

Carleton University
Department of Systems and Computer Engineering
SYSC 5703 - (ELG 6173) Integrated Database and Cloud Systems - Fall 2024
Course Outline

Instructor Information

Prof. Samuel A. Ajila, PhD., P.Eng., (samuelajila@cunet.carleton.ca)

- 1. This is an in-person and face-to-face class. The lecture will NOT be recorded.**
- 2. All exams and term paper presentations (no exception) will be on campus (i.e., Carleton University campus, Ottawa), in-person and face to face.**

Office hours: Mondays 1:00 pm to 2:00 pm (MC 7038) and by appointment only.

Calendar Information

Review of database concepts: Conceptual database design, relational and Object-oriented data models; Application of SQL, recursive queries, relational algebra, and data integration; Normalization theory, deductive approach to database, and query processing; Object-oriented database; OLAP, Data Warehousing, and Data Mining; Cloud Computing, Hadoop, and MapReduce.

<https://calendar.carleton.ca/grad/courses/SYSC/>

Prerequisite

Students should know (or have knowledge of):

- Fundamental and principle of database design
- Conceptual modeling, practical normalization, and SQL
- A University (or College) level understanding of linear algebra (sets theory and functions), calculus (with derivatives), and simple statistics
- Able to program using high level programing language e.g. Python, Java, and C++.

Course Objectives: To study the associations between data, data integration, data understanding, data mining; and the mapping with cloud systems and storage.

Learning Outcomes

- Ability to develop a conceptual model for a real-life complex system requirement
- Be able to design and develop a relational and/or object-oriented database model for a problem domain (engineering, business, etc.)
- Be able to apply optimization to a database model to improve its performance
- Ability to apply deductive approach to data integration and mining
- Be able to use machine learning techniques for data analysis, prediction, and forecasting
- An understanding of cloud computing and its relationship with data

Textbooks (or other resources): If you have a very good background in Database buy book number 1 only. If not, buy book number 2 only. You are free to use any textbook of your choice!

1. Michael Kifer, Arthur Bernstein, and Philip M. Lewis, Database Systems: An Application-Oriented Approach, 2nd Edition, Addison-Wesley, ISBN 0- 321-26845-8, 2006
(Recommended)
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental of Database Systems, 7th Edition, Pearson Addison Wesley, 2016 **(Recommended)**
3. Andriy Burkov, The Hundred-Page Machine Learning Book, ISBN 978-1-9995795-0-0, 2019 **(Referenced). I think a pdf version of this book is available online!**
4. Ian H. Witten, Eibe Frank, Mark A. Hall, and Christopher J. Pal, Data Mining – Practical Machine Learning Tools and Techniques, 4th ed., Morgan Kaufmann, Elsevier, New York, USA, 2017, ISBN 978-0-12-804291 **(Referenced)**
5. Published papers (conferences and journals) will be referenced – the sources will be made available in class as needed.

Evaluation and Grading Scheme

	Assignments & Readings	Term paper or project Group work is possible - <u>maximum of 2 students per group</u>	Closed book in-person face to face Final Exam
Weight	25%	30% 5% → Term Project proposal 5% → Midterm progress report 20% → Final project report (There could be possibility of project presentation!)	45% You MUST obtain at least 50% in the final exam to pass the course!
Date(s)	TBA in class	TBA in term project template	2- to 3-hour exam - to be scheduled by the University

Assignments & Readings, and Term paper or project **are due at 11:55 pm (i.e. 5 minutes to mid-night)** on the due date and must be submitted on the course Brightspace webpage. **Late submissions** will be graded according to the following policy: a 20% penalty per day with a maximum of two late days after which a grade of 0 (zero) is assigned. The penalty starts at 12:01 am, 1 minute (i.e., 6 minutes after deadline) past midnight of the due date.

Project and/or term paper specification will be given in class at the appropriate time.

The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the SCE department office to see your marked final examination after the final grades have been made available.

Week-by-Week breakdown

The first three topics are strictly self-study and study slides may be available on Brightspace course webpage. Check Brightspace for pdf slide-sets for the first three self-study (or revision) topics.

The relational data model → **Self-study (or revision)**

Conceptual Modeling with Entity-Relationship model → **Self-study (or revision)**

Relational Algebra, SQL, Triggers, and Active Databases → Self-study (or revision)

1. Introduction to Database and Cloud Systems
2. Introduction to Data Mining
3. Database Design with Normalization Theory
4. Using SQL in Applications- Static & Dynamic SQL, JDBC, SQLJ, & ODBC
5. Advanced Data Models, Deductive Databases, & Knowledge Graph
6. OLAP and Data Warehousing
7. Decision trees, entropy, information gain
8. Association Rules, Clustering and k-NN
9. Object Oriented Databases - Object Model, ODMG, Object SQL (OQL), and CORBA (or JDO or another modern DB interface)
10. Cloud Computing
11. Database and Cloud Security
12. Anomaly Detection and Data Streaming (if time permit!)

General Regulations

Academic Accommodation: Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

Student Responsibility: It is the student's responsibility to remain informed of all rules, regulations and procedures required by their program and by the Graduate Affairs of their faculty. Ignorance of regulations will not be accepted as a justification for waiving such regulations and procedures.

Academic Integrity: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: <https://carleton.ca/registrar/academic-integrity/>. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

Plagiarism: Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

Copyright on Course Materials: The materials created for this course (including the course outline and any slides, posted notes, labs, project, assignments, quizzes, exams and solutions) are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s) and the Instructor of the course.

Health and Safety: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: <http://sce.carleton.ca/courses/health-and-safety.pdf>

Students from the University of Ottawa: You can request to have access to cuLearn: please see <https://gradstudents.carleton.ca/resources-page/forms-policies/>

Final Grading Scheme for the course based on each University regulations:

Carleton University (12 points grading system)

A+	90-100%	12 grade points
A	85-89%	11 grade points
A-	80-84%	10 grade points
B+	77-79%	9 grade points
B	73-76%	8 grade points
B-	70-72%	7 grade points
C+	67-69%	6 grade points
C	63-66%	5 grade points
C-	60-62%	4 grade points
D+	57-59%	3 grade points
D	53-56%	2 grade points
D-	50-52%	1 grade point
F	< 50%	0 grade point

“A+” down to “B-” are the useful grades for graduate studies.

University of Ottawa (10 points grading system)

A+	90 - 100%	10 grade points
A	85 - 89%	9 grade points
A-	80 - 84%	8 grade points
B+	75 - 79%	7 grade points
B	70 - 74%	6 grade points
C+	65 - 69%	5 grade points**
C	60 - 64%	4 grade points
D+	55 - 59%	3 grade points
D	50 - 54%	2 grade points
E	40 - 49%	1 grade point
F	0 - 39 %	0 grade point

“A+” down to “B” are the useful grades for graduate studies.

(** Some programs at Ottawa U may accept C+ as pass grade. **Ottawa U students should find out if their programs accept C+ as pass grade**)