

DISTRIBUTED COMPUTING

COMP 4001 (August 15, 2024)

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1 DELIVERY METHOD

Lectures will be held in person. Students are expected to be available during class times. Homework assignments and other activities will be completed outside of class and submitted to Brightspace.

2 CONTACTS

- Evangelos Kranakis, Office 5366 HP
Office hrs W 1-3 pm (via Zoom Link in Brightspace)
- Teaching Assistants (Email) [Office Hours]
 - TA (Email) [Office Hours] [TBA]
 - TA (Email) [Office Hours] [TBA]
 - TA (Email) [Office Hours] [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; (**Assignment 2**)
5. **Week 05:** Group Search
6. **Week 06:** Connections (**Assignment 3**)
7. **Week 07:** Locality (**Mid-Term, Oct 17**)
 Oct 21-25 Fall Break
8. **Week 08:** Broadcasting;
9. **Week 09:** Trees in DC; (**Assignment 4**)
10. **Week 10:** Message Passing;
11. **Week 11:** Fault Tolerance;
12. **Week 12:** Shared Memory;
13. **Week 13:** Distributed Sorting;

NB: Material covered in lectures and assignment dates may vary slightly depending on time available. Lecture Notes (labeled LEC) in PDF are posted in Brightspace before the lecture 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	4	6%	24%	Homework
Mid-Term (60 min)	1	30%	30%	TBA
Final (90 min)	1	46%	46%	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 ten days 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 (within two weeks from the date the exam was held) a detailed critical analysis (about 20 pages long typewritten) of all the topics covered 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 but not the final 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 additional material provided during the course. 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.

If you want, 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 regarding Carleton's Academic Accommodation, Student Support Services, and University Policies see relevant links in this course's web-page in Brightspace. For information regarding Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Calendar.