

This is CS50

Favorite TV Shows

←

→

↻

https://docs.google.com/forms/

Incognito

Favorite TV Shows

* Required

title *

Title of your favorite TV show

Your answer

genres *

Genre(s) of your favorite TV show

☐ Action

☐ Adventure

☐ Animation

☐ Biography



Untitled spreadsheet - Google



https://docs.google.com/spreadsheets/

Incognito



Untitled spreadsheet



Share



File Edit View Insert Format Data Tools Add-ons Help



100%



.0

.00

123

Default (Ari...

10

B

I



A



fx

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							



Sheet1



flat-file database

CSV

relational database

SQLite

sqlite3

```
.mode csv  
.import FILE TABLE
```

SQL

C
R
U
D

CREATE

READ

UPDATE

DELETE

CREATE, INSERT

SELECT

UPDATE

DELETE

...

```
CREATE TABLE table (column type, ...);
```

.schema

```
SELECT columns FROM table;
```

```
...
```

AVG

COUNT

DISTINCT

LOWER

MAX

MIN

UPPER

...

WHERE

LIKE

ORDER BY

LIMIT

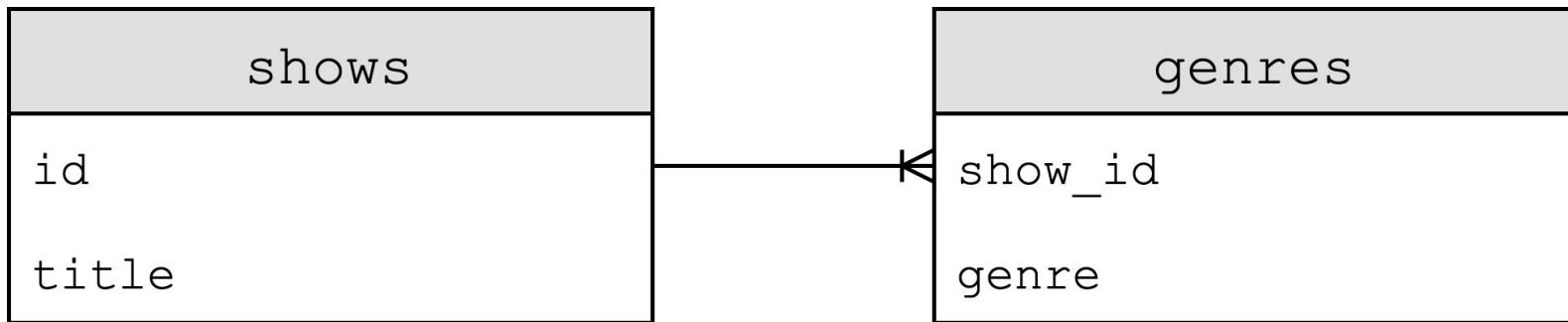
GROUP BY

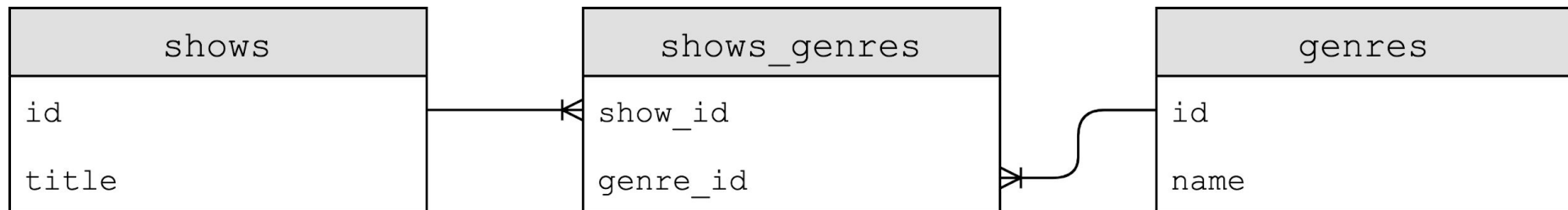
...

```
from cs50 import SQL
```

```
CREATE TABLE table (column type, ...);
```

```
INSERT INTO table (column, ...) VALUES(value, ...);
```





BLOB

INTEGER

NUMERIC

REAL

TEXT

NOT NULL

UNIQUE

PRIMARY KEY

FOREIGN KEY

BLOB

INTEGER

NUMERIC

REAL

TEXT

BLOB

INTEGER

 smallint

 integer

 bigint

NUMERIC

REAL

TEXT

BLOB

INTEGER

NUMERIC

REAL

 real

 double precision

TEXT

BLOB

INTEGER

NUMERIC

- boolean

- date

- datetime

- numeric(scale,precision)

- time

- timestamp

REAL

TEXT

BLOB

INTEGER

NUMERIC

REAL

TEXT

char(n)

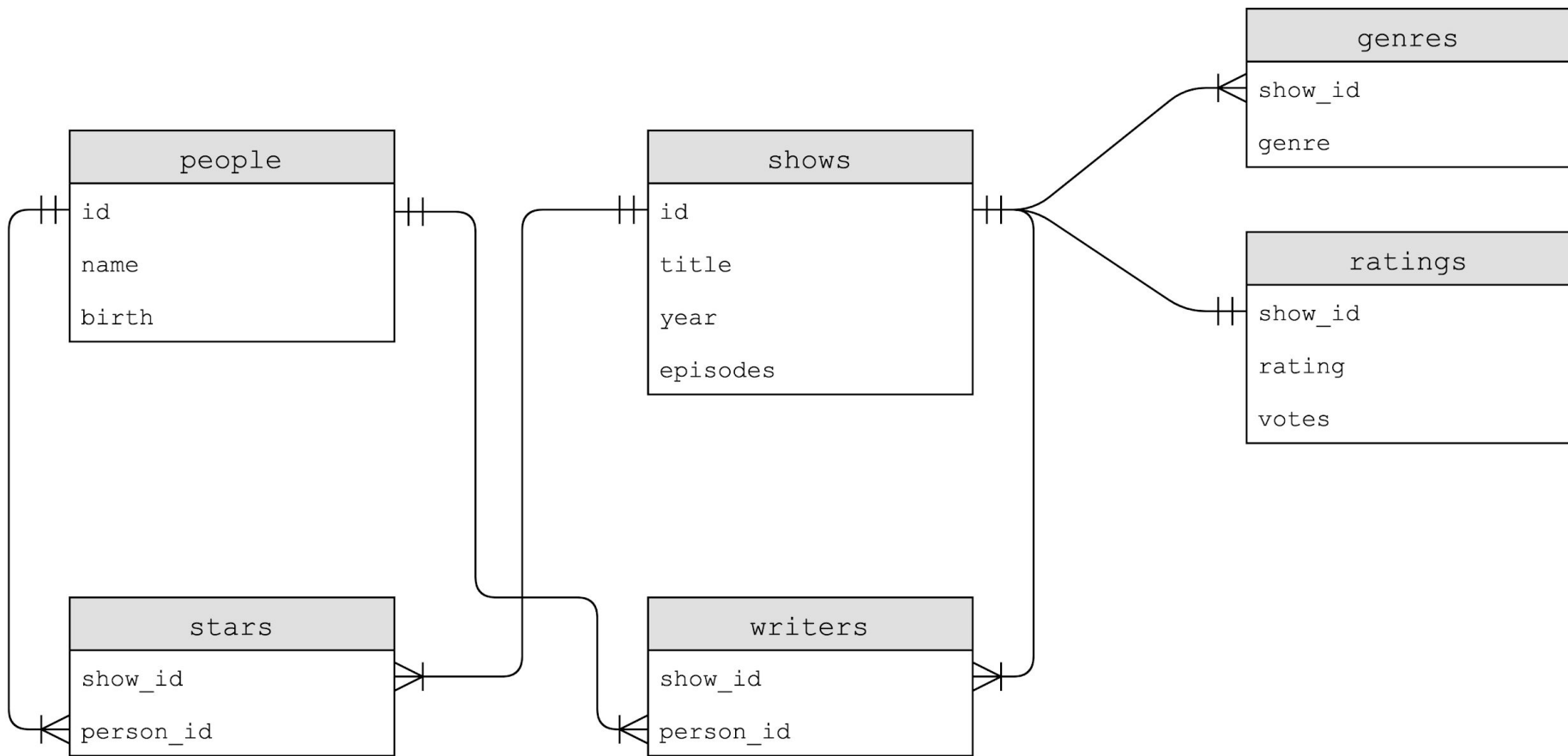
varchar(n)

text

```
UPDATE table SET column = value WHERE condition;
```

```
DELETE FROM table WHERE condition;
```

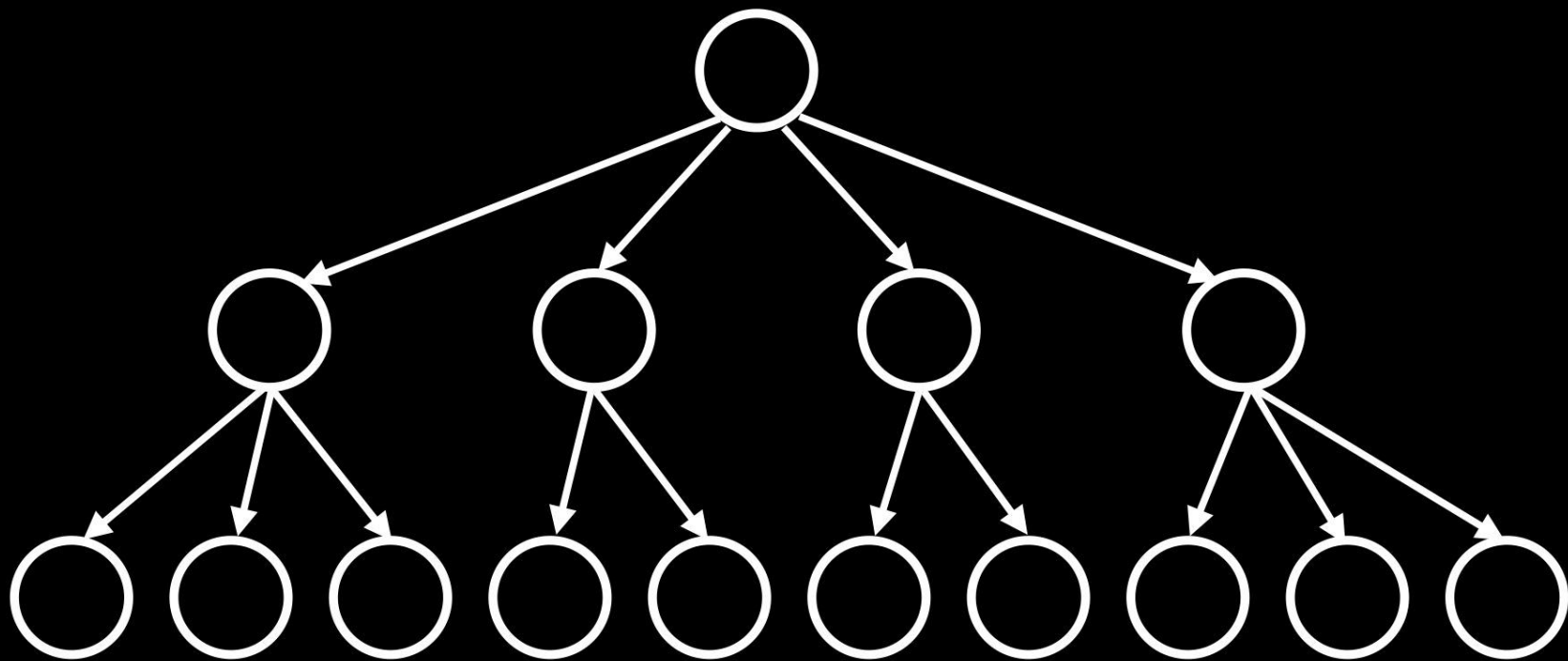
IMDb



indexes

```
CREATE INDEX name ON table (column, ...);
```

B-trees



JOIN

...

JOIN

...

JOIN

...

JOIN

...

```
CREATE INDEX name ON table (column, ...);
```

SQL injection attacks

Sign In

NetID

Password

[Forgot My Password](#)

LOGIN

Please Log In

To log in, please select your login type from the tabs below and enter your credentials. If you're not sure what login type to use, [look here for how you login with HarvardKey](#).

HarvardKey

Login Name (in the form of an email address):

me@examplemailprovider.com

Password:

Login

[Recover/Reset Your HarvardKey Password >](#)

[Recover Your HarvardKey Login Name >](#)

[Recover/Reset Passwords for Other Login Types >](#)

[Back to HarvardKey Home >](#)

Please Log In

To log in, please select your login type from the tabs below and enter your credentials. If you're not sure what login type to use, [look here for how you login with HarvardKey](#).

HarvardKey

Login Name (in the form of an email address):

malan@harvard.edu'--

Password:

Login

[Recover/Reset Your HarvardKey Password >](#)

[Recover Your HarvardKey Login Name >](#)

[Recover/Reset Passwords for Other Login Types >](#)

[Back to HarvardKey Home >](#)

```
rows = db.execute("SELECT * FROM users WHERE username = ? AND password = ?", username, password)
```

```
if len(rows) == 1:  
    # Log user in
```

```
rows = db.execute("SELECT * FROM users WHERE username = ? AND password = ?", username, password)
```

```
if len(rows) == 1:  
    # Log user in
```

```
rows = db.execute("SELECT * FROM users WHERE username = ? AND password = ?", username, password)
```

```
if len(rows) == 1:  
    # Log user in
```

```
rows = db.execute(f"SELECT * FROM users WHERE username = '{username}' AND password = '{password}'")

if len(rows) == 1:
    # Log user in
```

```
rows = db.execute(f"SELECT * FROM users WHERE username = '{username}' AND password = '{password}'")

if len(rows) == 1:
    # Log user in
```

```
rows = db.execute(f"SELECT * FROM users WHERE username = 'malan@harvard.edu--' AND password = '{password}'")

if len(rows) == 1:
    # Log user in
```

```
rows = db.execute(f"SELECT * FROM users WHERE username = 'malan@harvard.edu--' AND password = '{password}'")

if len(rows) == 1:
    # Log user in
```

```
rows = db.execute("SELECT * FROM users WHERE username = ? AND password = ?", username, password)
```

```
if len(rows) == 1:  
    # Log user in
```





ZU 0666',0,0); DROP DATABASE TABLE;

HI, THIS IS
YOUR SON'S SCHOOL.
WE'RE HAVING SOME
COMPUTER TROUBLE.



OH, DEAR - DID HE
BREAK SOMETHING?
IN A WAY-



DID YOU REALLY
NAME YOUR SON
Robert'); DROP
TABLE Students;-- ?



OH, YES. LITTLE
BOBBY TABLES,
WE CALL HIM.

WELL, WE'VE LOST THIS
YEAR'S STUDENT RECORDS.
I HOPE YOU'RE HAPPY.



AND I HOPE
YOU'VE LEARNED
TO SANITIZE YOUR
DATABASE INPUTS.

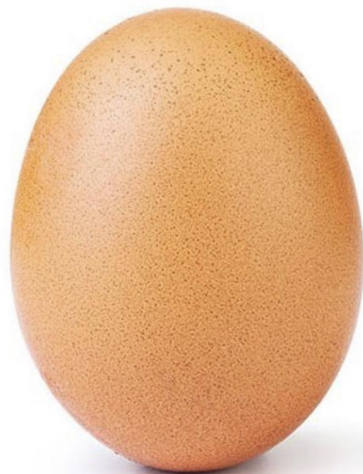
race conditions



Photo



world_record_egg



```
rows = db.execute("SELECT likes FROM posts WHERE id = ?", id);  
likes = rows[0]["likes"]  
db.execute("UPDATE posts SET likes = ? WHERE id = ?", likes + 1, id);
```


BEGIN TRANSACTION

COMMIT

ROLLBACK

```
db.execute("BEGIN TRANSACTION")
rows = db.execute("SELECT likes FROM posts WHERE id = ?", id);
likes = rows[0]["likes"]
db.execute("UPDATE posts SET likes = ? WHERE id = ?", likes + 1, id);
db.execute("COMMIT")
```

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