

Web Programming

with Python and JavaScript

SQL, Models, and Migrations

Data

origin	destination	duration
New York	London	415
Shanghai	Paris	760
Istanbul	Tokyo	700
New York	Paris	435
Moscow	Paris	245
Lima	New York	455

SQL

Database Management Systems

- MySQL
- PostgreSQL
- SQLite
- ...

SQLite Types

- TEXT
- NUMERIC
- INTEGER
- REAL
- BLOB

MySQL Types

- CHAR(size)
- VARCHAR(size)
- SMALLINT
- INT
- BIGINT
- FLOAT
- DOUBLE
- ...

CREATE TABLE

```
CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
);
```

```
CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
);
```

```
CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
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CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
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    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
);
```

```
CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
);
```

```
CREATE TABLE flights (  
    id INTEGER PRIMARY KEY AUTOINCREMENT,  
    origin TEXT NOT NULL,  
    destination TEXT NOT NULL,  
    duration INTEGER NOT NULL  
);
```


Constraints

- CHECK
- DEFAULT
- NOT NULL
- PRIMARY KEY
- UNIQUE
- ...

INSERT

```
INSERT INTO flights  
  (origin, destination, duration)  
VALUES ("New York", "London", 415);
```

```
INSERT INTO flights  
  (origin, destination, duration)  
VALUES ("New York", "London", 415);
```

```
INSERT INTO flights  
    (origin, destination, duration)  
VALUES ("New York", "London", 415);
```

```
INSERT INTO flights  
    (origin, destination, duration)  
VALUES ("New York", "London", 415);
```

```
INSERT INTO flights  
  (origin, destination, duration)  
VALUES ("New York", "London", 415);
```

```
INSERT INTO flights  
    (origin, destination, duration)  
VALUES ("New York", "London", 415);
```


SELECT

```
SELECT * FROM flights;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT origin, destination FROM flights;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT origin, destination FROM flights;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE id = 3;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE id = 3;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE origin = "New York";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455


```
SELECT * FROM flights WHERE origin = "New York";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500;
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500
AND destination = "Paris";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500
AND destination = "Paris";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500
OR destination = "Paris";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE duration > 500  
OR destination = "Paris";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE  
origin IN ("New York", "Lima");
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455


```
SELECT * FROM flights WHERE  
origin IN ("New York", "Lima");
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE  
origin LIKE "%a%";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

```
SELECT * FROM flights WHERE  
origin LIKE "%a%";
```

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

select all flights where origin contains "a"

% means selection can have any number of letters before or after the "a"

Functions

- AVERAGE
- COUNT
- MAX
- MIN
- SUM
- ...

UPDATE

```
UPDATE flights  
    SET duration = 430  
    WHERE origin = "New York"  
    AND destination = "London";
```

```
UPDATE flights  
    SET duration = 430  
    WHERE origin = "New York"  
    AND destination = "London";
```

```
UPDATE flights  
    SET duration = 430  
    WHERE origin = "New York"  
    AND destination = "London";
```



```
UPDATE flights  
    SET duration = 430  
    WHERE origin = "New York"  
    AND destination = "London";
```

```
UPDATE flights  
    SET duration = 430  
    WHERE origin = "New York"  
    AND destination = "London";
```

```
UPDATE flights
    SET duration = 430
    WHERE origin = "New York"
    AND destination = "London";
```

DELETE

```
DELETE FROM flights WHERE destination = "Tokyo";
```

```
DELETE FROM flights WHERE destination = "Tokyo";
```

```
DELETE FROM flights WHERE destination = "Tokyo";
```

```
DELETE FROM flights WHERE destination = "Tokyo";
```



```
DELETE FROM flights WHERE destination = "Tokyo";
```

Other Clauses

- LIMIT
- ORDER BY
- GROUP BY
- HAVING
- ...

Foreign Keys

flights

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

flights

id	origin	origin_code	destination	destination_code	duration
1	New York	JFK	London	LHR	415
2	Shanghai	PVG	Paris	CDG	760
3	Istanbul	IST	Tokyo	NRT	700
4	New York	JFK	Paris	CDG	435
5	Moscow	SVO	Paris	CDG	245
6	Lima	LIM	New York	JFK	455

airports

id	code	city
1	JFK	New York
2	PVG	Shanghai
3	IST	Istanbul
4	LHR	London
5	SVO	Moscow
6	LIM	Lima
7	CDG	Paris
8	NRT	Tokyo

flights

id	origin	destination	duration
1	New York	London	415
2	Shanghai	Paris	760
3	Istanbul	Tokyo	700
4	New York	Paris	435
5	Moscow	Paris	245
6	Lima	New York	455

flights

id	origin_id	destination_id	duration
1	1	4	415
2	2	7	760
3	3	8	700
4	1	7	435
5	5	7	245
6	6	1	455

passengers

id	first	last	flight_id
1	Harry	Potter	1
2	Ron	Weasley	1
3	Hermione	Granger	2
4	Draco	Malfoy	4
5	Luna	Lovegood	6
6	Ginny	Weasley	6

people

id	first	last
1	Harry	Potter
2	Ron	Weasley
3	Hermione	Granger
4	Draco	Malfoy
5	Luna	Lovegood
6	Ginny	Weasley

passengers

person_id	flight_id
1	1
2	1
2	4
3	2
4	4
5	6
6	6

JOIN

```
SELECT first, origin, destination
FROM flights JOIN passengers
ON passengers.flight_id = flights.id;
```

first	origin	destination
Harry	New York	London
Ron	New York	London
Hermione	Shanghai	Paris
Draco	New York	Paris
Luna	Lima	New York
Ginny	Lima	New York

JOINS

- JOIN / INNER JOIN
- LEFT OUTER JOIN
- RIGHT OUTER JOIN
- FULL OUTER JOIN

CREATE INDEX

```
CREATE INDEX name_index ON passengers (last);
```


SQL Injection

Username:

Password:

```
SELECT * FROM users  
WHERE username = username AND password = password;
```

Username:

harry

Password:

12345

```
SELECT * FROM users  
WHERE username = username AND password = password;
```

```
SELECT * FROM users  
WHERE username = "harry" AND password = "12345";
```

Username:

hacker" --

Password:

```
SELECT * FROM users  
WHERE username = username AND password = password;
```



```
SELECT * FROM users  
WHERE username = "hacker"--" AND password = "";
```

```
SELECT * FROM users  
WHERE username = "hacker" --" AND password = "";
```

Race Conditions

Models

Models are a way to create Python Class that represent data for Django

From the model, Django will figure out what SQL syntax it needs to use to create and manipulate tables. Django can then select, update, and insert changes the model.

Every model is going to be a Python Class. We need a model for each main table we care about storing information about.

Models are what Django uses to describe the database.

Migrations are what Django uses to modify the database.

SQL, Models, and Migrations

Migration is a 2-step process to make changes to database:

- 1) Create the instructions to manipulate the database
- 2) Perform the steps to apply changes to database

python manage.py makemigrations

to write Python CMD that get executed on this web application

python manage.py shell

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