

**SCICOMP201, Database Management
[Spring 2021]**

COVID-19

Tuesday, January 12, 2021

At the time of writing, it is planned that this course is taught online using Zoom. The intention is to hold the written Midterm and written Final on campus. Should circumstances change (for example, a return to lockdown), written exams may be substituted by open-book, take-home tests which will incorporate a number of unseen questions.



[SCICOMP201; Database Management]

[Spring 2021]

Classroom no:

Class times: MON 11:00-13:00 THU 11:00-13:00

Instructor: Dr. Andrew Brooks

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Office no. & location: Eleanor 1.09

Office hours: appointments - see Moodle scheduler activity

I. Track information

- a) Prerequisites for this course: C or better grade in **SCICOMP102** or by permission of the instructor.

This course is part of the Computer Science track. For further information about the track, please see the track document available on the UCR intranet.

II. Course description

Database management systems are one of the foundations upon which a modern economy is built. This is a course about such systems. The course begins by introducing SQL, a special-purpose language designed for managing data in a relational database management system (RDBMS). Then consideration is given to the theory underpinning relational databases, data storage and querying, and transaction management. The second meeting of the class each week is entirely devoted to laboratory work where students tackle exercises and demonstrate their work. Projects are undertaken to provide practical experience of the design, building, and evaluation of database management systems and of data cleansing. There is a written midterm exam and a written final exam. By the end of the course a student will have obtained a reasonable familiarity with both relational and non-relational database management systems.

III. Study Load

This course earns students four credits (equivalent to 7.5 ECTS). The class meets twice a week for two hours. Preparation time is approximately 10 hours per week.

IV. Course materials

There is no required textbook to purchase for this course. These books may be read freely: Watt, A. and N. Eng. (2014). Database Design – 2nd Edition.

<https://opentextbc.ca/dbdesign01/>

Concise Guide to Databases A Practical Introduction by Peter Lake & Paul Crowther (2013)

<https://doi-org.proxy.library.uu.nl/10.1007/978-1-4471-5601-7> (Solis-id required)

Class materials are provided in Moodle (see Appendix A for an example).

V. Course organization and requirements

The first session of each week will cover content. This session will involve a mix of lecturing, discussion, and various in-class activities (e.g. short presentations by students, online quizzes, one-to-one or group face-offs). Discussion-based learning will involve rotations of discussion group membership.

The second session of each week will be a laboratory in which exercises are undertaken. The instructor will provide assistance where needed and sign out completed exercises when they have been successfully demonstrated.

Homework and laboratories will be issued approximately on a weekly basis. If the number of issued homework or laboratories exceeds 10, the additional work will count as extra-credit. Other extra-credit opportunities may be available at the instructor's discretion.

At least two class moments (of 1 or 2 hours duration) will be provided to allow students the opportunity to work in-class on projects or on revision for written exams and to ask questions of the instructor.

A minimum of two office hours will be offered weekly with the opportunity for students to schedule a 15 minute appointment.

Students are expected to:

- (i) make use of their own (modern) laptop at every class
(note: a Chromebook is not a suitable device for this course)
- (ii) read materials placed or linked to in Moodle
- (iii) participate actively in class sessions when asked to do so
- (iv) monitor Moodle, the official mode of communication, on a daily basis
- (v) attend class and inform the instructor beforehand if they cannot attend because of illness or some other urgent reason
- (vi) work consistently on the laboratory exercises, outside of class meetings if necessary
- (vii) tackle all assessment individually unless the task is explicitly described as group-based or the instructor gives explicit guidance on acceptable collaborations
- (viii) be able to explain any programming code they have written or made use of
- (ix) not use mobile devices in class other than their own laptops for class exercises
- (x) not redistribute materials made available in Moodle to third parties
- (xi) attend office hours for help and guidance on any aspect of the course when required

Homework deadlines are firm. Homework should be submitted one week from the date of issue. Laboratories have full value for one week from the date of issue. After one week, their value is halved. After two weeks, they no longer have value.

This course is subject to UCR academic rules and procedures. Both students and instructors are required to know and follow these rules and procedures. Students should not commit acts of plagiarism or collusion. Students are advised that if they miss more than 6 class sessions they

will receive an automatic F (**i.e. 6 absences only are permissible**). Two hours of lateness in attending class meetings will count as one absence.

VI. Assessment

| assessed component | value | |
|------------------------------|--------------|-----------------------------------|
| written midterm | 20% | sample questions will be provided |
| written final | 20% | sample questions will be provided |
| project 1 | 10% | individual (SQL) |
| project 2 | 10% | individual (NoSQL) |
| project 3 | 10% | individual (data cleansing) |
| project 4 | 10% | individual (investigation) |
| homework (10 each at 1%) | 10% | individual |
| laboratories (10 each at 1%) | 10% | individual |

Homework, laboratories, written midterm and written final will be assessed on correctness of answers. Partial credit will be awarded for partial correctness. Comprehension questions will be asked of laboratory work. Partial credit will be awarded when comprehension questions are not fully answered.

The written midterm and written final may incorporate wild card questions on all course aspects (up to 2% of the 20%).

Projects are assessed on a sliding scale of accomplishment. **For example,**

| | |
|---|---|
| A | In addition to the expectations under B, results of an extensive experimental investigation are reported and demonstrated. |
| B | In addition to the expectations under C, results of a straightforward experimental investigation are reported and demonstrated. |
| C | In addition to the expectations under D, use of DBMS software is demonstrated. Some measurements are reported and demonstrated. |
| D | A presentation only is provided which is substantial and addresses important issues |
| F | A presentation only is provided which is lightweight and fails to address important issues. |

Full project specifications are available in Moodle.

VII. Course schedule

The course schedule may be subject to change. For example, if things are progressing very well, it might be possible to occasionally tackle more material in a week. National holidays or special college events may result in some content being covered in less depth. Key dates within any week will be posted in Moodle.

| Time | Topics to be discussed | Course material used | Assignments and assessment |
|------------------------------|--|----------------------|--|
| Week 1 [1 Feb] | introduction & traditional structure of a DBMS | see Moodle | homework & laboratory |
| Week 2 [8 Feb] | relational model & introductory SQL | see Moodle | homework & laboratory |
| Week 3 [15 Feb] | introductory SQL & database design | see Moodle | homework & laboratory |
| Week 4 [22 Feb] | intermediate SQL | see Moodle | homework & laboratory ~ project 1 deadline (10%) |
| Week 5 [1 Mar] | intermediate SQL continued | see Moodle | homework & laboratory |
| Week 6 [8 Mar] | advanced SQL | see Moodle | homework & laboratory |
| Week 7 [15 Mar] | advanced SQL continued | see Moodle | homework & laboratory |
| Week 8 [22 Mar] | | | midterm exam (20%) project 2 deadline (10%) |
| SPRING BREAK [29 Mar] | | | |
| Week 9 [5 Apr] | data cleansing | see Moodle | homework & laboratory |
| Week 10 [12 Apr] | relational algebra | see Moodle | homework & laboratory |
| Week 11 [19 Apr] | normalization | see Moodle | homework & laboratory ~ project 3 deadline (10%) |
| Week 12 [26 Apr] | normalization continued | see Moodle | homework & laboratory |
| Week 13 [3 May] | storage, file structure, indexing, & hashing | see Moodle | homework & laboratory |
| Week 14 [10 May] | query processing & query optimization | see Moodle | |
| Week 15 [17 May] | | | final exam (20%) project 4 deadline (10%) |

VIII. Student learning outcomes

Upon successfully completing this course, a student should be able to:

SLO 1 write SQL to initialize, populate and query a relational database of modest size

SLO 2 evaluate the quality of a database schema and measure query processing times

SLO 3 write procedural language extensions to SQL to clean data

SLO 4 demonstrate an understanding of the theory underpinning relational databases (e.g. writing queries in relational algebra, determining functional dependencies, performing normalizations)

SLO 5 demonstrate an understanding of data storage and querying (e.g. B+ trees, query processing and query optimization)

SLO 6 demonstrate an understanding of transaction management (e.g. ACID properties, concurrency control in a multi-user environment)

SLO 7 initialize, populate, and query a non-relational database (e.g. key-value pair databases, graph databases, object-oriented databases, XML databases) of modest size

SLO 8 investigate a research question about databases and communicate the results

| Period | Teaching activities | Student is able to do |
|-----------------------|--|------------------------------|
| Weeks 1-5 & Week 8 | lectures & homework & laboratories & written midterm examination & Project 1 | SLO 1 SLO 2 |
| Weeks 4-8 | Project 2 | SLO 7 |
| Weeks 6-11 | lectures & homework & laboratories & Project 3 | SLO 3 |
| Weeks 10-12 & Week 15 | lectures & homework & laboratories & written final examination | SLO 4 |
| Weeks 13-14 & Week 15 | lectures & homework & laboratories & written final examination | SLO 5 SLO 6 |
| Weeks 12-15 | Project 4 | SLO 8 |

Appendix A Course Materials

Course materials are provided Moodle.

For example, below is a copy of just some of the materials in the section on RDBMS Server Software

MySQL

<https://www.mysql.com/>

MySQL Community Downloads (Windows Linux Mac)

<https://dev.mysql.com/downloads/mysql/>

Download MySQL Workbench

<https://dev.mysql.com/downloads/workbench/>

MySQL™ Workbench Reference Manual

<https://dev.mysql.com/doc/workbench/en/>

5.2 Creating A New MySQL Connection (Tutorial)

<https://dev.mysql.com/doc/workbench/en/wb-getting-started-tutorial-create-connection.html>

Appendix A MySQL Workbench Frequently Asked Questions

<https://dev.mysql.com/doc/workbench/en/workbench-faq.html>

MySQL Forums

<https://forums.mysql.com/>

MySQL - Tutorial

<http://www.vogella.com/tutorials/MySQL/article.html>

MySQL and Java JDBC - Tutorial

<http://www.vogella.com/tutorials/MySQLJava/article.html>