# MySQL Introduction

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# MySQL Plan

- Part 1: Simple Queries
- Part 2: Creating a database:
  - creating a table
  - inserting, updating and deleting data
  - handling NULL values
  - datatypes
- Part 3: Joining tables
- Part 4: complex queries with groups, subqueries and sorting
- Reference: https://cs.wellesley.edu/~cs304/downloads/

# Files for this part

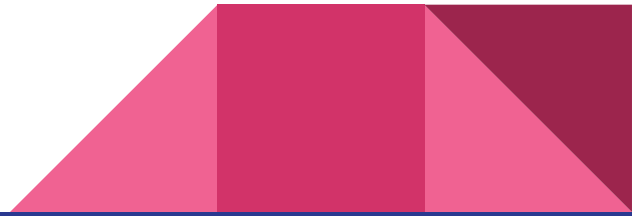
Do this with me:

```
$ cd ~/cs304
$ cp -r ~cs304/pub/downloads/part2 .
$ cd part2
$ ls
```

# Creating a table

Defining a database table requires a lot of information:

- a **name** for the table (traditionally the *singular*: `person` not `people`)
- one or more columns
- each column as a **name** and a **datatype**
- each table should have a **primary key**

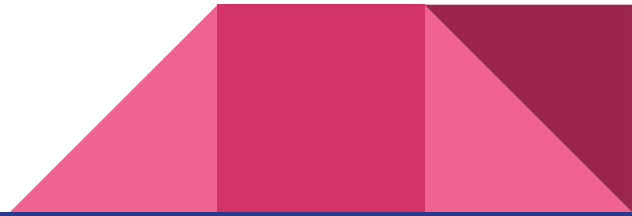


# Creating the Person table

You'll find this in `person-table.sql`. Run the file and look at the table.

```
CREATE TABLE person (
    nm int,
    name varchar(30),
    birthdate date,
    addedby int,
    primary key (nm)
);

mysql> describe person;
```



# Creating the Movie table

Our next example is the Movie table:

```
CREATE TABLE movie (
    tt int,
    title varchar(30),
    `release` char(4),
    director int,
    addedby int,
    primary key (tt)
);
```

the **release** column has backquotes because it's a reserved word

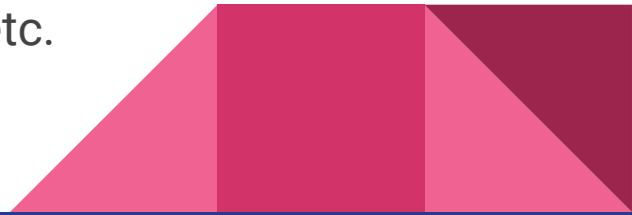
# Create table syntax

```
CREATE TABLE name (
    colname datatype,
    colname datatype,
    colname datatype,
    PRIMARY KEY (colname)
);
```

There is much more, but this is a good start.

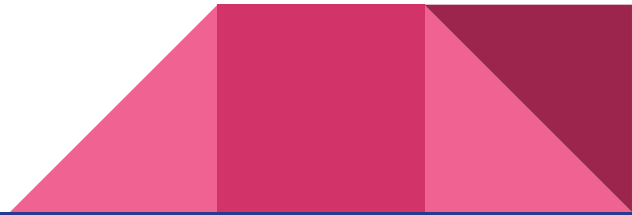
# Datatypes

- determine the storage requirements; e.g. 4 bytes for an integer
- determine the meaning of operations. Numbers are different from strings. Try these two queries:
  - `SELECT 3 < 11;`
  - `SELECT '3' < '11';`
- You should choose a datatype that
  - Can represent all the values you (reasonably) want to represent, and
  - Doesn't (unreasonably) waste space
- Space is increasingly cheap, but wasting space can also waste time, as unneeded storage is searched, sorted, transmitted, etc.



# Simple Datatypes

- **int** for integer values, like class size or number of children
- **float** for floating point values: numbers with a decimal point, like 3.14
- **char** for character strings.  E.g. char(4) for release year
- **varchar** for character strings of variable length, up to some maximum. E.g. varchar(30) for a person's name
- Note that **int** is for numbers that we might do arithmetic with. Numbers like zip codes and social security numbers would typically be char(5) and char(9)



# Dates and Times

- MySQL has several useful fourth-dimension types:
- `date` is like 2018-08-31
- `time` is like 13:01:30
- `datetime` is like 2018-08-31 13:01:30
- can be parsed and formatted in many ways

# Exercise:  Create a table

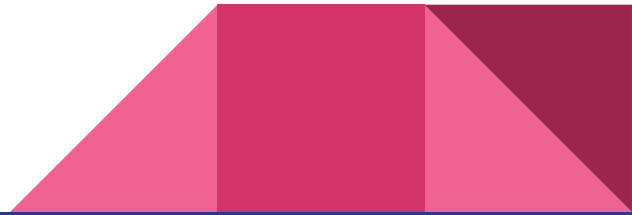
Create a table for a vet office.

Create a batch file for it.

It'll go in your personal database, so put a "use" statement at the top.

My table has columns for name, date of birth, and weight. I suggest editing `person-table.sql` and doing "save as" to `mypet.sql`

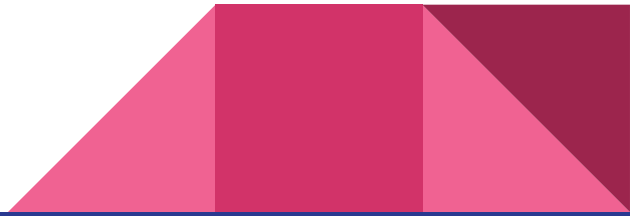
Run it with `mysql < mypet.sql`



# Solution

Here's my solution (`pet1.sql`). Yours might differ in unimportant ways.

```
create table pet (
    name varchar(30),
    dob date,
    weight float,
    primary key (name)
    );
```



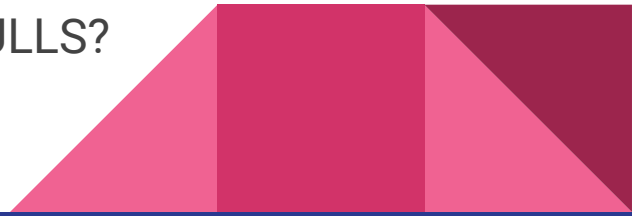
# Insert Data

Let's put some data into our table (`insert-pets1.sql`):

```
insert into pet(name)
values ("Santa's Little Helper");

insert into pet(name)
values ("Snowball"), ("Snowball II");
```

Do a select statement to show the rows. What are the NULLS?



# NULL values

- Database rows always have the same number of columns
- missing values (columns) are usually represented with NULL
- NULL is a special value. It is *not* a string ('NULL').
- Must be searched with special expressions:

```
select * from pet where weight = null;    --  WRONG
select * from pet where weight <> null;   --  WRONG
select * from pet where weight is null;   -- RIGHT
select * from pet where weight is not null;   -- RIGHT
```

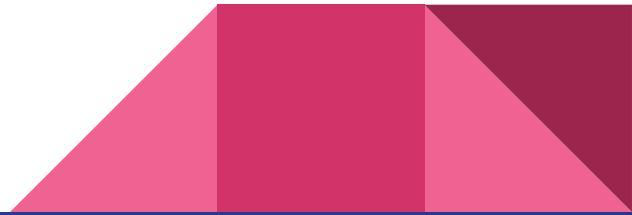
# More inserts and a problem

Use the `insert-pets2.sql` file to insert some more pets.

```
insert into pet(name,dob,weight) values
("Tiger","2011-01-01",11),
("Tiger","2013-01-01",8);   -- a different cat named Tiger
```

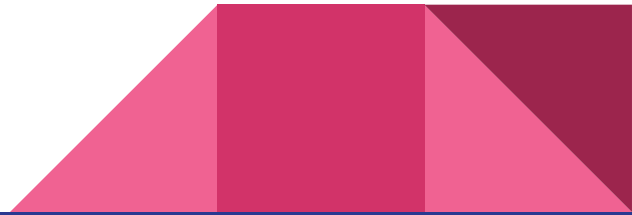
You'll see a problem: you can't have two primary keys with the same value:

```
$ mysql < insert-pets2.sql
ERROR 1062 (23000) at line 3: Duplicate entry 'Tiger' for
key 'PRIMARY'
```



# Primary Keys

- database tables are organized so that *searching* for rows based on the **primary key** is guaranteed to be *as fast as possible*.
- **but**, primary key values must be unique, like SSN
- Duplicate key errors are a good thing: you don't want data entry errors to cause your database to have bad data in it.
- Two solutions here:
  - We could add an "owner name" and make a two-part key, combining owner name and pet name: `primary key (owner,name)`
  - Or, use a made-up integer as the "pet id" or PID.



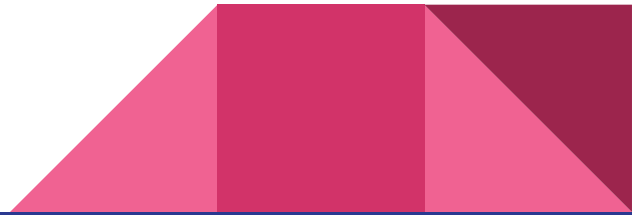
# Auto_increment

- An integer primary key field can be declared "auto_increment" and then a counter will be created and the value of the counter will used.

```
drop table if exists pet;
create table pet (
    pid int auto_increment,
    name varchar(30),
    dob date,
    weight float,
    primary key (pid)
    );
```

# Exercise: revise your table

- revise your batch file to have a PID
- include the "drop table if exists" which makes it easy to re-run the batch file
- use the batch file to re-create the table
- re-insert the data using batch files modelled on `insert-pets1.sql` and `insert-pets2.sql`
- `select *` from the table to see the PID values.
- You can also specify NULL or 0 for the PID value in the insert statement
- You can specify a PID value and override the `auto_increment` feature



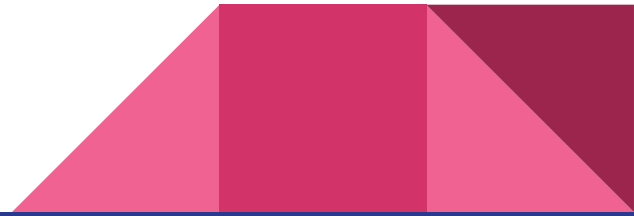
# Solution

See

`pet2.sql`

`insert-pets1.sql`

`insert-pets2.sql`



# The UPDATE Statement

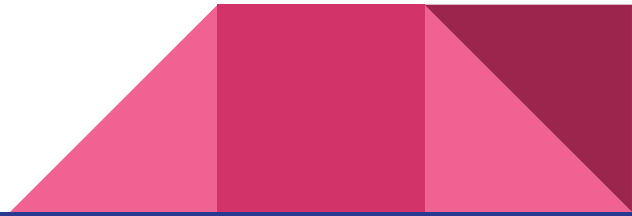
See `update-pet1.sql`. Looks like some of the pets have gotten heavier:

```
update pet
set weight = 11.5
where name = 'Fluffy';
```

Better to use a PID. This updates the younger Tiger:

```
update pet set weight = 8.9 where PID = 6;
```

The WHERE clause is the same as in SELECT



# The DELETE statement

If we want to get rid of some rows, it's easily done:

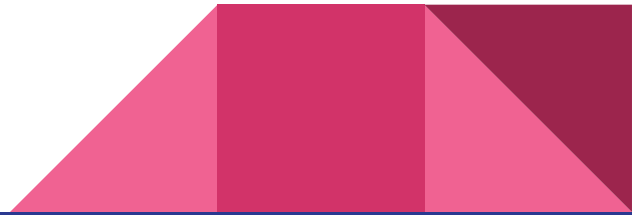
```
DELETE FROM pet WHERE name = 'Tiger';  -- both of them

DELETE FROM pet WHERE pid = 4;

DELETE FROM pet;  -- I hope you meant to delete all rows!
```

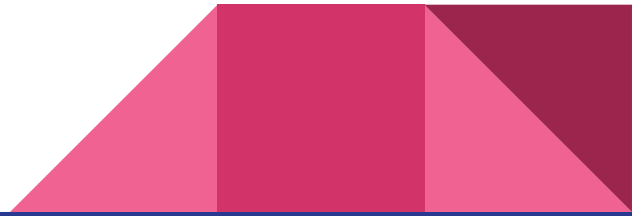
Be careful! MySQL deletes **all** matches and there is **no** "undelete."

Very much like the unix "`rm`" command!



# More Integer Datatypes

- all integers have limited range
- trade-off between number of bytes of storage and size of the range
- can also make them "**unsigned**" which means 0 to 2x instead of -x to +x
- See: integer types



# Sets and Enums

- enum is 1 or 2 bytes

```
sex enum('male','female')
neutered enum('yes','no')
species enum('dog','cat','rabbit')
```

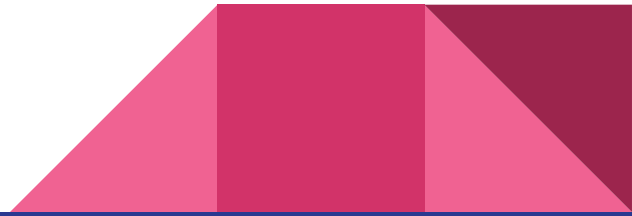
- set allows more than one choice:

```
behaviors set('bites','hisses','scratches')
```

- insert like a string

# Exercise

- Revise your pet table, adding some of the extra columns we talked about.
- Insert some rows
- Create an "owner" table with some reasonable columns

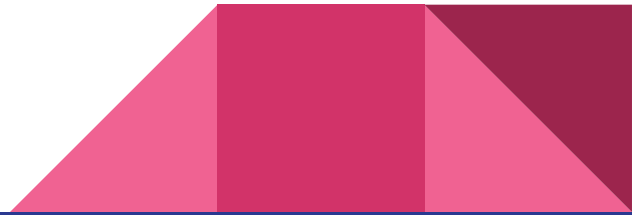


# Solution

See code in `pet3.sql, insert-pets3.sql` and `owner1.sql`

Obviously, these are just one of many possible solutions.

```
insert into
pet(name,dob,weight,sex,neutered,species,litters,behaviors)
values
("Eres","2008-01-01",12,'female','yes','cat',1,''),
("Sushi","2009-01-01",18,'male','yes','cat',null,'bites,hiss
es,scratches')
```

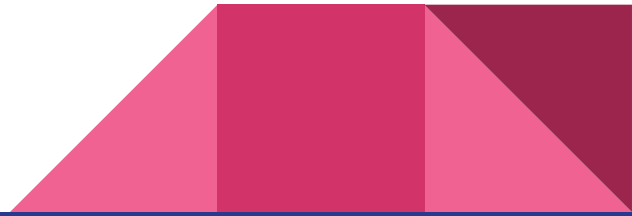


# mysqldump

- Not everything is done with batch files:
  - We could update rows using the MySQL shell.
  - We will have an online application that updates our database via the web.
- So, we can use mysqldump to **dump** the current state of the database to a SQL batch file that can re-create it in one go:

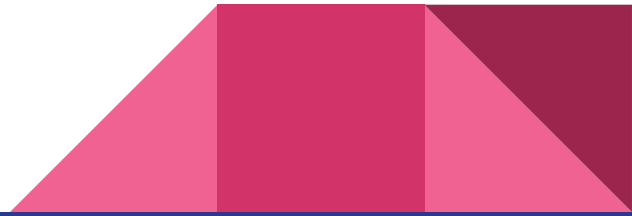
```
mysqldump my_db > dump-after-part2.sql
```

- You can restore it just by loading the batch file
- Experiment!



# Recap/replay

```
person-table.sql  -- creates that table
movie-table.sql  -- creates that table
pet1.sql -- first version of pet table
insert-pet1.sql -- works
insert-pet2.sql -- fails
pet2.sql -- second version
insert-pet1.sql -- works
insert-pet2.sql -- works
update-pet1.sql -- update
pet3.sql -- more datatypes
insert-pet{1,2,3}.sql -- works
owner1.sql -- owner table
mysqldump cs304guest_db > dump-after-part2.sql
```



# Summary of Part 2

- Create a MySQL table by defining the table name, column names and types, and a **primary key**
- primary key requires uniqueness but guarantees speed
- Datatypes like int, char, varchar, date
- Datatypes determine operations and storage costs
- `insert into table(col1,col2) values (val1,val2)`
- `update table set col1 = val1, col2 = val2 where expression`
- `delete from table where expression`
- `mysqldump database > file.sql`