DALHOUSIE UNIVERSITY
Faculty of Computer Science

CSCI4145/5409 - Cloud Computing (Course Syllabus – Winter 2024)

Instructor Information

Instructor:	Robert Hawkey	**Office:**	Microsoft Teams
E-mail:	rhawkey@dal.ca	**Office Hours:**	https://calendly.com/rhawkey
Class Meeting Time:	MW 13:05 – 14:25	**Room No:**	Online Synchronous
Lab Meeting Time	F 13:05 - 14:55	**Room No:**	Online Synchronous
Course Homepage:	https://dal.brightspace.com/		

Teaching Assistants

Lab TA:
Bharat Shankaranarayanan bh277785@dal.ca
Assignment Scripting:
Shaik Asaduddin sh465111@dal.ca
Support TAs:
Shaik Saifuddin shaik.saifuddin@dal.ca

Important Dates

- Last day to add/drop: January 22, 2024
- Munro day (University closed): February 2, 2024
- Last day to drop without a "W": February 6, 2024
- Nova Scotia Heritage Day (University closed): February 19, 2024
- Winter Study Break (No classes held): February 19 – 23, 2024
- Last day to drop with a "W": March 6, 2024
- Good Friday (University closed): March 29, 2024
- No class April 8, 2024 (it is treated as a Friday for course scheduling)
- **Final Exam: TBA, scheduled by the registrar's office**

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

Assessment	Due Date	Description
A1 - Docker	February 4, 2024	Building a multi-container docker environment that hosts a REST API.
A2 - Compute & Storage With Secure Networks	March 10, 2024	Building a webapp with AWS compute and storage mechanisms that also demonstrates the use of AWS network mechanisms for increased security.
CSCI5409 Only Kubernetes	March 24, 2024	Demonstrate DevOps skills by converting your Docker assignment to an autoscaling Kubernetes cluster deployed via CI/CD.
A3 – Serverless	March 31, 2024	Implementing a serverless state machine.
Term Assignment (Final Report and Video Demonstration)	April 9, 2024	An individual project you will complete throughout the entire semester as you learn how to use cloud technologies.

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
- This course includes applied experience in modern cloud computing technologies

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 online through Collaborate Ultra at the scheduled class time (accessed through Brightspace).
- Weekly tutorials will be held online through Collaborate Ultra. 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.
- Office hours with the instructor are available adhoc, scheduled through calendly (https://calendly.com/rhawkey), these meetings will be on Microsoft Teams.
- 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 email daily. To access your Dal email 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.

Our support TA will have a 2-hour support time scheduled for each week. The TA will be on Teams in our course General channel waiting in a meeting for you to join and to answer your questions about the course materials and technologies you need to work with.

Evaluation Criteria

- Individual Assignments (20%)
  - **No collaboration is permitted on the assignments.**
  - Three individual assignments that test your applied knowledge of cloud provider mechanisms.
  - Weight distributed equally across all assignments.
  - All assignments will be checked with MOSS.
  - Early & Late Policy:
    - Submitting assignments 2 days early (or earlier) earns you a bonus of 10% on each assignment. This bonus cannot exceed the 20% limit for assignments but can be beneficial if you make mistakes in assignments to cover the grade loss.
    - Submitting assignments late:
      - 24 hours late – 10%
      - 24 – 48 hours late – 50%
      - Assignments submitted beyond 48 hours of assignment deadline are not graded or given feedback and receive a grade of 0.
- Final Exam (50%)
  - This exam will be **IN PERSON** in a facility/room determined by the registrar.
  - Final is comprehensive from all material covered in lectures, labs, and assignments.
  - 3-hour exam scheduled by registrar during final exam period: April 11th – 23rd.
  - **Do not book travel during this time until the exam date is scheduled by the registrar and announced on Brightspace, no makeup exam is planned.**
- Term Assignment (**CSCI4145 - 30%**, **CSCI5409 – 20%**)
  - **No collaboration is permitted on the term assignment.**
  - All term assignment code will be checked against other student's code with MOSS.
  - **Due to grade submission deadlines, late submissions for the term assignment are not accepted.**

- **CSCI5409 Only** – Kubernetes Assignment (10%)
  - Graduate students must demonstrate an increased understanding of cloud computing technologies.
  - During this course, all students will gain a deep understanding of Kubernetes and the Google Kubernetes Engine (GKE), which includes learning about clusters, control planes, node pools, pods, workload deployment, services, and more. In addition to these topics, students will also become familiar with networking, security, and storage solutions that are specific to GKE.
  - After completing this assignment graduate students will be proficient in scaling, automating, and updating applications on GKE. They will also learn and demonstrate how to deploy workloads to GKE using CI/CD pipeline on Google Cloud Platform (GCP).
  - The individual assignment early & late policy applies to this assignment, the bonus cannot exceed the 10%, however it can make up for mistakes you may have in the submission.

Notes

- The use of Generative AI (ChatGPT, etc.) is not authorized in this course. When we ask you to write code it is so that you learn the technologies we care about. AI has already learned. Also, it currently writes bad code that sucks,.
- 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&loaduseredits=False
- No rounding will be performed on grades, your grade is your grade, it is fully in your control.

Student Declaration of Absence

Student declaration of absences are not authorized in this course.

We ensure 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 and incentivize you to do so.** Our late policy, and this lengthy period allow you to schedule and adapt to illnesses and unknowns, and thus alleviates the need for SDAs.

Final Exam Requirements

- Photo ID is required
- Closed book, no electronic or physical reference material allowed.
- All electronics (including smart watches and phones), watches, headphones and translators must be put away. It's best if you just don't bring these things to the exam.

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

Week	Lecture Topic
1	Syllabus, course overview, history of cloud computing & term assignment discussion
2	Intro to Cloud Computing
3	Cloud-enabling Technologies
4	Cloud Deployment & Delivery Models
5	Cloud Architectures
6	DevOps
7	Infrastructure as Code
8	Kubernetes
9	Security
10	Business Considerations
11	Microservice Architectures
12	Open discussion of current cloud computing news & topics
Week	**Tutorial Topic**
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 network (VPC, API Gateway)
8	Kubernetes on GKE with CI/CD
9	AWS security (IAM, Secrets Manager)
10	Serverless
11	No lab due to Good Friday
12	Exploring Cost Tools On AWS

Responsible Computing Policy

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

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

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** to learn more and book an appointment today.

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

Culture of Respect[1]

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

What we all need to do:

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

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

University Statements

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

Territorial Acknowledgement

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

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

Internationalization

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

Academic Integrity

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

Accessibility

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

Conduct in the Classroom — Culture of Respect

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

Diversity and Inclusion — Culture of Respect

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

Student Code of Conduct

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

Fair Dealing Policy

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

Originality Checking Software

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

Student Use of Course Materials

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

Learning and Support Resources

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