CS2102: Database Systems

Lecture 0 — Course Logistics

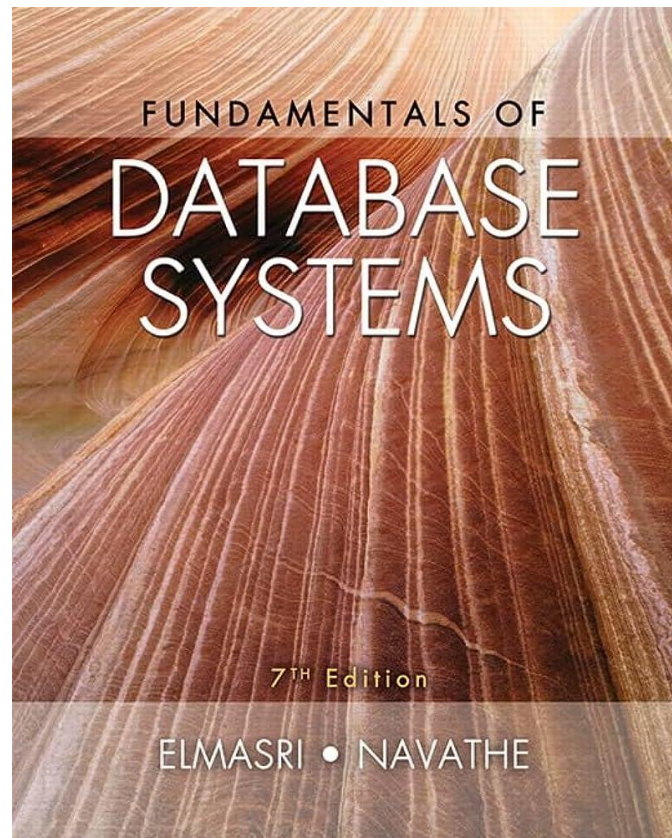# Lectures

- Lecturers
  - Shamkant NAVATHE
    (dcssbn@nus.edu.sg, COM2-03-26)

  - Stephane BRESSAN
    (steph@nus.edu.sg, COM1-03-20)

  - Christian VON DER WETH
    (chris@comp.nus.edu.sg, COM3-02-45)

- Hybrid Lecture
  - Tuesday, 12:00 - 14:00 (1h30min-1h45min effectively)

  - Venue: LT19

  - Online session via Zoom

  - All lectures will be broadcasted and recorded

Tutorials

- ## Physical classes
  - Duration: 1 h (40-45 min effectively)

  - All tutorials will be Thursdays and Fridays

  - Start: Week 3

  - Not all tutorial questions will be discussed in class
    (but solutions for all questions will be provided at the end of each week)

- ## Tutorial Participation
  - Attendance is compulsory.

  - Every student is expected to have prepared the tutorial by attempting all the questions

  - Every student is expected to participate actively (present her solution, ask questions, suggest alternative answers, etc.)

  - Unexcused absences (without official leave of absence) are penalized with one (1) mark starting from the third occurrence.

Prerequisites

- Advanced Programming
  - CS1020

  - CS2020

  - CS2030

  - CS2040

- Discrete Mathematics
  - CS1232

  - MA1100

Learning Objectives

- Design
  - Entity-relationship model
  - Functional dependencies
  - Normal forms

- Implementation
  - SQL
    - Data definition language
    - Queries
    - Stored procedures
    - Triggers
  - Theory
    - Relational calculus and algebra

The aim of this module is to introduce the fundamental concepts and techniques necessary for the understanding and practice of design and implementation of database applications and of the management of data with relational database management systems.

The module covers practical and theoretical aspects of design with entity-relationship model, theory of functional dependencies and normalization by decomposition in third and Boyce-Codd normal forms.

The module covers practical and theoretical aspects of programming with SQL data definition and manipulation sublanguages as well as relational algebra/calculus.

Learning Objectives

- ### Design
  - Entity-relationship model
  - SQL data definition language

- ### Query
  - Relational calculus and algebra
  - SQL queries
  - Stored procedures
  - Triggers

- ### Refinement
  - Functional dependencies
  - Normal forms

How to design an entity-relationship data model to capture the data requirements for an application and translate the conceptual data model to a relational database schema

How to refine a relational database schema using schema decompositions to avoid anomalies

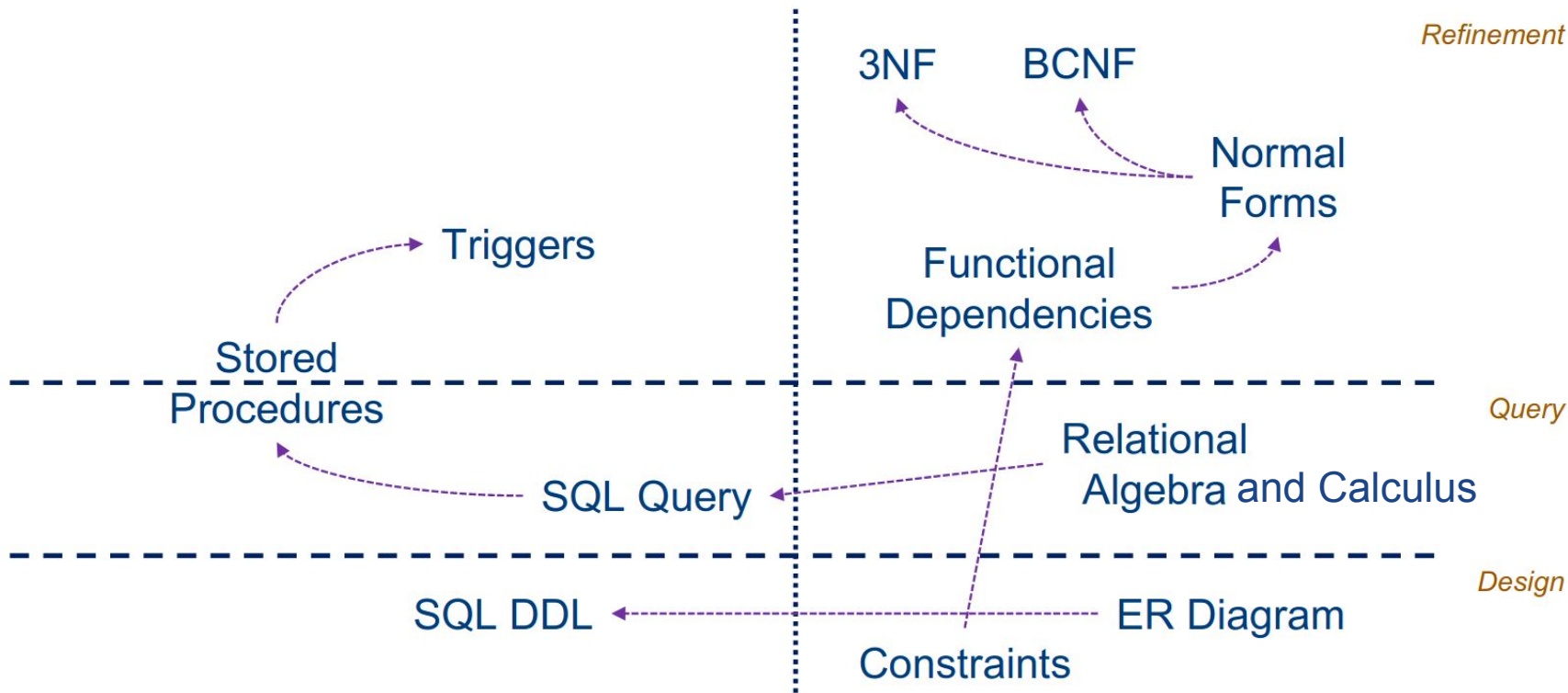How to use SQL to define relational schemas and write SQL queries on the schemas

How to reason about the correctness of relational queries based on the concepts of formal query languages (relational calculus and algebra)

How to apply knowledge of relational database systems to develop database applications

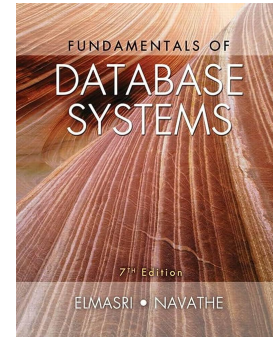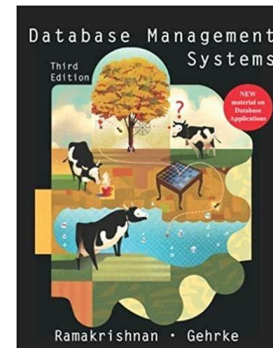# Roadmap

Course Readings (recommended)

- ## Fundamentals of Database Systems
  - Ramez Elmasri & Shamkant Navathe

  - Addison-Wesley, Seventh Edition, 2021

  - Relevant chapters will be uploaded to Canvas

- ## Database Management Systems
  - Raghu Ramakhrishnan & Johannes Gehrke

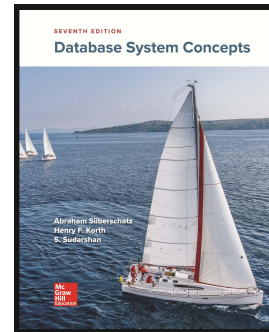 - McGraw-Hill, Third Edition, 2003

  - https://pages.cs.wisc.edu/~dbbook/

Course Readings (recommended)

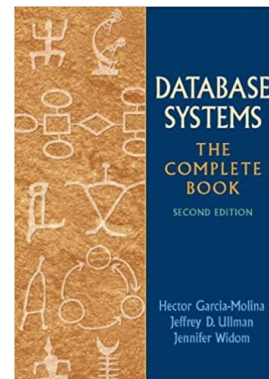- ## Database System Concepts
  - Avi Silberschatz, Hank Korth & S. Sudarshan

  - McGraw-Hill, Seventh Edition, 2019

  - https://www.db-book.com/

- ## Database System: The Complete Book
  - Hector Garcia-Molina, Jeffrey Ullman & Jennifer Widom

  - Prentice Hall, Second Edition, 2009

  - http://infolab.stanford.edu/~ullman/dscb.html

Workload & Assessment

- Workload
  - Number of credits: **4MC**

  - Workload per week: **10h**
    - 2h lecture
    - 1h tutorial
    - 4h assignments & project
    - 3h preparatory work

- Tentative module assessment
  - Minor adjustments of the weights for the group project possible

Assessment Component		Weight
Assignments	A1	5%
	A2	5%
Group Project	Part 1	6%
	Part 2	6%
	Part 3	18%
Midterm Test		20%
Final Test		40%

Assignments

- Individual assignments
  - Total marks: 10

- Tentative assignment deadlines

#	Assessment Component	Due Date
1	SQL	Week 6
2	Schema Refinement	Week 13

Project

- Objective: Develop a database application
  - Software: PostgreSQL database server

  - Languages: SQL of PL/pgSQL

- Project teams
  - Group of **4** team members (may belong to different tutorial groups)

  - Registration will be open by the end of Week 2

  - Teams to be formed by the end of Week 3

  - If you are unable to form a team or belong to a team with fewer than 4 members, you may be assigned or reassigned to a random team

Project

- Tentative project deadlines

Task	Due Date
Project Team Registration	Week 3
Submission of ER Data Model Design	Week 5
Submission of Project Report and Code	Week 6/7
Project Evaluation	Week 11

Assessment

- Midterm Test
  - Week 7, duration: 1 h (during lecture slot)

  - Open-book exam

  - You may run PostgreSQL on your laptop

  - No internet access

- Final Test
  - Week 14, Nov 27 (Monday) , 17:00 - 19:00

  - Closed-book exam

  - 1 double-sided A4-sized cheatsheet allowed

Software

- Examplify
  - Used for both midterm and final

  - Overview: https://wiki.nus.edu.sg/display/DA/Student

  - System Requirements:
    https://wiki.nus.edu.sg/display/DA/Device+Minimum+System+Requirements

  - Installation: https://wiki.nus.edu.sg/display/DA/Download+and+Install+Examplify

  - Briefing slides: https://wiki.nus.edu.sg/display/DA/Examplify+Student+Briefing+Slides

  - Emergency email: citbox25@nus.edu.sg

Software

- PostgreSQL version 14
  - https://www.postgresql.org/

  - Installation: https://wiki.postgresql.org/wiki/Detailed_installation_guides

Course Policies

- Students' Responsibilities
  - Attending lectures and tutorials

  - Checking Canvas and emails for course-related announcements and updates

  - For clarification on lecturer materials

    - The best way is to post your questions using Canvas Discussions
      (all students are welcome and encouraged to reply or otherwise actively contribute)

    - Questions emailed to lecturers may be posted to Canvas and answered there

    - You may email the lecturers to arrange for consultation sessions

Course Policies

- Zero tolerance for academic dishonesty
  - Students will be reported to University for disciplinary action for academic dishonesty offences including cheating and plagiarism
  - Offenders will receive an F grade for the module
  - Offender = student who cheated, plagiarised or student who enabled cheating or plagiarism

- Resources
  - https://www.nus.edu.sg/celc/programmes/plagiarism.html
  - https://www.comp.nus.edu.sg/cug/plagiarism/

Course Policies

- https://www.comp.nus.edu.sg/cug/plagiarism/

  [...] *The University takes a strict view of cheating in any form, deceptive fabrication, plagiarism and violation of intellectual property and copyright laws. Any student who is found to have engaged in such misconduct will be subject to disciplinary action by the University.*

  Academic dishonesty is any misrepresentation with the intent to deceive or failure to acknowledge the source or falsification of information or inaccuracy of statements or cheating at assessments/examinations/tests or inappropriate use of resources. There are many forms of academic dishonesty and plagiarism is one of them. ***Plagiarism is generally defined as the practice of taking someone else's work or ideas and passing them off as one's own*** *(The New Oxford Dictionary of English).* [...]

Course Policies

- https://www.nus.edu.sg/registrar/administrative-policies-procedures/undergraduate/acceptance-record

[...] *Students should adopt this rule -* **You have the obligation to make clear to the assessor which is your own work, and which is the work of others.** *Otherwise, your assessor is entitled to assume that everything being presented for assessment is being presented as entirely your own work. This is a minimum standard. In addition, the following guidelines will provide some assistance.* [...]

[...] *A student may not knowingly intend to plagiarise, but that should not be used as an excuse for plagiarism.* **Students should seek clarification from their instructors or thesis advisors if they are unsure whether or not they are plagiarising the work of another person.** [...]