CERTIFICATE / DEGREE IN COMPUTING, YEAR 2

DATABASE FUNDAMENTALS

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Unit 1: Introduction to Databases

What is a database?

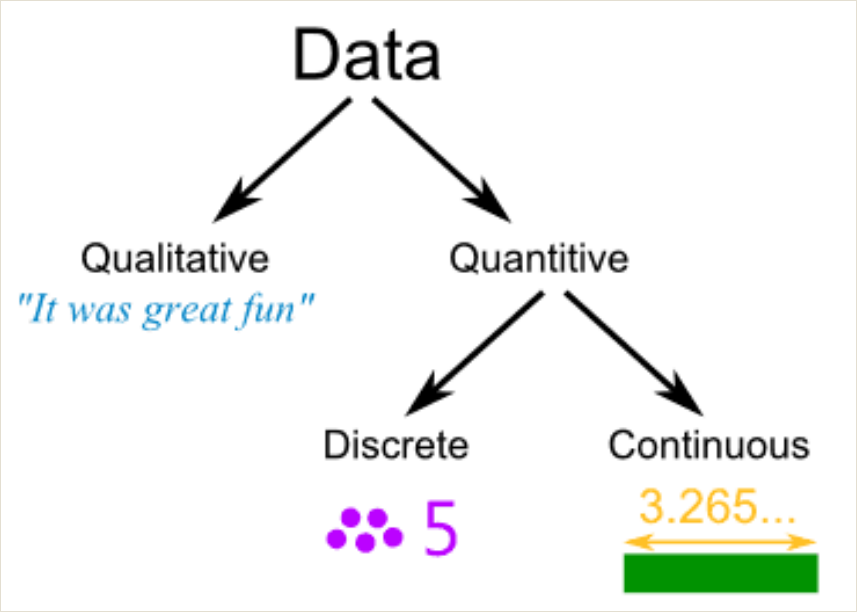
- At its simplest, a tool to store **data** permanently, i.e. a persistent data store

What is data?

- Data is a collection of facts, such as values or measurements
- It can be numbers, words, measurements, observations or even just descriptions of things.

What is data . . . .

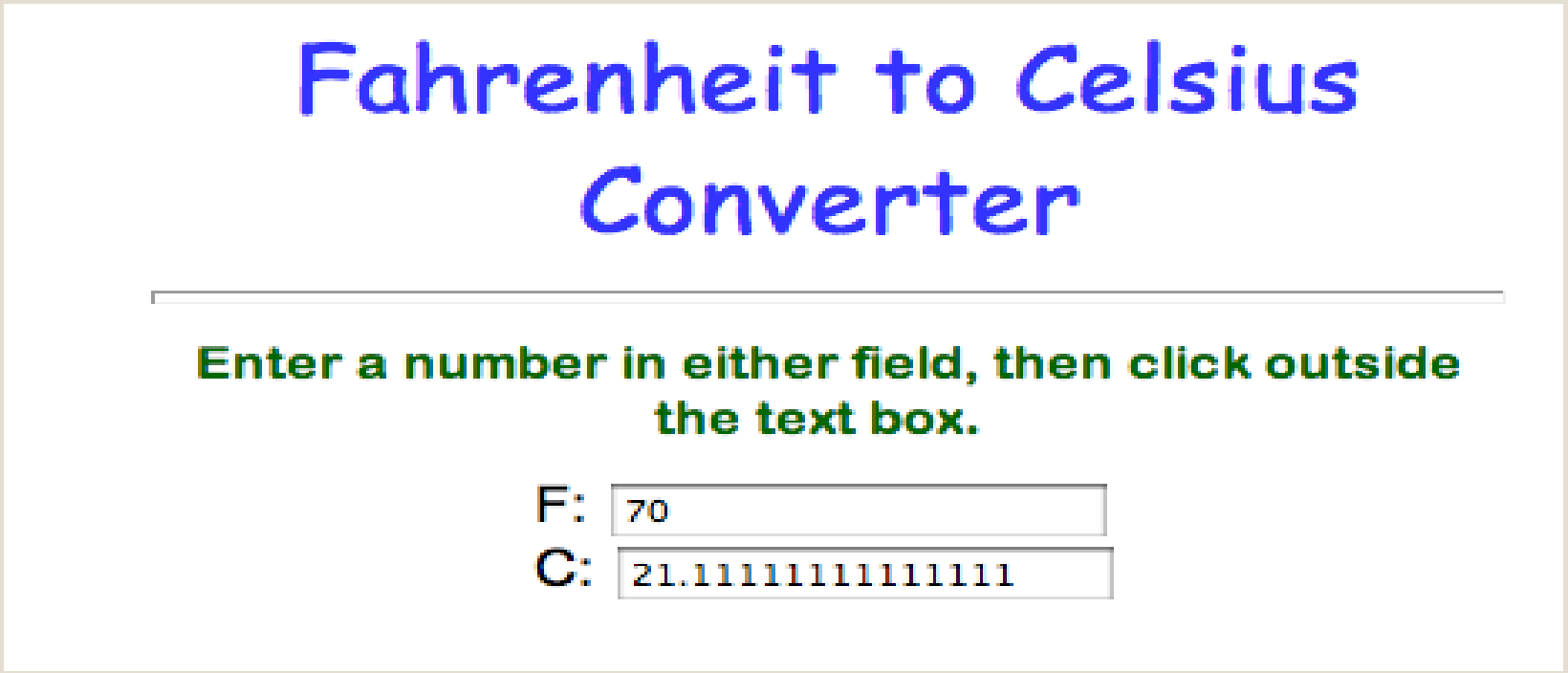
- Data can be qualitative or quantitative.
  - **Qualitative data is descriptive information (it *describes something)***
  - **Quantitative data**, is numerical information (numbers)



Collecting data

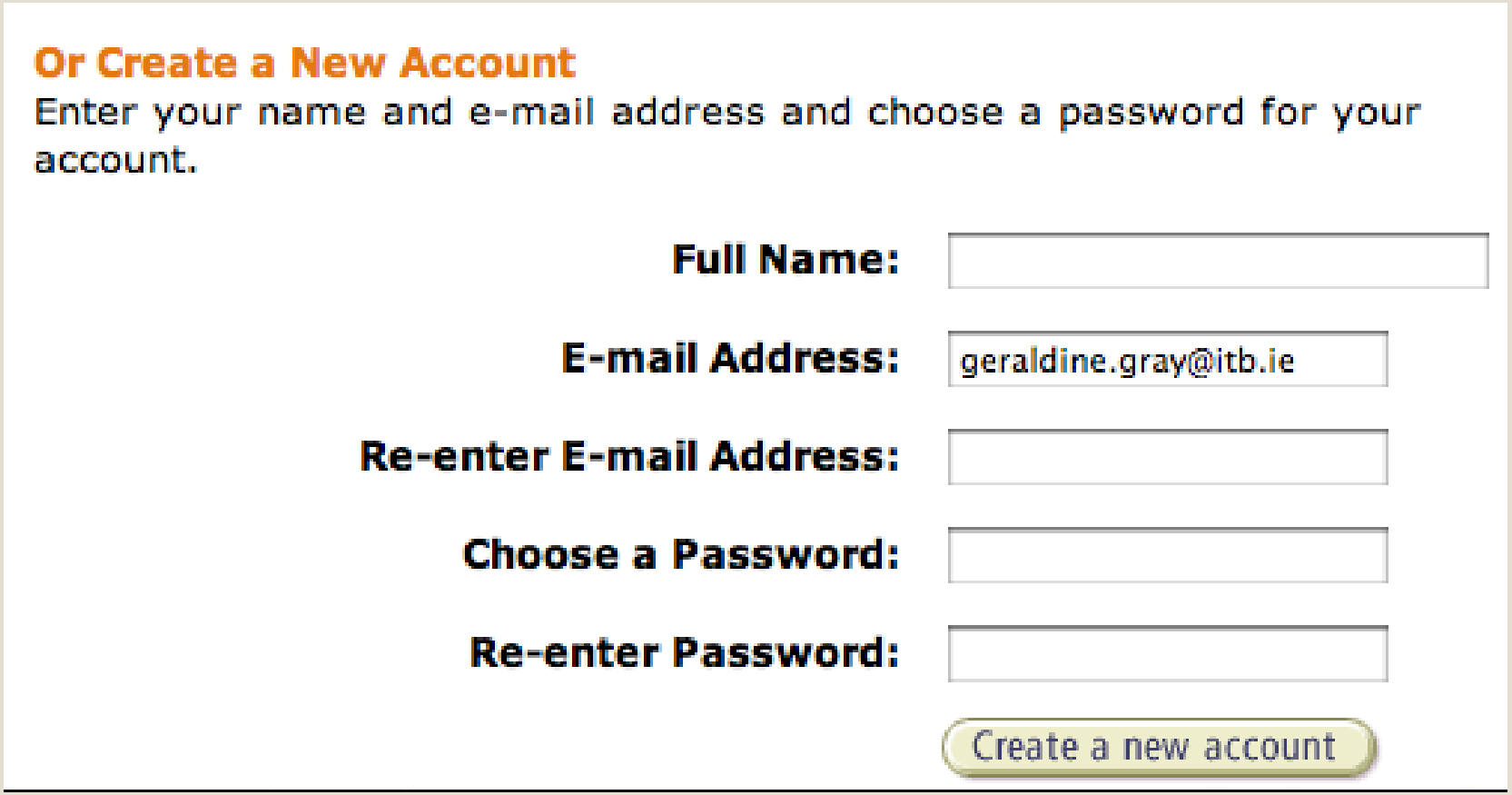
- Data is collected in many ways:
  - Observation: e.g. science experiment such as "What temperature does oil boil at"?
  - Doing a survey, e.g. the census
  - By computer programs . . .

More on data . . .



- What is the data used by the software program above?
- Where is it stored?
- Does it need to be recorded for use later?

More on data . . (from amazon.co.uk).



- What is the data used by the software program above?
- Where is it stored?
- Does it need to be recorded for use later?

Databases

The focus of this course is

how to store data

Efficiently,

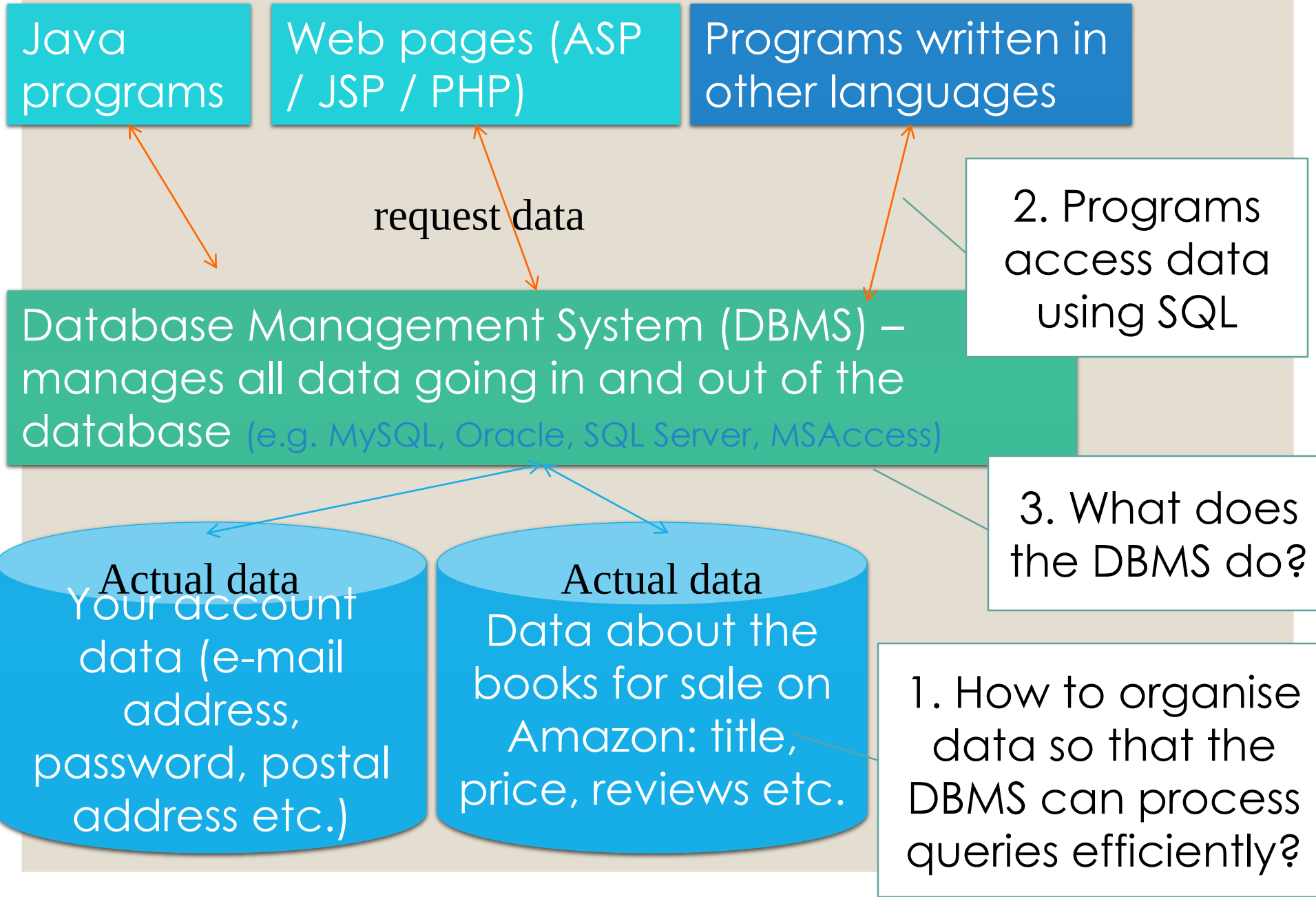
Accurately

and

Securely

so that it can be accessed easily from software programs

The big picture . . .



Learning outcomes . . . .

(Knowledge) Having succesfully completing this module the student will be able to:

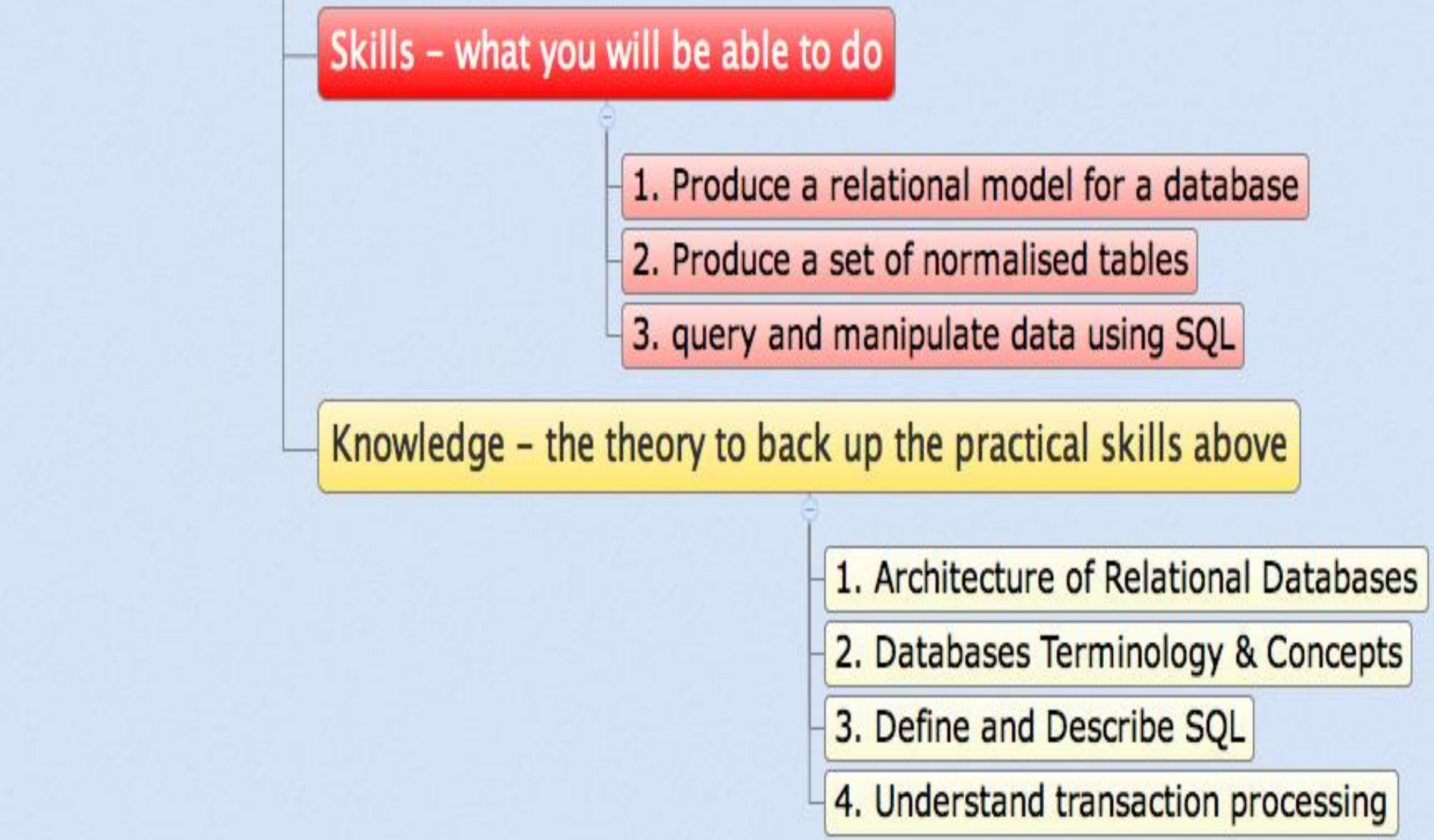
- describe the architecture of a relational database
- define the terminology and concepts associated with relational databases
- explain various aspects of transaction processing
- define and describe **SQL**

(Skills) Having successfully completed this module, the student will be able to:

- Model database requirements using an ERD
- produce a **normalised** set of tables
- query and manipulate database objects (using **SQL**)

Databases: Learning Outcomes

(diagram of text on last slide)



Topics

Topic 1: Features of a Relational Database

Topic 2: SQL

Topic 3: Database Design
(ERDs and Normalisation)

Topic 4: Transaction Processing, Security

Software: MySQL

Teaching approach

Effectiveness of a 2-hour lecture

Lecturers Role

Expectations

Memory:
-day of lecture
- next day
- 1 week later
- 1 month later

Students Role

House Keeping

Bring a printed copy of lecture notes to class each week

Schedule

- Continuous Assessment: 50%
- Exam: 50%
- Credits: 5

Moodle

- The enrolment keys for Moodle are as follows:

- **Group 1: dbf1**
- **Group 2: dbf2**
- **Group 3 : dbf3**
- **Group 4: dbf4**
- **BN762: dbf5**
- **BN026: dbf6**

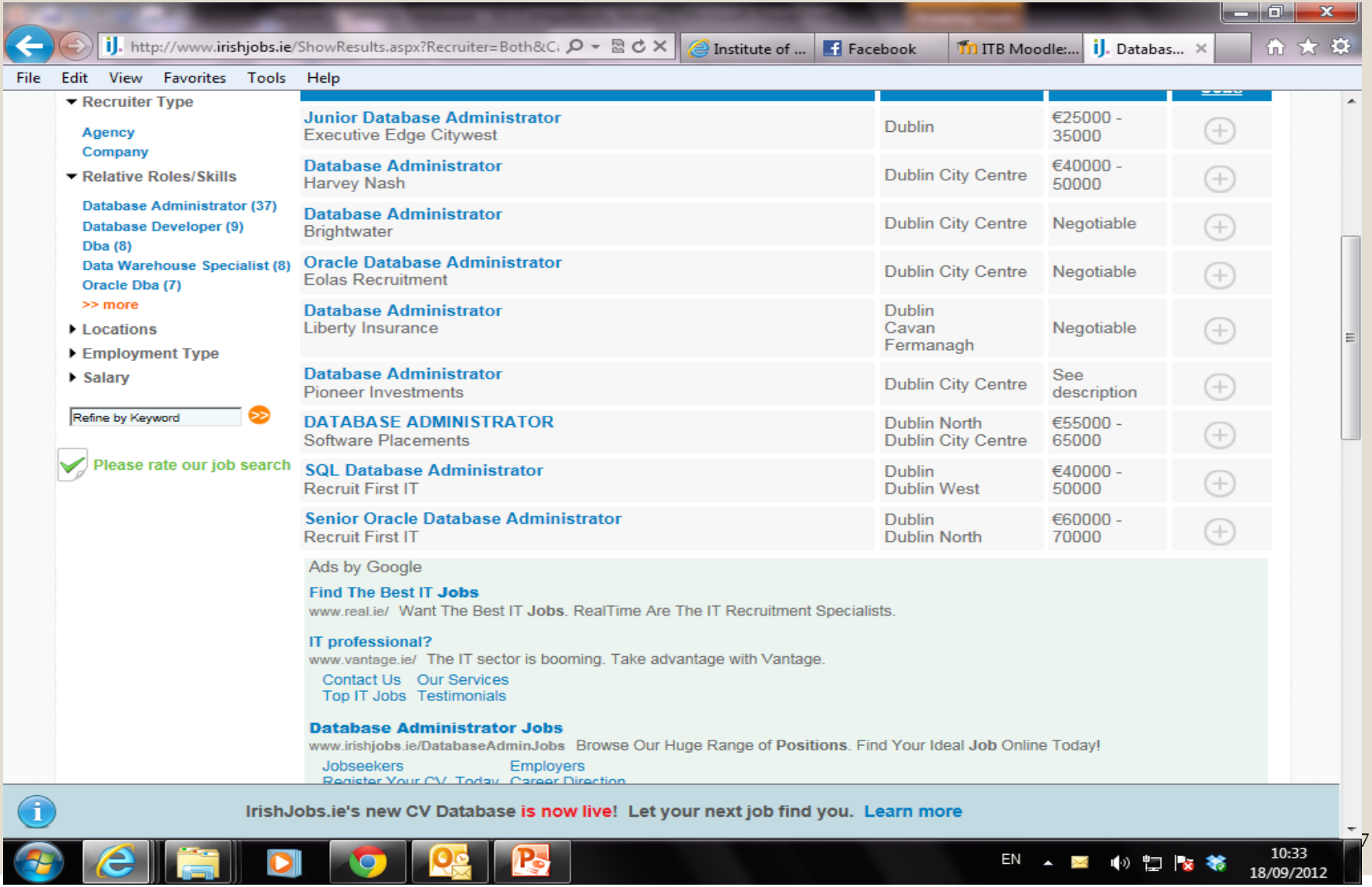
Continuous Assessment

- Total Value: 50%
  - 1. Lab worksheets - 10%
    - To be completed throughout the semester and a portfolio of lab worksheets expected
  - 2. SQL in-class test- 15%
    - Will be held about week 6
  - 3. Database Design Assignment as a class test - 25%
    - Will be held about week 11

Why study databases?

CORE IT Skill

– irishjobs.ie currently has 20 0f 64 jobs looking for SQL/Databases skills



Exercise time

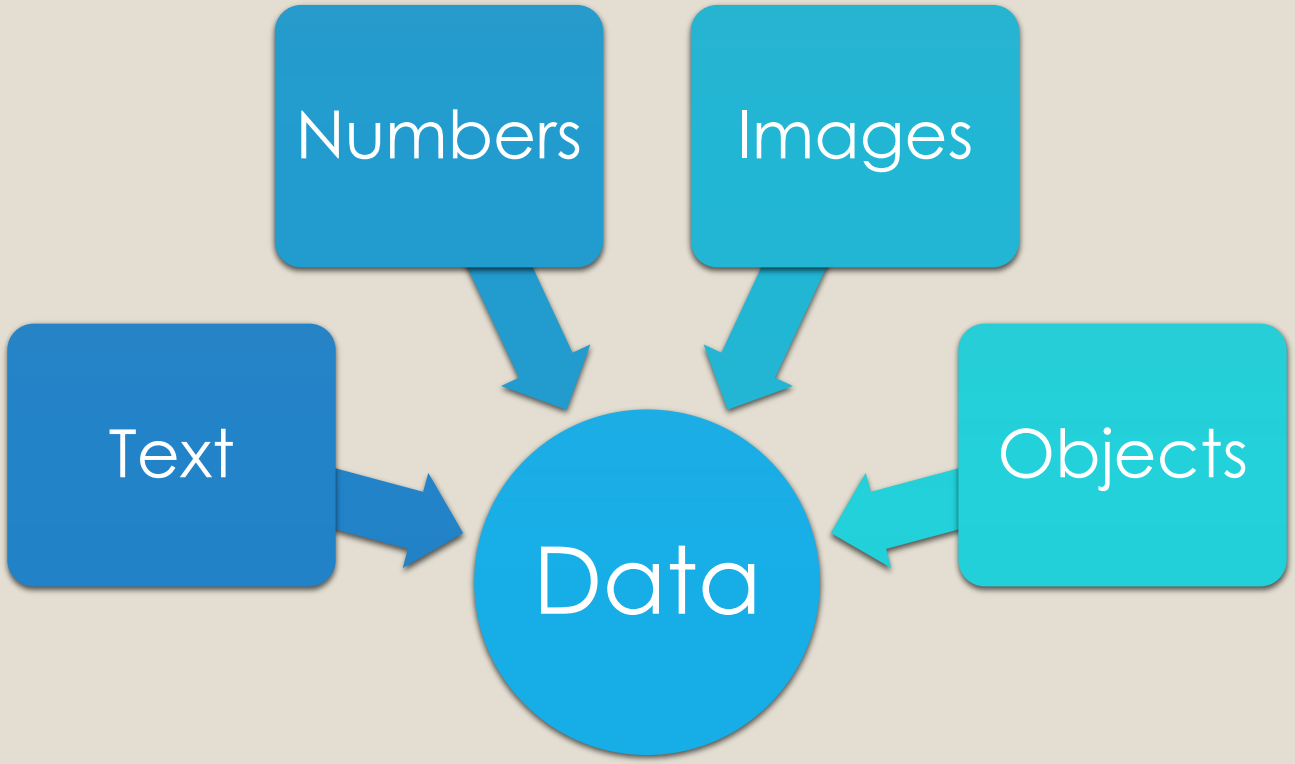
- Suppose you had to write an application for the following.
- Identify what information needs to be persistent (stored permanently) to a database . .

  - A competitor to face book
  - A recruitment web site like www.irishjobs.ie
  - A college system to handle student registrations and exam results.

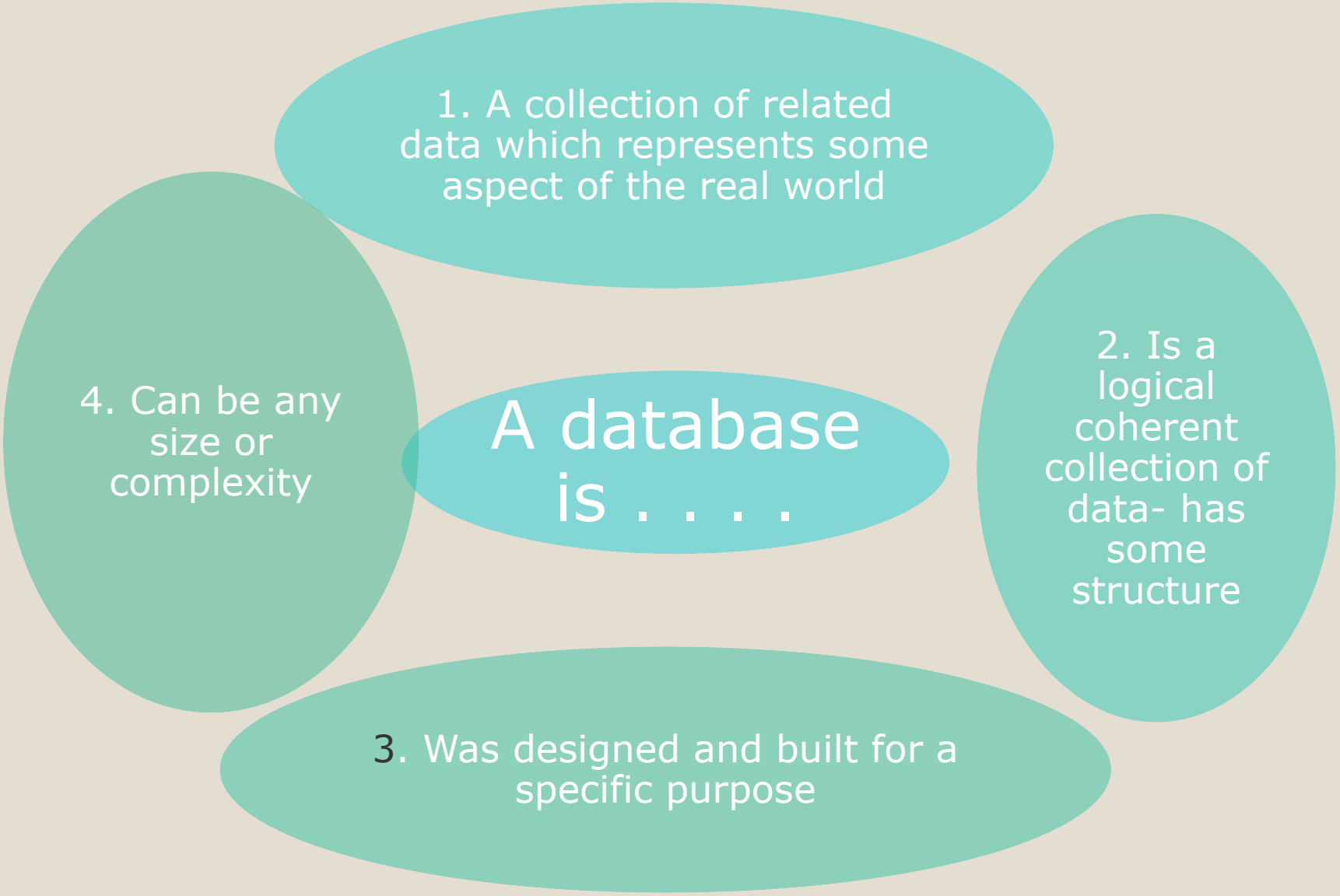
SOME BACKGROUND AND TERMINOLOGY

Some Terminology - data

1. Data: known facts that can be recorded



Some Terminology - database



Cells, Rows, Tables and Databases

- Database -- a collection of related tables describing various facets of a group of objects or events.

Database

Student Table

StudentID	StudentName	CourseCode
B00001234	Joe Bloggs	BN002
B00051413	Ann Ryan	BN001
B00012136	John Smith	BN005

Course Table

Course Code	Course Name
BN001	Certificate in Computer Engineering
BN002	Certificate in Computing
BN005	Certificate in Business Studies

Cells, Rows, Tables and Databases

- Table -- a series of rows describing separate objects or events.
  - (tables are also called relations)

StudentID	StudentName	CourseCode
B00001234	Joe Bloggs	BN002
B00051413	Ann Ryan	BN001
B00012136	John Smith	BN005

Cells, Rows, Tables and Databases

- Row -- a group of values representing a single instance of an entity – an object or event.
  - (rows are also called tuples)

B00001234	Joe Bloggs	BN002

Cells, Rows, Tables and Databases

- Cell -- a single value, an item of data.

B00001234

More on terminology – a database management system (DBMS)

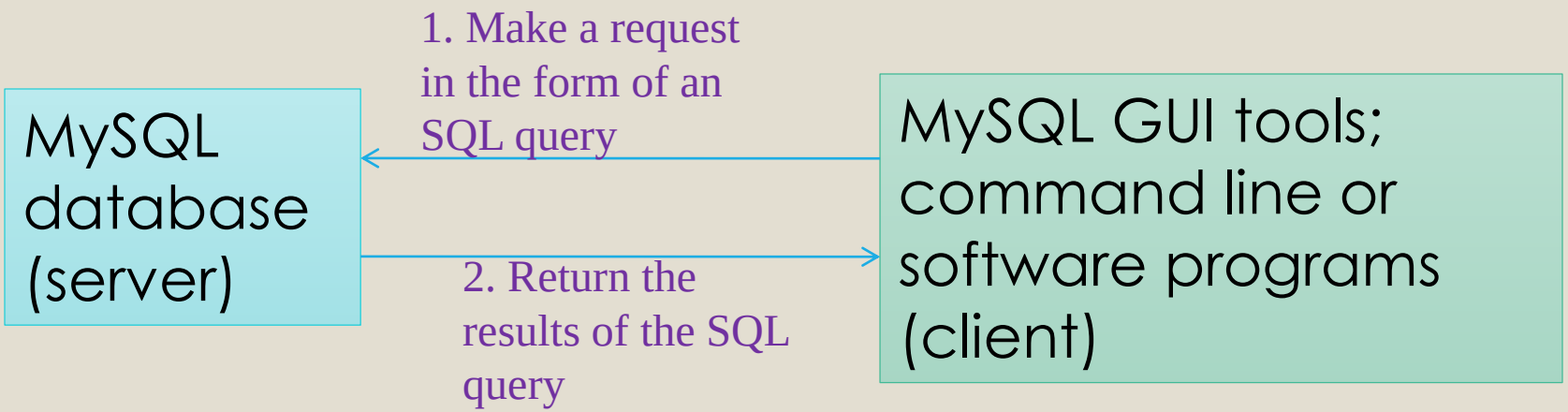
- A collection of programs that enables users to create and maintain a database.
  - Records the structure of the data in the databases (meta data)
  - Handles request from users and programs to:
    - Add data the the database
    - Delete data from the database
    - Update data in the database
    - Query the database (makes requests such as list all books sold by amozon in the last 30 minutes)

CRUD application – Acrostic for an application using a database. The letters stand for Create, Read, Update and Delete

MySQL – the DBMS we will be using in the lab

- MySQL is a Relational Database Management System (RDBMS).
- MySQL is the most popular Open Source database implementation
- MySQL Database Server is very fast, reliable, and easy to use.
- The MySQL Database Software is a client/server system.

MySQL – Client / Server



- Client program can be a MySQL command line client, GUI (Graphical User Interface) client, or a program written in any language such as C, Perl, PHP, Java that has an interface to the MySQL server.

MySQL

- Download from: http://dev.mysql.com/downloads/
- MySQL can be installed as a service which starts automatically when your machine starts up.
  - Can add icons on the desktop for starting and stopping the server.
- Alternatively it can be started from a terminal window.
- Default administrator user name and password is:

User name: root

Password:

Starting MySQL

To start the MySQL server, select start-> program files-> mysql -> mysql server 5.0 ->mysql command line client.

Just hit enter when asked for a password (the password is NULL on installation)

Alternatively, you can run the following from a terminal window:

c:\program files\mysql\mysql server 5.0\bin\mysqld --console

What have you just started?

Answer: A MySQL database **instance**.

- The term instance means a complete database environment, including the RDBMS software, table structures and other objects.
- Each database instance can store multiple databases (also called schemas).
- Each database will contain multiple tables.

Database instance

A MySQL Database **Instance**

RDBMS software

Sales **database** (also called a **schema**)

- Customer **table** holding details of all customers
- Sales order **table** holding details of all sales
- Promotions **table** showing details of all current promotions

and other tables . . . .

Payroll **database** (also called a **schema**)

- Employee **table** holding details of all employees
- Tax_bands **table** holding details of current tax bands and rates

and other tables . . . .

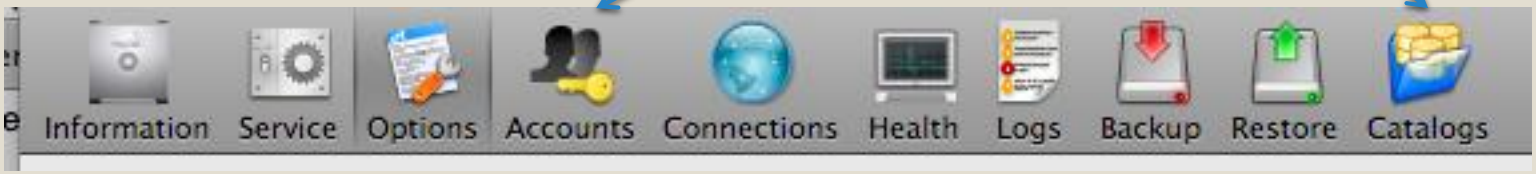
Working with MySQL

Once the server is started, you can interact with it using GUI clients such as:

- MySQL Administrator:- Server Administration to manage the database objects and users.
- MySql Query Browser:- for running SQL queries.
- MySQL workbench:- incorporates both tools above and an EER modelling tool

MySQL Administrator

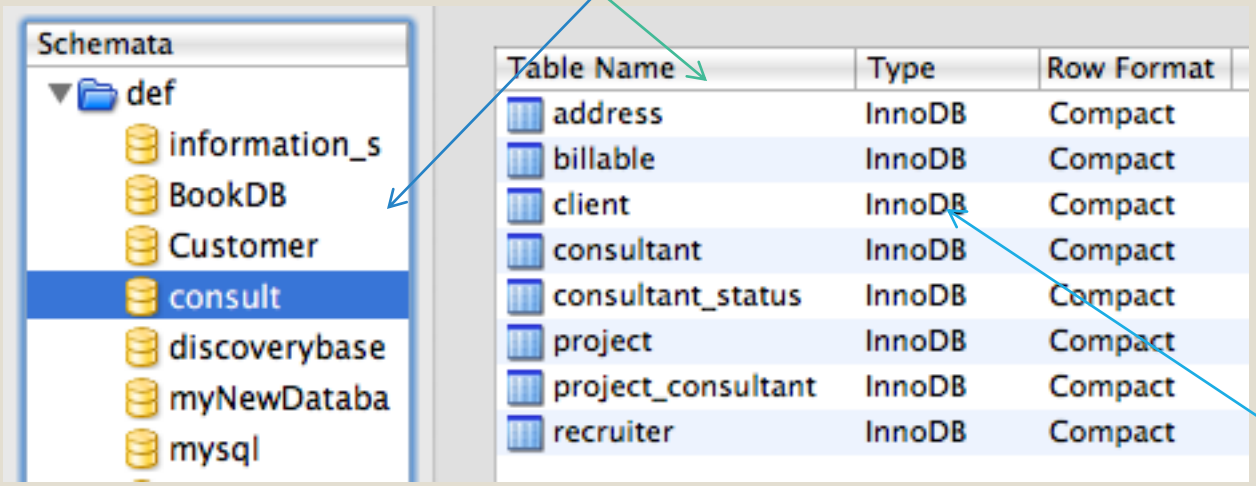
- Used to manage users (accounts) and databases (catalog)



- The following slides will look at
  - Catalogs and
  - Users / Accounts

Catalog

- Under catalog, you can see the databases (schemata) created on this instance. Selecting a database (schema) shows all the tables created as part of that database.



- This interface can be used to create new databases, and create new tables within a database.

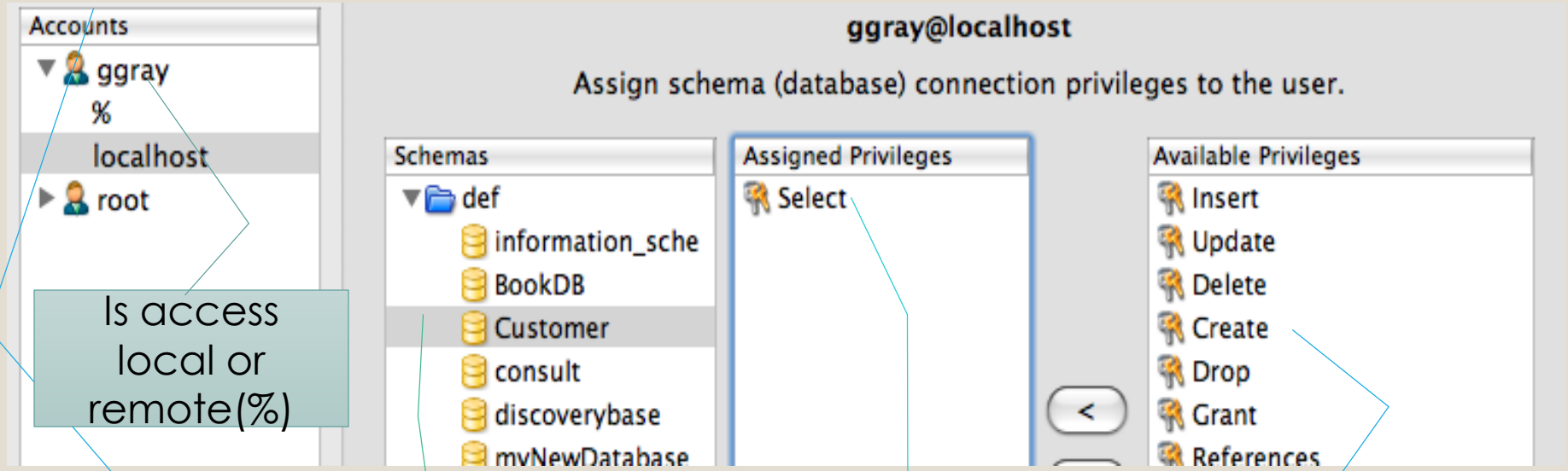
Catalog

- Each table will contain the details of the entity it represents. Below shows one row of data in the consultant table which is part of the consult databases.

※consultant_	status_id	email	password	hourly_rate	billable_hourly_rate	hire_date
1	A	janet.smart@jsfcrudconsultants.com	janet.smart	80.00	120.00	2007-02-

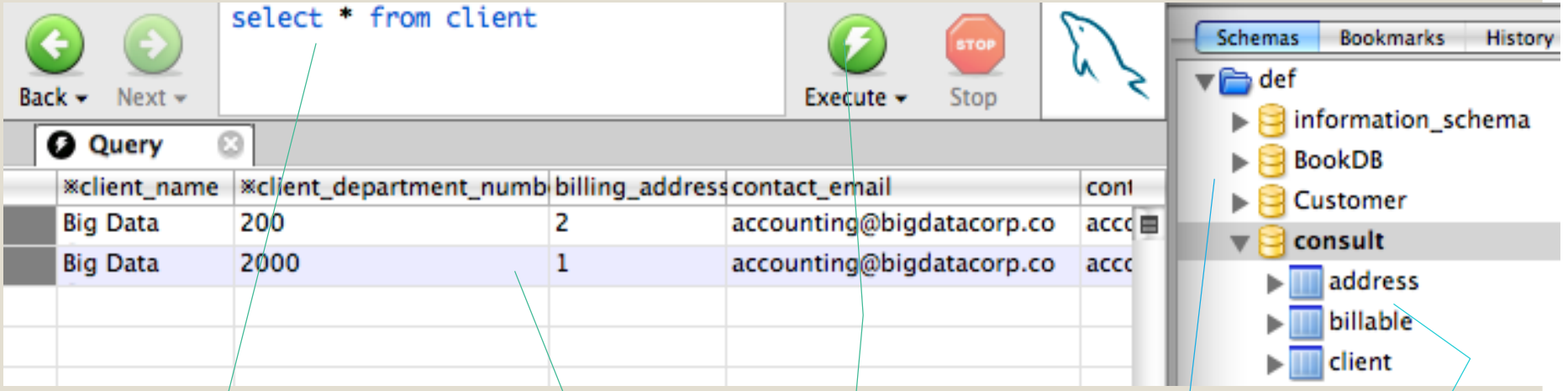
Accounts

- Accounts are used to create valid usernames and passwords to access a database. Each account has a set of privileges associated with it dictating what tables the user can access, and whether they can just view the data, or make changes to the data.



MySQL Query Browser

- SQL queries can be run from MySQL Query Browser.



1. Type in an SQL query

2. Click on Execute

3. Query results are displayed here

Available databases

Tables in the database

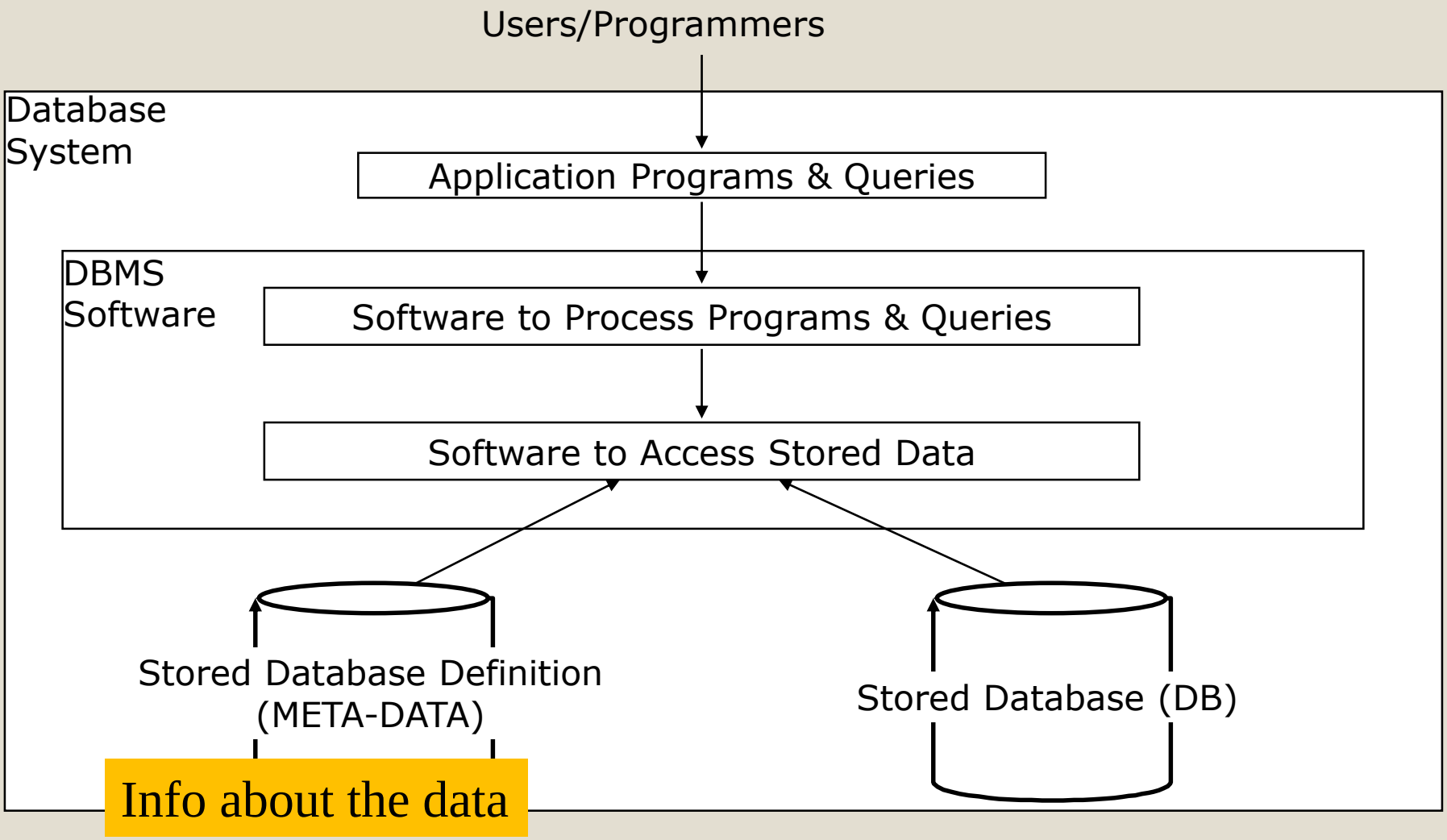
Some initial SQL queries

- Show databases: list all the database the current user has access to
- Use *databaseName*: tells MySQL which database to run the queries against, e.g. Use consult
- Describe *tablename* gives the column names and definitions of a table in the database, e.g. Describe client
- Select * from *tablename* lists all the data in the specified table, e.g. Select * from client

More on terminology – a database system

- The database system is the term given to all of the following together:
  - The DBMS,
  - The data
  - And the programs that access and maintain the data

A database system



Short Video

- Video:

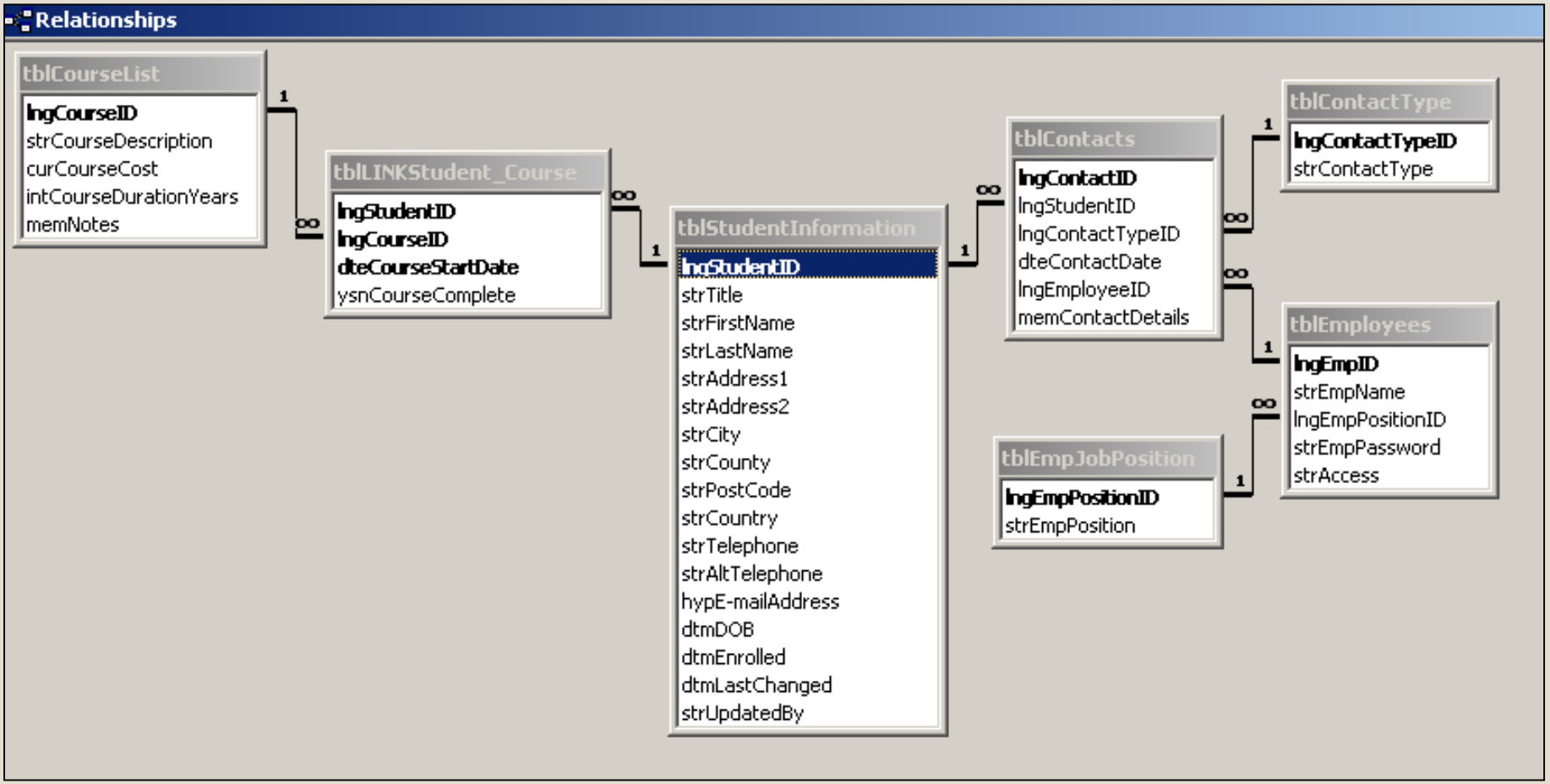
Intro to Databases and SQL

URL: http://www.youtube.com/watch?v=UeJKioNqe5w

Advantages if using a database

- The programmer does not need to know how to store the data.
- The programmer does not need to know where to store the data.
- The programmer does not need to know how to manage the data.

Exercise – Interpret the following:



Summary

- Definitions:
  - Data & sources of data
  - DBMS
  - Database Systems
- MySQL
  - Open source RDBMS
  - Tables organised into schema
  - GUI tools: administrator, query browser, EER
- Job market

Books

- Essential Reading:
- Colin Ritchie - **Relational Database Principles,** Letts Educational

- Recommended Reading:
- R.L. Warrender – **Databases**, Crucial
- McFadden et al, **Modern Database Management**, Addison Wesley
- Elmasri/Navaithe, **Fundamentals of Database Systems**, Addison Wesley
- Date, **An Introduction to Database Systems**, Addision Wesley
- Connolly & Beggs, **Database Systems**, Addison Wesley
- McDermid, Donald C, **Software Engineering for Information Systems,** Blackwell

More on books . . .

- There are many book's in the library covering an introduction to database systems, all of which cover most of the material in this course. Here are details of some of them.

Book	Comment
Watson et al, Data Management: Databases and Organisations John Wiley.	I would recommend this book as a starting point for those new to databases. It gives a comprehensive introduction to the topic, but lacks detail in sections.

McFadden et al, Modern Database Management Addison Wesley	**These three books give the best coverage of the topics on the course.**
Colin Ritchie, Relational Database Principles, Continuum International Publishing Group	
Connolly & Begg, Database Systems, Pearson Education	

More on books

Elmasri/Navaithe, Fundamental of Database Systems, Addison Wesley	For those with previous experience in databases and want to extent their knowledge, this book goes into more detail than the previous three books, and also covers relational algebra, the mathematical theory of relational databases.
Date, An Introduction to Database Systems, Addison Wesley	Date is probably the best know database book, and has been for many years. It is suitable if you want to extent your knowledge beyond the scope of this course.