WATERLOO | CHERITON SCHOOL OF COMPUTER SCIENCE

CS634
Security and Privacy in Health Systems
(MHI -- Online/Distance)

COURSE OUTLINE
Spring 2025

Teaching Team

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Teaching Assistant
No TAs this term.

Pre-requisites

Prereq: MHI, MHE or MPH program enrolment.

Course Overview

This course explores security and privacy issues in a variety of settings such as networks, databases, and applications. Where possible, we explore these topics through the the lens of information systems used in the health sector.

I hope you enjoy the course.

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A Message from the Professor

This is a long document, but it is an important document to read thoroughly. The structure and delivery approach used for this course may be different from other courses you have taken.

Do not allow yourself to be caught off-guard by not knowing a policy that applies for this course, or for assuming that because something happened one way in another course that this course is structured similarly.

For example, this course <u>does not</u> make reliable use of the CALENDAR feature in LEARN. *You need to track and record due dates yourself using a process of your choosing*. Important dates

[1] I won't maintain office hours on campus as participants in this course are all online and most of you are remote to Waterloo. My office hours will be online in TEAMS. However, if someone wishes to meet on-campus, I'm pleased to do so. .

related to our course might be missing or even incorrect in LEARN.

The secret is to pay careful attention to the START HERE page for each module and to this course outline.

The GRADES feature in LEARN is also not used in this course. I believe you will be able to see self-test scores in the Gradebook but you will not be able to find Assignment scores there. I provide feedback on assignments directly and maintain records in a spreadsheet at my end that is not accessible inside LEARN.

Course Objectives

After completing this course, you will:

1. understand risks and threats to computer-ized information systems used in the health sector
2. be able to contribute to the design of secure systems;
3. be familiar with processes to assess the security of information systems and the privacy of information; and
4. be able to play a role in the management of systems that require a high level of security and privacy, such as those used to support the delivery of health services.

Textbook

Charles P. Pfleeger and Shari Lawrence Pfleeger, **Security in Computing**, 6th edition, Prentice-Hall, 2024, ISBN-9780137891214.

You don't need to own a copy of the text unless you wish to purchase one. The text is available online through the UW library. At the time of writing this outline, there is a paywall stopping me from getting to the textbook that the university has already paid for us to have access.

The university is obviously troubled about the publisher trying to charge our students when we already paid a fortune to access these titles. Watch ASK THE INSTRUCTOR for updates which I will publish as soon as I learn that the university has this sorted on our behalf. (The library is working on this issue while I type.)

There are many excellent books on computer security. That's the good news. The bad news is that references addressing specific threats or remedies can go out of date quite quickly. I know. I have some awesome titles on my shelf for designing security into Windows NT. Pretty valuable books at one point in my career. Nothing but paperweights now.

Having said this, there are good books out there. I'd like us all to be on the lookout this term for crackerjack security and privacy titles that have a health systems focus. It would be even more exciting if you found texts in this field with a public health focus. If you find something interesting, please share it with all of us in the online Virtual Coffeeshop. (This would even be recognised via EAF about which you will watch a video in week 1.)

Other Useful Resources

Other resources that you might find interesting to follow:

The RISKS Digest
https://catless.ncl.ac.uk/Risks. A forum on risks to the public in computers and related systems.

CITP Blog (formerly Freedom To Tinker)
https://www.freedom-to-tinker.com
A blog which often discusses security and privacy issues, frequently related to copyright and to electronic voting.

Threat Level
https://www.wired.com/tag/threatlevel/
A forum dedicated to privacy, crime and security online.

Contacting the Instructor

You should feel free to contact me at any time. My availability is limited only by my meetings schedule.

Like many of us, I receive a large volume of email. While all messages are important, when I'm teaching, the most important messages are those

that come from my students. Thus you will always get as prompt a response as I can manage. If you want your messages to automatically rise to the top of my inbox, preface the subject line with CS634.

If you haven't heard from me within 48 hours, something is wrong. I'm either stuck in an airport (I'm actually updating this document from the Victora BC airport!) or I became overwhelmed by all the other messages that came that day. Please send again. I won't take offence, and won't consider you to be pestering.

To help reduce email traffic, I've set up an "Ask the Instructor" discussion forum in LEARN which is the right place to ask questions that may be of interest to others in the class.

I'll post answers to that same forum, thus reducing the amount of mail that we all receive. That forum is a great place to post questions where everyone in the class is going to need to know the answer. I will sometimes post and answer questions to the forum myself when I discover something that would benefit from clarification. Be sure to stay abreast of information that gets posted to the Ask the Instructor forum.

You'll also see I've created an "Ask a Colleague" discussion forum that you can use to pose questions that others in the class may be able to answer.

The spam filters in my university email account will reject mail that appears to be spam. Because of this, it is best to send messages to me from your @uwaterloo address.

Read the handout under Background Materials about the email practices we are required to follow if you aren't using a @uwaterloo email account to write to me.

Monitor your @uwaterloo account. **If I write to you at this address, the university considers that you have received the message.**

Delivery Modality

Like all MHI, MHE and MPH courses, this course is delivered online.

Each module includes a series of lectures that you can watch at a time of your own choosing.

There may also be a discussion question that I toss out to get us thinking about a particular topic.

Workload

This is a graduate course. The fact that the course is delivered in an online format does not change the workload expectations. If anything, I suspect the logistics of needing to coordinate one's activities around the milestones may actually increase the amount of time that must be committed to the course over that which would be required in a classroom setting.

My experience is if you budget 10 hours per week for a grad course, you will have MORE than enough time to watch the module videos and complete assigned tasks. (Assume that a full course load of 3 graduate courses is equivalent to a full time job of 35 hrs/week.)

I understand that there are many other demands on your time. However, these other demands cannot be used as a reason to reduce your commitment to any university education.

Thematic Topics

The course is delivered as a series of seven modules. Modules last 2 weeks except for Module 1 and 7 which are 1 week in length.

The modules for this term are:

Module 1 - *Computer Security and Privacy*
Mon May 5/25 – Fri May 9/25 (one week module)
The meaning of computer security; comparing security with privacy; types of threats and attacks; methods of defense

Module 2 - *Program Security*
Mon May 12 – Fri May 22/25
Secure programs; non-malicious program errors; malicious code; controls against program threats

Module 3 - *Operating System Security*
Mon May 26 – Fri June 6/25

Methods of protection; access control; user authentication

Module 4 - *Network Security*
Mon June 9 – Fri June 20/25
Network threats; firewalls, intrusion detection systems

Module 5 - *Internet Application Security and Privacy*
Mon June 30 – Fri July 4/25
Basics of cryptography; security and privacy for Internet applications (email, instant messaging, web browsing); privacy-enhancing technologies

Module 6 - *Database Security and Privacy*
Mon July 7-- Fri July 18/25
Security and privacy requirements; reliability, integrity, and privacy; inference; data mining; k-anonymity

Module 7 - *Non-technical Aspects*
Mon July 21 – end of term (Wed July 30/25)
Administration of security systems; policies; physical security; economics of security; legal and ethical issues

Module content is delivered using a collection of video lectures with a set of accompanying printable slides. Both can be found in LEARN, organised by module.

Please listen to the video recording for Module 1 Part 1 to learn more about navigating using the printed slide deck.

Evaluation

Assignments (3) (Individual)	60%
Self-test Quizzes (3) (Individual)	40%
Effort Adjustment Factor	0.92 – 1.08

Your final grade is determined using the break-down above but can be affected (upwards or downwards) by the Effort Adjustment Factor. The Effort Adjustment Factor is used in lieu of having a participation grade.

WATCH the video on how the Effort Adjustment Factor works. The video can be found in the IMPORTANT COURSE INFORMATION folder in LEARN.

I find it helpful to remind everyone that online learning does not mean independent study. This is not a course where you can decide what to do, how much to do, and when to do it. Everyone in the class, including me, is counting on your involvement.

Imagine this course to be exactly like a course delivered on campus, It just happens that we are all sitting in front of our computer monitors instead of sitting together in a classroom.

If you have questions about my expectations, be sure to ask.

Details on the deliverables that contribute to your evaluation are described in the sections that follow.

Deliverables

Assignments
(Individual activity – do 3)

A1 due Friday 30 May 2025 at 23h59
A2 due Friday 27 June 2025 at 23h59
A3 due Friday 25 July 2025 at 23h59

If you've spoken with students who have taken this course before you'll know traditionally the main deliverable has been a curated portfolio of many small tasks with the ability to choose which small tasks you wished to tackle. Given the financial challenges the university is facing, regrettably we'll need to move back to a more traditional assessment structure as we no longer have the resources to sustain this approach.

As a result, we will have 3 more substantial assign-ments – one in each month of the course. I tend to craft deliverables that mimic things you might experience in the real world. So you could expect to find yourself creating a briefing note for government, or maybe undertaking some type of risk assessment, or maybe even making a policy recommendation. Details will be posted to the ASSIGNMENTS folder.

My assignments almost always ask you to assume a persona. Maybe you will be a policy advisor. Maybe a security consultant. Maybe a hacker! When completing assignments, imagine yourself in the role that I've assigned and write/craft your deliverable from that perspective.

Self-tests (3) + Course Outline Quiz (1)
Individual

The self-tests are available for a 7 day window after the end of modules 2, 4 and 6. The self-tests are of the 'multiple choice' style and are administered inside LEARN.

Self-tests help you remain current with the material, and gauge your grasp of what we are discussing on an ongoing basis.

There is also a short quiz designed to ensure you are familiar with the course structure. The course outline quiz is due before Module 2 begins. There are no marks directly associated with the course outline quiz, and you can try the quiz as many times as you like, but if you watch the video on EAF you will appreciate how I might view people's attention to this quiz.

Deadlines and LEARN

A comment about submitting on time…

It is tricky for LEARN to figure out when midnight happens. (Something due at midnight tonight is treated as being due tomorrow morning by LEARN.) This is why I set all deliverables to be due at 23h59. This removes any confusion for both LEARN and the class.

If I could offer a strong bit of advice – don't play poker with LEARN's clock. Submit well before 23h59. LEARN is ruthless. Submitting at the last minute can result in your submission not being accepted because of technical reasons (e.g., 1,000 CHEM100 students submitting at that time) or because your watch is showing a time that is a minute earlier than "LEARN time".

Note for students with disabilities

AccessAbility Services collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility at the beginning of each academic term.

Equity, Diversity and Inclusivity

I welcome and embrace diversity in opinions, backgrounds and beliefs and count on you to do the same.

Demonstrate respect and dignity towards others in the class and in your group settings, as I know you will.

If you have a PGP that you prefer I use, I welcome you sharing if you wish to. My PGP is he/him/his.

For some of us, the name stored in the university's records is sometimes not the name by which our family and friends know us. Should you have a preferred name, simply let me know. I'll happily update my class list to reflect that choice.

Please also help me correctly pronounce your name should I say it incorrectly. Many of us have names that don't follow English pronunciation patterns. My name is a good example. You would think my name (Ian) is pronounced "eye-an" as the "i" is followed by a vowel meaning by English pronunciation rules it should be a "long" *i*, but my name is pronounced as, "eee-an." (You'll make me smile if you call me "eye-an.")

While many of you will have heard my name before and will know how it is pronounced, unless you speak Gaelic (I'm from Scotland) I bet nobody in the class can pronounce other names in my family like Oighrig. (Let me know if you can guess! No cheating by checking YouTube.) My family has spent our lives helping teachers learn how to pronounce our names (and spelling our names, letter by letter, when talking to a call centre – some of you will know that experience!), so please help me learn how to correctly pronounce your name. I love learning new names.

The Land We Are On

On our main campus we are living and working on the traditional territory of the Attawandaron (also known as Neutral), Anishinaabe and Hauden-osaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes ten kilometres on each side of the Grand River.

Security Information

In this course, you will be exposed to information about security problems and vulnerabilities with computing systems and networks. You are not to use this or any other similar information to test the security of, break into, compromise, or otherwise attack, any system or network without the express consent of the owner. Depending upon the scenario, attempting any of these actions could be considered not only unethical behavior but also criminal behavior. In particular, you will comply with all applicable laws and UW policies, including, but not limited to, the following:

- UW Policy 33, Ethical Behaviour
- Guidelines on Use of UW Computing and Network Resources
- MFCF Account Usage Policy
- CSCF-Specific Policies

Violations will be treated severely, and with zero tolerance.

The fine print

Sadly, this section of the course outline seems to grow longer by the year as both the University and I seek to ensure that nobody is caught unaware by the University's policies and regulations.

In an effort to ensure no-one finds themselves saying, "I didn't know that," this section summarises information I'm sure won't come as a surprise to experienced grad students:

General University Policies

It is your responsibility to familiarize yourself with University policies regarding academic integrity, accommodations available due to illness, acceptable use of Waterloo's resources, and how to appeal a decision that affects your academic affairs. Those policies form an integral part of this course outline and can be found on the University's website.

Literacy

Written assignments must reflect university level literacy in English.

If English is your second language, consider using grammar and spelling checkers. (This can also be a great idea when English is your first language!)

Late Submissions

Consistent with School policies, late assignments are marked and then a penalty of 10% for each day late is applied. (Whether 10 minutes late or 24 hours late.) There is no opportunity to submit a quiz late.

For assignments, weekends count as 2 days and a grade of zero is assigned after 5 days. There is normally no exception to this rule without documentation or prior arrangement with the instructor or a TA. University regulations preclude pre-arranged holiday trips, assignments due in other courses, or events like your friend's brother's birthday from being acceptable reasons for a late submission – as legitimate as some of these reasons might seem.

The quizzes are short and simple so only for extenuating circumstances should it not be possible to complete a quiz during the block of time available. Should you miss a quiz for an accepted documented reason, your other quiz scores will be used for the quiz you were unable to complete. You will not be expected to make-up for the missed quiz in these cases.

Although the School has a late policy, I like to remind people that common sense always prevails. If your home is without electricity for days (Montreal in April 2023 or is anybody old enough to remember Ottawa in 1998?), I do not want you risking life or limb to find an internet café just so you can submit something on time. Likewise, if you are a healthcare provider who is paged to come in and save someone's life and thus miss a deadline, don't panic. If we have ice storms, tsunamis, or other events truly beyond your control (dare I say, like a pandemic), I will make alternate arrangements with you. Simply keep me in the loop, as early as possible.

Voluntary Absence

Undergraduates now have the ability to, once per term, declare a voluntary short term absence (up to 3 days) from school without needing any documentation or to even explain the reason. Deliverable expectations in ALL courses are paused for the period the student self-declares. Course policies explain what happens if a voluntary absence is declared. (Described below for us.)

I had a large class last term and while I found the Voluntary Absence Program to be a nightmare to administer, I was impressed with the mental and physical health benefits this policy offers. There seems to be something similar in place for grad students, but I haven't quite figured out how it works. (Grad students appear to trigger a voluntary absence via QUEST while undergrads use a different system.)

Long story short, I'm happy to see us make use of this "feature" if it is available to us. Watch ASK THE INSTRUCTOR where I will post details and a link once I figure out how it works (or doesn't work) at my end.

The policies we'll use if we do have access to the voluntary absence system is if you self-declare an absence for a period that includes a quiz, I will use your other quiz scores for the quiz that was missed. If you self-declare an absence for a period that includes the due date for an assignment, there will be no late penalty applied until 2 days after your voluntary absence period expires.

Academic Integrity

I can't encourage you strongly enough to read material the University has prepared for students regarding academic integrity and related university policies. If you have never read these materials, go and READ THEM NOW. All of this information is found on the excellent academic integrity website. https://subjectguides.uwaterloo.ca/gradaiguide.

Claiming you didn't know a policy existed is rarely accepted as an excuse if you find yourself violating a rule – deliberately or accidentally.

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. (Check the Office of Academic Integrity for more information.)

It's important that we all recognize that academic misconduct by any individual compromises the educational experience of everyone who is affiliated with Waterloo. You want to be proud of your UW degree, just as I am very proud of my Waterloo degree.

When someone cheats, or takes actions detrimental to the education of others, it diminishes the quality of the degree the rest of us worked so hard to earn. Who wants to have a degree from a University where "the word on the street" is that the degree can be obtained by cheating? None of us!

This is one of the reasons I take academic misconduct so seriously. When someone engages in academic misconduct the real impact is on everyone else who acted honestly and fairly when earning our Waterloo degree. So I encourage you to help me here. If you see cheating, call it out. Let people know this is unacceptable.

By now, all of you should have passed your Academic Integrity milestone.

When completing tasks it is fine to talk to one another, the instructor, or to anyone else but any assistance must be limited to discussion of the problem and sketching general approaches to a solution. You must always create your own solutions, including code and documentation if appropriate.

Basing your solution upon someone else's solution is prohibited, and obviously solutions may not be copied from any source. Nor can you come up with a solution and ask others if they think you have the correct answer. (Be careful here. Students who post their self-created answers to a discussion forum simply to ask if others think they've solved something correctly can be found guilty of academic misconduct if someone takes that solution and submits it as their own.)

To be clear, submitting assignments copied in whole or in part from assignment submissions to a previous offering of this course, or from any offering of any other course, is forbidden, *even if you are resubmitting your own work*. These and any other forms of collaboration on assignments constitute cheating. If you have any questions

about whether some activity constitutes cheating, please ask the instructor.

Academic misconduct includes more than plagerism. Academic misconduct also includes cheating, falsification and behaviours that interfere with the rights of other students to pursue their studies. So it's not only about plagiarism, although plagiarism or inappropriate collusion with colleagues seem to be what gets many students into a tough spot.

For sure, penalties vary with the nature of the transgression. But in my many years as a professor, I continue to meet students who think that if they get caught they will simply get zero on their assignment. Instead, I've experienced situations deemed so serious as to see the student being removed completely from their program – their academic careers ended. It happens. Don't let it happen to you.

The University is becoming increasingly vigilant in this area, as it should be. You may have seen on the news that a few years ago a student was charged with a criminal offence for a cheating incident during an exam at Waterloo. That's much more serious than simply failing a course.

Having gone on for a bit about the seriousness with which we approach issues of Academic Misconduct, it is also really important for me to stress that that the University is committed to fairness and equity in our decision-making process. There are avenues open to you should you ever feel a decision I've made, or the University has made, is unreasonable or unfair given the circumstances.

Thanks for reading this section. My hope is we can enjoy a term where the section on Academic Integrity and norms wasn't needed even though the university requires instructors to include this discussion in our outlines.

Grievances

Notwithstanding University of Waterloo policies, a student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please contact the School's Associate Director for Graduate Students (Dr Meyer) who will provide further assistance.

Discipline

A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. (Check the Office of Academic Integrity for more information.) A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals

A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there are grounds. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Writing Style, Page Layout, Submission Length and References

There is no "academic writing" required in this course. (Such as is required for a journal article, essay, or thesis.) Instead, your **written submissions should employ a business writing style.** Grammatically correct point form is fine when appropriate. Short, concise sentences are welcomed.

Submissions must reflect university level literacy in English.

You will note I rarely specify particular fonts or sizes, page margins, line spacing, page layouts, etc. for submissions. I will leave it to you (just as your employer will do) to make decisions regarding how you wish to present your recommendations in

a professional manner. Having said this, **presentation style is assessed.**

You can use any convention you wish when citing sources. (APA, Chicago, or even something you've created yourself, etc.) Our only criteria is that you provide sufficient information for us to be able to locate a source you are citing should we wish to do so.

Turnitin.com and alternatives

Text matching software (such as Turnitin) may be used to screen assignments. Turnitin has been tweaked to assess whether ChatGPI or other AI tools appear to have been used in the preparation of written text.

Contact me if you wish to explore an alternate process for screening your submissions.

Use of Generative AI

This course includes the independent development and practice of specific skills, such as assessing situations, developing recommenddations, and making decisions about how to present information to management.

The use of Generative artificial intelligence (GenAI) trained using large language models (LLM) or other methods to produce text, images,music, or code, like Chat GPT, DALL-E, or GitHub CoPilot, is therefore **not permitted** in this class.

Unauthorized use in this course, such as running course materials through GenAI or using GenAI to complete a course assessment is considered a violation of Policy 71 (plagiarism or unauthorized aids or assistance). Work produced with the assistance of AI tools does not represent the author's original work and is therefore in violation of the fundamental values of academic integrity including honesty, trust, respect, fairness, responsibility and courage (ICAI, n.d.).

You should be prepared to show your work. To demonstrate your learning, you should keep your rough notes, including sources, research notes, brainstorming, drafting notes and prompts. You may be asked to submit these notes along with earlier drafts of your work, either through saved drafts or saved versions of a document. If the use of GenAI is suspected where not permitted, you may be asked to meet with your instructor or TA to provide explanations to support the submitted material as being your original work. If you cannot sufficiently support your work, academic misconduct allegations may be brought to the Associate Dean.

In addition, you should be aware that the legal/copyright status of generative AI inputs and outputs is unclear. More information is available from the Copyright Advisory Committee.

Students are encouraged to reach out to campus supports if they need help with their coursework including:

- Student Success Office for help with skills like notetaking and time management
- Writing and Communication Centre for assignments with writing or presentations
- AccessAbility Services for documented accommodations
- Library for research-based assignments

Publishing Course Content

Sites encouraging students to publish course materials (lectures, slides, solutions, etc.) have sprung up like mushrooms. As a result, the university has asked that we include this statement in our course outlines…

This course contains the intellectual property of your instructor, TAs, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TAs or used by the instructor or TAs with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, ***sharing intellectual property without the intellectual property owner's permission is a violation of intellectual property rights and is illegal*****.** For this reason, it is necessary to ask the instructor, TAs and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TAs or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

That's it for the fine print.

Enjoy the term. Let me know what's working in the course, and what doesn't work. Let me know topics that you'd like to see us explore. Be engaged. Your grad school experience will be something you remember for your whole life. As I'm prone to saying, you will get out of university what you put into it. Make it the best experience you can.

(ideas$) CS634 Outline v1q

Revision History
S14 v1a built from CS458/658 W14
S16 v1a built from CS698 S14
S17 v1a built from CS634 S16
S18 v1a built from CS634 S17 – new deliverables
S18 v1b date clarifications
S19 v1b deliverable clarifications; summary added
S20 v1d portfolio chgd, grading changed, index added
S21 v1g built from S20 v1d
S22 v1h built from S21 major section reorg of v1f
S23 v1j built from v1f. Minor updates.
S24 v1k built from v1j. Crowdmark added
S24 v1p Crowdmark removed. Portfolio removed.
S24 v1q GenAI added