**Course Syllabus**

**CMPT 434: Computer Networks**

**Catalogue Description**

The principles and practice of computer networking, focusing on the Internet and its structure, protocols, and applications. Topics include network applications and programming, reliable data transfer, flow and congestion control, routing, multimedia networking, local area networks, security, and network management.

**Prerequisite:** CMPT 332. Students with credit for CMPT 424 may not take this course for credit.

**Class Time & Location:** M W F, 9:30-10:20, Thorv 159

No Tutorials

**Website:** Moodle

**Instructor Information**

**Instructor:** Derek Eager

**Contact:** Email: eager@cs.usask.ca

Office Phone: 4899

**Office Hours:** Location: Thorv 281.2

Hours: feel free to drop by my office anytime, or make appointment via email

**Course Overview and Objectives**

This course provides a comprehensive survey of the design and organization of computer networks. After beginning with some background on the fundamentals of data communication and communication infrastructures, and on socket programming, the course will largely follow a bottom-up approach, covering protocols for reliable data transfer, multiple access protocols, layer 2 networks, routing, congestion control, quality of service, and transport layer protocols, before finally looking at some important applications and the cross-cutting issues of network security. The principles we discuss will be made concrete through study of existing systems, most notably the Internet and its structure, protocols, and applications.

Assignments will involve both programming (specifically, *socket programming using C on Linux*) and non-programming problems. There will also be a group project that can take the form of either a critical survey of a current issue in networking research, or an implementation.

After completing this course, students should be able to:

- Define and describe the layered structure of a typical networking architecture.
- Design and potentially implement network protocols.
- Describe the components of network addressing in IPv4 and IPv6 and how addresses are used in routing and forwarding.
- Implement applications using reliable and unreliable socket communication.
- Compare and contrast the various approaches to multiple-access communication channels.
- Describe the organization of wireless networks and the support for mobile users.
- Implement, simulate, and/or evaluate methods of congestion control with respect to issues of performance and fairness.
- Compare and contrast how frames/packets are delivered between hosts and switches/routers at the data link and network layers.
- Evaluate the need for and effectiveness of error detection/correction mechanisms in different network...
contexts.

- Determine the role and appropriate use of encryption and decryption algorithms in network applications.
- Describe the purpose of different message types in application layer protocols.
- Compare and contrast different approaches to quality of service in networks carrying time-sensitive data.

Student Evaluation

There will be three equally-weighted assignments, involving both programming (specifically, socket programming using C on Linux) and non-programming problems. Likely approximate due dates for the assignments are late January, mid-February, and mid-March. There will also be a group project that can take the form of a critical survey of a current issue in networking research or an implementation or experimental study of some kind, that will be due on April 6th. Due dates are strict — if an extension is required for some special reason (e.g. medical), the instructor must be contacted as soon as feasible. A midterm exam will be held in early March. The midterm exam and the three-hour final exam will be closed book, with no electronic devices permitted.

Grading Scheme

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<tbody>
<tr>
<td>Assignments (3)</td>
<td>24</td>
</tr>
<tr>
<td>Project</td>
<td>16</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>15</td>
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<tr>
<td>Final Exam</td>
<td>45</td>
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<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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Final Exam Scheduling:

The Registrar schedules all final examinations, including deferred and supplemental examinations. Students are advised not to make travel arrangements for the exam period (April 9th through April 29th inclusive) until the official exam schedule has been posted.

Note: All students must be properly registered in order to attend lectures and receive credit for this course.

Textbook Information

Lecture notes will be posted, as well as links to various on-line resources. There is no required textbook, but the following book is a recommended reference for many of the concepts we will cover:


Another recommended book on computer networks is:


Lecture Schedule (all timings approximate)

1. Background (1.5 weeks)
   Transmission media, limits on achievable data rate, digital modulation, communication infrastructures, socket programming.

2. Basics of Point-to-Point Data Transfer (1 week)
   Protocols for reliable data transfer, error detection and correction, point-to-point data transfer at the link
layer, end-to-end argument.

3. Multiple Access Protocols and Layer 2 Networks (1.5 weeks)
   Classes of multiple access protocols, Ethernet, link layer switching, 802.11, Bluetooth, RFID/NFC, LPWAN.

4. Network Layer (3 weeks)
   Datagram vs. virtual circuit networks, routing, congestion control, quality of service, network layer
   addressing in the Internet, IP, routing in the Internet, Software Defined Networking.

5. Transport Layer (1.5 weeks)
   Internet transport protocols, TCP connection establishment and release, data transfer in TCP, TCP
   congestion control, current problem areas with conventional TCP, new protocols.

6. Application Layer (1.5 weeks)
   DNS, email, the Web, streaming media, content delivery, P2P, blockchain.

7. Network Security (1.5 weeks)
   Cryptography, digital signatures, message digests, public key management, authentication, security in the
   Internet, social issues.

Policies

Recording of Lectures
Students may record lectures if desired.

Late Assignments/Project
Due dates are strict – if an extension is required for some special reason (e.g. medical) the instructor must be
contacted as soon as possible.

Missed Assignments/Project
Students who do not submit anything for an assignment or the project by the due date (possibly as extended
by the instructor) will receive a grade of zero for it.

Missed Examinations
1. Students who miss an exam should contact the instructor as soon as possible. If it is known in advance
   that an exam will be missed, the instructor should be contacted before the exam.

2. "If a student is absent from a final examination due to an extenuating circumstance, they may be eligible
to apply for a deferred exam. Students in the College of Arts and Science must contact the Undergraduate
   Student Office within three business days of the missed exam to be considered."
   (http://artsandsscience.usask.ca/undergraduate/advising/strategies.php)

Incomplete Course Work and Final Grades

"When a student has not completed the required class work, which includes any assignment or examination
including the final examination, by the time of submission of the final grades, they may be granted an
extension to permit completion of an assignment, or granted a deferred examination in the case of absence
from a final examination.

Extensions past the final examination date for the completion of assignments must be approved by the
Department Head, or Dean in non-departmentalized Colleges, and may exceed thirty days only in unusual
circumstances. The student must apply to the instructor for such an extension and furnish satisfactory reasons for the deficiency. Deferred final examinations are granted as per College policy.

In the interim, the instructor will submit a computed percentage grade for the class which factors in the incomplete class work as a zero, along with a grade comment of INF (Incomplete Failure) if a failing grade.

In the case where the student has a passing percentage grade but the instructor has indicated in the class syllabus that failure to complete the required class work will result in failure in the class, a final grade of 49% will be submitted along with a grade comment of INF (Incomplete Failure).

If an extension is granted and the required assignment is submitted within the allotted time, or if a deferred examination is granted and written in the case of absence from the final examination, the instructor will submit a revised assigned final percentage grade. The grade change will replace the previous grade and any grade comment of INF (Incomplete Failure) will be removed.

A student can pass a class on the basis of work completed in the class provided that any incomplete class work has not been deemed mandatory by the instructor in the class syllabus as per College regulations for achieving a passing grade.” (https://policies.usask.ca/policies/academic-affairs/academic-courses.php)

For policies governing examinations and grading, students are referred to the Assessment of Students section of the University policy “Academic Courses Policy on Class Delivery, Examinations, and Assessment of Student Learning” (https://policies.usask.ca/policies/academic-affairs/academic-courses.php)

**Academic Honesty**

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.


For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at: https://secretariat.usask.ca/student-conduct-appeals/index.php

**Access and Equity Services (AES) for Students**

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, check https://students.usask.ca/health/centres/access-equity-services.php, or contact AES at 306-966-7273 or aes@usask.ca.
Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

**Student Supports**

**Student Learning Services**

Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site [https://library.usask.ca/studentlearning/](https://library.usask.ca/studentlearning/).

**Teaching, Learning and Student Experience**

The Teaching, Learning and Student Experience Unit (TLSE) focuses on providing developmental and support services and programs to students and the university community. For more information, see [https://students.usask.ca](https://students.usask.ca).

**College Supports**

Students in Arts & Science are encouraged to contact the Undergraduate Student Office and/or the Trish Monture Centre for Success with any questions on how to choose a major; understand program requirements; choose courses; develop strategies to improve grades; understand university policies and procedures; overcome personal barriers; initiate pre-career inquiries; and identify career planning resources. Contact information is available at: [http://artsandscience.usask.ca/undergraduate/advising/](http://artsandscience.usask.ca/undergraduate/advising/)