DALHOUSIE UNIVERSITY
Faculty of Computer Science

THERE WILL BE NO CONVERTING OF FINAL GRADES TO PASS/ILL THIS SEMESTER.
ALL LETTER GRADES WILL BE FINAL!

CSCI 5410 -- (Serverless Data Processing)
Course Syllabus

Instructor Information

Instructor:	Dr. Saurabh Dey	**Online Office:**	Teams Virtual Office (Link given in Brightspace)
E-mail:	saurabh.dey@dal.ca	**Office Hours:**	Use mention @ to send me messages on Teams for scheduling meetings
Class Meeting Time:	Tue, Thu 4:05 PM – 5:25 PM	**Location:**	Studley KENNETH C ROWE MANAGEMENT 1020
Lab Meeting Time	[B01] Wed 10:05 AM – 11:25 AM	**Lab Location:**	Carleton COLLABORATIVE HEALTH EDUC BLDG C264
	[B02] Wed 4:05 PM – 5:25 PM		Carleton COLLABORATIVE HEALTH EDUC BLDG C264
Course Homepage:	https://dal.brightspace.com/		

Important Dates

- National Day for Truth and Reconciliation, University closed – Sep 30, 2022
- Thanksgiving Day, University closed – Oct 10, 2022
- Project Plan & Worksheet - Oct 21, 2022
- Fall Study Break, No classes (University open) – Nov 7 to 11, 2022
- Remembrance Day, University closed – Nov 11, 2022
- Exam Period for Computer Science and Engineering - Dec 9, 2022 to Dec 20, 2022
- Project Demo – Nov 30 to Dec 2

Course Overview

Students will gain knowledge of serverless cloud architectures using the real-world problem domain of large scale data analytics. Serverless architecture provides more flexibility, scalability, and faster deployment without the need of server-centric architecture. Serverless model reduces a customer's computing cost by eliminating the need of running a server on cloud. It can be viewed as a utility computing or Function as a Service (FaaS). In addition, students will gain experience designing and provisioning cloud infrastructure required for large scale applications. The course will focus on utilizing framework/ tools in an optimized manner to speedup large scale data analysis, and improve robustness of the cloud platform. Further, the course will focus on solving real-world problems, such

as analyzing large scale financial records, where security, robustness, and completeness of data analysis are the primary concerns. Through lectures, lab sessions, assignments, and group project students will be able to gain knowledge about various concepts related to serverless technologies, large scale data analysis, which could be used to solve real-world business problems.

Learning Outcomes

By the end of the course students will be able to

- Compare vendor specific cloud platform and applications, such as Amazon AWS, Microsoft Azure etc. by working on assignments and participating in online discussions
- Understand the cloud security setup through literature review
- Summarize the fundamental challenges of Data Analytics on cloud platform exploring various case studies
- Apply various techniques to reduce cloud platform operation cost by implementing project in serverless manner
- Apply ETL techniques before performing data analysis by developing codes for data extraction, transformation and load
- Build and use state machine in Cloud by developing an event driven application
- Understand the serverless Cloud architecture and justify the robustness and maximum uptime
- Apply Queueing, and Notification services by adding specific modules in the project
- Create, and test on demand serverless setup on cloud platform.

Course Format & Communication

- Content will be delivered through in-person sessions.
- Lecture slides will be posted on Brightspace.
- There will be a set of
  - (i) **Face-to-face** or **in-person sessions** and
  - (ii) **Asynchronous** or **self-paced learning sessions**
- Course format, and important dates will be posted on Brightspace
- Course announcement will be sent through office 365 Teams channel
- Instructor office hours, and communication with TA will be done through office 365 Teams channel and in-person (1:1) or group meetings
- Lab tutorials will be offered weekly (in-person mode only).

Modules Outline

The course has five modules, and each module has multiple topics

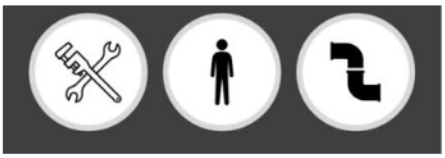
Module 1: Concepts of Cloud Computing

The primary objective of this module is to understand the concepts of cloud computing, and deployment models. Before using the cloud computing and related technologies it is very critical to explore the deployment models to minimize the cost, maximize the efficiency, performance, and security.

Topics:

- **Cloud Deployment Models**
- **Cloud Delivery Models**
- **Cloud Storage**

Module 2: Data Processing in Cloud



The primary objective of this module is to understand the concepts of ETL in cloud, and Principles of Serverless Data Processing. Before building and deploying a serverless cloud application, we need to consider how to effectively select the components, and how to reduce the operation cost.

Topics:

- Challenges in data processing
- Container based architecture
- Cloud data analytics and ETL
- Principles of Serverless Computing

Module 3: Identity Access Management, Chatbots

The primary objective of this module is to learn how to build a chatbot using AWS Lex, and what are the different roles, and resource management services available in different cloud platforms. Without understanding cloud user identity and access management, it is not easy to implement an application or use cloud based services

Topics:

- Building Chatbots
- Cloud IAM
- Access Management Policy

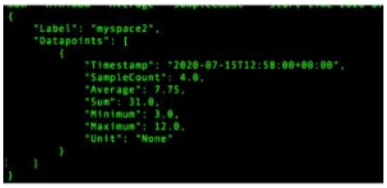
Module 4: Cloud Functions, Messaging Services

The primary objective of this module is to learn how to create and use cloud functions, such as Lambda. The messaging services will also be discussed in this module, and it will be explored how these services can be used in an enterprise level application development.

Topics:

- AWS Lambda and Cloud Functions
- State machine and step functions
- AWS SNS/SQS, Google Pub/Sub

Module 5: Cloud Processing & Management



The primary objective of this module is to understand the concepts of data stream processing, monitoring cloud events, resources, and Cloud Management. The topics in this module can help reducing cost, improve cloud application uptime, and optimized resource utilization.

Topics:

- AWS Kinesis
- CloudWatch, CloudFormation

Assessments

1. Quizzes (10%) – Individual Task & Formative Assessment Component

Format:

- Timed Quizzes will be designed using Brightspace (10 min/Quiz)
- Each quiz may contain maximum of 10 questions.
- There is no negative marking.
- Each Quiz window will be during class-time
- Quiz date will be announced a day before in the course's Teams channel and Brightspace.
- There will be no **makeup quizzes**.
- The quizzes must be taken using the "Respondus lockdown browser".
- A quiz may contain – True/False, Multiple-Choice, or matching left with right column types of questions.

2. Assignments (50%) – Individual Task & Summative Assessment Component

Format:

- There will be 5 assignments (10% each).
- Due date is posted on Brightspace and available in this Syllabus.
- Submissions are accepted only through Brightspace on or before the due date.
- Late submissions will not be accepted. Any late submission will result a 10% deduction/day.
- Please double check your file before uploading to Brightspace.
- No collaboration is permitted on the assignments.
- All assignments will be checked for plagiarism.

No.	Given Date	Due Data
Assignment 1	Sep 20, 2022	Oct 2, 2022
Assignment 2	Oct 4, 2022	Oct 16, 2022
Assignment 3	Oct 18, 2022	Oct 30, 2022
Assignment 4	Nov 1, 2022	Nov 13, 2022
Assignment 5	Nov 15, 2022	Nov 27, 2022

Assignment Rubric - based on the discussion board rubric (McKinney, 2018)

	Excellent (25%)	Proficient (15%)	Marginal (5%)	Unacceptable (0%)
Completeness including Citation	All required tasks are completed	Submission highlights tasks completion. However, missed some tasks in between, which created a disconnection	Some tasks are completed, which are disjoint in nature.	Incorrect and irrelevant
Correctness	All parts of the given tasks are correct	Most of the given tasks are correct However, some portions need minor modifications	Most of the given tasks are incorrect. The submission requires major modifications.	Incorrect and unacceptable
Novelty	The submission contains novel contribution in key segments, which is a clear indication of application knowledge	The submission lacks novel contributions. There are some evidences of novelty, however, it is not significant	The submission does not contain novel contributions. However, there is an evidence of some effort	There is no novelty
Clarity	The written or graphical materials, and developed applications provide a clear picture of the concept, and highlights the clarity	The written or graphical materials, and developed applications do not show clear picture of the concept. There is room for improvement	The written or graphical materials, and developed applications fail to prove the clarity. Background knowledge is needed	Failed to prove the clarity. Need proper background knowledge to perform the tasks

Citation:

McKinney, B. (2018). The impact of program-wide discussion board grading rubrics on students' and faculty satisfaction. Online Learning, 22(2), 289-299.

3. Group Project (40%) – Group Task & Formative Assessment Component

Format & Expectations:

- This requires developing a group project.
- Regular project status update is required.
- Project documentations, and deliverables are required at different stages.
    - ***Project Planning Report (10%)*** – Project overview, design Plan, timeline, and technical framework with possible class/activity/data flow diagrams. In addition, database design, timeline, potential test cases must be added.
    - ***Project Execution Q&A (10%)*** – 1:1 conversation with Instructor and/or TA
    - ***Final Report (10%)*** – Implementation details, pseudo-code, flowchart/ activity diagram, Individual contribution, team contribution, meeting logs, test cases, evidence of testing, and limitations.
    - ***Project Demo (10%)*** – Pre-recorded 1 hr. video should cover - Explanation of major/important code modules, and demonstration of the final product.
      **Every member of a team must participate in Q&A and the recordings.

- Outcome is teamwork, gaining knowledge on Cloud services, serverless infrastructure, cloud engineering.
- Project details will be posted on Brightspace.
- The timeslots for each project group are maximum 1 hour 10 min: Pre-recorded

Project Rubric - based on the discussion board rubric (McKinney, 2018)

	Excellent (20%)	Proficient (15%)	Marginal (10%)	Unacceptable (0%)

Completeness including Citation	All required tasks are completed	Submission highlights tasks completion. However, missed some tasks in between, which created a disconnection	Some tasks are completed, which are disjoint in nature.	Incorrect and irrelevant
Correctness	All parts of the given tasks are correct	Most of the given tasks are correct However, some portions need minor modifications	Most of the given tasks are incorrect. The submission requires major modifications.	Incorrect and unacceptable
Novelty	The submission contains novel contribution in key segments, which is a clear indication of application knowledge	The submission lacks novel contributions. There are some evidences of novelty, however, it is not significant	The submission does not contain novel contributions. However, there is an evidence of some effort	There is no novelty
Clarity	The written or graphical materials, and developed applications provide a clear picture of the concept, and highlights the clarity	The written or graphical materials, and developed applications do not show clear picture of the concept. There is room for improvement	The written or graphical materials, and developed applications fail to prove the clarity. Background knowledge is needed	Failed to prove the clarity. Need proper background knowledge to perform the tasks
Group Work	Evidence of group work, meeting logs, Coordination	Evidence of group work. However, missed meeting logs, room for improvement in Coordination	Missed meeting logs, failed to display group coordination	No group work done. Project is unacceptable

Notes

- A minimum grade of "B-" must be achieved to pass the course as a graduate student.
- The grade conversion scale available in section 7.6.2 "Course Assessment and Grading Policy" of Graduate Calendar will be used.

Required Texts and Resources

- Textbook: Serverless Architectures on AWS, Second Edition by Peter Sbarski, Ajay Nair (ISBN 9781617295423).
- Azure Serverless Computing Cookbook, Second Edition by Praveen Kumar Sreeram (ISBN 978-1-78961-526-5)
- Lecture slides, video recordings with closed caption and additional materials, will be posted on (Brightspace)

Student Declaration of Absence

The Student Declaration of Absence policy shall apply. https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html The student has a maximum of two (2) SDAs per course per semester. The student **must** notify the instructor of their inability to meet a deadline **before** the deadline by contacting the instructor or submitting the completed SDA. Upon notification the student has 3 days after the deadline to submit the SDA.

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.

Responsible Computing Policy

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (http://its.dal.ca/policies/) 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."

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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.

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=111&loadusereditits=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 jus- tice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. (read more: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-con.html)

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://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assigments-and-use-of-originality.html)

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