

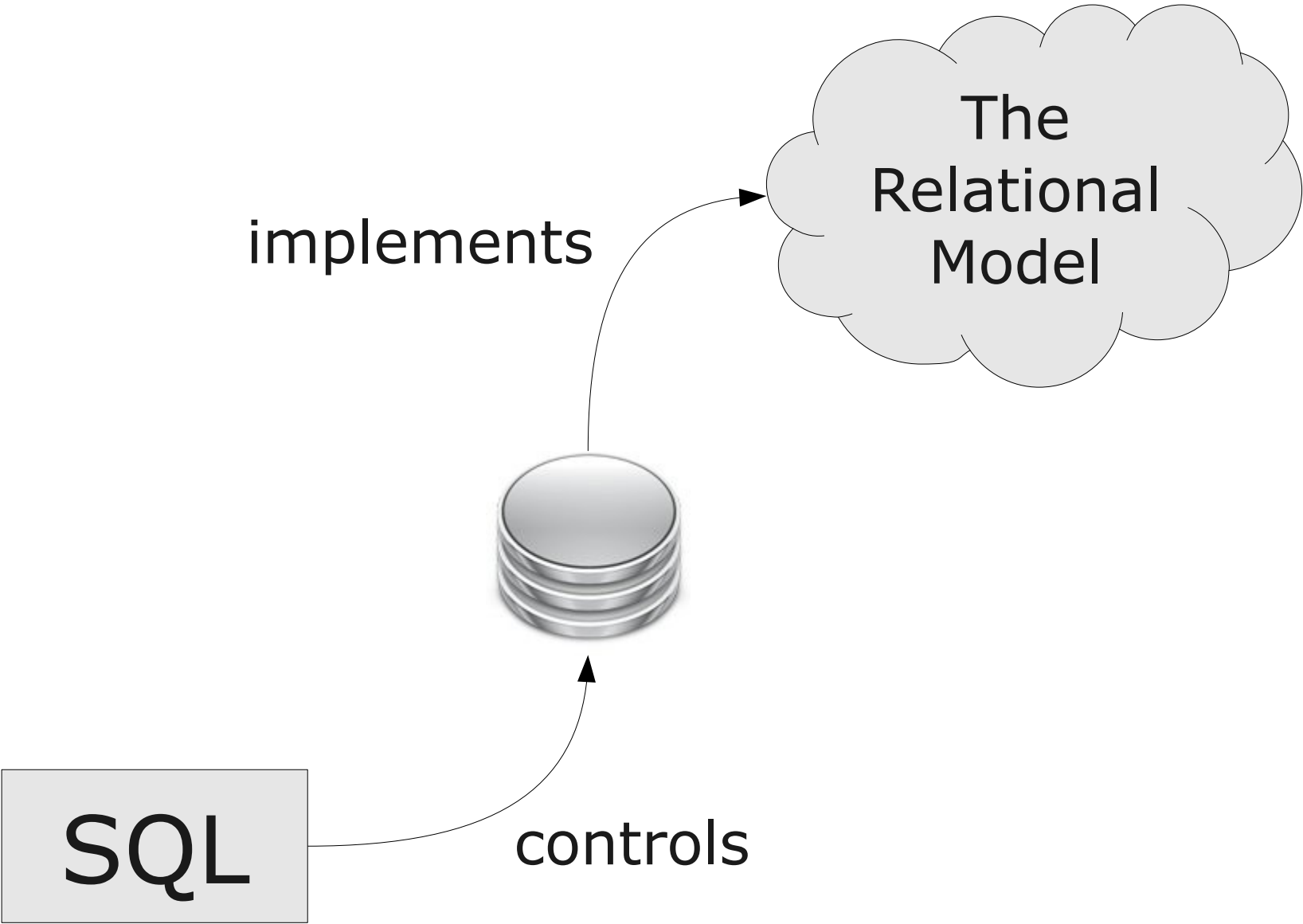
CCT395, Week 2

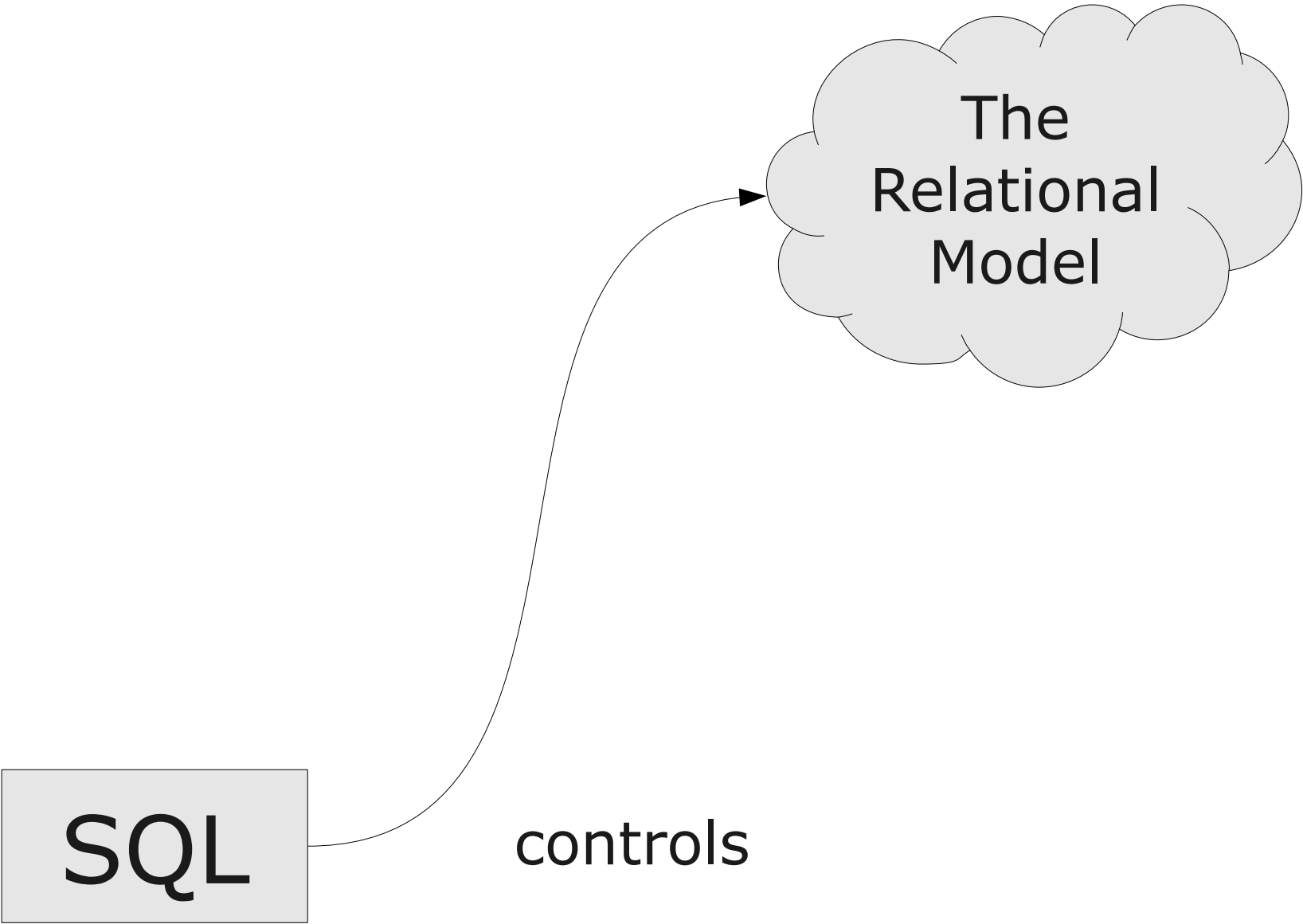
Introduction to SQL

Yuri Takhteyev
University of Toronto
September 15, 2010



This presentation is licensed under Creative Commons Attribution License, v. 3.0. To view a copy of this license, visit <http://creativecommons.org/licenses/by/3.0/>. This presentation incorporates images from the Crystal Clear icon collection by Everaldo Coelho, available under LGPL from <http://everaldo.com/crystal/>.







an SSH client (aka "telnet")

MacOS

1. Use the “Terminal” app:



2. Type in:

It's pre-installed!



```
ssh <utorid>@yoda.ischool.utoronto.ca
```

3. Provide your username (utorid) and password (to be emailed); pick a new password.

Windows

1. Use PuTTY:

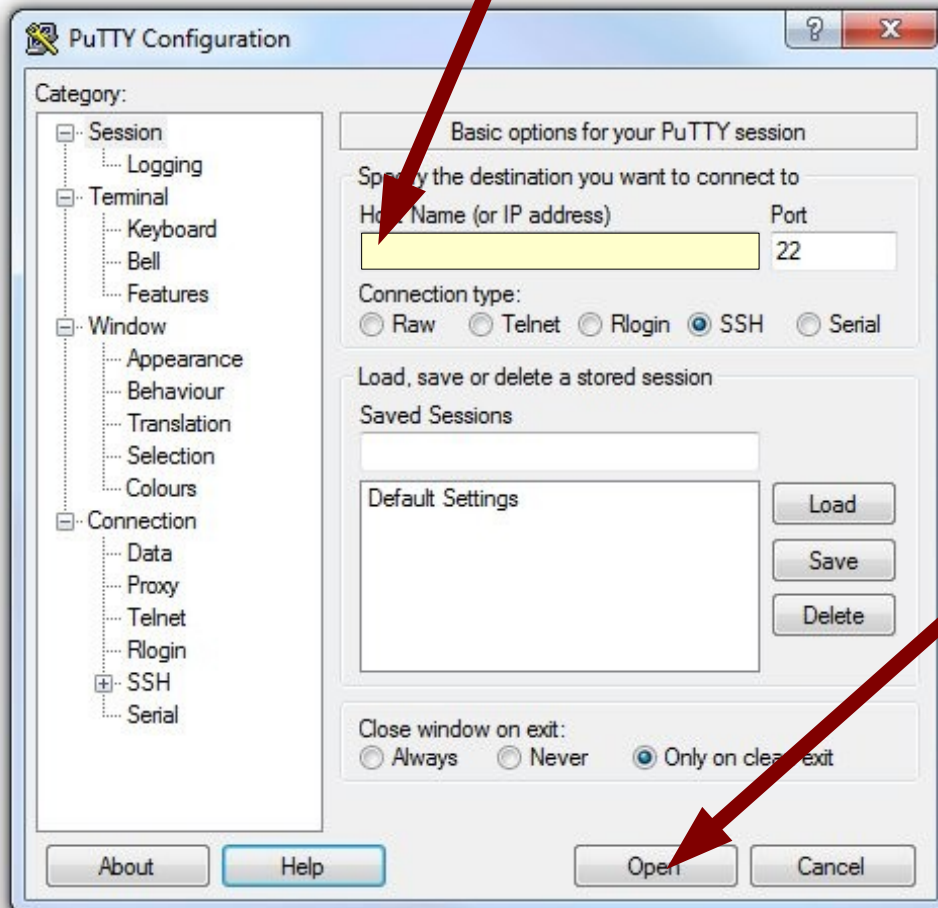


Get it at:

<http://www.chiark.greenend.org.uk/~sgtatham/putty/>

Connecting with PuTTY

yoda.ischool.utoronto.ca



click to connect

Login

1. Enter your utorid
2. Enter your password
(to be emailed)
3. Pick a new password

Once Connected

1. Type:

```
mysql -u <username> -p
```

e.g.:

```
mysql -u kenobio7 -p
```

2. Enter your password
(to be emailed)

Available Databases

```
mysql> show databases;
```

```
+-----+
| Database |
+-----+
| information_schema |
| diveshop |
| kenobio7 |
| menagerie |
+-----+
7 rows in set (0.00 sec)
```

There is no database called "monkeys"!

Selecting a Database

```
mysql> use menagerie;
```

```
Database changed
```

Listing Tables

```
mysql> show tables;
```

```
+-----+  
| Tables_in_menagerie |  
+-----+  
| event                |  
| pet                  |  
+-----+  
2 rows in set (0.00 sec)
```

Describing a Table

```
mysql> describe pet;
```

Field	Type	Null	Key	Default	Extra
name	varchar(20)	YES		NULL	
owner	varchar(20)	YES		NULL	
species	varchar(20)	YES		NULL	
sex	char(1)	YES		NULL	
birth	date	YES		NULL	
death	date	YES		NULL	
weight	float	YES		NULL	

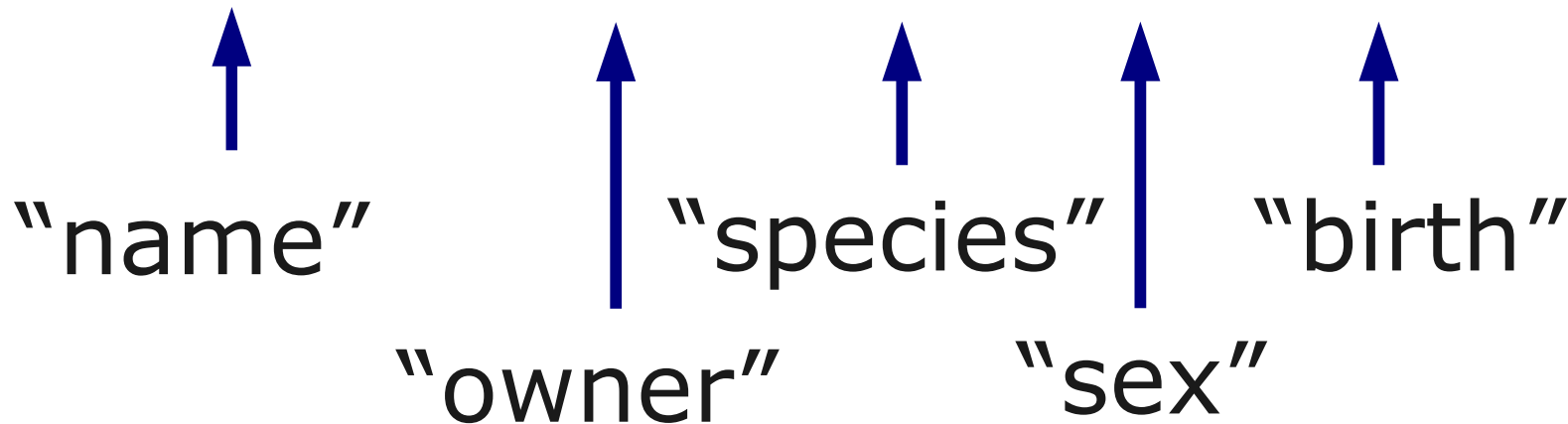
```
7 rows in set (0.00 sec)
```

Relation

(Fluffy, Harold, cat, f, 1993-02-04)

(Buffy, Harold, dog, f, 1989-05-13)

(Chirpy, Gwen, bird, f, 1998-09-11)



Table

name	owner	species	sex	birth
Fluffy	Harold	cat	f	1993-02-04
Bluffy	Harold	dog	f	1989-05-13
Chirpy	Gwen	bird	f	1998-09-11

Order Doesn't Matter

birth	owner	name	sex	species
1993-02-04	Harold	Fluffy	f	cat
1989-05-13	Harold	Bluffy	f	dog
1998-09-11	Gwen	Chirpy	f	bird

Projection



name	owner	species	sex	birth
Fluffy	Harold	cat	f	1993-02-04
Bluffy	Harold	dog	f	1989-05-13
Chirpy	Gwen	bird	f	1998-09-11

Projection

name	species	sex
Fluffy	cat	f
Bluffy	dog	f
Chirpy	bird	f

Projection in SQL

```
select <fields> from <table>;
```

For instance:

```
select name, species, sex  
from pet;
```

Projection in SQL

```
mysql> select name, species,  
      -> sex from pet;
```

```
+-----+-----+-----+  
| name      | species | sex  |  
+-----+-----+-----+  
| Fluffy    | cat     | f    |  
| Claws     | cat     | m    |  
| Buffy     | dog     | f    |  
| Fang      | dog     | m    |  
| Bowser    | dog     | m    |  
| Chirpy    | bird    | f    |  
| Whistler  | bird    | NULL |  
| Slim      | snake   | m    |  
| Puffball  | hamster | f    |  
+-----+-----+-----+  
9 rows in set (0.00 sec)
```

Projection in SQL

```
mysql> select name, owner  
      -> from pet;
```

```
+-----+-----+  
| name   | owner |  
+-----+-----+  
| Fluffy | Harold |  
| Claws  | Gwen  |  
| Buffy  | Harold |  
| Fang   | Benny |  
| Bowser | Diane |  
| Chirpy | Gwen  |  
| Whistler | Gwen |  
| Slim   | Benny |  
| Puffball | Diane |  
+-----+-----+  
9 rows in set (0.00 sec)
```

Selection

("Restriction" in Harrington)



name	owner	species	sex	birth
Fluffy	Harold	cat	f	1993-02-04
Bluffy	Harold	dog	f	1989-05-13
Chirpy	Gwen	bird	f	1998-09-11

Columns vs Rows

Projection:

choosing columns by name

Selection:

choosing rows with a condition

Selection in SQL

```
select <fields> from <table>  
where <condition>;
```

For instance:

```
select name from pet  
where owner="Harold";
```


Selection in SQL

```
mysql> select name from pet  
      -> where owner="Harold";
```

```
+-----+  
| name  |  
+-----+  
| Fluffy|  
| Buffy |  
+-----+
```

```
2 rows in set (0.00 sec)
```

Complex Conditions

```
select <fields> from <table>  
where <condition1> and  
<condition2>;
```

For instance:

```
select name, owner, species  
from pet  
where owner="Harold"  
and species="dog";
```

```
+-----+-----+-----+
| name   | owner   | species |
+-----+-----+-----+
| Buffy  | Harold  | dog     |
+-----+-----+-----+
1 row in set (0.00 sec)
```

Or We Can Use "OR"

```
select <fields> from <table>  
where <condition1> or  
<condition2>;
```

For instance:

```
select name, owner, species  
from pet  
where owner="Harold"  
or species="dog";
```

```
+-----+-----+-----+
| name   | owner  | species |
+-----+-----+-----+
| Fluffy | Harold | cat     |
| Buffy  | Harold | dog     |
| Fang   | Benny  | dog     |
| Bowser | Diane  | dog     |
+-----+-----+-----+
4 rows in set (0.00 sec)
```

And Why Not "Not"?

```
select <fields> from <table>  
where not <condition>;
```

For instance:

```
select name, owner from pet  
where not owner="Harold";
```

```
+-----+-----+
| name      | owner    |
+-----+-----+
| Claws     | Gwen     |
| Fang      | Benny    |
| Bowser    | Diane    |
| Chirpy    | Gwen     |
| Whistler  | Gwen     |
| Slim      | Benny    |
| Puffball  | Diane    |
+-----+-----+
7 rows in set (0.00 sec)
```

Tests: Equality

```
where <column>=<value>;
```

For instance:

```
select name from pet  
where owner="Harold";
```


Tests: Inequality

```
where <column> != <value>;
```

For instance:

```
select name, owner from pet  
where owner != "Harold";
```

```
+-----+-----+
| name      | owner    |
+-----+-----+
| Claws     | Gwen    |
| Fang      | Benny   |
| Bowser    | Diane   |
| Chirpy    | Gwen    |
| Whistler  | Gwen    |
| Slim      | Benny   |
| Puffball  | Diane   |
+-----+-----+
7 rows in set (0.00 sec)
```

More: >, <, <=, >=

where <column><<value>;

For instance:

```
select name, birth from pet
where birth<"1980-01-01";
```

```
+-----+-----+
| name   | birth       |
+-----+-----+
| Bowser | 1979-08-31 |
+-----+-----+
1 row in set (0.00 sec)
```

Between

```
where <column> between  
<value1> and <value2>;
```

For instance:

```
select name, birth from pet  
where birth between  
"1980-01-01" and "1990-01-01";
```

```
+-----+-----+
| name   | birth       |
+-----+-----+
| Buffy  | 1989-05-13  |
+-----+-----+
1 row in set (0.00 sec)
```

Like

```
where <column> like <pattern>;
```

For instance:

```
select name from pet  
where name like "%uff%";
```

```
+-----+
| name   |
+-----+
| Fluffy |
| Buffy  |
| Puffball |
+-----+
```

3 rows in set (0.00 sec)

In

```
where <column> in (<values>);
```

For instance:

```
select name, species  
from pet where species  
in ("cat", "dog");
```

```
+-----+-----+
| name   | species |
+-----+-----+
| Fluffy | cat     |
| Claws  | cat     |
| Buffy  | dog     |
| Fang   | dog     |
| Bowser | dog     |
+-----+-----+
5 rows in set (0.00 sec)
```

The 6th Column

```
mysql> describe pet;
```

Field	Type	Null	Key	Default	Extra
name	varchar(20)	YES		NULL	
owner	varchar(20)	YES		NULL	
species	varchar(20)	YES		NULL	
sex	char(1)	YES		NULL	
birth	date	YES		NULL	
death	date	YES		NULL	
weight	float	YES		NULL	

```
7 rows in set (0.00 sec)
```

What's in it?

```
mysql> select name, death  
      > from pet;
```

```
+-----+-----+  
| name      | death      |  
+-----+-----+  
| Fluffy    | NULL       |  
| Claws     | NULL       |  
| Buffy     | NULL       |  
| Fang      | NULL       |  
| Bowser    | 1995-07-29 |  
| Chirpy    | NULL       |  
| Whistler  | NULL       |  
| Slim      | NULL       |  
| Puffball  | NULL       |  
+-----+-----+  
9 rows in set (0.00 sec)
```

NULL = no value
provided (unknown,
does not apply, etc.)

Is NULL

```
where <column> is null;
```

For instance:

```
select name, death from pet  
where death is null;
```

```
+-----+-----+
| name      | death    |
+-----+-----+
| Fluffy    | NULL     |
| Claws     | NULL     |
| Buffy     | NULL     |
| Fang      | NULL     |
| Chirpy    | NULL     |
| Whistler  | NULL     |
| Slim      | NULL     |
| Puffball  | NULL     |
+-----+-----+
8 rows in set (0.00 sec)
```

Is Not NULL

```
where <column> is not null;
```

For instance:

```
select name, death from pet  
where death is not null;
```

```
+-----+-----+
| name   | death       |
+-----+-----+
| Bowser | 1995-07-29 |
+-----+-----+
1 row in set (0.00 sec)
```


Null with And and Or

Null and True → Null

Null and False → False

Null or True → True

Null or False → Null

Removing Duplicates

```
select distinct <columns> ...
```

For instance:

```
select distinct species  
from pet where owner="Gwen";
```

```
+-----+
| species |
+-----+
| cat     |
| bird    |
+-----+
2 rows in set (0.00 sec)
```

VS

```
+-----+
| species |
+-----+
| cat     |
| bird    |
| bird    |
+-----+
3 rows in set (0.00 sec)
```

Sorting the Results

```
select ... from ... where ...  
order by <column>;
```

For instance:

```
select name, birth from pet  
order by birth;
```

```
+-----+-----+
| name      | birth      |
+-----+-----+
| Bowser    | 1979-08-31 |
| Buffy     | 1989-05-13 |
| Fang      | 1990-08-27 |
| Fluffy    | 1993-02-04 |
| Claws     | 1994-03-17 |
| Slim      | 1996-04-29 |
| Whistler  | 1997-12-09 |
| Chirpy   | 1998-09-11 |
| Puffball  | 1999-03-30 |
+-----+-----+
9 rows in set (0.01 sec)
```

Limit

```
select ... from ... limit <N>;
```

For instance:

```
select name, birth from pet  
order by birth limit 5;
```

```
+-----+-----+
| name   | birth   |
+-----+-----+
| Bowser | 1979-08-31 |
| Buffy  | 1989-05-13 |
| Fang   | 1990-08-27 |
| Fluffy | 1993-02-04 |
| Claws  | 1994-03-17 |
+-----+-----+
5 rows in set (0.00 sec)
```

Aggregating: Count

```
select count (<columns>)  
from ...;
```

For instance:

```
select count (name) from pet  
where birth < "1994-12-31";
```



```
+-----+
| count(name) |
+-----+
|           5 |
+-----+
1 row in set (0.00 sec)
```

Counting Distinct

```
select count(distinct owner)
from pet
where birth < "1994-12-31";
```


Summation

```
select sum(weight) from pet
where species="cat";
```

```
+-----+
| sum(weight) |
+-----+
| 13.130000114441 |
+-----+
1 row in set (0.00 sec)
```

More Aggregation

`avg, min, max`

For instance:

```
select min(weight) from pet;
```

```
+-----+
| min(weight) |
+-----+
| 0.032000001519918 |
+-----+
1 row in set (0.00 sec)
```

Grouping

```
... group by <columns>;
```

For instance:

```
select species, sum(weight)  
from pet group by species;
```



```
+-----+-----+
| species | sum(weight) |
+-----+-----+
| bird    | 0.453000005334616 |
| cat     | 13.1300001144409 |
| dog     | 52.3299984931946 |
| hamster | 0.127000004053116 |
| snake   | 0.209999993443489 |
+-----+-----+
5 rows in set (0.02 sec)
```

“Having”

```
select species, sum(weight)  
from pet group by species  
having sum(weight) < 1;
```

Similar to “where” conditions, but can refer to the aggregate values.

```
+-----+-----+
| species | sum(weight) |
+-----+-----+
| bird    | 0.453000005334616 |
| hamster | 0.127000004053116 |
| snake   | 0.209999993443489 |
+-----+-----+
3 rows in set (0.00 sec)
```

Data Types

```
mysql> describe pet;
```

Field	Type	Null	Key	Default	Extra
name	varchar(20)	YES		NULL	
owner	varchar(20)	YES		NULL	
species	varchar(20)	YES		NULL	
sex	char(1)	YES		NULL	
birth	date	YES		NULL	
death	date	YES		NULL	
weight	float	YES		NULL	

```
7 rows in set (0.00 sec)
```

Data Types

name	}	text ("string")
owner		
species		
sex		
birth	}	date
death		
weight	}	numbers

String

Characters or bytes

What character set? How many?

- char(n)
- varchar(n) and text
- blob, varbinary
- enum and set

Numeric

Numbers

How precise? What is the range?

- int(n), int(n) unsigned, bigint(n)
- float(n), double(n)
- boolean (or "bool")

Date and Time

Date, time, or both

- date
- time
- datetime
- timestamp

Questions?