

## CSCI4145/5409 --- Cloud Computing (Course Syllabus – Winter 2023)

### Instructor Information

<b>Instructor:</b>	Robert Hawkey	<b>Office:</b>	Goldberg 219
<b>E-mail:</b>	<a href="mailto:rhawkey@dal.ca">rhawkey@dal.ca</a>	<b>Office:</b>	W 14:00 -15:00
<b>Class Meeting Time:</b>	MW 08:35 - 09:55	<b>Hours:</b>	
<b>Lab Meeting Time</b>	F 08:35-9:55	<b>Room No:</b>	Kenneth C Rowe Management 1020
<b>Course Homepage:</b>	<a href="https://dal.brightspace.com/">https://dal.brightspace.com/</a>	<b>Room No:</b>	Kenneth C Rowe Management 1020
<b>Teaching Assistants</b>	<b>Lab TAs:</b> Kamran Awaisi <a href="mailto:km521977@dal.ca">km521977@dal.ca</a> (Dr. Meredith's Section) Bharat Shankaranarayanan <a href="mailto:bh277785@dal.ca">bh277785@dal.ca</a> <b>Assignment Scripting:</b> Shaik Asaduddin <a href="mailto:sh465111@dal.ca">sh465111@dal.ca</a> <b>Support TAs:</b> Shathish Annamalai <a href="mailto:sh495601@dal.ca">sh495601@dal.ca</a> Lav Patel <a href="mailto:lv842182@dal.ca">lv842182@dal.ca</a>		

### Important Dates

- Last day to add/drop: January 20, 2023
- Munro Day (University closed, no classes or labs): February 3, 2023
- Last day to drop without a "W": February 6, 2023
- Winter Study Break (no classes or labs): February 20 – 24, 2023
- Last day to drop with a "W": March 13, 2023
- Good Friday (University closed, no classes or labs): April 7, 2023
- **Final Exam: TBA in the first week of February 2023**

### Deadlines (All items due at 23:59 Atlantic on date specified)

Assessment	Due Date	Description
A1 - Docker	February 5, 2023	Building a multi-container docker environment that hosts a small web app.
Midterm	February 15, 2023	In-class test.
A2 - Compute & Storage	February 26, 2023	Using AWS compute and storage mechanisms to build a webapp that stores information in a database and files in a block store.
A3 – Network & Security	March 19, 2023	Building a small web app that demonstrates the use of AWS network and security mechanisms.
A4 – Serverless	April 2, 2023	Implementing a serverless state machine.
Term Assignment (Final Report and Video Demonstration)	April 12, 2023	An individual project you will complete throughout the entire semester.

## Course Description

*"Cloud computing is a specialized form of distributed computing that introduces utilization models for remotely provisioning scalable and measured resources."* - Cloud Computing, Erl/Mahmood/Puttini

Cloud computing provides users with the ability to access and use compute, storage, network, and security resources offered by cloud providers. This course provides students with the foundations of cloud computing and hands-on experience in using various cloud technologies. Topics covered are related to the types of cloud services, cloud infrastructure, distributed storage models, and programming models offered as general services by leading cloud providers. Topics will also include underlying technologies, such as virtualization.

## Learning Outcomes

- Understand and explain key cloud computing terminology
- Understand the history and motivation behind the paradigm shift towards cloud computing, and evaluate its goals, benefits, risks, and challenges
- List and describe the technologies that make cloud computing possible: data center technology, broadband networks & internet architecture, virtualization, and the world wide web
- Understand and differentiate between cloud deployment models
- Understand and differentiate between cloud delivery models
- Understand and develop risk mitigation plans for cloud-specific security threats
- Understand and explain common cloud computing architectures, then apply this understanding to the design of a major term assignment
- Use the core compute, network, storage, security, and monitoring mechanisms of a major cloud provider to implement a major term assignment
- Identify and calculate up-front, on-going, and additional business costs in cloud computing as well as the metrics for choosing and evaluating cloud services
- Understand service-level agreements and the service quality metrics used to audit cloud computing service performance
- Learn and apply cloud development supporting tools and techniques such as containerization, CI/CD, and infrastructure as code

## Course Rationale

Due to the agility provided by flexible resource assignment cloud computing is currently one of the most important computing paradigms. This course teaches cloud computing theory combined with applied use of current technologies to build software in the cloud.

## Class Format and Course Communication

- Weekly lectures will be held in person.
- **Masks are required in all labs, tutorials, exams and when visiting the instructor for office hours. Students not wearing masks will be asked to leave.**
- Weekly tutorials will be held in person. These tutorials will cover the minimum set of cloud technologies and services you must understand and be able to use to work in the cloud. Attendance is optional; if you can find another way to learn this material that's up to you, however, you will be responsible for completing individual assignments that assess your understanding of these tools and services.
- We will use Microsoft Teams for general course discussion and for technical support from TAs.
- Please note all lectures and labs will be recorded and made available to the TAs and students enrolled in the course. Participation in lectures and labs will automatically indicate that you

consent to your voice, text or screen sharing being recorded for viewing by those enrolled in or assisting in the delivery of the course.

- Students must ask permission before recording, screen capturing or screen sharing.
- Major course announcements will be posted to Brightspace, which should trigger a notification email to your Dal email account. It is the student's responsibility to check their Dal e-mail daily. To access your Dal e-mail account please see:  
<https://www.dal.ca/dept/its/o365/services/email.html>

## Asking Questions

My students come from diverse cultural and educational backgrounds. Therefore, I would like to clarify my expectations for your approach to learning in my course. When you have a question, I always want you to ask the question and keep asking until you understand the material. There are no time-wasting questions, dumb questions, or unwanted questions. In fact, sometimes questions lead to some of the best learning opportunities for everyone. The only time questions become problematic is when they are repeated!

Often when you have a question many other students have the same question, or they may contribute to your question and ask things you didn't think of. Therefore, you should feel free to ask questions in the General channel on Microsoft Teams at any time.

Additional office hours will be provided by our TAs. There will be 2 times per week where TAs are available for 2 hours on Teams to answer your questions about the course materials and technologies you need to work with.

## Evaluation Criteria

- Individual Assignments (20%)
  - Four individual assignments that test your applied knowledge of cloud provider mechanisms.
  - Weight distributed equally across all assignments.
  - **No collaboration is permitted on the assignments.**
  - All assignments will be checked with MOSS.
- Exams (40%)
  - Midterm – Held in class (see important dates for date)
  - Final Exam – Scheduled by registrar.
  - The exam with your **highest** grade will be worth **25%**
  - The exam with your **lowest** grade will be worth **15%**
- Term Assignment (40%)
  - **No collaboration is permitted on the term assignment.**
  - All term assignment code will be checked against other student's code with MOSS.

### Notes

- Graduate students must achieve a minimum grade of B- to pass this course.
- A minimum grade of C is required in this course if it is core to your FCS degree, or if it will be used as a prerequisite for a subsequent CSCI course.
- As of 2019, students who receive a grade lower than C in the same required CS course twice, will be dismissed.
- The grade conversion scale in Section 17.1 of the Academic Regulations, **Undergraduate Calendar** will be used.  
<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=7302&topicgroupid=32188&loaduserredits=False>
- No rounding will be performed on grades, your grade is your grade, it is in your control.
- **It is up to the discretion of the instructor to use remote proctoring in online testing. Students may be required to download proctoring software onto their devices. Students who cannot meet system requirements for remote proctoring should contact the**

**instructor for an alternate assessment. (Typical system requirements are: (i) Mac OS or Windows, (ii) a web-cam, and (iii) an internet connection.)**

## **Student Declaration of Absence**

**Student declaration of absences are not authorized in this course.**

We give a minimum of 2 weeks between when an assignment is released and when it is due. We recommend you begin working on assignments immediately when they are released. The lengthy period allows you to schedule and adapt to illnesses and unknowns, and thus alleviates the need for SDAs.

## **Midterm and Final Exam Requirements**

- Photo ID is required
- Closed book, no electronic or physical reference material allowed.
- All electronics (including smart watches and phones) must be put away.
- Masks are required.

## **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.

## **Required Texts and Resources**

- There is no required textbook for this course.
- Lecture and lab slides will be posted on Brightspace before each session.
- Content will be delivered through lectures, tutorials and content provided by AWS Academy.

## **Prerequisites**

**4145** – CSCI 2141.03, CSCI3120.03, and CSCI3171.03

**5409** – CSCI5100.03, CSCI5308.03, and CSCI 5408.03

## **Tentative List of Topics**

<b>Week</b>	<b>Lecture Topic</b>
<b>1</b>	Syllabus, course overview, history of cloud computing & term assignment discussion
<b>2</b>	Intro to cloud computing
<b>3</b>	Cloud-enabling technologies
<b>4</b>	Cloud deployment & delivery models
<b>5</b>	DevOps & managing releases
<b>6</b>	Infrastructure as code & Midterm
<b>7</b>	Fundamental cloud architectures
<b>8</b>	Advanced cloud architectures

9	Security
10	Business considerations
11	Microservice architectures (or Service-Oriented Architectures, SOA)
12	Guest lecture & open discussion of current cloud computing news
<b>Week</b>	<b>Tutorial Topic</b>
1	Docker basics
2	Web apps running in Docker
3	Multi-container Docker environments
4	No lab due to Munro Day
5	AWS compute & storage (EC2 & S3)
6	AWS compute & storage (Elastic Beanstalk & DynamoDB)
7	AWS security (IAM, Secrets Manager)
8	AWS network (VPC & API Gateway)
9	Serverless
10	Exploring AWS cost analysis tools
11	Demonstration of microservice architecture
12	No lab due to Good Friday

## 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](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](https://www.dal.ca/content/dam/dalhousie/pdf/faculty/computerscience/policies-procedures/fcs_policy_local.pdf)

## Use of Plagiarism Detection Software

All submitted code may be passed through a plagiarism detection software, such as the plagiarism detector embedded in Codio, the Moss (<https://theory.stanford.edu/~aiken/moss/>) Software Similarity Detection System, or similar systems. If a student does not wish to have their assignments passed through plagiarism detection software, they should contact the instructor for an alternative. Please note, that code not passed through plagiarism detection software will necessarily receive closer scrutiny. [https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university\\_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf](https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf)

## 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: registered nurses, doctors, counsellors and a social worker. Visit [dal.ca/studenthealth](https://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 [dal.ca/mentalhealth](https://dal.ca/mentalhealth).

## Culture of Respect<sup>1</sup>

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.

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. **Appeal 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&loaduserredits=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>

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<sup>1</sup> 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](mailto:lyndsay.anderson@dal.ca) [www.dal.ca/think](http://www.dal.ca/think).

## ***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](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](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](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](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](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](https://www.dal.ca/campus_life/academic-support.html)