

Course Introduction

SWEN304 / SWEN435

Database System Engineering

Trimester 1, 2024

Lecturer: Dr Hui Ma

Engineering and Computer Science



Lecturers

- A/Prof. Hui Ma (course coordinator)
 - CO 259
 - Ph: 04 356 5657 (extn: 5657)
 - Hui.Ma@ecs.vuw.ac.nz
 - Office hour: 2-3pm, Tuesday
- Kevin Shedlock
 - CO 357
 - kevin.shedlock@ecs.vuw.ac.nz

People

- Tutors:
 - TBA

- School office: CO358, Ph. 463 5341

- Class representative, please nominate
 - SWEN304
 - SWEN435

Lectures

- Three lectures per week (2 lectures + 1 tutorial)

Day	Time	Where
Monday	10:00 -- 10:50	CO LT122
Tuesday	10:00 -- 10:50	CO LT122
Thursday	10:00 -- 10:50	CO LT122

- Slides will be posted on the course website
- Expected workload: 10 hours a week

Tutorials and Help Desks

- Lectures and tutorials will not be strictly divided
- In principle, Thursday time slots will be for tutorials
 - Stuff from lectures,
 - extending stuff from lectures,
 - Assignments, and
 - Projects
- Help desks will be offered from week 3 in lab CO246 to help you with your assignments and projects
 - Details is posted on the course website

SWEN304 Assessment

- Assessment:

Assignment 1:	10%	}	26%	}	50%
Assignment 2:	8%				
Assignment 3:	8%				
Project 1:	14%	}	24%		
Project 2:	10%				
Exam	50%				

- Assignments and projects are available at the SWEN304 website
- Submit via: <https://apps.ecs.vuw.ac.nz/submit/SWEN304>

SWEN435 Assessment

- Assessment:

Assignment 1:	8%	}	18%	}	55%
Assignment 2:	5%				
Assignment 3:	5%				
Project 1:	12%	}	22%		
Project 2:	10%				

- Essay 15%
- Exam 45%

- Assignment and projects are available at **SWEN435** website
- Submit via <https://apps.ecs.vuw.ac.nz/submit/SWEN435>

To Pass the Course

- Mandatory Requirements:
 - at least 40% of the overall marks for projects and assignments
 - for SWEN304 $40\% * 50$,
 - for SWEN439 $40\% * 55$
 - achieve at least a D grade for the exam
- To pass the course
 - meet the mandatory requirements
 - at least 50% grade overall

Online Resources

- Slides and other information will be posted on the course website:

https://ecs.wgtn.ac.nz/Courses/SWEN304_2024T1/WebHome

- Discussion Forum on Nuku

Online Resources

- Video of Lectures can be accessed via Nuku
- Assignments and Projects
 - Helpful Links:
 - PostgreSQL documentation,
 - Java Tutorial Manual

General Information

- Prerequisite:
 - COMP 261 or SWEN 221; and
 - ENGR 123 or MATH 161

- Textbook:

ElMasri, Navathe: **Fundamentals of Database Systems**, 6th/7th Edition, Addison Wesley

Why Learn Database Systems?

- Databases and database systems are essential components of everyday life
 - Traditional database applications: student records, census data, bank accounts, etc.
 - Multimedia databases: images, audio, video streams
 - Geographic information systems (GIS): maps, weather data, satellite images
 - Data warehouses and online analytical processing (OLAP)
 - Real-time and Active Databases
 - Many other applications

Why Learn Database Systems?

- Databases play a critical role in almost all areas where computers are used,
 - e.g. business, e-commerce, engineering, medicine, government, education
- The efficiency of an application depends on the quality of (logical and physical) data organization
- Databases is a matured area with a sound theoretical foundation and great practical knowledge
- We need to understand fundamentals of database technology
- This course is an introduction to database systems and database system engineering

An Example

- UNIVERSITY database
 - Information concerning students, courses, and grades in a university environment
- **Data records**
 - STUDENT
 - COURSE
 - GRADES
- Specify structure of records of each file by specifying **data type** for each **data element**
 - String of alphabetic characters
 - Integer, etc.

An Example

- Construct UNIVERSITY database
 - Store data to represent each student, course, and grade report as a record in an appropriate file
- Relationships among the records
- We can query and update the database

An Example

- Examples of queries:
 - Retrieve the transcript of a student
 - List the names of students who took the 'SWEN304' course and their grades
 - List the prerequisites of the 'SWEN435' course
- Examples of updates:
 - Change the major of 'Smith' to 'SWEN'
 - Create a new course 'WISE'
 - Enter a grade of 'A' for 'Smith' in the 'SWEN304'

An Example (cont'd.)

- Phases for designing a database:
 - Requirements specification and analysis
 - Conceptual design
 - conceptual model
 - Logical design
 - Relational model
 - Physical design

An Example

- A graphical representation with a set of interrelated tables with data
 - represents an UoD,
 - is well structured,
 - can reflect changes, and
 - have users and applications.

STUDENT			
Id	Lname	Fname	Major
300111	Smith	Susan	COMP
300121	Bond	James	MATH
300132	Smith	Susan	COMP

COURSE			
Course_id	Cname	Points	Dept
SWEN304	DB sys	15	Engineering
COMP301	softEng	20	Engineering
MATH214	DisMat	15	Mathematics

GRADES		
Id	Course_id	Grade
300111	SWEN304	A+
300111	COMP301	A
300111	MATH214	A
300121	COMP301	B
300132	COMP301	C
300121	SWEN304	B+
300132	SWEN304	C+

Actors on the Scene

- **Database administrators (DBA)** are responsible for:
 - Authorizing access to the database
 - Coordinating and monitoring its use
 - Acquiring software and hardware resources
- **Database designers** are responsible for:
 - Identifying the data to be stored
 - Choosing appropriate structures to represent and store this data
- **End users:** people whose jobs require access to the database, e.g.,
 - Casual users: different queries via DB query interface
 - Naïve or parametric users, bank customers, booking agents
 - sophisticated users: access DBMS via own applications
 - standalone users: use read-make program package

Actors on the Scene (cont'd.)

- **System analysts**
 - determine requirements of end users
 - develop specifications for standard canned transactions to meet the requirement

- **Application programmers**
 - implement these specifications as programs,
 - test, debug, document, and maintain these canned transactions

Workers behind the Scene

- **DBMS system designers and implementers**
 - Design and implement the DBMS modules and interfaces as a software package
- **Tool developers**
 - Design and implement **tools**
- **Operators and maintenance personnel**
 - Responsible for running and maintenance of hardware and software environment for database systems

Topics

- Introduction to Database Systems (basic terms and concepts),
- Relational data model (RDM) and database management system (DBMS),
- Structured Query Language (SQL),
- Query optimization

- Database Design
 - ER Data Model
 - Update Anomalies
 - Lossless Join
 - Functional Dependencies
 - Normal Forms and Normalization
- Transaction processing, concurrency control, and recovery

Plan for next lecture

- Databases (DB) and data
- Database management systems (DBMS)
- Database systems (DBS)

- Reading:
 - Chapter 1 of the textbook