



CST8109

Network Programming

Course Outline

2022-2023

Pre-requisite(s)	CST8116 and MAT8001C
Co-requisite(s)	N/A
Prepared by	Wenjuan Jiang
Approved by	Sandra Brancatelli, M.Eng., P.Eng., Academic Chair, ICT - Applications & Programming
Normative hours	70.00
Grading system	A+ Through F
Experiential Learning	No

Applicable Program(s)	Level	Core/Elective
0336X01FWO - Computer Programming	3	Core
0336X03FWO - Computer Programming	3	Core
0336X07PAO - Computer Programming	3	Core
0336X09FAO - Computer Programming	3	Core
1561X01FWO - Computer Programming and Analysis	3	Core
1561X03FWO - Computer Programming and Analysis	3	Core

Course Description

Software programming in today's environment requires detailed knowledge of the underlying network topology, its implementation and programming support functions. Gaining an appreciation and perspective of this technology is imperative to developing good network programming applications. Students explore topics including the basic structure, design and layered communications models, with an emphasis on data communications, TCP/IP protocol suite, socket programming and multi-threading concepts. Labs include practical exercises in basic networking and using socket programming, along with multi-threading, in an environment rich with common networking tools for diagnosing and troubleshooting typical network programming problems.

Vocational Learning Outcomes

This course provides the opportunity for you to achieve the following outcomes:

0336X01FWO - Computer Programming

- VLO 1** Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
- VLO 2** Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
- VLO 4** Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X03FWO - Computer Programming

- VLO 1** Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
- VLO 2** Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
- VLO 4** Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X07PAO - Computer Programming

- VLO 1** Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
- VLO 2** Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
- VLO 4** Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

0336X09FAO - Computer Programming

- VLO 1** Identify, analyze, develop, implement, verify and document the requirements for a computing environment. (T, A)
- VLO 2** Contribute to the diagnostics, troubleshooting, documenting and monitoring of technical problems using appropriate methodologies and tools. (T, A)
- VLO 4** Implement robust computing system solutions through validation testing that aligns with industry best practices. (T, A)

1561X01FWO - Computer Programming and Analysis

1561X03FWO - Computer Programming and Analysis

Assessment Levels —T: Taught A: Assessed CP: Culminating Performance

Essential Employability Skills

This course contributes to your program by helping you achieve the following Essential Employability Skills:

- EES 1Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience. (T, A)
- EES 2Respond to written, spoken or visual messages in a manner that ensures effective communication. (T, A)
- EES 3Execute mathematical operations accurately. (T, A)
- EES 5Use a variety of thinking skills to anticipate and solve problems. (T, A)
- EES 8Show respect for diverse opinions, values, belief systems and contributions of others. (T, A)
- EES 9Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. (T, A)
- EES 11Take responsibility for one's own actions, decisions and consequences. (T, A)

Assessment Levels —T: Taught A: Assessed CP: Culminating Performance

Course Learning Requirements / Embedded Knowledge and Skills

When you have earned credit for this course, you will have demonstrated the ability to:

1. Explain the basics of network topologies

- State the definition of network topology
- List network topologies commonly used in network design
- Explain the difference between physical topologies and logical topologies

2. Discuss types of commonly used computer networks.

- List types of computer networks
- Identify the type of computer network in use for a given network

3. Use network protocol models to explain the layers of communications in data networks

- Explain the importance of data networks and the Internet in supporting business communications and every day activities
- Explain how communication works in data networks and the Internet
- Explain the role of protocols in networks
- Describe the protocols and services provided by the application layer in the OSI and TCP/IP models and describe how this layer operates in various networks
- Analyze the operations and features of common application layer protocols such as HTTP, Domain Name System(DNS), Dynamic Host Configuration Protocol (DHCP), Simple Mail Transfer Protocol (SMTP), Telnet, FTP, POP, IMAP, and HTTPS

4. Apply subnet masks and addresses (IPv4 and IPv6) to devices in a network.

- Describe the importance of addressing and naming schemes at various layers of data networks
- Determine specific network addresses give a subnet and mask
- Determine the number of usable hosts given network ID and subnet mask
- Configure devices in a network using given a network ID and subnet mask

5. Build a simple Ethernet, IPv4 and IPv6 networks using routers and switches

- Explain fundamental Ethernet concepts such as media, services, and operation
- Describe how ARP is used in an Ethernet network
- Recognize the devices and services that are used to support communications across an Internetwork
- Utilize common network utilities to verify small network operations and analyze data traffic
- Configure a PC for network use including DHCP addressing, Static addressing, DNS and gateway
- Deploy a SOHO network including the use of NAT

6. Employ basic cabling and network designs to connect devices

- Describe the operation of protocols at the OSI data link layer and explain how they support communications
- Explain the role of physical layer protocols and services in supporting communications across data networks
- Describe the differences between a variety of media types, their benefits and limitations of each type
- Describe the causes of line noise in communication systems
- Describe various modulation schemes
- Explain the difference between synchronous and asynchronous communication
- Be able to convert numbers between binary, decimal and hexadecimal formats

7. Analyze the operations and feature of the transport and network layer protocols and services

- Describe the functioning of transport layer protocols including the differences between connectionless and connection oriented communications
- Describe the purpose and use of port numbers in the TCP/IP Protocol suite
- Explain in detail how TCP connections are established and torn-down
- Analyze the operations and features of network layer protocols and services and explain the fundamental concepts of routing

8. Design and implement network applications using blocking and non-blocking sockets.

- Describe the concept of Client/Server communication
- Describe sockets, ports and socket-based communication
- Write network applications based on TCP or UDP sockets
- Discuss the differences between blocking and non-blocking socket programming in network applications
- Write network applications using blocking and non-blocking socket programming

9. Explain and apply multithreading concepts to client/server programming.

- Explain the concept of threads and how to use them
- Describe thread priorities and scheduling
- Explain thread synchronization
- Use multithreading into Client/Server program

Learning Resources

Required:

This course is part of the mobile (laptop) program initiative at Algonquin College. Students are required to have a functioning laptop at all lecture and lab classes. Students with laptops that do not meet the requirements listed on the Algonquin College BYOD web page, may experience difficulties in the labs in this course. For the required specifications and further information visit the Algonquin College BYOD web page at

<http://www7.algonquincollege.com/byod/prospective/mobile2015-2016/mobile-device-better-comp-sci.htm>

Optional Reference Book:

Java How to Program, 11th Edition, by Deitel and Deitel, Published by Pearson Education Inc., ISBN: 9780134800301.

Big Java Early Objects. 7th, by Cay Horstmann, 2019. Ed. Wiley. ISBN: 9781119499091.

Introduction to Networks Companion Guide, Cisco Press, ISBN-13: 978-1-58713-316-9

Introduction to Network Lab Manual, Cisco Press, ISBN-13: 978-1-58713-312-1

Recommended Resource:

Blocking vs non-blocking network socket programming in Java - <https://www.developer.com/java/data/what-is-non-blocking-socket-programming-in-java/>

Learning Activities

This course has 2 hours of lecture, 1 hour of hybrid activities, and 2 hours of lab each week.

Samples of learning activities include:

1. Reading and fully understanding the prescribed theory materials:

Cisco curriculum (as found in the hardcopy or online textbook) acts as the foundation for the course knowledge set.

Assigned reading from a provided reading list will guide you through the text.

End of chapter questions in the book and in the online curriculum are used to test your recall and understanding.

Online chapter quizzes are used to evaluate your knowledge, as well as give you feedback as to which parts of the chapter require further emphasis and review.

2. Attending lectures that make use of and supplement the text material:

Lectures will indicate key points and clarify what is important for term tests, final exam and other evaluations.

3. Completing assigned homework to supplement lecture & lab material:

These are designed to encourage creative thinking around a topic area, and to help develop your ability to analyze situations and solve problems.

4. Completing prescribed lab work:

Pre-defined Evaluation / Earning Credit

The following list provides evidence of this course's learning achievements and the outcomes they validate:

Quiz(zes)/Test(s) (35%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 7, CLR 8, CLR 9, EES 2, EES 3, EES 5, EES 11

Final Exam (30%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 7, CLR 8, CLR 9, EES 2, EES 3, EES 5

Lab Activity(ies) (20%)

Validates Outcomes: CLR 1, CLR 3, CLR 4, CLR 5, CLR 6, CLR 8, CLR 9, EES 1, EES 2, EES 5, EES 8, EES 9

Demonstration(s) of Skill (15%)

Validates Outcomes: CLR 1, CLR 4, CLR 5, CLR 6, CLR 8, CLR 9, EES 2, EES 5, EES 8

Prior Learning Assessment and Recognition

Students who wish to apply for Prior Learning Assessment and Recognition (PLAR) need to demonstrate competency at a post-secondary level in all outlined course learning requirements. Evidence of learning achievement for PLAR candidates includes:

- Challenge Exam
- Performance Test

Other Information

Students are required to respect the confidentiality of employer, client and/or patient information, interactions, and practices that occur either on Algonquin College premises, or at an affiliated clinical/field/co-op placement site. Concerns regarding clients, patients, and/or employer practices are to be brought to the attention of the program coordinator, or designated field/clinical/co-op placement supervisor so that they may be resolved collaboratively. Such concerns are not to be raised publically either verbally, in writing, or in electronic forums. These matters are to be addressed through established program communication pathways.

Grade Scheme

Final Grade	Mark Equivalent	Numeric Value	Final Grade	Mark Equivalent	Numeric Value
A+	90% - 100%	4.0	A	85% - 89%	3.8
A-	80% - 84%	3.6	B+	77% - 79%	3.3
B	73% - 76%	3.0	B-	70% - 72%	2.7
C+	67% - 69%	2.3	C	63% - 66%	2.0
C-	60% - 62%	1.7	D+	57% - 59%	1.4
D	53% - 56%	1.2	D-	50% - 52%	1.0
F	0% - 49%	0	FSP	0	0

Course Related Information

Please refer to the Course Section Information (CSI) / weekly schedule for specific course-related information as provided by your professor. Assessment of student learning will be done by means of class and online tests and quizzes, final exam, laboratory assignments and a lab test. Laboratory attendance is compulsory, and absence from three or more laboratory sessions without the prior consent of the professor will result in a final grade of “F”. Students are responsible for keeping a record of the number of laboratory sessions they have missed. Professors will not inform students of an impending failure because of missed laboratory sessions. All laboratory assignments must be successfully completed in order to obtain course credit. Late assignments will be penalized and receive a mark of zero, but they must still be completed. Any missed evaluation points will result in a grade of “0”. In the case of a documented emergency the professor, in consultation with the Chair, will determine how the marks will be made up and/or final grade adjusted. The Information and Communications Technology Department requires that all course assignments (homework exercises, laboratory work, projects, etc) be submitted by students using a standard which could be specific to one or more courses. Professors will ensure, at the beginning of the term, that students are advised of the exact details of these course specific submission requirements. Professors will also post them online alongside the course outline. Student submissions that do not meet the course published submission standards may not be marked, and may incur a penalty of up to 100% of the submission mark. All students are required to write the final exam. There are no provisions for “making up” a missed final exam. If, as a result of being off-track in your program or some unforeseen circumstance, you note that there is a scheduling conflict in your final exam schedule, it is your responsibility to alert your course professor no later than one week before final exams start, to allow for any special arrangements.

In order to pass the credit course, students must achieve a minimum contribution of:
32.5% from an average of invigilated tests/exams (items #1 and #2 combined)
17.5% from an average of practical work (items #3 and #4 combined)

Department Information

STUDENT ACADEMIC RESPONSIBILITIES

- Each student is responsible for:
- Knowing the due dates for marked out-of-class assignments.
 - Attending all classes and knowing the dates of in-class marked assignments and exercises.
 - Maintaining a folder of all work done in the course during the semester for validation claims in cases of disagreement with faculty.
 - Keeping both paper and electronic copies of all assignments, marked and unmarked, in case papers are lost or go missing.
 - Regularly checking both Brightspace announcements as well as one's Algonquin e-mail account for important messages from both professors and college administration.
 - Participating in on-line and classroom exercises and activities as required.
 - Retaining course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Department Grading Policy - For all courses that have both a theory and practical (lab) component, students must have a grade of at least 50% (or “D-”) on both the theory component as well as in the practical (i.e. lab) component in order to achieve a passing grade in the course. i.e. Even if your combined grade exceeds 50% for the entire course, if you fail either the theory component or the practical component, you will not achieve a passing grade in the course.

Lab/Practical Assessment Demonstration "Demo" Requirements - Certain courses require students to demo their work after it has been submitted. These will be scheduled by the professor and involve 1-2 rudimentary questions to assure the professor that the work submitted by the student is their own. Demos are not graded items - the work submitted is graded. However, where demos are required, if a student does not demo their work, the work will not be graded (i.e. grade of 0 on the lab or practical assessment).

Department Academic Dishonesty Policy - Academic Integrity is very important to all of our faculty and administrative staff and as such, measures have been put into place to detect all forms of academic dishonesty, including plagiarism of code. If plagiarism is detected by a professor, the incident will be reported and investigated. If the findings of the investigation are that a student has submitted plagiarized work as their own, they will be subject to the following policy:

1. The first offence will result in the plagiarized assessment being assigned a grade of 0.
2. The second offence will result in the assignment of a grade of F for the course.
3. The third offence will result in removal of a student from the program of study.

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether involving a professor and a student or amongst students, will not be tolerated on the college premises. Action taken will start with a formal warning and proceed to the full disciplinary actions as outlined in Algonquin College Policies - HR22 and SA07. Harassment means one or a series of vexatious comment(s) (whether done verbally or through electronic means), or conduct related to one or more of the prohibited grounds that is known or ought reasonably to be known to be unwelcome/unwanted, offensive, intimidating, derogatory or hostile. This may include, but is not limited to: gestures, remarks, jokes, taunting, innuendo, display of offensive materials, offensive graffiti, threats, verbal or physical assault, stalking, slurs, shunning or exclusion related to the prohibited grounds.

For further information, a copy of the official policy statement can be obtained from the Student Association.

Violation of the Copyright Act
General – The Copyright Act makes it an offence to reproduce or distribute, in whatever format, any part of a publication without the prior written permission of the publisher. For complete details, see the Government of Canada website at <http://laws.justice.gc.ca/en/C-42> . Make sure you give it due consideration, before deciding not to purchase a textbook or material required for your course.

Software Piracy - The Copyright Act has been updated to include software products. Be sure to carefully read the licensing agreement of any product you purchase or download, and understand the terms and conditions covering its use, installation and distribution (where applicable). Any infringement of licensing agreement makes you liable under the law.

Disruptive Behaviour is any conduct, or threatened conduct, that is disruptive to the learning process or that interferes with the well being of other members of the College community. It will not be tolerated. Members of the College community, both students and staff, have the right to learn and work in a secure and productive environment. The College will make every effort to protect that right. Incidents of disruptive behaviour must be reported in writing to the departmental Chair as quickly as possible. The Chair will hold a hearing to review available information and determine any sanctions that will be imposed. Disciplinary hearings can result in penalties ranging from a written warning to expulsion.

For further details, consult the Algonquin College Policies AA32, SA07 and IT01 in your Instaguide.

College Related Information

Algonquin College's policies have been developed to ensure the health, safety and security of all students, faculty and staff, and the proper and fair operation of the College as an academic institution and employer. Please refer to the Algonquin College Policies website for the most current policy information available at <http://www.algonquincollege.com/policies/>.

Students are especially encouraged to be aware of the following College expectations

Academic Integrity

Algonquin College is committed to the highest standards of academic integrity, and students are expected to uphold these standards as part of the learning process. Any academic work submitted by a student is expected to be their own work, unless designated otherwise and all sources must be attributed. All students should be familiar with the Algonquin College policy [AA48: Academic Integrity](#) which outlines student's roles and responsibilities and what represents academic dishonesty. In some courses, online proctoring may be used to prevent academic dishonesty. Additional information can be found at [Academic Integrity - Student Survival Guide - Subject Guides at Algonquin College \(libguides.com\)](#) and via [Academic Integrity Student Resources](#). Students with any questions about the course expectations regarding academic integrity are encouraged to speak to their professor and the College's academic integrity team at acaio@algonquincollege.com

Centre for Accessible Learning

Students with visible and/or non-visible disabilities are encouraged to register with the [Centre for Accessible Learning \(CAL\)](#) in order to be eligible for appropriate learning supports and/or accommodations. Students are strongly encouraged to make an appointment with the Centre for Accessible Learning as early as possible when starting a program. Once your needs are identified, a Letter of Accommodation (LOA) will be issued which you can share with your professors. If you are a returning student, please ensure that professors are given a copy of your LOA each semester.

College Email

Students at Algonquin College are provided with a college email account. This is the address that will be used when the College, your professors, or your fellow students communicate important information about your program or course activities. Your network credentials can be found in the [ACSIS portal](#) and you are expected to check your Algonquin email regularly and to use it to send and receive college-related email. Support is available through the college Information Technology Service (ITS) at: <https://www.algonquincollege.com/its/>

Retroactive Accommodations

Students are expected to meet evaluation and completion deadlines as stated in course outline and course section information documents. In circumstances where evaluation and/or completion deadlines are missed or student performance has been affected by a temporary or permanent disability (including mental health), interim or retroactive accommodations may be considered. In such instances, please consult your course faculty member. For other situations where deferral of evaluations may be warranted, please consult Algonquin College Policy [AA21: Deferred Evaluation](#).

Student Course Feedback

Algonquin College invites students to share their course experience by completing a student course feedback survey for each course they take. For further details consult Algonquin College Policy [AA25: Student Course Feedback](#).

Use of Mobile Devices in Class

With the proliferation of small, personal mobile devices used for communications and data storage, Algonquin College believes there is a need to address their use during classes and examinations. During classes, the use of such devices unless authorized by your professor can be disruptive and disrespectful to others. During examinations, the use of such devices is generally prohibited unless authorized by your professor. Otherwise use is considered academic dishonesty in the form of cheating. For further details consult Algonquin College Policy [AA32: Use of Mobile Devices in Class](#)

Technology Requirements

Students are required to have access to a computer and to the internet. There may also be additional technology-related resources required to participate in a course that are not included in the course materials fee, such as headphones, webcams, specialized software, etc. Details on these requirements can be found in the Course Section Information of the course outline for each course available on Brightspace.

Transfer of Credit

It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Safe Harbour

In the event of an unexpected major event (pandemic, etc.), your course may have changes that are not reflected in the Course Outline. Should this happen, the Course Section Information document will have updated information about your course.