

# IS5102

## Database Management Systems

### Lecture 1: Introduction

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(with thanks to Susmit Sarkar)

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## Course Information – CS Student Handbook

<https://info.cs.st-andrews.ac.uk/student-handbook/modules/IS5102.html>

### Lecturers

- ▶ Dr Alexander Konovalov
- ▶ Dr Michael Young (support)

### Resources – accessible directly or through the Module Management System (MMS)

- ▶ Module directory on **Studres** <http://studres.cs.st-andrews.ac.uk/IS5102>
- ▶ MMS <https://mms.st-andrews.ac.uk/>
  - ▶ IS5102 team in Microsoft Teams
  - ▶ Lecture recordings on **Panopto** (<https://st-andrews.cloud.panopto.eu/>)
  - ▶ Also link to the Studres module directory

## Meeting Logistics

- ▶ 2 lectures per week via Microsoft Teams:
  - ▶ **1pm** on **Mondays** (1 hour)
  - ▶ **1pm** on **Thursdays** (1 hour)
- ▶ 1 exercise session per week via Microsoft Teams:
  - ▶ **1pm** on **Tuesdays** (1 hour)

Selected material available online by the end of the preceding week
- ▶ 1 on-line drop-in surgery session **each week**
  - ▶ **1pm** on **Wednesdays** via Microsoft Teams
- ▶ 1 in-person drop-in surgery session **fortnightly**
  - ▶ **1pm** on **Mondays** even weeks, details TBC
- ▶ Lecture slides (including this one) & other materials on **Studres**
- ▶ Lectures (including this one) and exercise classes recordings on **Panopto**

## How we will use Teams

- ▶ I will record the meeting and upload the video on Panopto afterwards
- ▶ What will be recorded:
  - ▶ my application window (e.g. slides, database browser, terminal, etc.)
  - ▶ my video and my voice
- ▶ What will **not** be recorded:
  - ▶ your video and your voice
  - ▶ conversations in the meeting chat
- ▶ Teams etiquette and illusion of presence:
  - ▶ please mute your microphone when not speaking
  - ▶ type your questions in the meeting chat
  - ▶ raise hand if you want to talk
  - ▶ **only** if you are comfortable: turn on your camera (it will not be recorded)
- ▶ Not necessary, but may be helpful: earphones and an external screen

## Logistics: Assignments

- ▶ **Three** assignments, submitted via MMS (dates TBA)
  - ▶ (20 %) Data Modelling
  - ▶ (20 %) SQL
  - ▶ (20 %) Group Research
- ▶ One 48-hour exam replacement assessment in December (date TBA), worth 40 %
  - ▶ examinable material:  
lectures, exercises, coursework, relevant chapters of textbooks
  - ▶ we will practise at the end of the semester by looking at past papers

- ▶ **Database Design** by A. Watt & N. Eng

- ▶ 2nd Ed., e-book (CC BY 4.0), Victoria, B.C. : <https://opentextbc.ca/dbdesign01/>

- ▶ **Database Systems** by T. Connolly & C.E. Begg

- ▶ 6th Ed., Pearson Education, e-book:  
[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb2379911](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb2379911)
  - ▶ 6th Ed., Pearson Education, printed:  
[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb2379725](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb2379725)
  - ▶ 5th Ed., Addison-Wesley, printed:  
[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb1668114](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb1668114)

► **Database System Concepts** by A. Silberschatz, H. Korth & S. Sudarshan

Web page with supplementary materials, including slides for each chapter:

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

- 7th Ed., McGraw-Hill, printed:

[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb2696468](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb2696468)

- 6th Ed., McGraw-Hill, printed:

[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb1854246](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb1854246)

- 5th Ed., McGraw-Hill, printed:

[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb1527546](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb1527546)

- 4th Ed., McGraw-Hill, printed:

[https://encore.st-andrews.ac.uk/iii/encore/record/C\\_\\_Rb1394850](https://encore.st-andrews.ac.uk/iii/encore/record/C__Rb1394850)

- ▶ You are assumed to be familiar with the whole [student handbook](#)
- ▶ Read the [Good Academic Practice policy](#)
- ▶ Check that coursework submitted to MMS has been received successfully, and that it is the right piece of coursework
- ▶ Coursework submitted after deadline is subject to automatic penalty
- ▶ Any special circumstances must be documented immediately through the self-certification system, and followed up with coordinator if you are seeking any allowance
- ▶ You must be available for the entire exam period
- ▶ Familiarise yourself with the [School](#) and [University](#) health & safety guidance

## Key points from student handbook:

<https://info.cs.st-andrews.ac.uk/student-handbook/key-points.html>



*The database is now the underlying framework of the information system*

*Connolly and Begg*

- ▶ Collection of inter-related data
- ▶ A logically coherent collection of data with some inherent meaning
- ▶ A representation of some aspect of the real world
- ▶ A fundamental part of most large software systems

- ▶ A collection of related data (database)
- ▶ A set of programs to access, manipulate and present the data
  
- ▶ Primary goal
  - ▶ A means to store and retrieve data
  - ▶ In a convenient and efficient way

- ▶ Banking: transactions
- ▶ Airlines: reservations, schedules
- ▶ Universities: registration, grades
- ▶ Sales: customers, products, purchases
- ▶ Online retailers: order tracking, customized recommendations
- ▶ Manufacturing: production, inventory, orders, supply chain
- ▶ Human resources: employee records, salaries, tax deductions
- ▶ ...

- ▶ Application program examples
  - ▶ Add new students, instructors and courses
  - ▶ Enrol students on courses, and generate class lists
  - ▶ Assign grades, compute grade point averages and generate transcripts
  - ▶ ...

- ▶ Earlier, database applications were built directly on top of file systems
  - ▶ Supported by OS
  - ▶ Ad-hoc programs
- ▶ Ever tried to sort your Documents folder?

- ▶ Data redundancy and inconsistency
  - ▶ Multiple file formats, duplication of information in different files
- ▶ Difficulty in accessing data
  - ▶ New programs need to be written to carry out new tasks
- ▶ Data isolation
  - ▶ Multiple files and formats
- ▶ Integrity problems
  - ▶ Integrity constraints (e.g., account balance  $\geq \text{£}20$ ) become hidden in program code rather than being stated explicitly
  - ▶ Hard to add new constraints or change existing ones
- ▶ Security problems
  - ▶ Hard to provide access to some, not all, data
- ▶ Lack of concurrency
  - ▶ When an application opens a file, it is locked, and nobody else can access it at the same time

Database systems provide a centralised, well-controlled data repository

- ▶ Can deal with **enormous** amounts of persistent data
- ▶ And do so **efficiently** and **flexibly**
- ▶ Can design with **security** in mind
- ▶ Can deal with **multiple** concurrent accesses



## Database management system (DBMS)

A complex set of applications that enables users to create and maintain a database.

Main features of modern DBMS:

- ▶ Provide facilities to store, retrieve and update data
- ▶ Provide a user-accessible catalog which gives descriptions of stored data items and is accessible to users
- ▶ Provide mechanisms to support authorisation
- ▶ Transaction Support – ensures that either all the updates corresponding to a given transaction are made or that none of them are made
- ▶ Concurrency control – allows shared access

## ▶ Reading

- ▶ Chapters 1-3, [Database design](#)
- ▶ Chapter 1, [Database System Concepts](#)

## ▶ Practice

- ▶ To prepare for the exercise session tomorrow, install **DB Browser for SQLite**:  
<https://sqlitebrowser.org/>