

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



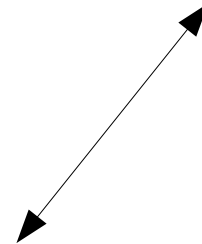
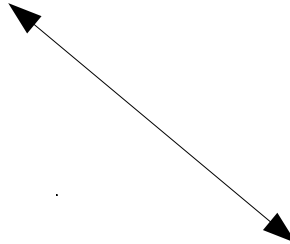
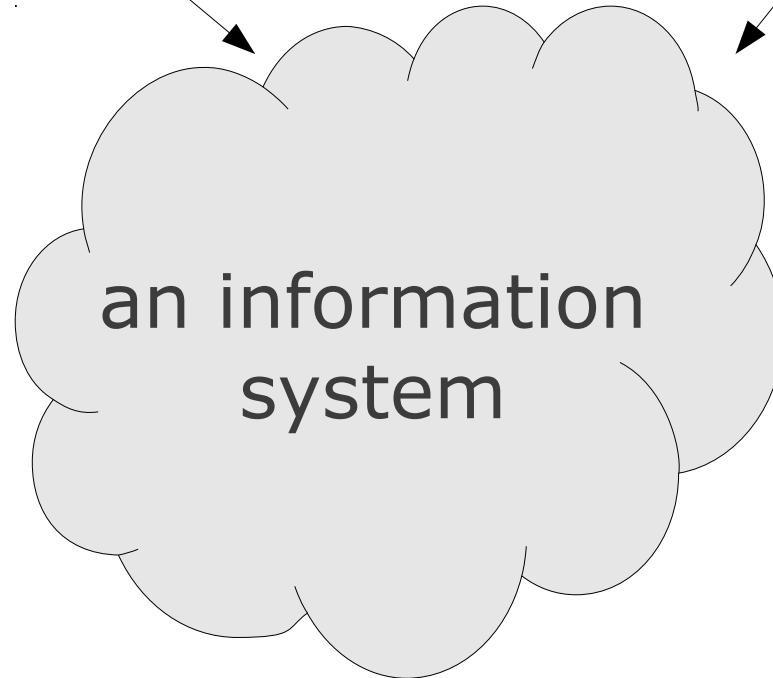
Bob



Alice



Bob

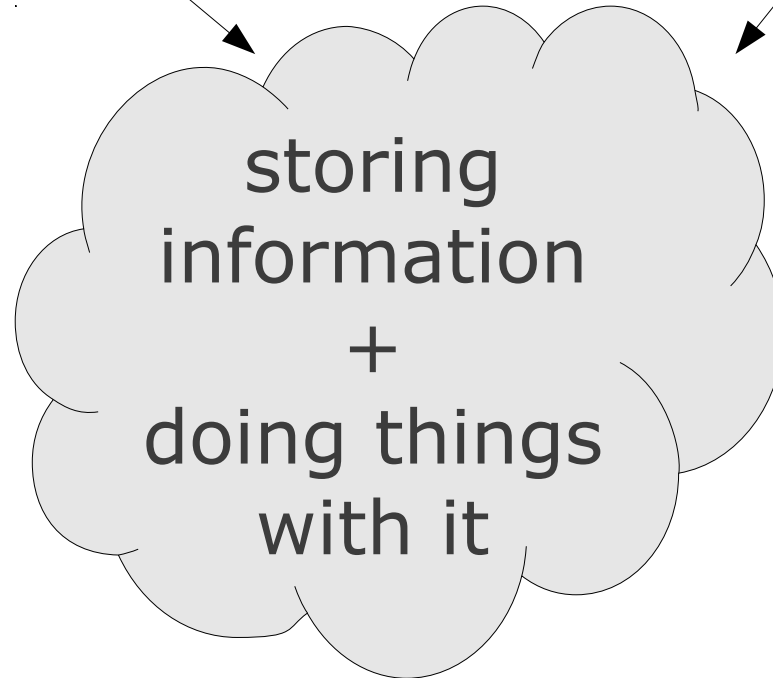
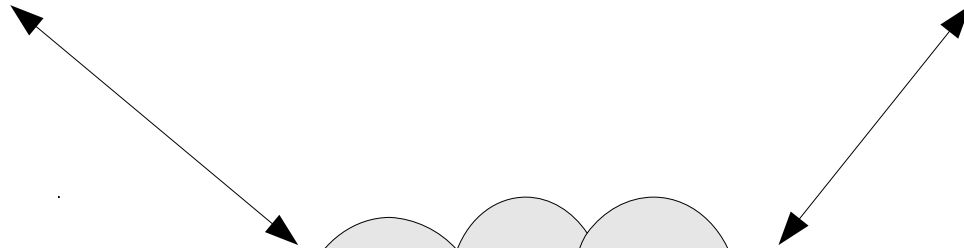




Alice

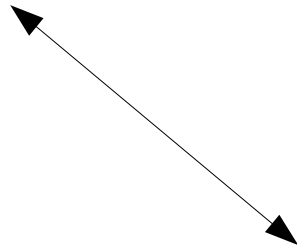


Bob

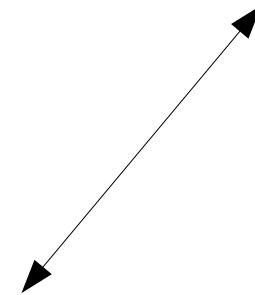




Alice



Bob

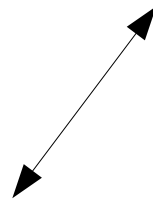


application software



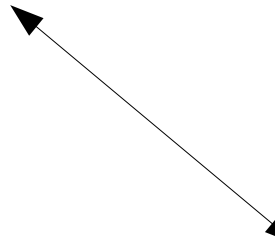
database

"persistent storage"

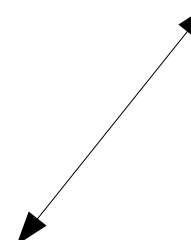




Alice

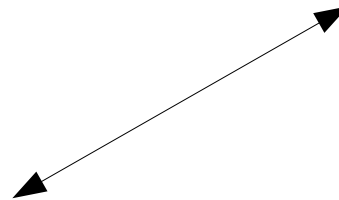


Bob



database

"persistent storage"



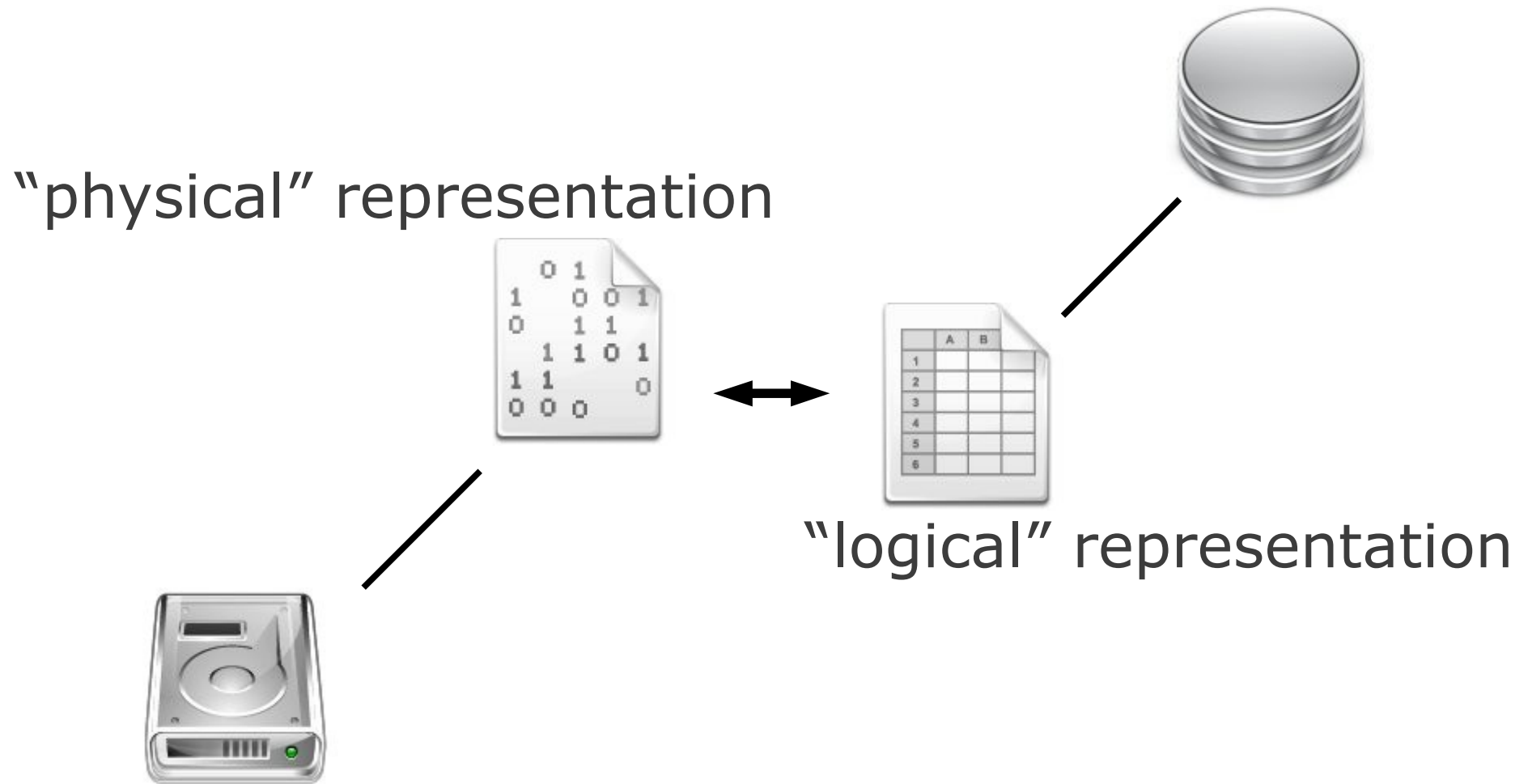
What is Data?

Knowledge

Information

Data

Database Elements



Basic Data Types

Numbers

42, 2.7, 7.2×10^{-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)

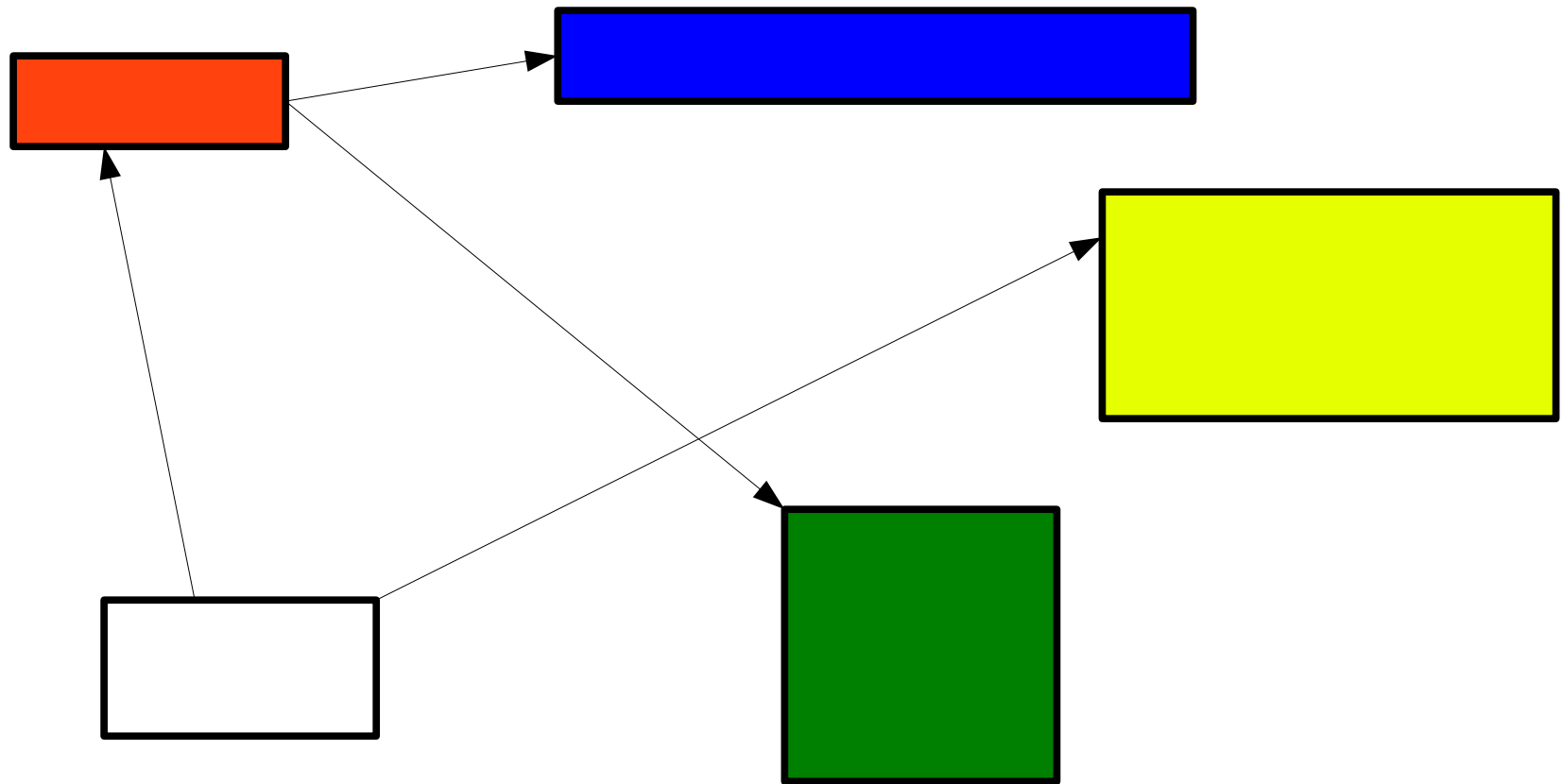
Binary “Blobs”

contents of an image file

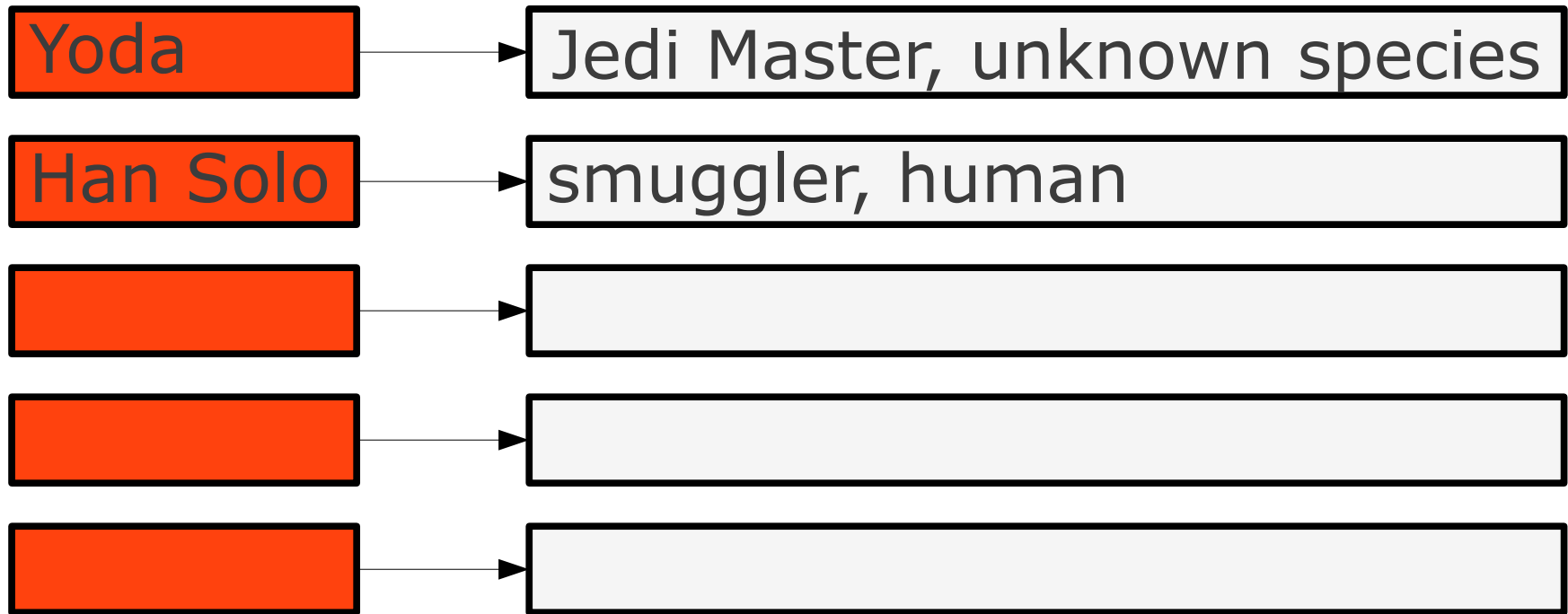
Geometric

a line, a polygon

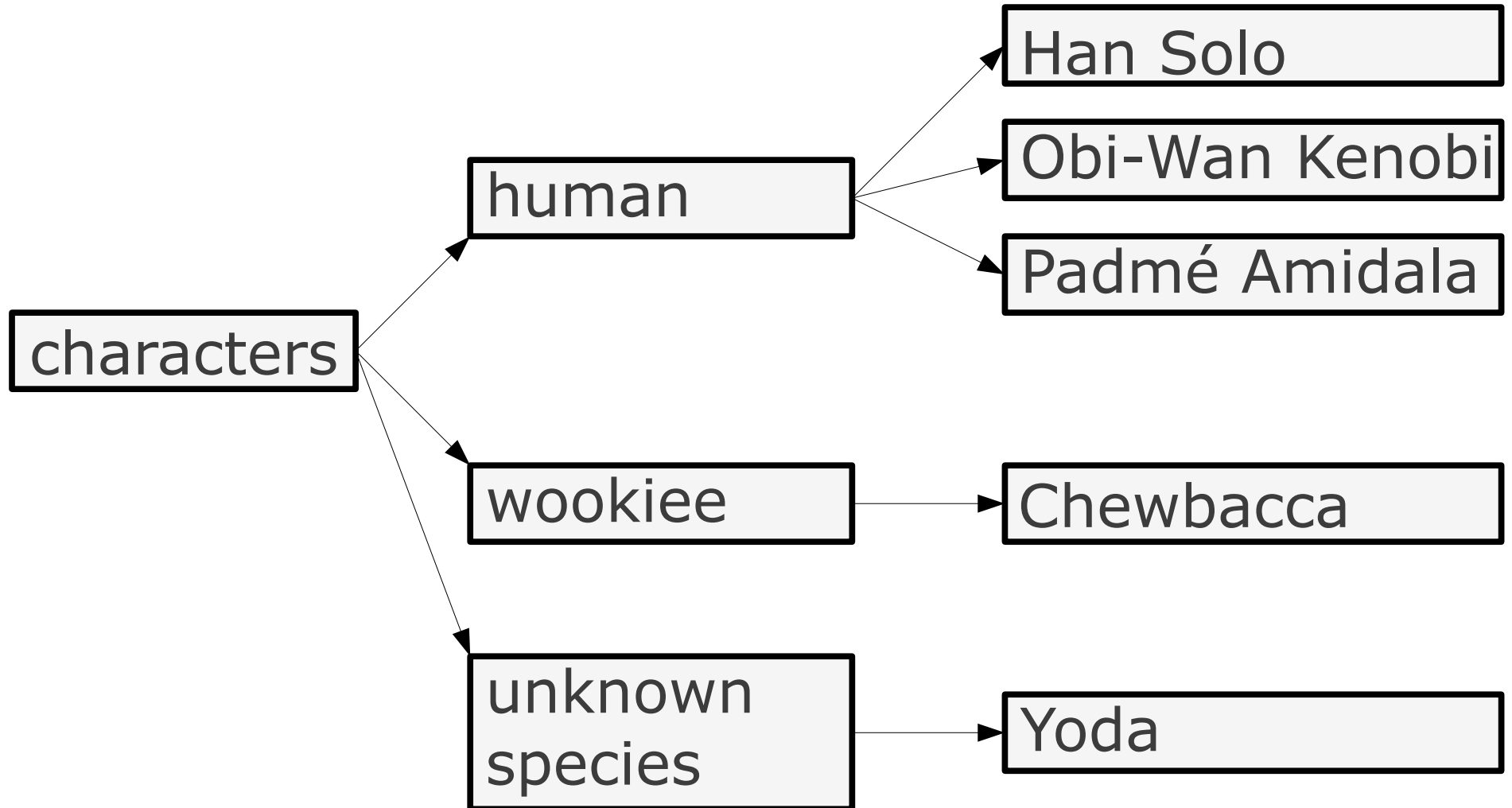
Databases Models



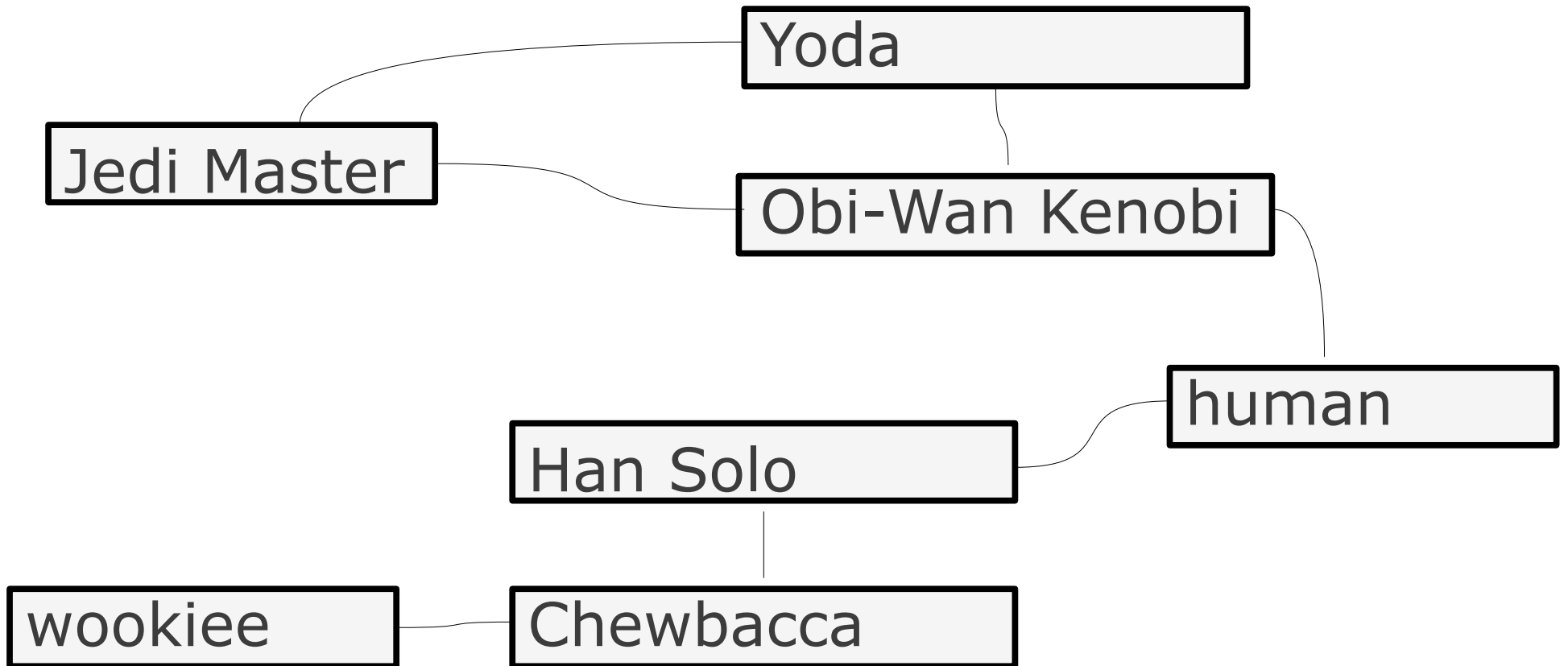
Key-Value



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

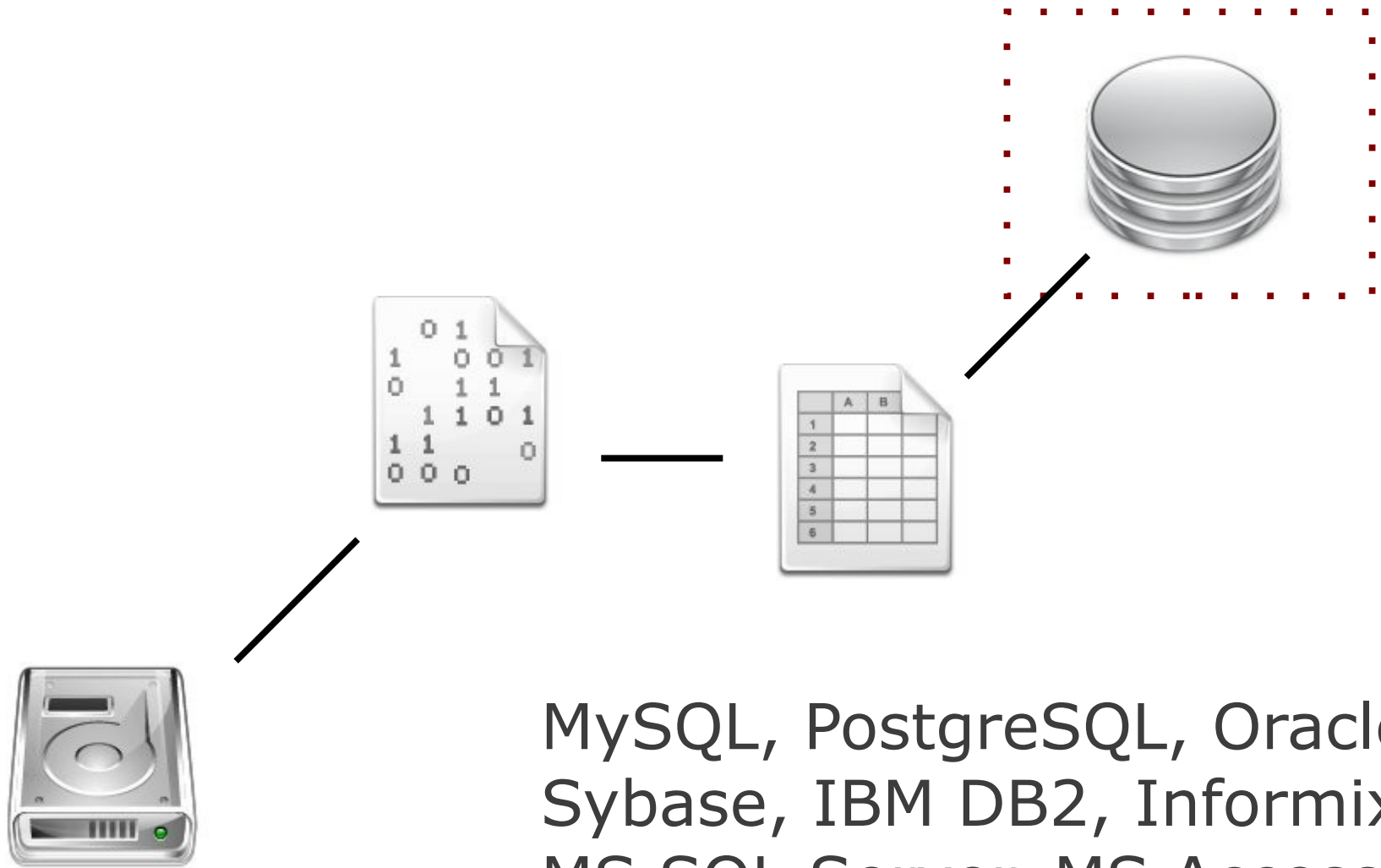
species_type

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*

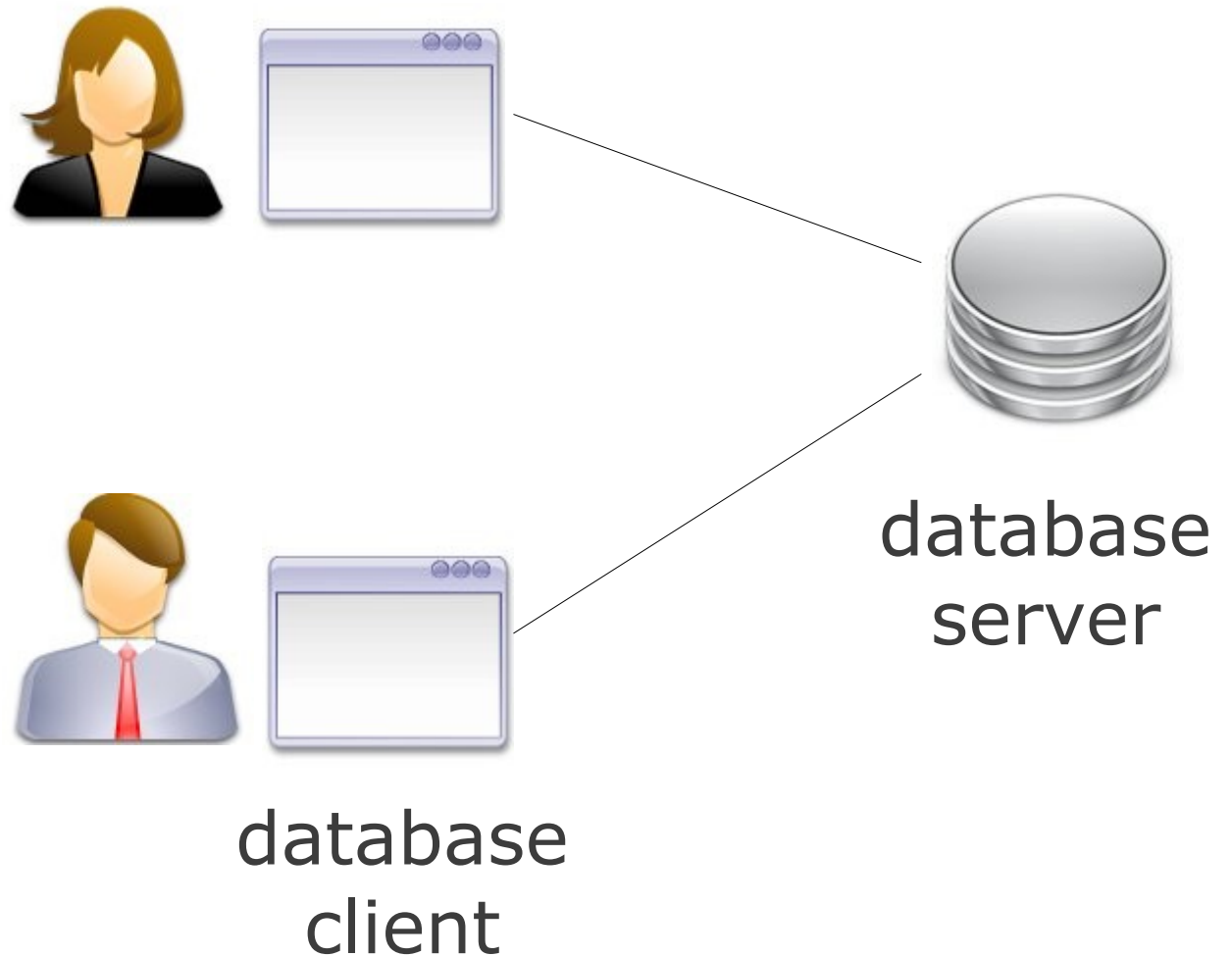
Accessing a Database



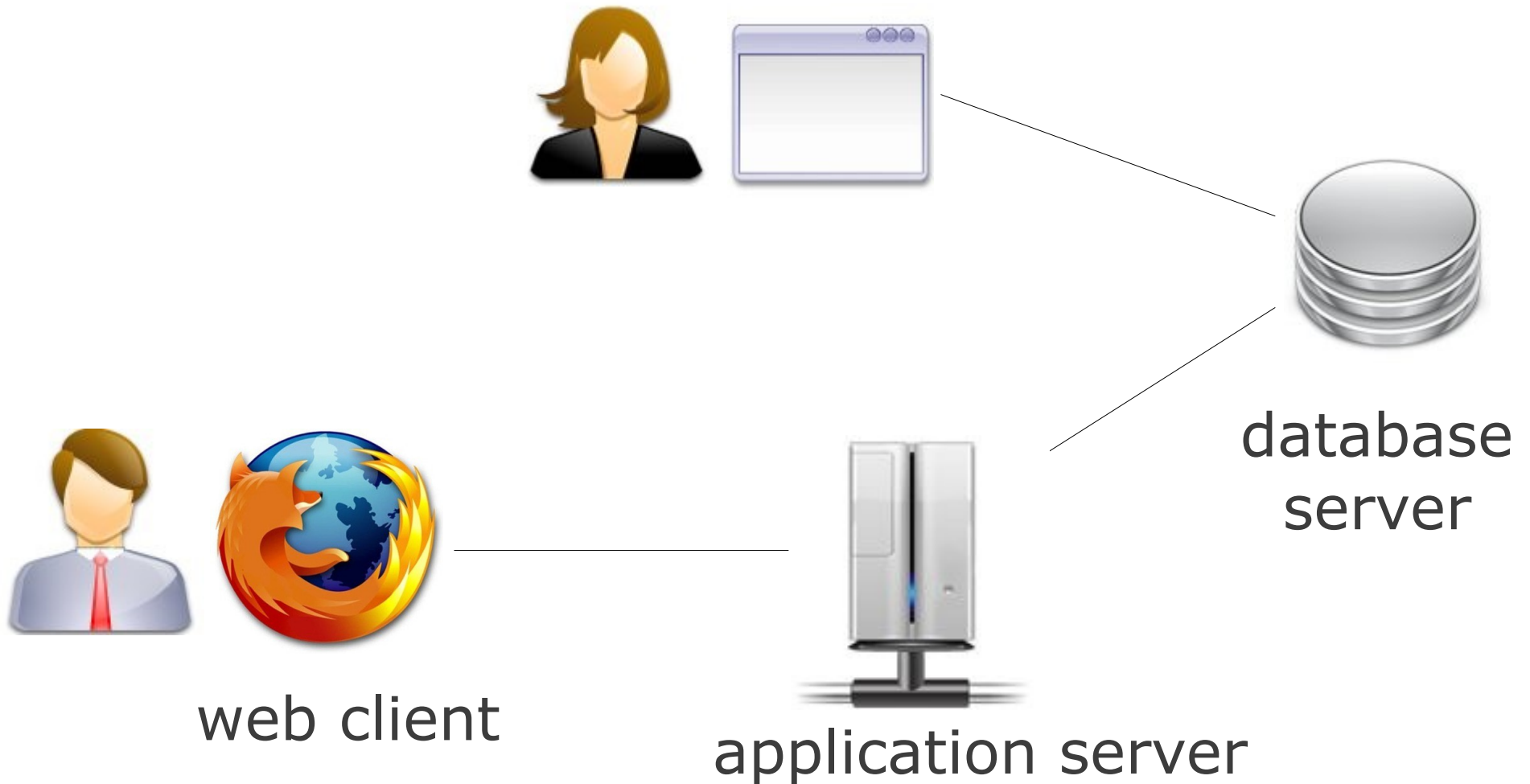
Built-in GUI



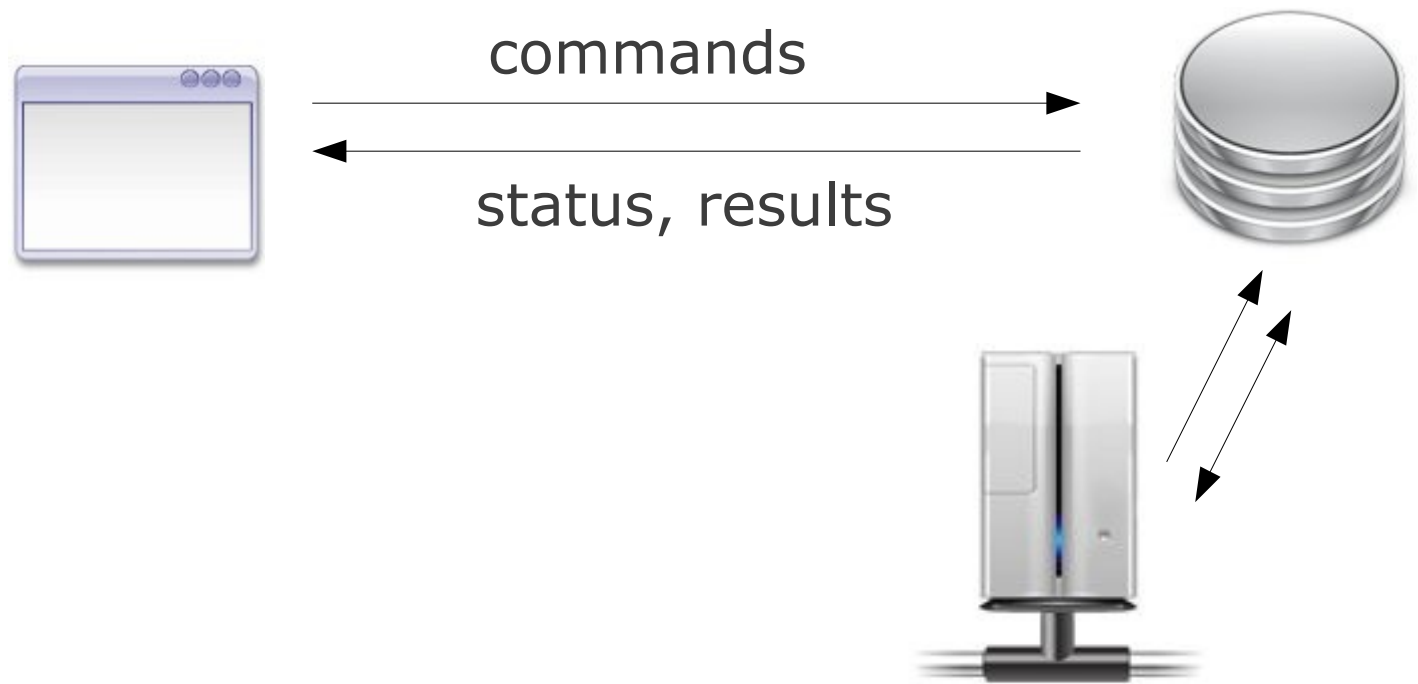
Networked Client



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



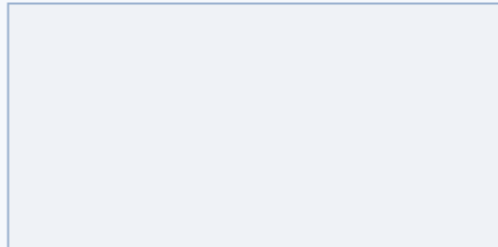
SQL Development

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.



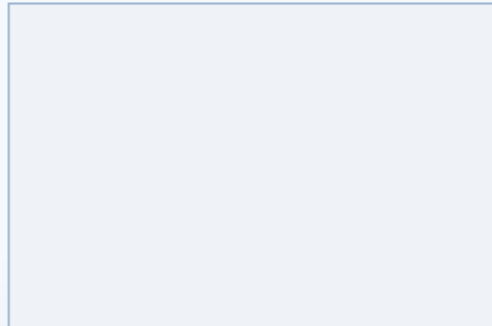
Data Modeling

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.



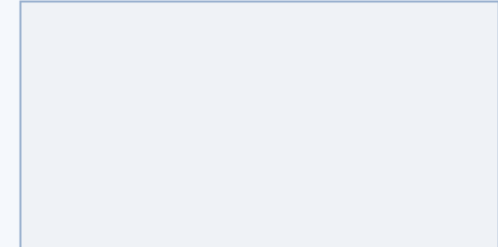
Server Administration

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.

Workbench Central



Workspace



Open Connection
Or click a Database

New Connection
Add a new connection

Edit Table
Select a connection

Edit SQL Script
Open an existing SQL Script file for editing.

Manage Connections
Modify connection settings or add connections.

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: Method to use to connect to the RDBMS

Parameters | Advanced

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

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.



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.



r2

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



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



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Read about all changes in this MySQL Workbench release.



MySQL Doc Library



MySQL Bug Reporter



Workbench Team Blog



Planet MySQL



Workbench Forums

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.

New Server Instance

Register a new server instance to manage.

Manage Import / Export

Create a new server instance from a backup file.

Manage Security

Manage user accounts and assign privileges.

Manage Server Instances

Add, delete and update server instance settings.

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.

your database password from the handout



Object Browser

Default:

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

Scratch

1

```
show databases;
```

1

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



Object Browser

Default:

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

Scratch x

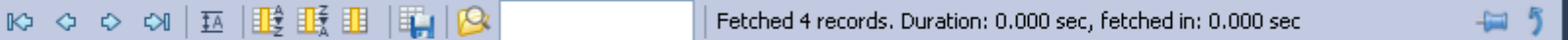
```
1 • show databases;  
2 • use starwars;
```

Overview

Output

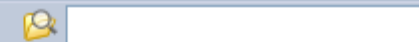
Snippets

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

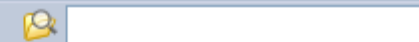
Clear

	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

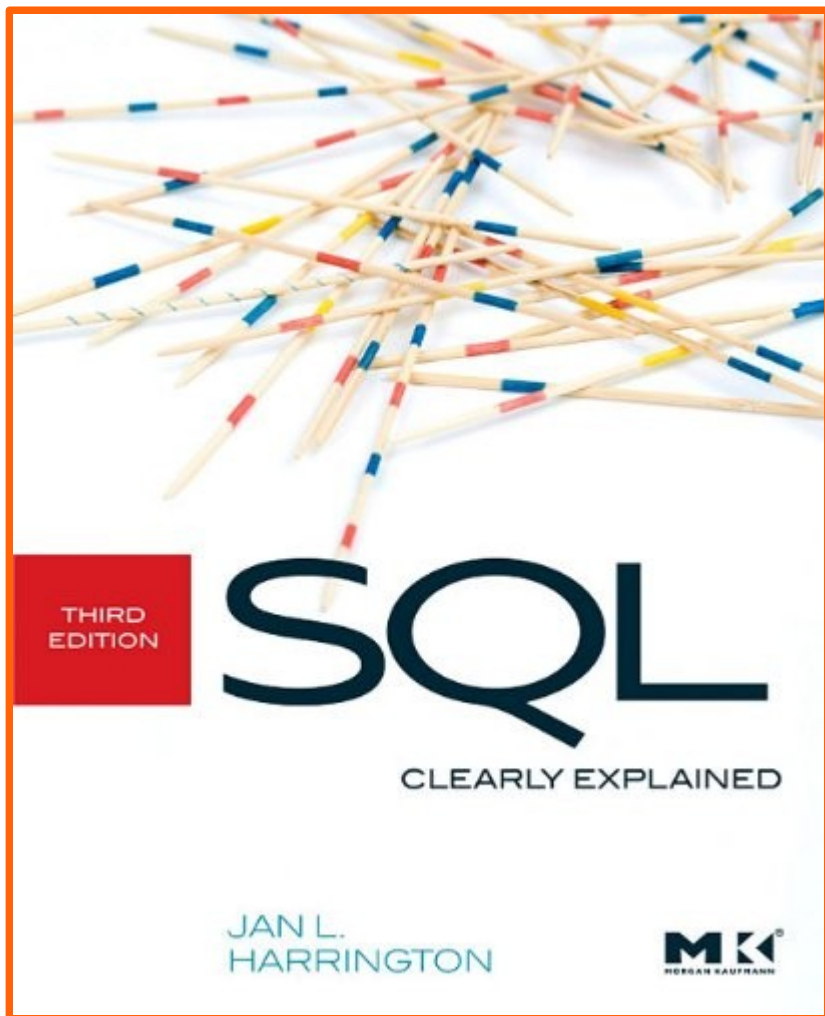
Email:

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

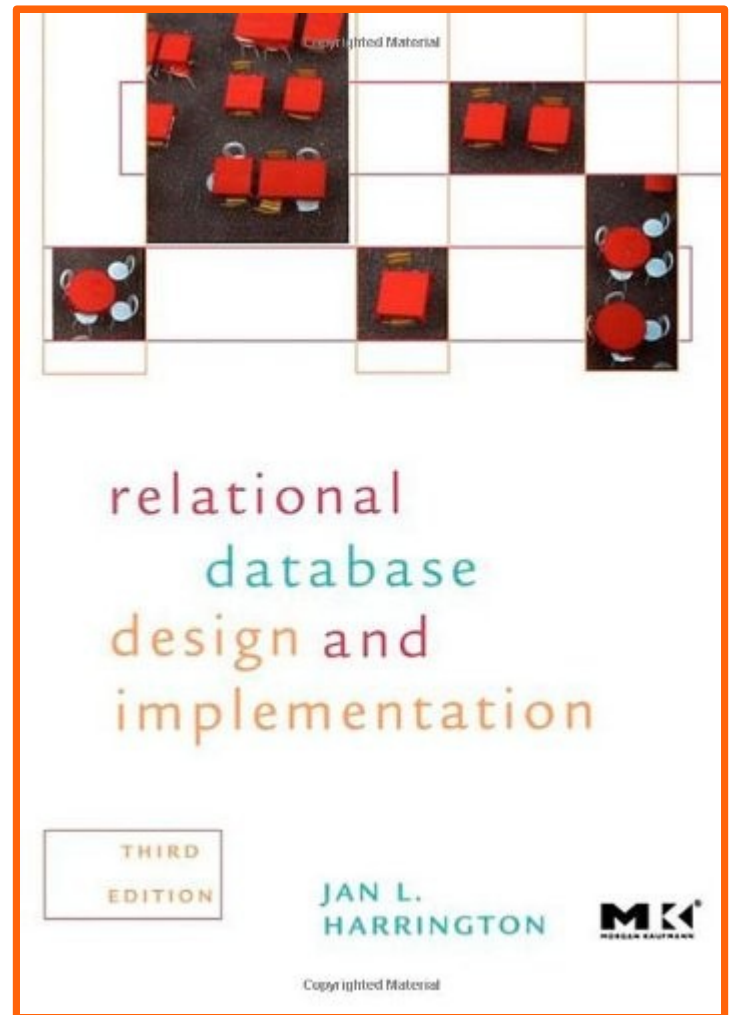
The Q&A System

<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?