# Course Introduction

SWEN 304

Database System Engineering

Trimester 2, 2019

Lecturer: Dr Hui Ma

**Engineering and Computer Science**

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

# People

- Lecturer and course coordinator:
  - Dr. Hui Ma
  - CO 259
  - Ph: (extn) 5657
  - Hui.Ma@ecs.vuw.ac.nz
  - Office hour: 2-3pm, Wednesday

  - A/Prof Jens Dietrich
  - CO 261
  - Ph: (extn) 9514

# People

- Tutors:
  - Tao Shi: Tao Shi <Tao.Shi@ecs.vuw.ac.nz>
  - Chen Wang: Chen.Wang@ecs.vuw.ac.nz
  - Qurrat Ul Ain qurrat.ul.ain@ecs.vuw.ac.nz
  - Soheila Sadeghiram: soheila.sadeghiram@ecs.vuw.ac.nz

- School office: CO358, Ph. 463 5341

- Class representative:
  - please nominate and fill the form at:

  http://www.vuwsa.org.nz/class-representatives/

# Lectures

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

| Day | Time | Where |
|---|---|---|
| Tuesday | 13:10 -- 14:00 | HM LT104 |
| Wednesday | 13:10 -- 14:00 | HM LT104 |
| Friday | 13:10 -- 14:00 | HM LT104 |

- 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
- What:
  - Stuff from lectures,
  - extending stuff from lectures,
  - Assignments, and
  - Projects
- Help desks will be offered from week 3 in the labs (CO219) to help you with your assignments and projects
  - Details will be posted on the course website and announced in the lectures

# Assessment

- Assessment:

| | | | |
|---|---|---|---|
| Assignment 1: | 10% | 20% | 45% |
| Assignment 2: | 5% | | |
| Assignment 3: | 5% | | |
| Project 1: | 15% | 25% | |
| Project 2: | 10% | | |
| Final examination | 55% | | |

# To Pass the Course

- Mandatory Requirements:
  - at least 40% of the overall marks for projects and assignments.

- 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.victoria.ac.nz/Courses/SWEN304_2019T2/

- Discussion Forum:

https://ecs.victoria.ac.nz/cgi-bin/yabb/YaBB.pl?board=SWEN304_2019T2

- 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,** Sixth 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
- 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 (cont'd.)

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

# An Example (cont'd.)

- Examples of queries:
  - Retrieve the transcript
  - List the names of students who took the 'SWEN304' course and their grades
  - List the prerequisites of the 'SWEN304' 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
  - Logical design
  - Physical design

# An Example (cont'd.)

| 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, Naïve or parametric users, sophisticated users, standalone users

# Actors on the Scene (cont'd.)

- **System analysts**
  - Determine requirements of end users
- **Application programmers**
  - Implement these specifications as programs

# 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
- Stored procedures, Triggers, and User Defined Functions

# Topics

- 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