Course Outline
COMPSCI 2DB3: Databases–Winter 2023

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1 Administrative Details

Term Winter 2023.

Lectures Three lectures per week (37 lectures in total; January 10, 2023–April 14, 2023)

- ► **Tuesdays: 3:30PM–4:20PM (TSH 120)**.
- ► **Wednesday: 3:30PM–4:20PM (TSH 120)**.
- ► **Friday: 3:30PM–4:20PM (TSH 120)**.

Tutorials Starting January 16, there is one tutorial per week.

- ► T01: 1:30PM–2:20PM on Friday (JHE A102).
- ► T02: 2:30PM–3:20PM on Thursday (T13 127).
- ► T03: 11:30AM–12:20PM on Monday (BSB 108).
- ► T04: 12:30AM–1:20PM on Thursday (JHE A102).

Website Avenue to Learn (https://avenue.mcmaster.ca).
Announcements, course material, assignments, submission of assignments, and miscellaneous material.

Office hours Regular: Tuesdays and Fridays
(11:00AM–12:15PM and 1:00PM–3:00PM).

Prerequisite(s) COMPSCI 2LC3 or COMPSCI 2DM3.

Instructor

Jelle Hellings (jhellings@mcmaster.ca, https://jhellings.nl)
ITB, room 124 (floor map).

Teaching Assistants

- ► Mark Hutchison (hutchm6@mcmaster.ca).
- ► Nancy Kansal (kansan1@mcmaster.ca).
- ► Yi Luo (luoy94@mcmaster.ca).
- ► Maryam Valian (valianm@mcmaster.ca).
- ► Jin Xu (xu15@mcmaster.ca).

Course and learning objectives

The course provides a broad introduction to databases, with a specific focus to relational databases. The following seven topics will be covered in detail:

- ▶ The entity-relationship data model.

- ▶ Querying data using SQL.

- ▶ Constructing relational schemas and table structures (including SQL DDL).

- ▶ Querying data using the relational algebra.

- ▶ Dependency theory with a main focus on functional dependencies and multivalued dependencies.

- ▶ Decomposition and normal forms with a main focus on 3NF, BCNF, and 4NF..

- ▶ Introduction to the workings of DBMSs with a main focus on concurrency control.

At the end of the course, the students should be able to design relational schemas, reason about the quality of such schemas, implement relational schemas as tables, query relational data, and reason about concurrent access to data.

2 Materials & Fees

We use the textbook *Database Management Systems, Third Edition* by Raghu Ramakrishnan and Johannes Gehrke. Available via the McMaster Campus Store.

In this course, we cover the following material from the book:

- ▶ Part I (Chapter 1–5).

- ▶ Part III (Chapter 8).

- ▶ Part V (Chapter 16 and 17).

- ▶ Part VI (Chapter 19).

- ▶ Part II is useful background knowledge (not covered).

See Section 3 for further details.

3 Study Guide

This study guide indicates the content of the course. The course consists of the following parts:

Textbook. The *textbook*, which contains most of the material covered in this course. In this study guide, we indicate which chapters and sections of the textbook we will cover. Furthermore, we indicate which exercises in the book are relevant for the course material we covered: these exercises are a good starting point to figure out whether you understood the material.

Lectures and slides. The *lectures* will introduce the main topics of the course. The lectures will cover some material not included in the textbook. At the same time, the textbook will cover some material not included in the lectures. Hence, the textbook and the lectures are not replacements for each other. The slides of the lectures are available via Avenue to Learn.

Tutorials. The *tutorials* will go deeper into the material. The TAs will help with technical issues (e.g., connecting to the DB2 server), will provide detailed examples of the course material, and will answer questions on the course material. To make the most use out of the tutorials, we advice to always prepare by reviewing the previous lectures (and the corresponding course material in the book) before taking part in the tutorials.

Assignments. The *assignments* determine 48% of your grade. The seven assignments will each cover a main topic of the course and are a good indication of what *our expectations* of the learning outcomes. For each assignment, we will organize a general feedback session during the lectures to discuss their solutions. Furthermore, there is room in the tutorials (or during office hours) to get detailed feedback on your individual solutions. Feedback on the assignments can reveal deficiencies in your understanding of the course material, which you should address before the exam.

Final Exam. The *final exam* determines 52% of your grade and can cover any part of the course material listed in this study guide. This includes all course material covered by the textbook, the lectures, and the tutorials, and all course material practiced in the assignments.

The below guide is structured on a per-topic basis, which roughly corresponds with chapters from the book. Each topic will be covered in the span of several lectures.

▶ *Introduction.*
Study Chapter 1 (excluding Section 1.7) from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 1.1, 1.2, 1.3, 1.6, and 1.8.

▶ *The Entity-Relationship Model.*
Study Chapter 2, Sections 2.1–2.6, Section 2.8 from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 2.1–2.8.

▶ *SQL–The Structured Query Language.*
Study Chapter 5, Sections 5.1–5.6, Chapter 3, Section 3.1 and Section 3.4, Chapter 6 is recommended reading as it serves as a starting point to use databases in an application. from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 5.1–5.5.

▶ *The Relational Data Model and SQL.*
Study Chapter 3, Chapter 5, Section 5.7–Chapter 5.9 from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 3.1–3.20, and 5.7–5.10.

▶ *The Relational Algebra.*
Study Chapter 4 from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 4.1–4.6, but only for relational algebra.

▶ *Dependency Theory.*
Study Chapter 19, Sections 19.2, 19.3, Subsection "Minimal Cover for a Set of FDs" of Section 19.6.2, Section 19.8 (except Subsections 19.8.2 and 19.8.4 from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 19.6, 19.7(a), 19.8.1(i), 19.10(a), 19.12, 19.13, 18.15, 19.16, 19.17, and 19.23.

Almost all exercises of Chapter 19 mix Dependency Theory topics with Decomposition and Normal Forms (the next topic). Here, I only list those (sub)exercises that are only *about Dependency Theory.*

▶ *Decomposition and Normal Forms.*
Study Chapter 19 from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 19.1–19.29.

▶ *Databases–Inside the Black Box.*
Study Chapter 16 and 17 (except Sections 17.2, 17.3, 17.5.2, 17.5.3, and 17.6) from the textbook.
After studying the material, you should be able to answer the review questions and Exercises 16.1–16.9, 17.2, 17.4.(1,2,3), 17.5, and 17.9.

In addition, we provide assignments of last year and their solutions as advanced practice exercises and we provide a try-out exam (which will be discussed in one of the last lectures).

How to study   Keep up with the textbook, preferably *before* the lectures. See above for which parts of the textbook are relevant. Being prepared before the lecture allows you to ask targeted questions about the course material.

Follow each lecture and tutorial. Use the tutorials to practice the material seen in the textbook and during the lectures. During the tutorials, *TAs can help with exercises, example assignments, and understanding assignments.*

The assignments require that you understand the material you are working with: get initial practice via the textbook exercises *before* diving into the assignments. Learn from your mistakes during the assignments: the exam will cover the same material as the assignments. Hence, understanding the material of the assignments completely will translate directly to your exam preparation.

TAs cannot help make the assignments, provide answers, or verify your answers.

Take the opportunity to practice the try-out exam before the final lectures in which we discuss the try-out exam. The final exam will have the same format and similar difficulty as the try-out exam.

4   Course Overview and Assessment

There is an open-book final exam. Only the textbook and material provided alongside the exam can be used, however. Furthermore there are seven assignments (one for each topic):

Final Exam 52% of the final grade.

Assignments Seven assignments of which the best six count, 8% of the final grade each.
The deadlines are as follows:

▶ *January 29*: The Entity-Relationship Model.

▶ *February 8*: SQL: The Structured Query Language.

▶ *February 19*: The Relational Data Model and SQL.

▶ *March 1*: The Relational Algebra.

▶ *March 12*: Dependency Theory.

▶ *March 22*: Decomposition and Normal Forms.

▶ *March 31*: Databases–Inside the Black Box.

Assignments are posted on Avenue and solutions must be submitted via Avenue. Each assignment will include a description of the criteria that are used to evaluate the assignment.

Each assignment will have specific instructions on the submission format. For most assignments, your submission must be a PDF file (e.g., generate a PDF via LaTeX or via your favorite word processor) and

the main *textual content* of the file must be your solution to the assignments. For the SQL-portions of assignments, we will require submissions in plain text format. Handwritten documents will not be accepted or graded.

Submissions that do not follow the assignment-specific instructions will get a grade of zero.

Bonus grades are awarded at the discretion of the instructor for any feedback that leads to the improvement of the course material.

Late submission policy

All assignments will be made public more than two weeks in advance of their deadline. We require students to *submit on time*. Late submissions will receive a late penalty of 20% on the score per day late (with a five hour grace period on the first day, e.g., to deal with technical issues) and submissions five days (or more) past the due date are not accepted.

Technical or other issues are not an excuse for late submissions: in case of technical issues while submitting, contact the instructor *before* the deadline (e.g., e-mail the solutions).

Missed work and extensions

Assignment solutions are discussed in the first lecture after *ten days after the deadline*. Hence, only in exceptional circumstances will a deadline be extended by more than ten days.

Requests for relief must always follow the Policy on Requests for Relief for Missed Academic Term Work.

Students that request relief via a *Self Report (Type A) request* via the McMaster Student Absence Form, e.g., due to missed academic work resulting from medical or personal situations lasting up to three (3) calendar days, will receive a three (3) calendar day extension on their assignment deadline. Students must immediately follow up with the instructor after submitting the Self-Report (Type A) request. Failure to do so may negate the opportunity for relief.

For students that request relief via an *Administrative Report (Type B) request* via the McMaster Student Absence Form, the appropriate relief will be determined by the instructor based on the situation. If the student situation requires a long-term extension (more than ten days after the assignment deadline), then a replacement assignment will be provided. Students must immediately follow up with the instructor after being notified their request has been processed. Failure to do so may negate the opportunity for relief.

5   Plagiarism and Academic Dishonesty

Plagiarism is a *serious academic offense* and will be handled accordingly.
All suspicions will be reported to the *Office of Academic Integrity*.

(in accordance with the Academic Integrity Policy.)

All assignments are *individual* assignments: do not submit work of others. All parts of your submission *must* be your own work and be based on your own ideas and conclusions. Only *discuss or share* any parts of your submissions with your TA or instructor. You are *responsible for protecting* your work: you are strongly advised to password-protect and lock your electronic devices (e.g., laptop) and to not share your logins with partners or friends!

If you *submit* work, then you are certifying that you have completed the work for that assignment by yourself. By submitting work, you agree to automated and manual plagiarism checking of all submitted work.

In case of doubt, contact the instructor *before handing in your work*.

All cases of academic dishonesty will be handled in accordance with the Academic Integrity Policy via the Office of Academic Integrity.

6 Advisory statements

6.1 ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at `https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/`.

The following illustrates only three forms of academic dishonesty:

▶ plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.

▶ improper collaboration in group work.

▶ copying or using unauthorized aids in tests and examinations.

6.2 AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to `https://www.mcmaster.ca/academicintegrity.`

6.3 COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

6.4 ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

6.5   CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue to Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

6.6   ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or `sas@mcmaster.ca` to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

6.7   REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

6.8   ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation <u>or</u> to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

6.9   COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

6.10   EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, Avenue to Learn and/or McMaster email.