DALHOUSIE UNIVERSITY
Faculty of Computer Science

CSCI 4171 Networks and Communications
CSCI 6704 Advanced Topics in Networks

Fall 2023

Course Professor:
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Course Description

Welcome to Networks and Communications/Advanced Topics in Networks. The fourth-year undergraduate course CSCI 4171 is co-listed (and co-taught) with the graduate level course CSCI 6704. The primary objective of this course is to give the student a comprehensive understanding and specialized knowledge in networks and its emerging technologies. Topics covered in this course include network design principles and concepts, network architecture, routing protocols, internetworking, wireless networks, optical networks, and IPv6 networks.

Starting with basic local area networks, the course focuses on wireless LANs, techniques to extend LANs, internetworking and emerging network technologies. Group case studies emphasize research and industry-driven problems in networking.

Course Format

This is an **in-person course** with all lectures held in person in the classroom. Lectures will be live streamed via Collaborate Ultra. You are expected to attend the lectures in person by default and use the remote option only as an exception. Attendance to lectures is important for completing the course successfully. You must not have conflicts during the lecture times since quizzes will be conducted during these times.

Lecture Sessions

Lectures for this course will be on TR 2.30 – 4 PM in the **Sir James Dunn Building Room 117.**

Attendance

You are **strongly encouraged** to attend all the lecture sessions in person. Use the remote option only occasionally. Short quizzes will be held during the lecture sessions. There will be a 2% bonus for students who attend 70% or more lectures in person.

Lecture Notes

Skeletal lecture notes will be available on Brightspace before the start of each module. Annotated notes will be posted on Brightspace after the completion of the module.

Panopto Recordings

Lectures will not be recorded. Instead, short videos on important concepts will be made available on Panopto on Brightspace. Note: Recordings are not a replacement for live lecture sessions.

Grading Scheme

Assignments:	20%
Group Case Study/Research Project:	10%
Short quizzes during lecture sessions:	10%
Test 1:	15%
Test 2:	15%
Final Exam:	30%

Prerequisites

CSCI 4171: Intended for fourth year CS students; Prerequisite is CSCI 3171 or equivalent. Note: You cannot take 3171 and 4171 concurrently.
CSCI 6704: Intended for graduate students. All students must have completed an undergraduate course in networking. Note: If you have taken 4171 during your undergraduate degree at Dalhousie, you cannot take 6704. MACS students who have taken CSCI 5901 this summer cannot take 6704.

Hardware/Software

Programming languages: Java, C, C++, Python. Students will also get an exposure to network simulators, configuring and testing tools.

Assignment Details

Assignments are worth **20% of your grade**. **Each assignment will be worth 4%** and will be of approximately equal level of difficulty. Assignments will be posted on Brightspace, and submission is on Brightspace. No collaboration is permitted – you must work on your assignment independently.

There will be **six assignments, one of which is optional** – it means that the best five out of six assignments will be taken for grading. You can choose to do all six assignments, or simply aim to do the any five out of six.

Pop Quizzes

There will be eight short pop quizzes held during the lecture sessions. These are worth **10% of your grade**. They are mainly meant to be reflective, and to encourage you to attend the lecture sessions. **Two quizzes will be dropped.** These quizzes will be on Brightspace. Pop Quizzes are open book.

Project/Case Study

This component is worth 10% of your grade.

There will be group research project for CSCI 6704 students and a group case study for CSCI 4171 students. The topics for the project/case study will be from an emerging research/industry-oriented area in networks. The deliverable will be a presentation which will be held at the end of the term.

Late Submissions

Assignments are due at 11.59 PM on the day of the submission due date. It is understandable that there may be last minute Internet issues. Hence **late submissions of up to 5 hours will be accepted without late penalty**. Past the five hours grace period, the assignment or the lab will be marked as late. Late assignments will be subject to a penalty of 10% per day up to 5 days. Late assignments which are more than 5 days late will not be accepted.

Student Declaration of Absence (SDA) – not required.

You have the option of dropping one assignment. You have the option of dropping one of your pop quizzes.
In view of the above flexibility already in the course, there is no need to submit SDAs.

Tests and Exams

Tests and the final exam are closed-book and will be held in person. They will be on Brightspace with Respondus Lockdown Browser.

Test 1 (worth 15% of your grade):
Thursday, October 12, 7 PM – 8.30 PM
Test 2 (worth 15% of your grade):
Thursday, November 9, 7 PM – 8.30 PM
Final exam (worth 30% of your grade):
In December, Date Scheduled by Registrar.

To pass the course, you must score a minimum of 50% out of the total weightage for the tests and the final exam. That is, your minimum mark for passing the course is 30 out of 60.

Students with accommodations will take their tests and exams in the Accessibility Centre.

Course Calendar

Important Dates

Sept. 5:	First lecture
Sept.19:	Last day to register
Oct. 4:	Last day to drop course without a "W"
Oct. 12:	TEST 1 (7 – 8.30 PM)
Nov. 2:	Last day to drop course with a "W"
Nov. 9:	TEST 2 (7 – 8.30 PM)
Nov. 13 – 17:	Fall Study Break
Dec. 1:	Last Lecture
Dec. 8 - 19:	Final Exam period

Assignments

A1: Given: Monday, Sept.18, Due: Monday, Oct. 2
A2: Given: Monday, Oct. 2, Due: Monday, Oct. 16
A3: Given: Monday, Oct. 16, Due: Monday, Oct. 30
A4: Given: Monday, Oct. 30, Due: Monday, Nov.13
A5: Given: Monday, Nov.13, Due: Monday, Nov.27
A6: Given: Monday, Nov. 27, Due: Monday, Dec.7

Case Study/ Research Paper

Case Study and Research Paper presentations will be held at the end of the semester in December (actual date to be specified later).

Responsible Use of ChatGPT and Generative AI Tools

You may use ChatGPT and other generative artificial intelligence (AI) tools in a responsible manner, mainly to enhance your understanding, and as a supplement to your learning outcomes. I will not be using any ChatGPT checkers. However, you must acknowledge its use if you used its assistance your assignments and labs.

Tests and the Final Exam are closed book and in person, and will have no access to such tools.

Course Communication

All course information, including announcements, lecture material, project/case study information, assignments, etc. will be posted on Brightspace. Some announcements will be sent to the course mailing list. Please **check Brightspace and your Dal e-mail** daily.

BROAD OVERVIEW OF TOPICS

Module 1 - Fundamental Concepts: Network Topologies, Internet structure, Connection Strategies, Service Types, Addressing, Performance Issues.

Module 2 – TCP/IP: The TCP/IP Layered Architecture, Functions of layers, TCP/IP Stack, Data Encapsulation, Addressing and Demultiplexing, Overview of TCP, UDP, IP and Ethernet headers.

Module 3 – Basic LANs: Characteristics and Design Issues, Transmission Media, Digital Encoding, Framing, Error Detection, Cyclic Redundancy Check, Medium Access Control. - Es

Module 4 – Extending LANs: Extending LANs with repeaters, bridges and switches; Networks with routers – router functions, routing terminology, routing process, router features.

Module 5 – Routing Protocols: Distance vector, Link State, Routing protocol examples, Border Gateway Protocol, Names to address conversion.

Module 6 – IPv6 Networks: Motivation for IPv6, IPv4 Limitations, IPv6 Advantages, IPv6 Addresses – Representation and Format, IPv6 Datagram – Structure, IPv6 Extension Headers, Transition from IPv4 to IPv6.

Module 7- Wireless Networks: Motivation for wireless, Types of wireless networks and standards, IEEE 802.11 Wireless LANs, Cellular Networks.

Module 8 – Optical Networks: Motivation, Evolution, Optical Network Components and Architectures.

Module 9 - Emerging Technologies: Industry-driven problems in networks, emerging wireless technologies, Internet of Things, Industrial control systems and Quantum Computing.

The above is a broad overview of the modules. Detailed breakdown of topics will be provided as the course progresses.

REFERENCES

There is no textbook prescribed for the course. Lecture notes and modules will be the main resource. In addition, the following books are recommended as references.

1. *Computer Networks* by Tanenbaum and Wetherall, Prentice-Hall, 5th Edition
2. *Data Communications and Networking* by B.A. Forouzan, McGraw Hill Publishers, latest edition
3. *Data and Computer Communications* by W. Stallings, Prentice Hall, latest edition
4. *Computer Networking: A top down approach featuring the Internet* by J.F. Kurose and K.W.Ross, Addison Wesley, latest edition
5. *IPv6 The New Internet Protocol* by C.Huitema, Prentice-Hall, latest edition.

Additional references and web sites of interest will be given as and when appropriate.

LEARNING OUTCOMES

- Learn the principles and concepts of emerging network technologies.
- Discover the principles of building a network from a systems perspective using a bottom-up approach.
- Get an insight into network architecture, network software and protocols.
- Understand the principles of the Internet.
- Understand the principles of high speed and wireless networking.
- Know the industry-driven and emerging issues in networking.

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THERE WILL BE NO CONVERTING OF FINAL GRADES TO PASS/ILL THIS SEMESTER.
ALL LETTER GRADES WILL BE FINAL!

University and Faculty of Computer Science Policies

Responsible Computing Policy

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (https://www.dal.ca/dept/university_secretariat/policies/information-management-and-technology/acceptable-use-policy-.html) and the Faculty of Computer Science Responsible Computing Policy. For more information please see https://www.dal.ca/content/dam/dalhousie/pdf/faculty/computerscience/policies-procedures/fcs_policy_local.pdf

Academic Standards

Failure to properly attribute sources in your work will be treated as an academic standards issue and points may be deducted for not following citation requirements. For example, forgetting to quote text taken from other sources, failure to include in-text citations, or a failure to include required information in the citations or references. Please see the resources on proper citation provided by the Dalhousie Writing Center (https://dal.ca.libguides.com/c.php?g=257176&p=5001261).

Please note that if it appears that the error was made with intent to claim other people's work as your own such as a lack of both citations and references, an allegation of plagiarism will be submitted to the Faculty Academic Integrity Officer, which could result in consequences such as a course failure.

Student Health and Wellness

Taking care of your health is important. As a Dalhousie student, you have access to a wide range of resources to support your health and wellbeing. Students looking to access physical or mental health & wellness services at Dalhousie can go to the Student Health & Wellness Centre in the LeMarchant Building. The team includes egistered nurses, doctors, counsellors and a social worker. Visit **dal.ca/studenthealth** to learn more and book an appointment today.

Students also have access to a variety of online mental health resources, including telephone/texting counselling and workshops/training programs. Learn more and access these resources at d**al.ca/mentalhealth**.

Culture of Respect[1]

Every person has a right to respect and safety. We believe inclusiveness is fundamental to education and learning. Misogyny and other disrespectful behaviour in our classrooms, on our campus, on social media, and in our community is unacceptable. As a community, we must stand for equality and hold ourselves to a higher standard.

[1] Source: Speak Up! © 2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full "Speak Up" document found at: http://www.dal.ca/dept/dalrespect.html. Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University, 902.494.4140, lyndsay.anderson@dal.ca www.dal.ca/think.

What we all need to do:

1. **Be Ready to Act:** This starts with promising yourself to speak up to help prevent it from happening again. Whatever it takes, summon your courage to address the issue. Try to approach the issue with open-ended questions like "Why did you say that?" or "How did you develop that belief?"
2. **Identify the Behaviour:** Use reflective listening and avoid labeling, name-calling, or assigning blame to the person. Focus the conversation on the behaviour, not on the person. For example, "The comment you just made sounded racist, is that what you intended?" is a better approach than "You're a racist if you make comments like that."
3. A**ppeal to Principles:** This can work well if the person is known to you, like a friend, sibling, or co-worker. For example, "I have always thought of you as a fair-minded person, so it shocks me when I hear you say something like that."
4. **Set Limits:** You cannot control another person's actions, but you can control what happens in your space. Do not be afraid to ask someone "Please do not tell racist jokes in my presence anymore" or state "This classroom is not a place where I allow homophobia to occur." After you have set that expectation, make sure you consistently maintain it.
5. **Find or be an Ally:** Seek out like-minded people that support your views, and help support others in their challenges. Leading by example can be a powerful way to inspire others to do the same.
6. **Be Vigilant:** Change can happen slowly, but do not let this deter you. Stay prepared, keep speaking up, and do not let yourself be silenced.

University Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&loaduseredits=False

Territorial Acknowledgement

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Dalhousie acknowledges the histories, contributions, and legacies of the African Nova Scotia people and communities who have been here for over 400 years.

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect. As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. (read more: http://www.dal.ca/dept/university_secretariat/academic-integrity.html)

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion please contact: https://www.dal.ca/campus_life/academic-support/accessibility.html for all courses offered by Dalhousie with the exception of Truro.

Conduct in the Classroom — Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion — Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). (read more: http://www.dal.ca/cultureofrespect.html)

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/Code%20of%20Student%20Conduct%20rev%20Sept%202021.pdf)

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. (read more: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html)

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work, and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf)

Student Use of Course Materials

These course materials are designed for use as part of the CSCI courses at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading material to a commercial third party website) may lead to a violation of Copyright law.

Learning and Support Resources

Please see https://www.dal.ca/campus_life/academic-support.html