

INF1343, Winter 2012

# Data Modeling and Database Design

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# **Week 1**

# Introducing Databases the Relational Data Model and SQL

# What is a “Database”?

“an organized collection of data”  
(digital, managed with software)

↑  
“DBMS”



Alice



information



Bob



Alice



information



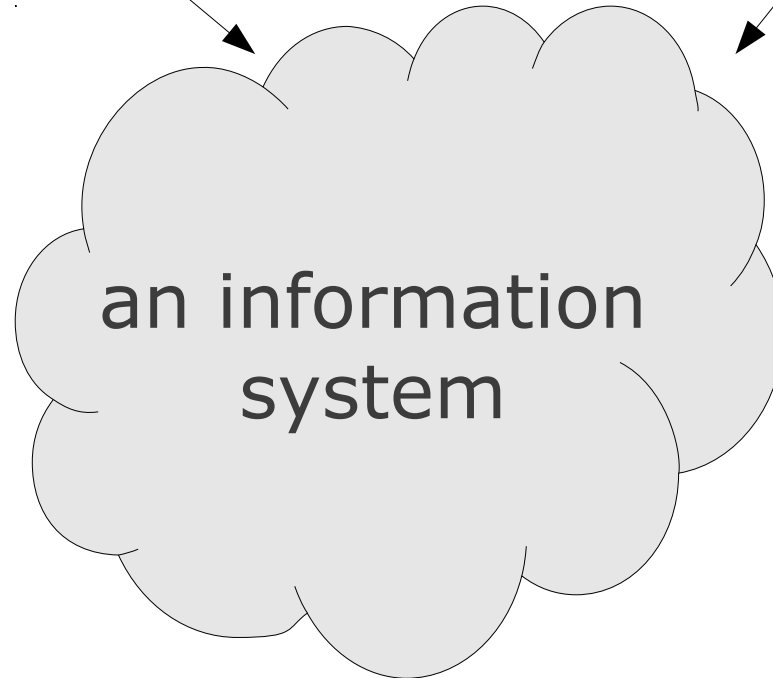
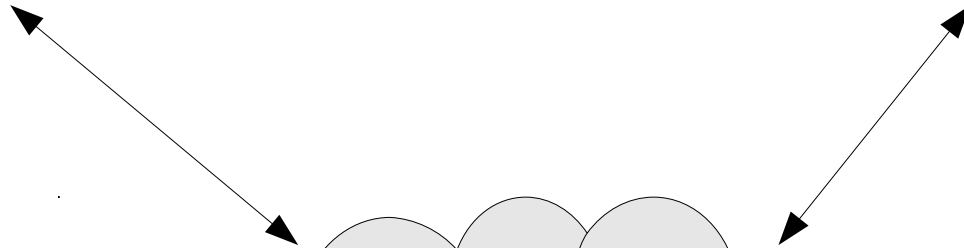
Bob



Alice



Bob

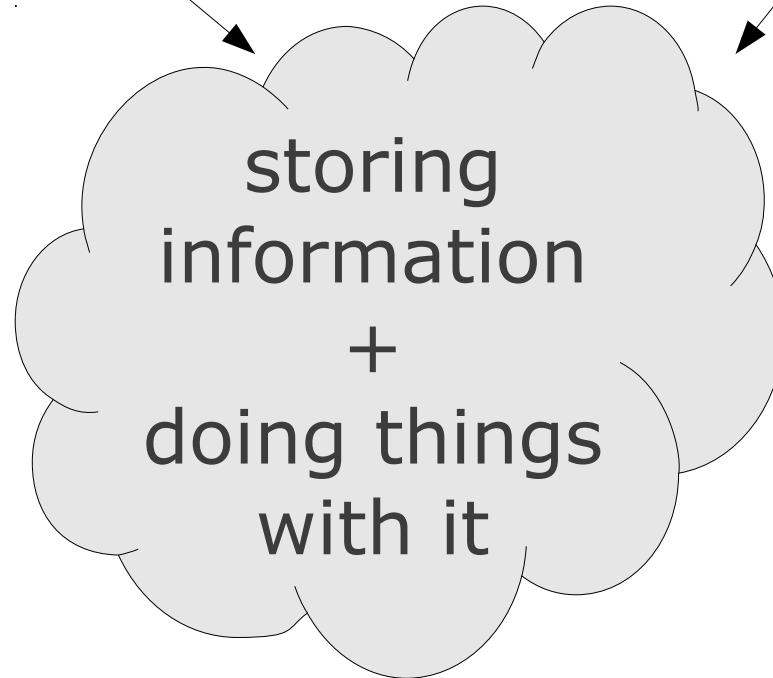




Alice

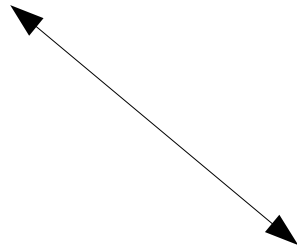


Bob

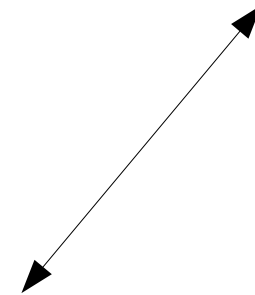




Alice



Bob

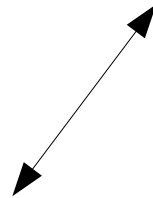


application software



database

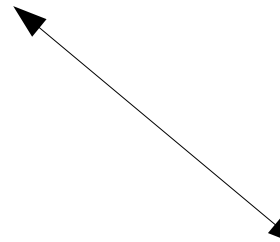
"persistent storage"



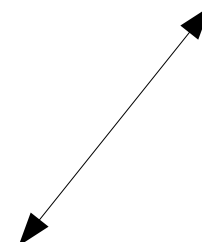




Alice

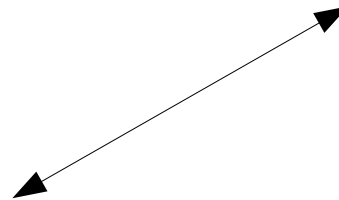


Bob



database

"persistent storage"



# What is Data?

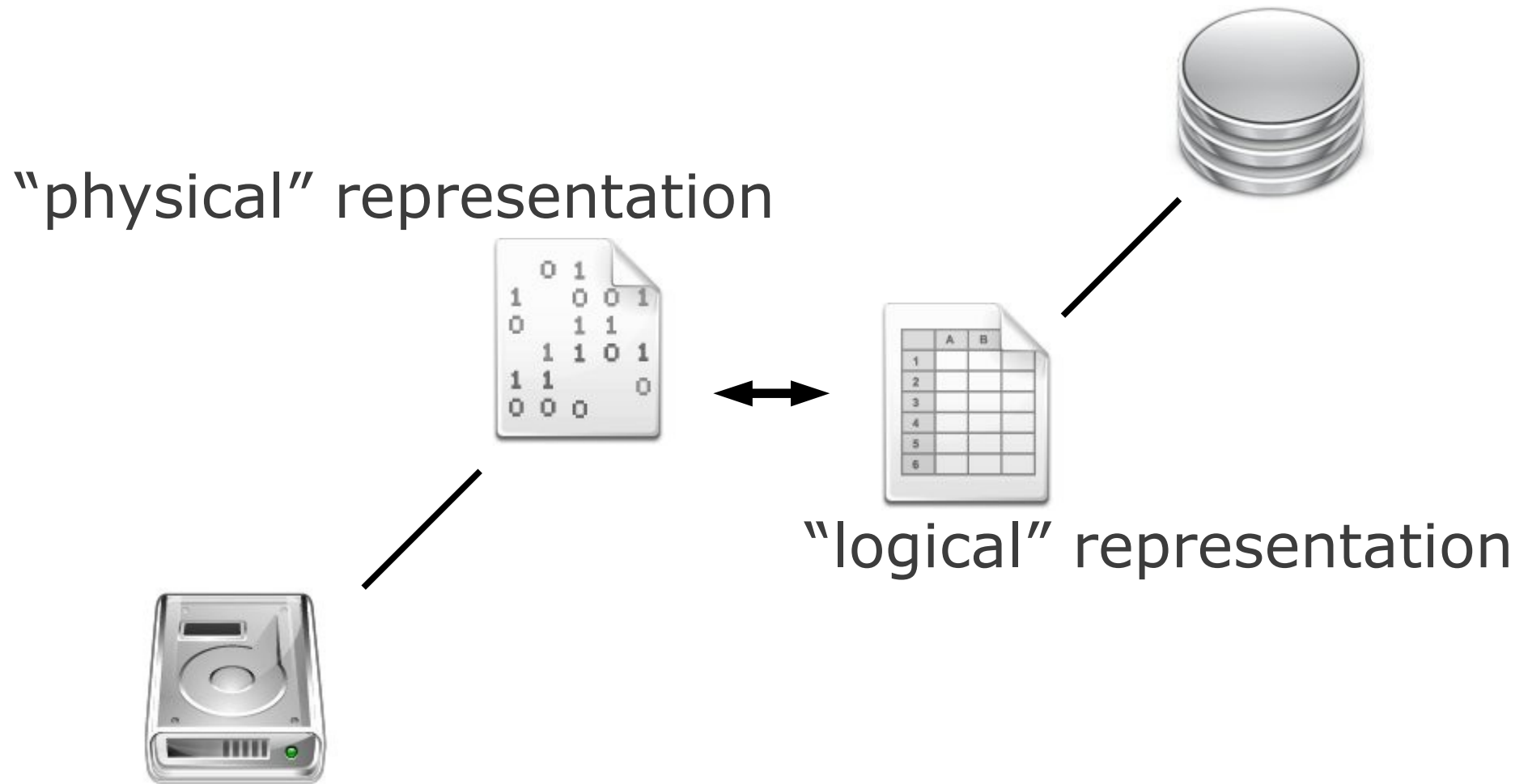
Knowledge

Information

Data



# Database Elements



# Basic Data Types

## **Numbers**

42, 2.7,  $7.2 \times 10^{-19}$ , 879284337621

## **Text “Strings”**

“Yoda”, “Chewbacca”, “A long time ago in a galaxy far, far away....”

# More Complex Data

## **Time**

“Sept. 7, 2011” (2011-09-07)

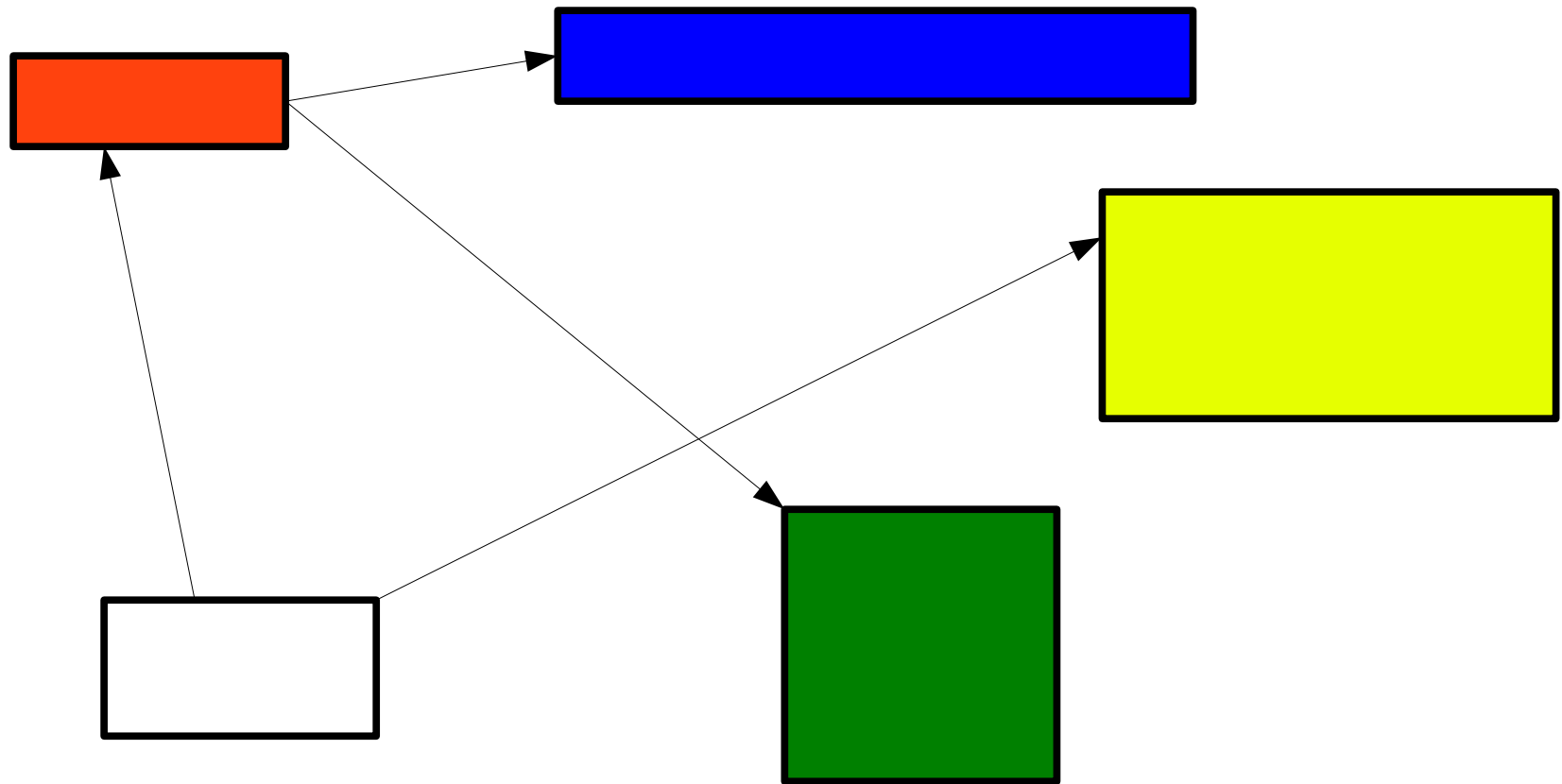
## **Binary “Blobs”**

contents of an image file

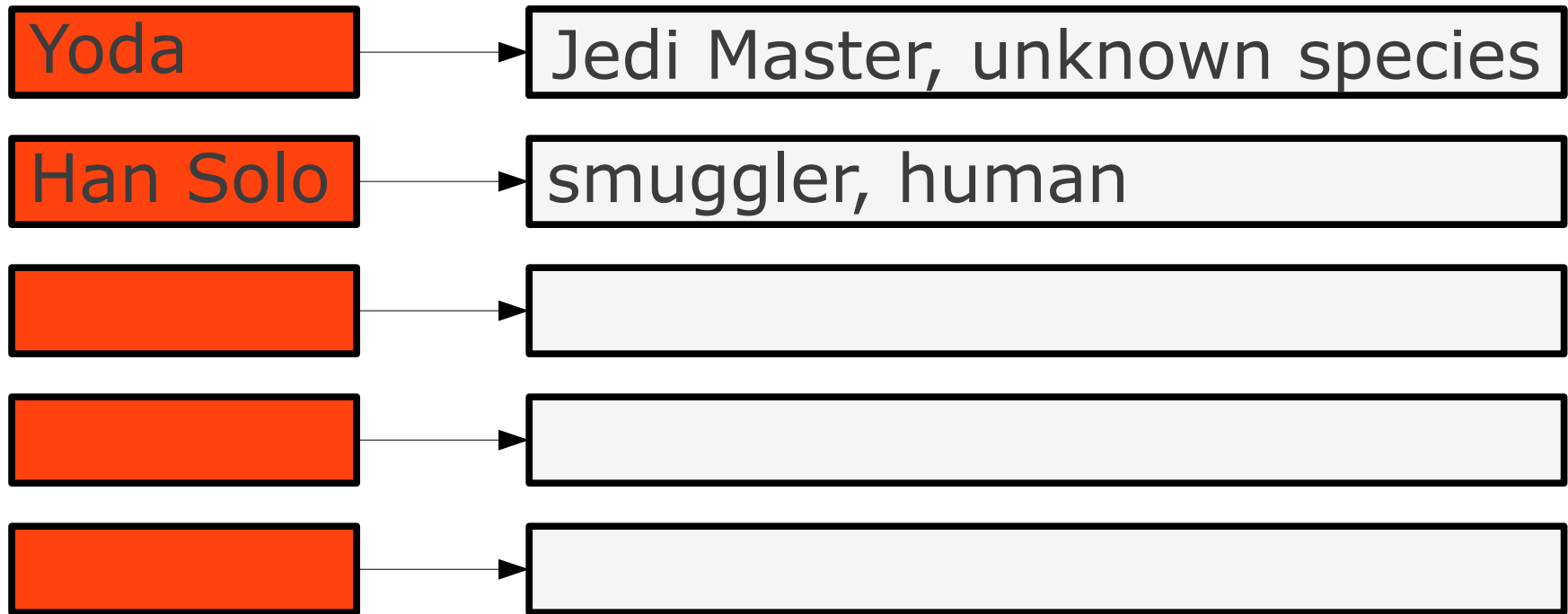
## **Geometric**

a line, a polygon

# Databases Models

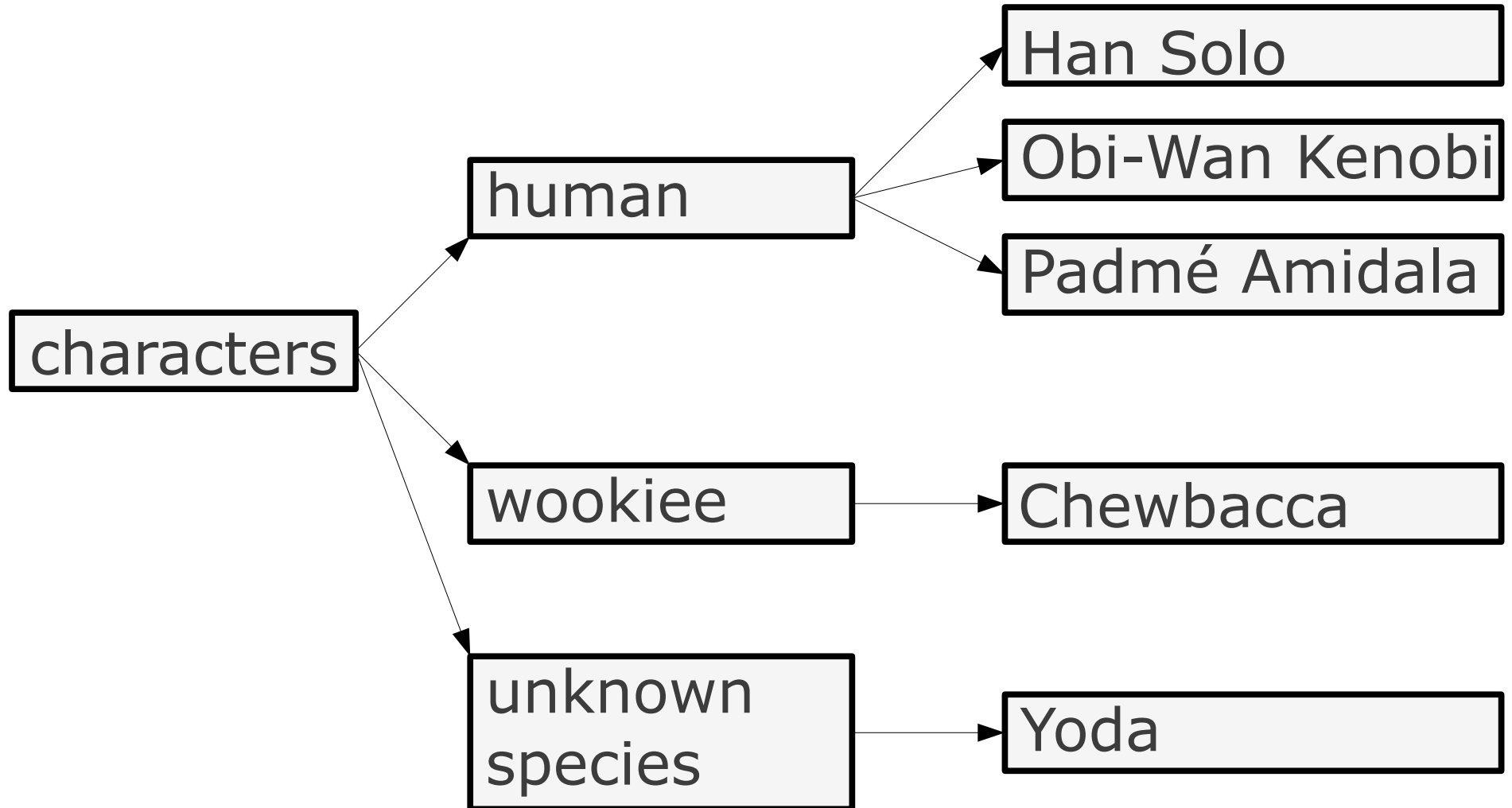


# Key-Value

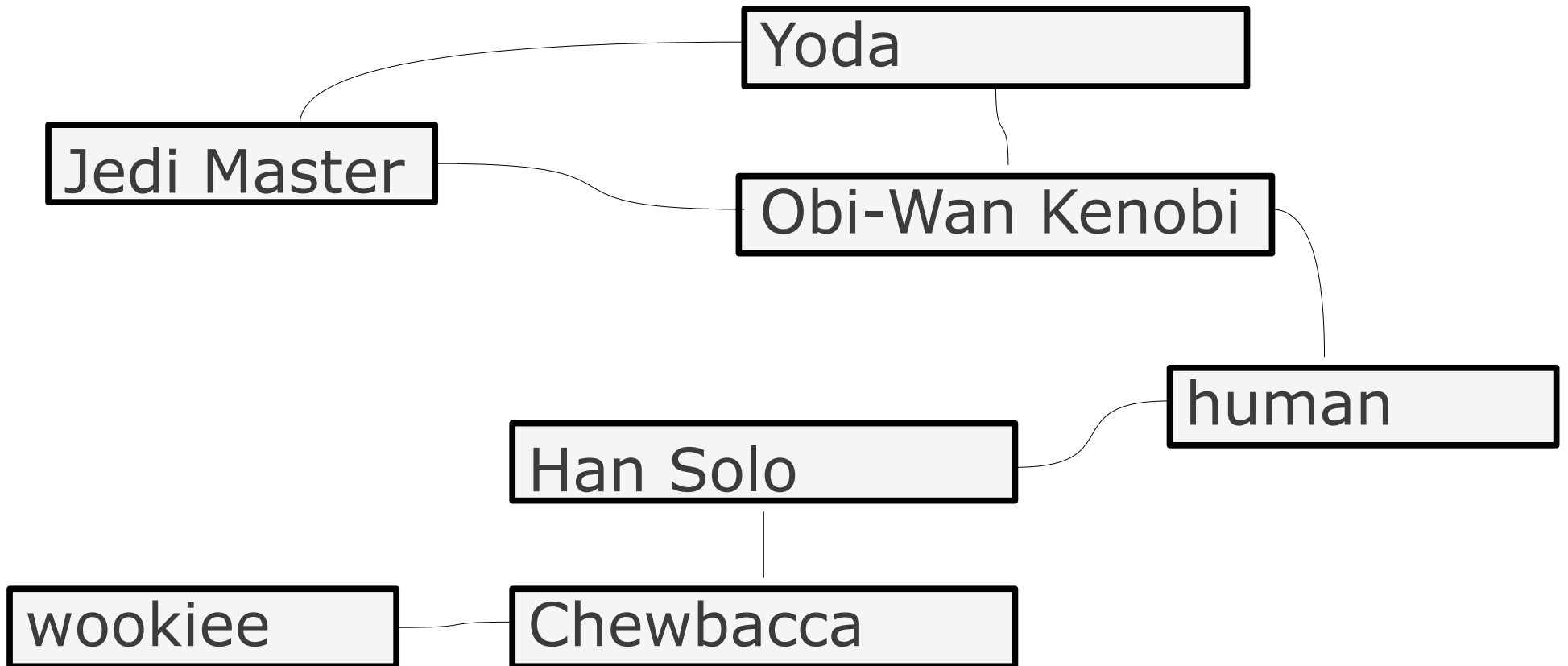




# Hierarchical



# Network



# Relational

A notion of a “relation”



not to be  
confused with  
a “relationship”

# A Relation

("Yoda", "Jedi Master")

# A Relation

("Yoda", "Jedi Master",  
"unknown species")

# A Relation

("Yoda", "Jedi Master", "unknown species")

("San Solo", "smuggler", "Human")

("Padmé Amidala", "queen", "Human")

("Jabba", "crime lord", "Hutt")

("Jar Jar Binks", "senator", "Gungan")

# Another Relation

("Human", "humanoid", 1.7)

("Gungan", "humanoid", 1.89)

("Hutt", "gastropod", 3.5)

("Ewok", "furry biped", 0.9)

# And Another

("humanoid", 2)

("gastropod", 0)



# Tabular Form

species

Human	humanoid	1.7
Hutt	gastropod	3.5

persona

Jabba	Hutt
Obiwan Kenobi	Human

species\_type

gastropod	0
humanoid	2

# Tabular Form

species

Human	humanoid	1.7
Hutt	gastropod	3.5

persona

Jabba	Hutt
Obi-Wan Kenobi	Human

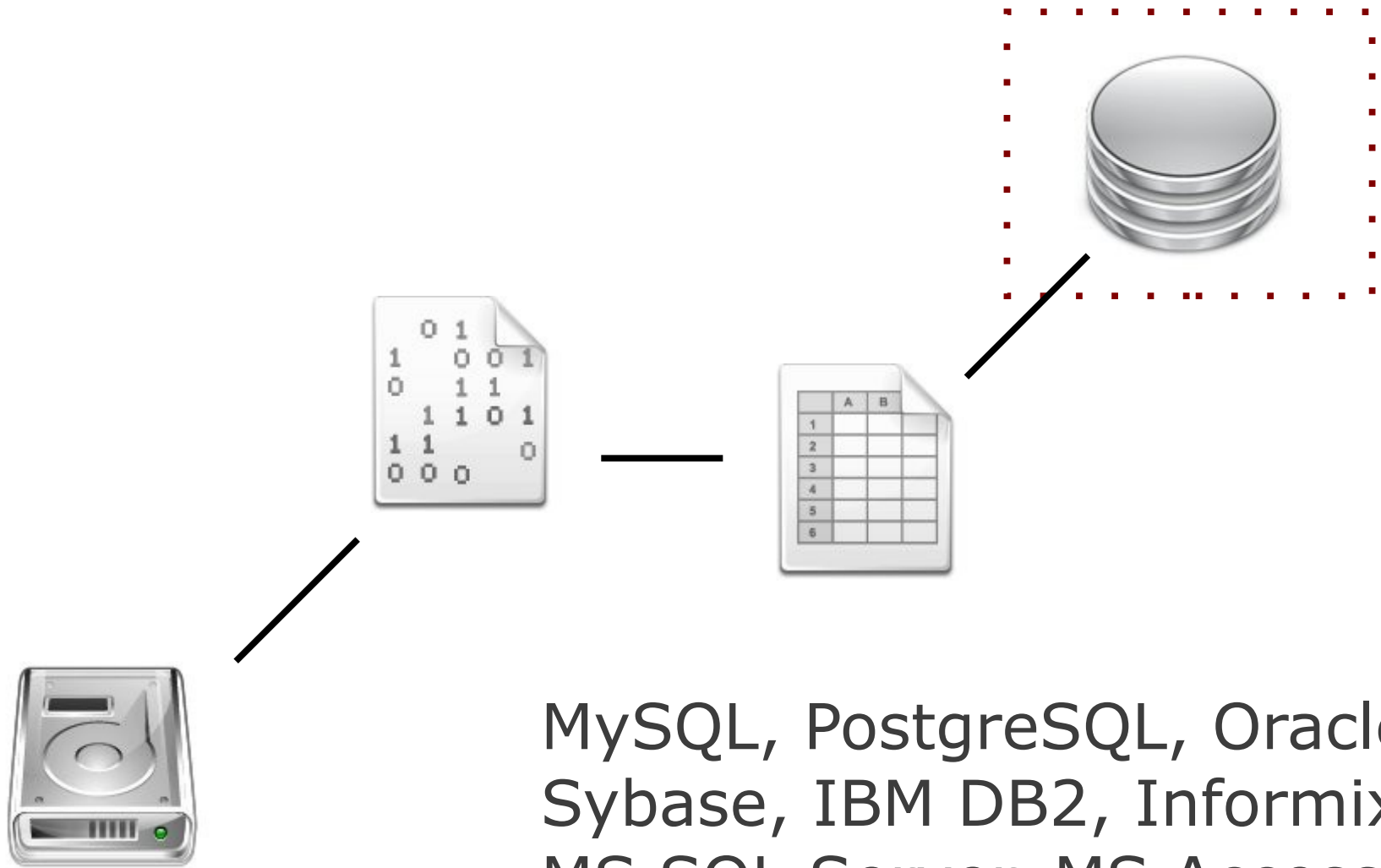
species\_type

gastropod	0
humanoid	2

# Relational Data Modeling

Finding a proper relational  
representation for data

# RDBMS



MySQL, PostgreSQL, Oracle,  
Sybase, IBM DB2, Informix,  
MS SQL Server, MS Access\*

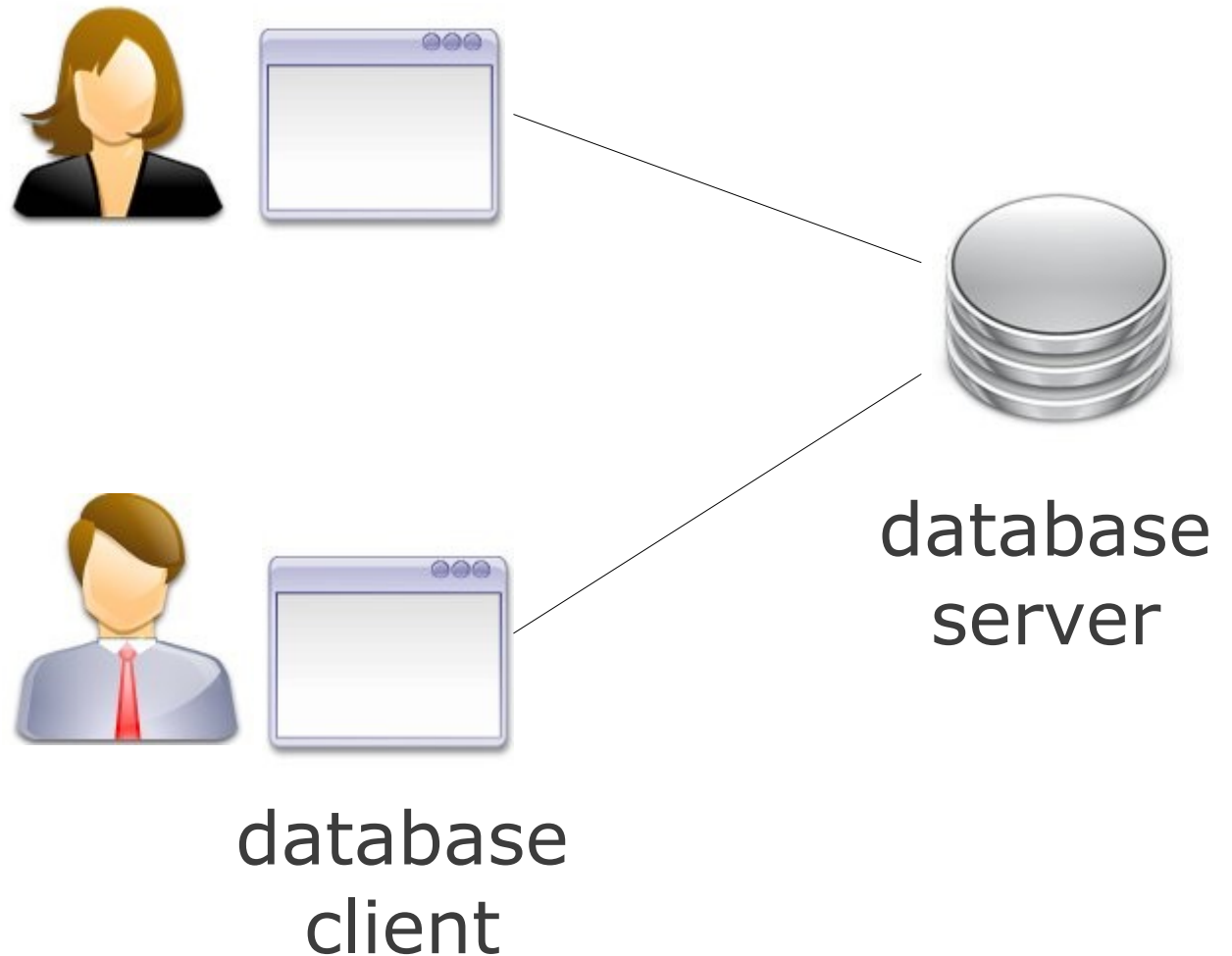
# Accessing a Database



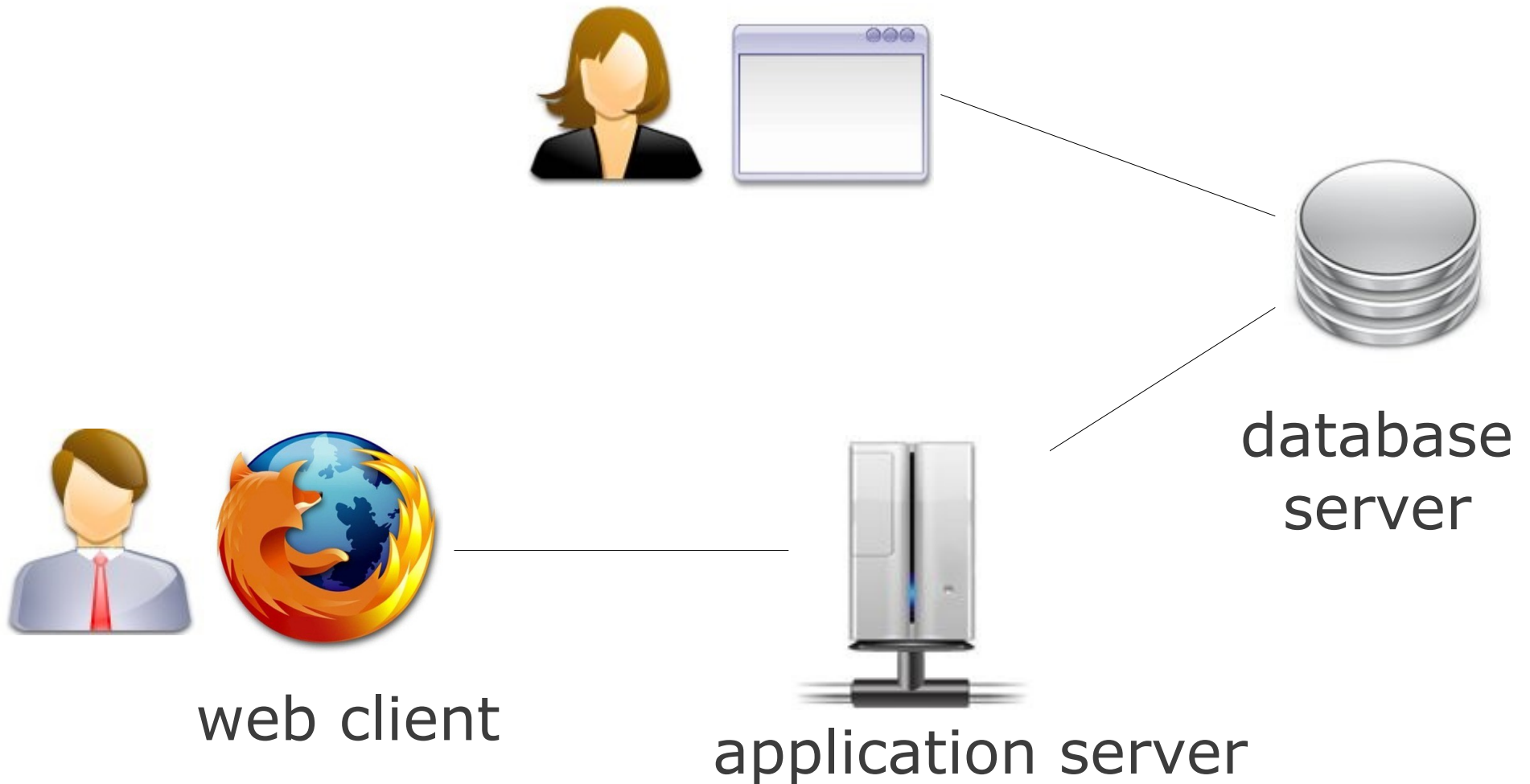
# Built-in GUI



# Networked Client

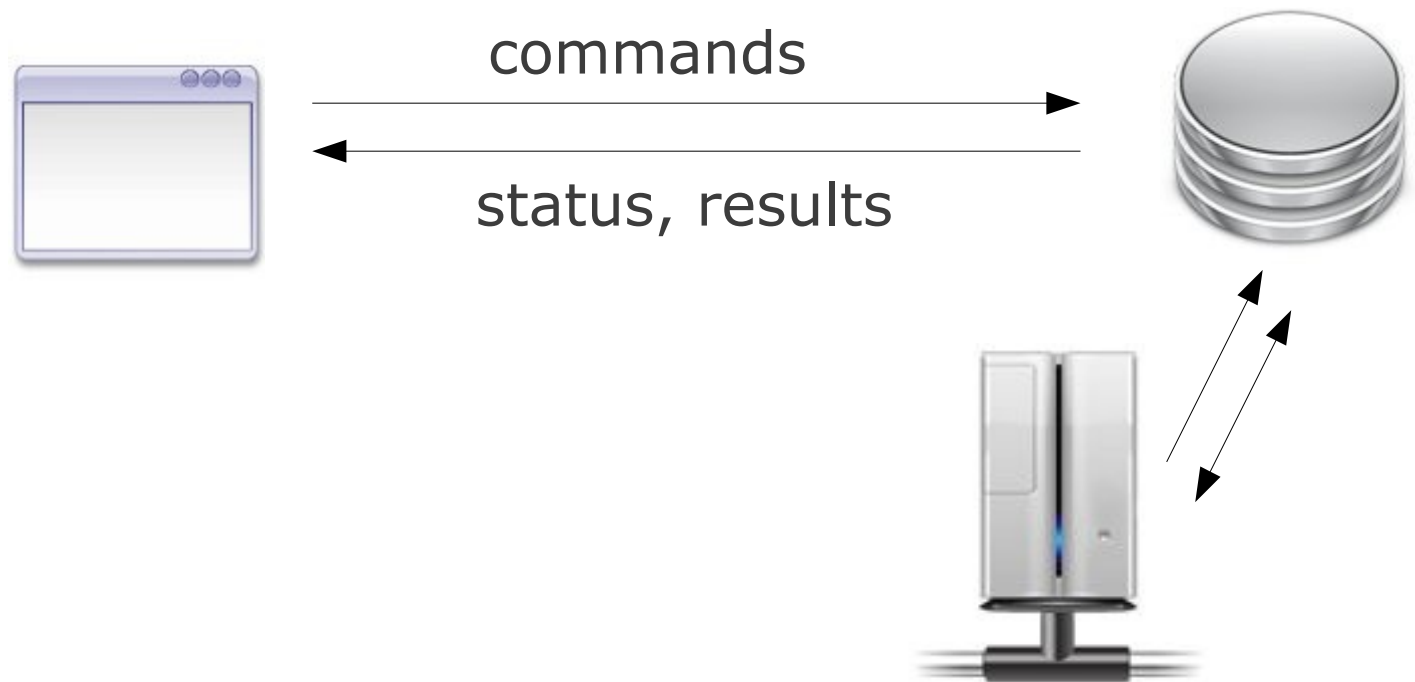


# A 3-Tier System





# A Query Language



# Structured Query Language

(Some people say “Sequel”)

# An SQL Statement

```
select name, occupation  
from persona  
where species="Wookiee";
```

# An SQL Statement

```
select name, occupation  
from persona  
where species="Wookiee";
```

## persona

name	occupation	species
Obi-Wan Kenobi	Jedi Master	Human
Yoda	Jedi Master	
Jabba	crime lord	Human
Chewbacca	co-pilot	Wookiee
Luke Skywalker	Jedi Knight	Human
Han Solo	smuggler	Human
Padmé Amidala	queen	Human
Leia Organa	princess	Human
R2-D2	astromech	droid
C-3P0	protocol droid	droid
...	...	...

# MySQL Workbench

**<http://wb.mysql.com/>**  
(also available in this lab)

Workbench Central



# Welcome to MySQL Workbench

➔ **What's New in This Release?**  
Read about all changes in this MySQL Workbench release.



MySQL Doc Library



MySQL Bug Reporter



Workbench Team Blog



Planet MySQL



Workbench Forums

Workspace



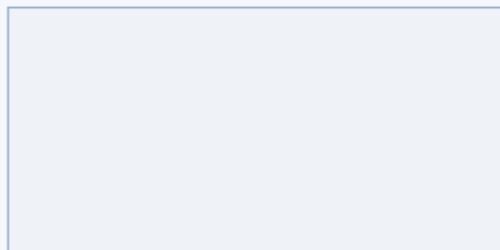
## SQL Development

Connect to existing databases and run SQL Queries, SQL scripts, edit data and manage database objects.



### Open Connection to Start Querying

Or click a DB connection to open the SQL Editor.



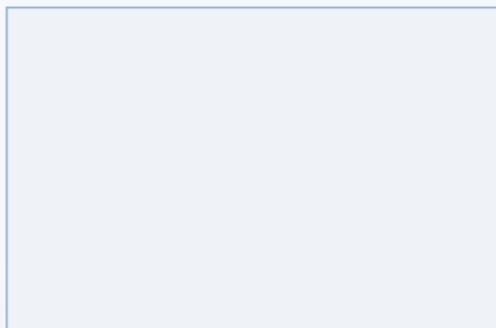
## Data Modeling

Create and manage models, forward & reverse engineer, compare and synchronize schemas, report.



### Open Existing EER Model

Or select a model to open or click here to browse.



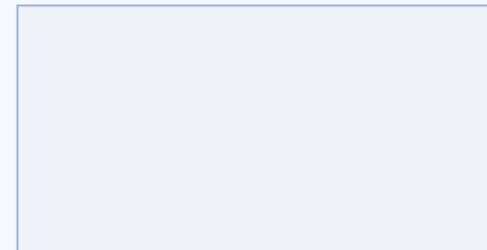
## Server Administration

Configure your database server, setup user accounts, browse status variables and server logs.



### Server Administration

Or click to manage a database server instance.



### New Connection

Add a new database connection for querying.



### Edit Table Data

Select a connection and schema table to edit.



### Edit SQL Script

Open an existing SQL Script file for editing.



### Manage Connections

Modify connection settings or add connections.



### Create New EER Model

Create a new EER Model from scratch.



### Create EER Model From Existing Database

Create by connecting and reverse engineering.



### Create EER Model From SQL Script

Import an existing SQL file.



### New Server Instance

Register a new server instance to manage.



### Manage Import / Export

Create a dump file or restore data from a file.



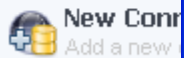
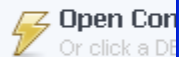
### Manage Security

Manage user accounts and assign privileges.



### Manage Server Instances

Add, delete and update server instance settings.



## Setup New Connection

Connection Name:  Type a name for the connectionConnection Method:  Method to use to connect to the RDBMSParameters  Advanced Hostname:  Port:  Name or IP address of the server host - TCP/IP portUsername:  Name of the user to connect with.Password:   The user's password.Default Schema:  The schema that will be used as default schema **Create EER Model From Existing Database**  
Create by connecting and reverse engineering. **Create EER Model From SQL Script**  
Import an existing SQL file. **Manage Security**  
Manage user accounts and assign privileges. **Manage Server Instances**  
Add, delete and update server instance settings.



**Setup New Connection**

Connection Name:  Type a name for the connection

Connection Method: Standard (TCP/IP) Method to use to connect to the RDBMS

Parameters **Advanced**

**r2.ischool.utoronto.ca**

Hostname:  Port:  Name or IP address of the server host - TCP/IP port

Username:  Name of the user to connect with.

Password:   The user's password.

Default Schema:  The schema that will be used as default schema

**your database username  
from the handout  
(NOT your utoid)**

Workbench Central



# Welcome to MySQL Workbench

➔ **What's New in This Release?**  
Read about all changes in this MySQL Workbench release.



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MySQL Bug Reporter



Workbench Team Blog



Planet MySQL



Workbench Forums

Workspace



## SQL Development

Connect to existing databases and run SQL Queries, SQL scripts, edit data and manage database objects.



### Open Connection to Start Querying

Or click a DB connection to open the SQL Editor.



r2

User: okenobi Host: r2.ischool.utoronto.c...



## Data Modeling

Create and manage models, forward & reverse engineer, compare and synchronize schemas, report.



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Or select a model to open or click here to browse.



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Workspace



SQL Developer

Connect to existing databases, SQL Queries, SQL scripts, edit, manage database objects.



Open Connection to Start Query  
Or click a DB connection to open the SQL Editor



r2  
User: okenobi Host: r2.ischool.utoronto.ca

Connect to MySQL Server



Please enter password for the following service:

Service: Mysql@r2.ischool.utoronto.ca:3306

User: okenobi

Password:

Save password in vault

OK

Cancel

Server Administration

Configure your database server, setup user accounts, browse status variables and server logs.

Server Administration

click to manage a database server instance.

New Connection

Add a new database connection for querying.

Edit Table Data

Select a connection and schema table to edit.

Edit SQL Script

Open an existing SQL Script file for editing.

Manage Connections

Modify connection settings or add connections.

Create New EER Model

Create a new EER Model from scratch.

Create EER Model From Existing Database

Create by reverse engineering an existing database.

Create EER Model From SQL Script

Import an existing SQL file.

New Server Instance

Register a new server instance to manage.

Manage Import / Export

Create, import and export data.

Manage Security

Manage users, accounts and assign privileges.

Manage Server Instances

Add, delete and update server instance settings.

**your database password from the handout**



## Object Browser

Default: 

- diveshop
  - Tables
  - Views
  - Routines
- okenobi
- starwars

## Scratch

1

```
show databases;
```

## Overview

## Output

## Snippets

**diveshop**  
MySQL Schema**okenobi**  
MySQL Schema**starwars**  
MySQL Schema

Tables (0 items)

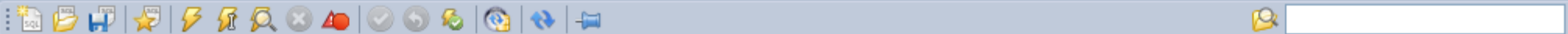
Add Table

Views (0 items)

Add View

Routines (0 items)

Add Routine



Home SQL Editor (r2) x

Object Browser

Default: [dropdown]

- [-] okenobi
  - [+] Tables
  - [+] Views
  - [+] Routines

Scratch x

```
1 • show databases;
```

Overview Output Snippets Result (1) x

[Navigation icons] [Search icon] [Input field] Fetched 4 records. Duration: 0.000 sec, fetched in: 0.000 sec [Pin icon] [Refresh icon]

Database
▶ information_schema
diveshop
okenobi
starwars



Home SQL Editor (r2) x

## Object Browser

Default: 

- diveshop
  - Tables
  - Views
  - Routines
- okenobi
- starwars

Scratch x

```
1 • show databases;  
2 • use starwars;
```

Overview

Output

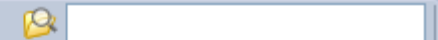
Snippets

Result (1) x



Fetched 4 records. Duration: 0.000 sec, fetched in: 0.000 sec

Database
information_schema
diveshop
okenobi
starwars



Home SQL Editor (r2) x

## Object Browser

Default: starwars

- diveshop
  - Tables
  - Views
  - Routines
- okenobi
- starwars

Scratch x

```
1 • show databases;  
2 • use starwars;
```

Overview

Output

Snippets



Show output from:

Actions

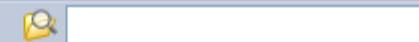
Clear

	Time	Action	Message	Duration / Fetch
1	12:46:50	show databases	4 row(s) returned	0.000 sec / 0.000 sec
2	12:47:36	use starwars	0 row(s) affected	0.000 sec

Event 2 of type Info at 12:47:36

Action: use starwars

Message: 0 row(s) affected



Home SQL Editor (r2) x

## Object Browser

Default: starwars

- diveshop
  - Tables
  - Views
  - Routines
- okenobi
- starwars

Scratch x

```
1 show databases;  
2 use starwars;  
3 show tables;  
4 describe world;  
5 select world_name from world;  
6 select * from world where world_name="Tatooine";  
7
```

Overview

Output

Snippets

Result (1) x



Fetched 1 records. Duration: 0.000 sec, fetched in: 0.000 sec

	world_name	region	distance_to_core	coordinates	diameter	percent_water	population
▶	Tatooine	Outer Rim	43000	R-16	11456	1	200000



# An SQL Statement

```
select name, occupation  
from persona  
where species = "Wookiee";
```

keywords

— not case-sensitive (de facto)

identifiers

— often are case sensitive

strings

— depends on configuration

# An SQL Statement

**so:**

select = SELECT\* = seLecT\*\*

from = FROM\* = From\*\*

\* some people prefer this

\*\* ugly, don't do this

**but:**

persona ≠ PERSONA ≠ Persona

"Wookiee" ≠ "wookiee" (sometimes)

# Quotes

## Text Strings

must always be quoted

## Identifiers

must be when the happen to be keywords (use **backticks**: ``...``)

## Quote Types

`"..."` or `'...'`, not `"..."` or `'...'`  
( `"` must be closed by `"`, `'` by `'` )

# The Semi-Colon

Don't forget the semi-colon;

# This Course

<http://takhteyev.org/courses/12F/inf1343/>

# Office Hours

## **Time:**

Mondays, 14:00–15:00

(Not today, though.)

Or by appointment.

## **Place:**

Room 328 in **iSouth**

(45 Wilcocks St.)

# Contact

## **Email:**

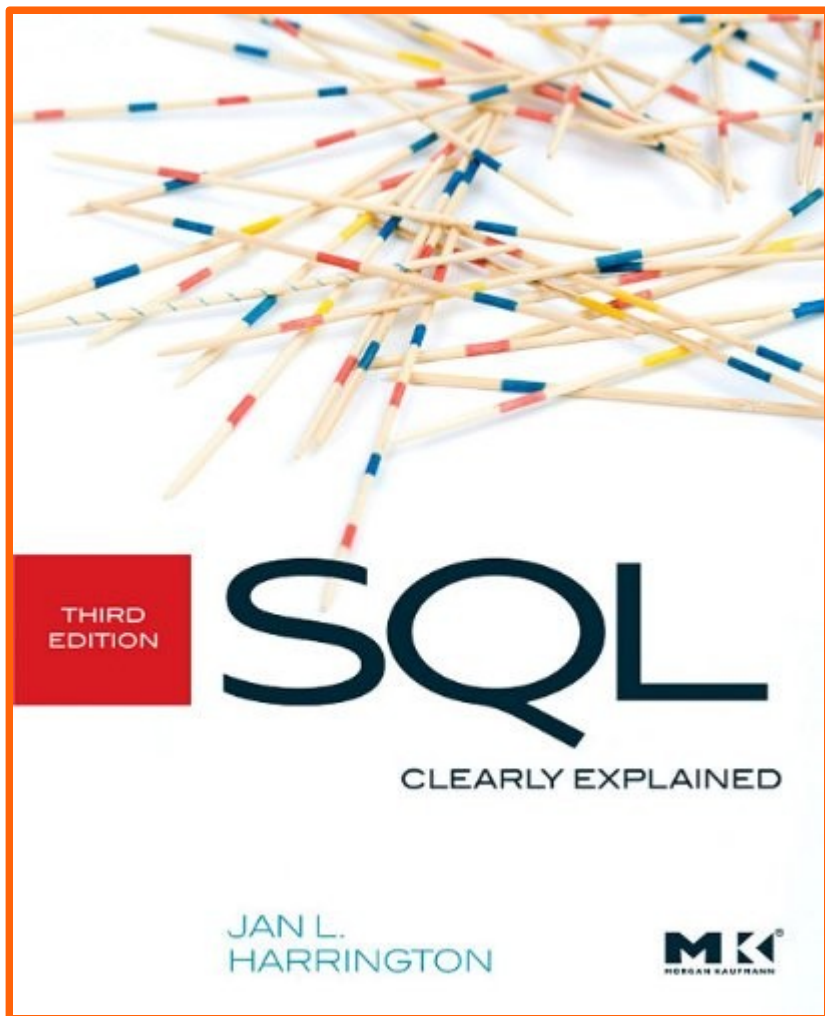
Use the Q&A system if possible.  
If emailing, use UToronto mail  
Put "INF1343" in the subject.  
Expect 2 day turn-around.

# The Q&A System

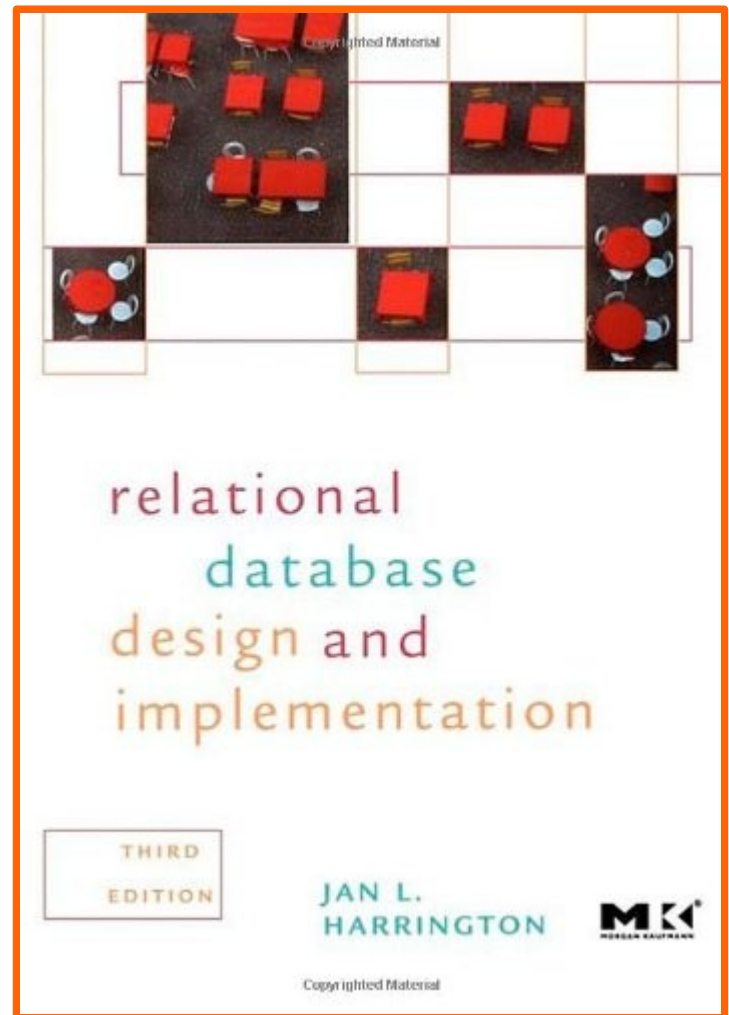
<http://inf1343.ischool.utoronto.ca/>

- use for all non-private questions
- feel free to **answer** too!





"SQL"



"RDD"

# The Course Outline

# Grading

Exercises & Quizzes

Final Project (2 deliverables)

The Final Exam

“Standard” grading  
vs “the Project Option”

Questions?