Introduction to Databases 

- Press `Space` to navigate through the slides
- Use `Shift+Space` to go back

Module Structure 📖

- Lecture
    - **MONDAY** – 15:00-17:30
- Breakdown of assesments
    - **CA1** – 20%
    - **CA2** – 30%
    - **EXAM** – 50%
- 2% penalty per day for late submissions

Plagiarism 🚫

- **CCT** is constantly striving to build a culture which values and supports good academic conduct
- Academic dishonesty is **a serious offence** that will not be tolerated
- Students found to be involved in plagiarism will be brought before the **Academic Standards Board**

In-Class Technologies 👨‍💻

- **GitHub** – http://github.com (http://github.com)
- **Slack** – http://slack.com (http://slack.com)
- **Jupyter Notebook** – http://jupyter.com (http://jupyter.com)
- **Binder** – http://mybinder.org (http://mybinder.org)
- **Moodle** – http://moodle.cct.ie (http://moodle.cct.ie)

A Brief History of Databases 🏺

- **pre-1960s:** Punch cards, paper data reels, magnetic tapes
- **1960s:** File systems, Database Management Systems (CODASYL, IMS)
- **1970s:** Relational databases (Codd's 12 Rules, Ingres & System R, ER Model), RDBMS
- **1980s:** Personal Computers, SQL
- **1990-2000s:** The Internet, client-server & database connectors, open source RDBMS
- **Now:** Big data, virtualisation & distibuted processing, noSQL

What is a Database? 🤷‍♀️

A collection of information organised in such a way that a computer application can quickly select desired pieces of data:

- To-Do list
- Shopping list
- Address book
- Family tree

What are the ways of carrying that information?

- Written, remembered, stored, recorded, etc.

Use Cases 🖱️

What is the difference between your Address Book 📕 and iCloud Contacts 🍎?

Complexity*, *Scale*, *Availability*, *Security*... *Volume*, *Velocity*, *Variety – `Big Data`

Relational Database Management Systems (RDBMS) 🗄️

A software that is responsible for the storage, retrieval and updating of data in a computer system.

- Data is stored only once and hence multiple record changes are not required. Deletion and modification of data is simple and storage efficiency is very high. Backup, import/exports and maintenance functions are in-built.
- Complex queries can be carried out using the Structure Query Language.
- Security is built in. Users can set access barriers to limit access to the available content.

- Provision for future requirements as new data can easily be added and appended to the existing tables and can be made consistent with the previously available content.
- Offers standard application programming interface (API) for accessing databases
- There are quite a few database systems available (such as MySQL, PostgreSQL, IBM Db2 and Oracle Database, etc.). DB-Engines (https://db-engines.com/en/ranking) collects and presents information on DBMSs and provides a monthly listing of them, ranked by their current popularity.

Structured Query Language 🔍

- **SQL (Structured Query Language, pronounced "sequel" or ess-cue-ell)** is a domain-specific language used in programming and designed for managing data held in a relational database management system (RDBMS)

- It is particularly useful in handling structured data where there are relations between different entities/variables of the data

- A relational database is, simply, a database that stores related information across multiple tables and allows you to query information in more than one table at the same time. Within a table, the data is organised in a tabular format with rows and columns

ID	Student	Course	Module
1	Lisa	IT	Databases
2	Alan	Business	HR
3	Julia	IT	Mobile Dev

ID	Lecturer	Department
1	John	Business
2	Sarah	Computer Science
3	Michael	Computer Science

Structured Query Language 🔍

These SQL commands are mainly categorised into four elements as:

- **DDL** – Data Definition Language
- **DQl** – Data Query Language
- **DML** – Data Manipulation Language
- **DCL** – Data Control Language

C.R.U.D. – Create, Read, Update, Delete

SQL 🔦

- A standardised language for interacting with RDBMS
- Performs C.R.U.D. operations
- Allows performing asministrative tasks, such as user management, security, backups, etc.
- Used to define tables and structures
- Not identical between various RDBMS

Database Queries 🕵️

- Queries are requests made to RDBMS in order to retrieve required information
- As complexity of a database rises, it gets harder to find specific data
- Provide an example of a query

Summary 🕶️

- Database is any collection of information
- Computers + DB = 😍
- Relational Database Management Systems (RDBMS) is used to create, maintain and protect a database
- RDBMS uses Structured Query Language (SQL) to perform C.R.U.D. and other essential tasks
- Relational databases use SQL and store data in tables with rows and columns