commercial bookstore. Use also information available in the internet or in numerous other books.

6 Undergraduate Academic Advisor

The Undergraduate Advisor for the School of Computer Science is available in Room 5302C HP; or by email at scs.ug.advisor@cunet.carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services. SCS Computer Laboratory

SCS students can access one of the designated labs for your course. The lab schedule can be found at: <https://carleton.ca/scs/tech-support/computer-laboratories/>. All SCS computer lab and technical support information can be found at: <https://carleton.ca/scs/technical-support/>. Technical support is available in room HP5161 Monday to Friday from 9:00 until 17:00 or by emailing SCS.Tech.Support@cunet.carleton.ca.

7 University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Calendar.

Pregnancy Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit [Equity Services](#).

Religious Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit <https://carleton.ca/equity/focus/discrimination-harassment/religious-spiritual-observances/>.

Academic Accommodations for Students with Disabilities If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Menton Centre](#) website.

Survivors of Sexual Violence. As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities. Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see [the policy](#).

Student Academic Integrity Policy. Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of *F* in the course or even being expelled from the program or University. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found [here](#).

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science. Standard penalty guidelines can be found [here](#).

Unauthorized Co-operation or Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.

Special Information

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

Masks: Carleton has paused the COVID-19 Mask policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: While proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.