

COLLEGE OF ENGINEERING
Department of Computer Science and Engineering

CMPT 606 - Advanced Database

Fall 2019

Instructor Information

Abdelkarim Erradi

Associate Professor

Office: Office 132, Female Engineering Building

Phone: 4403 4254

E-mail: erradi@qu.edu.qa

Office Hours: Tuesday 4pm to 5pm at CSE meeting room and after the class

Class/Laboratory Schedule

Tuesday 5pm to 8pm at BCR - Corridor I212

Coordinator Information

Same as the instructor.

Course Information

Catalog Description:

The course covers elements of data modeling; relational models and mapping; system architectures; security, transactions, concurrency control, recovery, query, optimization, and database tuning; hands-on applications on the design and use of database systems.

Credits:

3

Contact Hours:

3

Textbook(s):

Elmasri, R. and S. B. Navathe; *Fundamentals of Database Systems*, 7th Edition, Pearson Education, 2016. ISBN: 1292097612

References:

- Martin Kleppmann, *Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems*, O'Reilly Media, Inc., 2017, ISBN: 9781449373320

- Pramod J. Sadalage and Martin Fowler; *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, 1st Edition; Addison-Wesley Professional, 2012. ISBN: 0321826620

Course Objectives:

- Apply principles and techniques for building modern data management systems.
- Explain and discuss new database architectures and trends.

Course Learning Outcomes (CLO):

1. Model and implement a database application using relational and non-relational database management systems.
2. Explain and apply approaches for improving a database's performance, including the use of indexes and query optimization.
3. Explain and discuss database mechanisms for achieving Atomicity, Consistency, Isolation, and Durability.
4. Critically discuss different architectures for distributed databases, database future trends and emerging applications.

Relationship of Course Outcomes (COs) to Student Outcomes (SOs):

CO #	Related to SOs	Contribution to SO Assessment
1	CMPT-SO(d)	
2	CMPT-SO(b)	
3	CMPT-SO(b)	
4	CMPT-SO(a)	

CMPT-SO(a): Conduct independent research or project to solve a specific problem in the field of computing

CMPT-SO(b): Analyse, assimilate and produce technical documents in computing

CMPT-SO(c): Recognize professional computing practices in realistic contexts such as global, economic, environmental, and/or social issues.

CMPT-SO(d): Design and evaluate a computer-based system, process, or component to meet desired needs.

CMPT-SO(e): Engage in self-directed lifelong learning.

Topics Covered:

Topics	Chapter(s)	Weeks
Database concepts and Architecture	1, 2	1
Data modeling	3, 4, 14	1
Advanced SQL	6,7	1
Storage and database file organization	16	1
Indexing techniques	17	2
Query processing and optimization	18, 19	2
Concurrency control techniques	20, 21	1
Database recovery techniques	22	1
Introduction to NoSQL and NewSQL databases	Online Resources	1
Document-Oriented Database		1

Database future trends (e.g., Stream Processing, Spatiotemporal data, Data Management for Microservices and Cloud data services)	Research papers	2
Total		14

Method of Instruction

The course is taught primarily through lectures with frequent class discussions, examples, demos and a project. The approach adopted is project oriented learning by developing hands-on assignments and a project to reinforce the concepts introduced in the lectures. Throughout the course, students perform hands-on exercises that build their practical knowledge and skills to design, build, test, and advanced databases. The course uses concrete examples taken from real applications.

Learning Activities

To achieve the objectives of the course, students will carry out several learning activities:

1. **Readings:** The lectures will follow the topics listed in the course detailed schedule. The students are expected to read the assigned textbook chapters, research papers and lecture slides. The reading assignments will elaborate on information presented in the lectures. **Students are responsible for reading all related material prior to each lecture.** This is a Master course and students are expected to learn independently as much as needed in order to complete the course requirements.
Frequent class discussions are organized based on reading assignments.
2. **Lectures:** students are expected to attend every lecture; this is where the course material will be discussed and ambiguities clarified. Class participation is highly encouraged. Some of the technologies to be applied in the project and the assignments will be presented in the lectures via examples and demos.
There are no labs for this course but students are required to practice and extend the examples and the demos provided. Also during some classes, time will be allocated to clarify implementation issues and provide further guidelines about the assignments.
3. **Assignments:** homework assignments will be given so that students practice and apply the material covered in class. The assignments are used as a tool to help the student reinforce the concepts covered in class and gain hand-on development skills. It also offers an opportunity to study covered concepts in more depth and to apply them to realistic scenarios.
4. **Exams:** The midterm and the final exams focus on fundamental concepts covered in the lectures and the assigned readings.
5. **Presentation and discussion leading:** each group will present and demo their project outcomes including a literature survey based on recent papers. Students will present their project and lead the discussion. In-class participation is based on student participation in discussions.

Assessment Methods and Grading Policy

Homework (5 assignments)	15%
Review Paper and presentation	15%

Project (2 phases of 15% each)	30%
Midterm Exam	20%
Final Exam	20%

Computer/Software Usage

All submissions must be in MS Word format. Many database management systems will be used such as SQL Server and various NoSQL databases such as MongoDB, Neo4j, Redis, and VoltDB.

Laboratory Projects

None

Course Ground Rules

- Assessment deliverable items should be submitted on time and following the embedded instructions.
- Attendance: Attendance is mandatory according to University policies and more than 25% absence will not qualify you for the course credit.
- Cheating and/or Plagiarism: Cheating and/or Plagiarism will not be tolerated and disciplinary actions will be taken in accordance with Qatar University regulations and policies. Outsourcing or getting external help to complete assignments is strongly prohibited, and disciplinary actions will be taken. Check the students' handbook for further details on University policies.
- Blackboard: Check the course website frequently for updates (e.g. announcements, lectures notes, examples, etc.).
- Taking Notes: Students are responsible for taking notes during the lecture. Exams will include some of the material discussed during lecture in addition to that given in the textbook and class notes.
- Due Dates: It is the responsibility of every student to remember all due dates.

University Code of Conduct

QU expects its students to adopt and abide by the highest standards of conduct in their interaction with professors, peers, staff members and the wider university community. Moreover, QU expects its students to act maturely and responsibly in their relationships with others. Every student is expected to assume the obligations and responsibilities required from them for being members of the QU community.

As such, a student is expected not to engage in behaviors that compromise their integrity, as well as the integrity of QU. Further information regarding the University Code of Conduct may be found on the web at <http://www.qu.edu.qa/students/code-of-conduct>

Support for Students with Special Needs

It is Qatar University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to

participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Needs Section will exert all efforts to accommodate for individuals' needs.

Contact Information for Special Needs Section:

Tel-Female: (00974) 4403 3843

Tel-Male: (00974) 4403 3854

Location: Student Activities Building

Email: specialneeds@qu.edu.qa

Academic Support and Learning Resources

The University Student Learning Support Center (SLSC) provides academic support services to male and female students at QU. The SLSC is a supportive environment where students can seek assistance with academic coursework, writing assignments, transitioning to college academic life, and other academic issues. SLSC programs include: Peer Tutoring, the Writing Lab, Writing Workshops, and Academic Success Workshops. Students may also seek confidential academic counseling from the professional staff at the Center.

Contact Information for Students Support and Learning Resources:

Tel: (00974) 4403 3876

Fax: (00974) 4403 3871

Location: Female Student Activities Building

E-mail: learningcenter@qu.edu.qa

Student Complaints Policy

Students at Qatar University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

Declaration

This syllabus and contents are subject to changes in the event of extenuating circumstances. The instructor (with approval of the Head of Department) reserves the right to make changes as necessary. If changes are necessitated during the term of the course, the students will be notified by email communication and posting the notification on the online teaching tool Blackboard. It is student's responsibility to check on announcements made while they were absent.

Faculty Name: Abdelkarim Erradi

Last Modified: 13/08/2019

Date: 13/08/2019



كلية الهندسة
College of Engineering
QATAR UNIVERSITY جامعة قطر