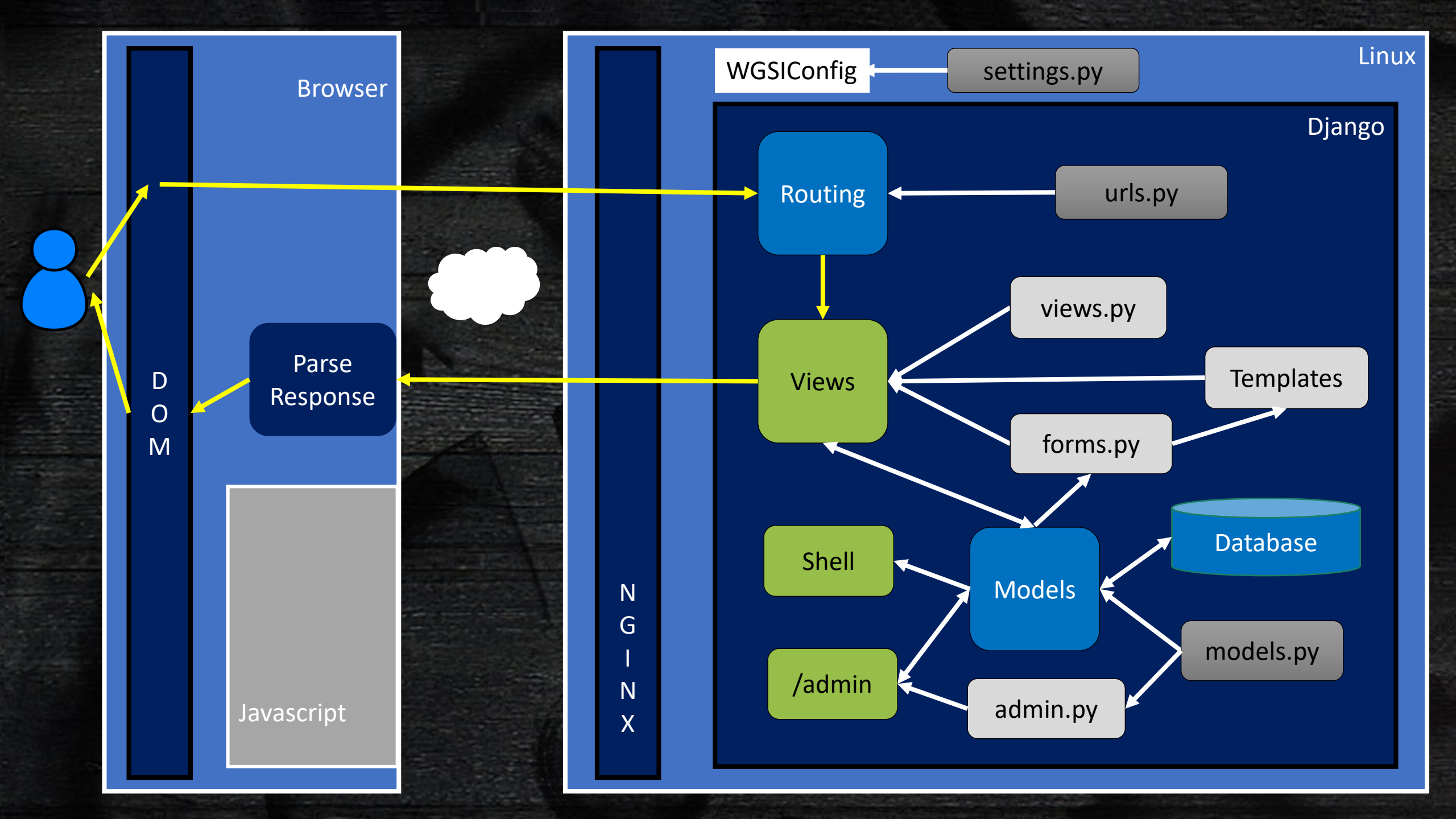
Table of Contents

This slide deck consists of slides used in 2 lecture videos in Week 1. Below is a list of shortcut hyperlinks for you to jump into specific sections.

Charles Severance
www.dj4e.com

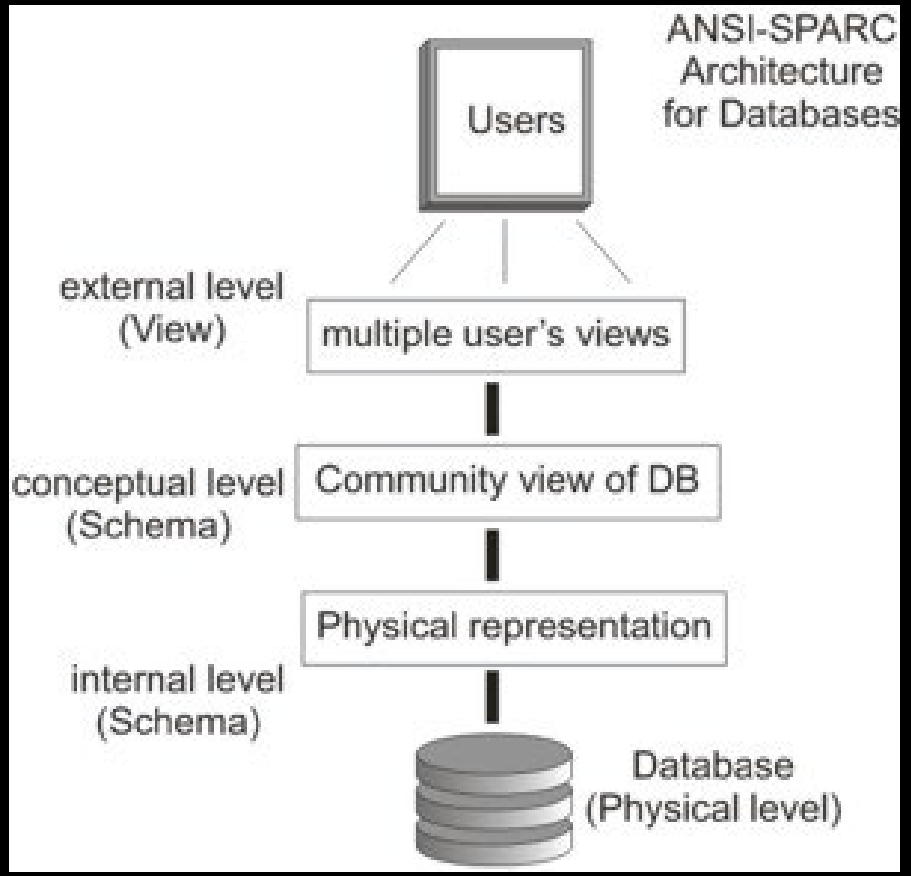
Simple Django Models


Browser
DOM
Parse Response
Javascript
NGINX
WGSIConfig
settings.py
Linux
Django
Routing
urls.py
views.py
Views
Templates
forms.py
Shell
Models
Database
models.py
/admin
admin.py

SQL

Structured Query Language is the language we use to issue commands to the database

- Create/Insert data
- Read/Select some data
- Update data
- Delete data



http://en.wikipedia.org/wiki/SQL

https://en.wikipedia.org/wiki/ANSI-SPARC_Architecture

Start Simple - A Single Table

```
$ sqlite3 zip.sqlite3
SQLite version 3.11.0 2016-02-15 17:29:24
Enter ".help" for usage hints.
sqlite> .tables
sqlite> CREATE TABLE Users(
   ...>   id INTEGER NOT NULL
   ...>       PRIMARY KEY AUTOINCREMENT,
   ...>   name VARCHAR(128),
   ...>   email VARCHAR(128)
   ...> ) ;
sqlite> .tables
Users
sqlite> .schema Users
CREATE TABLE Users(
  id INTEGER NOT NULL
      PRIMARY KEY AUTOINCREMENT,
  name VARCHAR(128),
  email VARCHAR(128)
);
sqlite>
```

```
CREATE TABLE Users(
    id integer NOT NULL
      PRIMARY KEY
      AUTOINCREMENT,
  name VARCHAR(128),
  email VARCHAR(128)
);
```

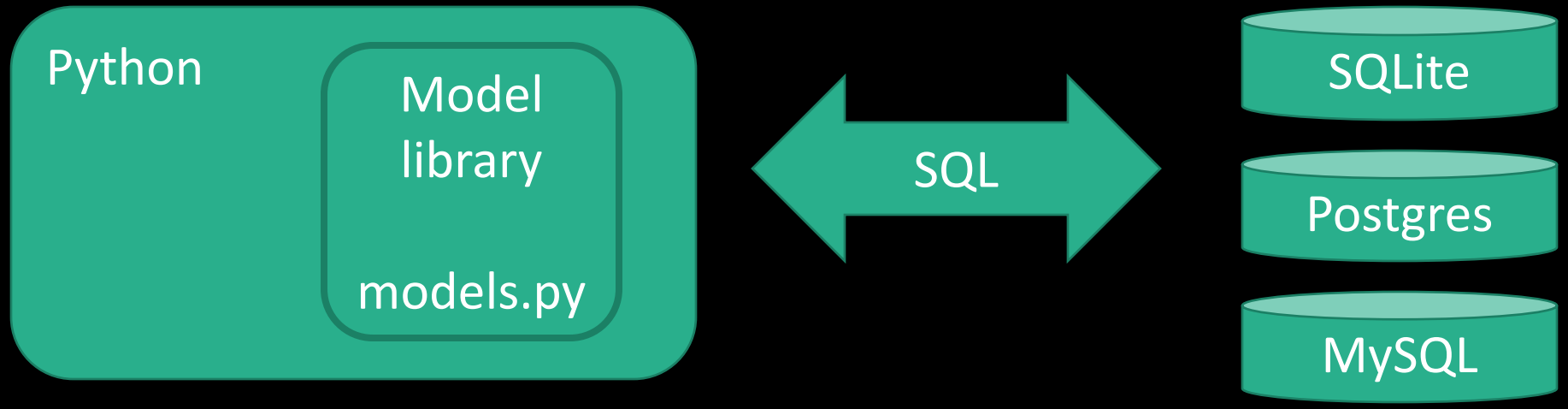
https://www.dj4e.com/lectures/SQL-01-Basics.txt

SQL Summary

```
INSERT INTO Users (name, email) VALUES ('Kristin', 'kf@umich.edu')

DELETE FROM Users WHERE email='ted@umich.edu'

UPDATE Users SET name="Charles" WHERE email='csev@umich.edu'

SELECT * FROM Users

SELECT * FROM Users WHERE email='csev@umich.edu'

SELECT * FROM Users ORDER BY email
```

Object Relational Mapping (ORM)

- Allows us to map tables to objects and columns
- We use those objects to store and retrieve data from the database
- Improved portability across database dialects (SQLite, MySQL, Postgres, Oracle)



Defining a table

SQL:

```
CREATE TABLE Users(
   name VARCHAR(128),
   email VARCHAR(128)
);
```

models.py:

```
from django.db import models

class User(models.Model):
    name = models.CharField(max_length=128)
    email = models.CharField(max_length=128)
```

https://github.com/csev/dj4e-samples/tree/master/users

Creating the Table from the Model

```
$ cd ~/dj4e-samples
$ python3 manage.py makemigrations
Migrations for 'users':
users/migrations/0001_initial.py
    - Create model User

$ python3 manage.py migrate
Running migrations:
Applying contenttypes.0001_initial... OK
...
Applying sessions.0001_initial... OK
Applying users.0001_initial... OK
```

models.py:

```
from django.db import models

class User(models.Model):
    name = models.CharField(max_length=128)
    email = models.CharField(max_length=128)
```

https://github.com/csev/dj4e-samples/tree/master/users

Checking...

```
$ cd ~/dj4e-samples
$ sqlite3 db.sqlite3
SQLite version 3.24.0 2018-06-04 14:10:15
Enter ".help" for usage hints.
sqlite> .tables
auth_group                  django_admin_log
[ ..snip ..]
auth_user                   django_session
auth_user_groups            users_user
auth_user_user_permissions
sqlite> .schema users_user
CREATE TABLE IF NOT EXISTS "users_user" (
    "id" integer NOT NULL PRIMARY KEY AUTOINCREMENT,
    "name" varchar(128) NOT NULL,
    "email" varchar(128) NOT NULL
);
sqlite> .quit
```

https://github.com/csev/dj4e-samples/tree/master/users

Inserting a Record

```
$ cd ~/dj4e-samples
$ python3 manage.py shell
>>> from users.models import User
>>> u = User(name='Kristen', email='kf@umich.edu')
>>> u.save()
>>> print(u.id)
1
>>> print(u.email)
kf@umich.edu
>>>
```

INSERT INTO Users (name, email) VALUES ('Kristin', 'kf@umich.edu')

https://github.com/csev/dj4e-samples/tree/master/users

Checking...

```
>>> from django.db import connection
>>> print(connection.queries)
[
{'sql': 'BEGIN', 'time': '0.000'},
{'sql': 'INSERT INTO "users_user" ("name", "email")
         VALUES (\'Kristen\', \'kf@umich.edu\')',
    'time': '0.002'}
]
>>>
```

INSERT INTO Users (name, email) VALUES ('Kristin', 'kf@umich.edu')

https://github.com/csev/dj4e-samples/tree/master/users

CRUD in the ORM

```
u = User(name='Sally', email='a2@umich.edu')
u.save()

User.objects.values()
User.objects.filter(email='csev@umich.edu').values()

User.objects.filter(email='ted@umich.edu').delete()
User.objects.values()

User.objects.filter(email='csev@umich.edu').update(name='Charles')
User.objects.values()

User.objects.values().order_by('email')
User.objects.values().order_by('-name')
```

Model Field Types

- AutoField
- BigAutoField
- BigIntegerField
- BinaryField
- BooleanField
- CharField
- DateField
- DateTimeField
- DecimalField
- DurationField
- EmailField
- FileField
- FilePathField
- FloatField
- ImageField
- IntegerField
- GenericIPAddressField
- NullBooleanField
- PositiveIntegerField
- PositiveSmallIntegerField
- SlugField
- SmallIntegerField
- TextFIeld
- TimeField
- URLField
- ForeignKey
- ManyToManyField
- OneToOneField

https://docs.djangoproject.com/en/2.1/ref/models/fields/#field-types

Models, Migrations, and Database Tables

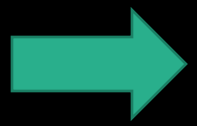
Migrations: From Model to Database

- The makemigrations command reads all the models.py files in all the applications, end creates / evolves the migration files
- Guided by the applications listed in settings.py
- Migrations are portable across databases

- The migrate command reads all the migrations folders in the application folders and creates / evolves the tables in the database (i.e. db.sqlite3)

makemigrations

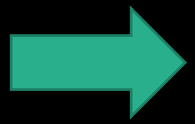
```
dj4e-samples$ ls */models.py
autos/models.py         many/models.py
bookone/models.py       menu/models.py
crispy/models.py        myarts/models.py
favs/models.py          pics/models.py
favsql/models.py        rest/models.py
form/models.py          route/models.py
forums/models.py        session/models.py
getpost/models.py       tmpl/models.py
gview/models.py         tracks/models.py
hello/models.py         users/models.py
home/models.py          views/models.py
dj4e-samples$
```



```
dj4e-samples$ ls  */migrations/0*.py
autos/migrations/0001_initial.py
bookmany/migrations/0001_initial.py
bookone/migrations/0001_initial.py
favs/migrations/0001_initial.py
favsql/migrations/0001_initial.py
forums/migrations/0001_initial.py
gview/migrations/0001_initial.py
many/migrations/0001_initial.py
myarts/migrations/0001_initial.py
pics/migrations/0001_initial.py
rest/migrations/0001_initial.py
tracks/migrations/0001_initial.py
users/migrations/0001_initial.py
dj4e-samples$
```

migrate

```
dj4e-samples$ ls  */migrations/0*.py
autos/migrations/0001_initial.py
bookmany/migrations/0001_initial.py
bookone/migrations/0001_initial.py
favs/migrations/0001_initial.py
favsql/migrations/0001_initial.py
forums/migrations/0001_initial.py
gview/migrations/0001_initial.py
many/migrations/0001_initial.py
myarts/migrations/0001_initial.py
pics/migrations/0001_initial.py
rest/migrations/0001_initial.py
tracks/migrations/0001_initial.py
users/migrations/0001_initial.py
dj4e-samples$
```



```
dj4e-samples$ sqlite3 db.sqlite3
SQLite version 3.24.0 2018-06-04 14:10:15
Enter ".help" for usage hints.
sqlite> .tables
auth_group                  gview_car
auth_group_permissions      gview_cat
auth_permission             gview_dog
auth_user                   gview_horse
auth_user_groups            many_course
auth_user_user_permissions  many_membership
autos_auto                  many_person
autos_make                  myarts_article
bookone_book                pics_pic
bookone_instance            rest_breed
bookone_lang                rest_cat
django_admin_log            social_auth_association
django_content_type         social_auth_code
django_migrations           social_auth_nonce
django_session              social_auth_partial
favs_fav                    social_auth_usersocialauth
favs_thing                  tracks_album
favsql_fav                  tracks_artist
favsql_thing                tracks_genre
forums_comment              tracks_track
forums_forum                users_user
sqlite> .quit
dj4e-samples$
```

Re-running makemigrate

```
dj4e-samples$ rm bookone/migrations/0001_initial.py
MacBook-Pro-92:dj4e-samples csev$ python3 manage.py makemigrations
Migrations for 'bookone':
  bookone/migrations/0001_initial.py
    - Create model Book
    - Create model Instance
    - Create model Lang
    - Add field lang to book
dj4e-samples$
```

Re-running migrate from scratch

```
dj4e-samples$ rm db.sqlite3
dj4e-samples$ python3 manage.py migrate
Operations to perform:
  Apply all migrations: admin, auth, autos, bookone, contenttypes, ...
Running migrations:
  Applying contenttypes.0001_initial... OK
  Applying auth.0001_initial... OK
  Applying admin.0001_initial... OK
  Applying admin.0002_logentry_remove_auto_add... OK
  Applying contenttypes.0002_remove_content_type_name... OK
  Applying auth.0002_alter_permission_name_max_length... OK
[ ...snip ... ]
  Applying social_django.0008_partial_timestamp... OK
  Applying tracks.0001_initial... OK
  Applying users.0001_initial... OK
dj4e-samples$
```

Summary

- The Django Models feature implements an Object Relational Mapper
- Benefits
  - We can write only Python code (i.e. no explicit SQL)
  - We gain database portability
  - Migrations both create and evolve our database schema
  - A sweet administrator interface
  - Automatic form generation and validation (later)

Acknowledgements / Contributions

Initial Development: Charles Severance, University of Michigan School of Information

Insert new Contributors and Translators here including names and dates

Continue new Contributors and Translators here