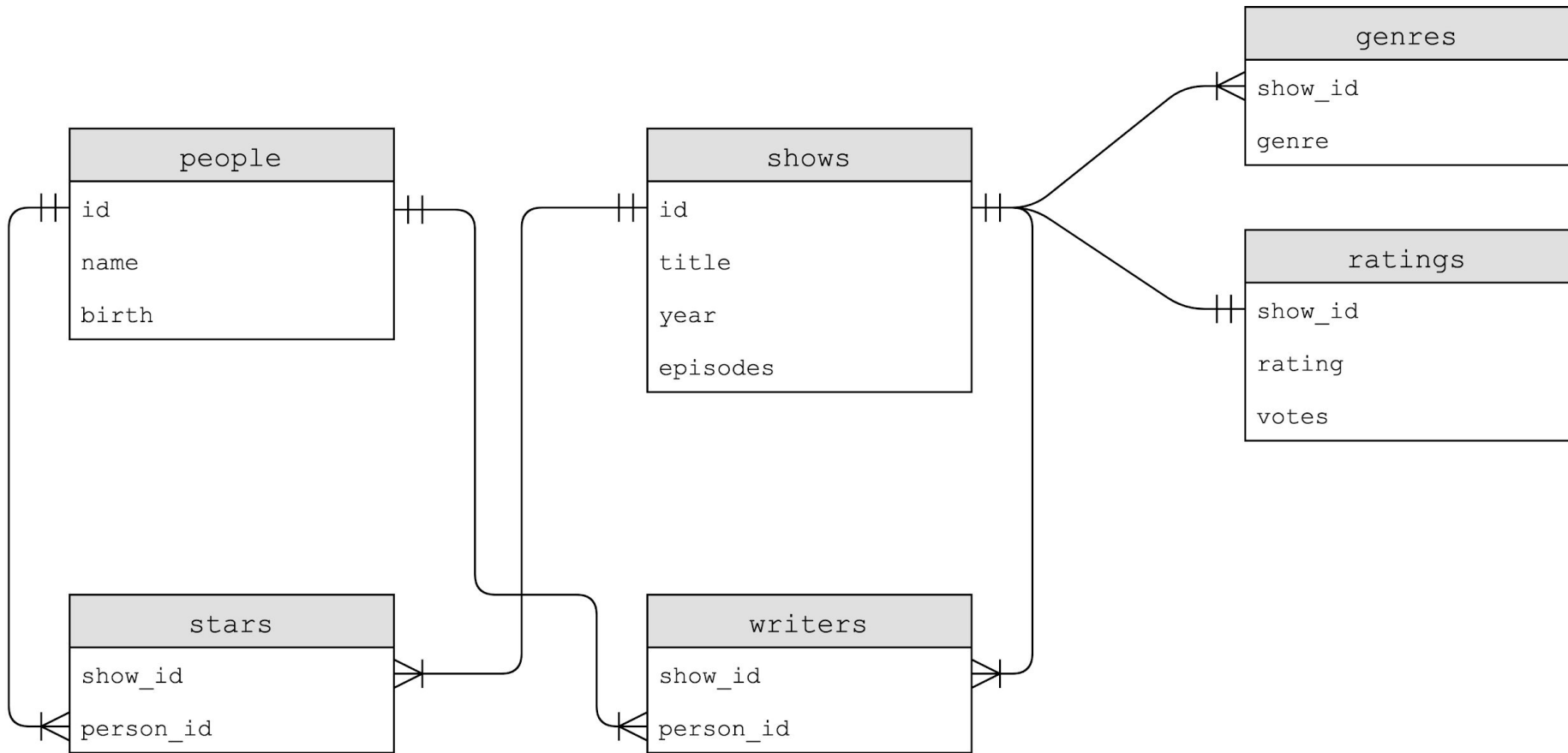


CS50 for MBAs

Databases



JOIN

...

JOIN

...

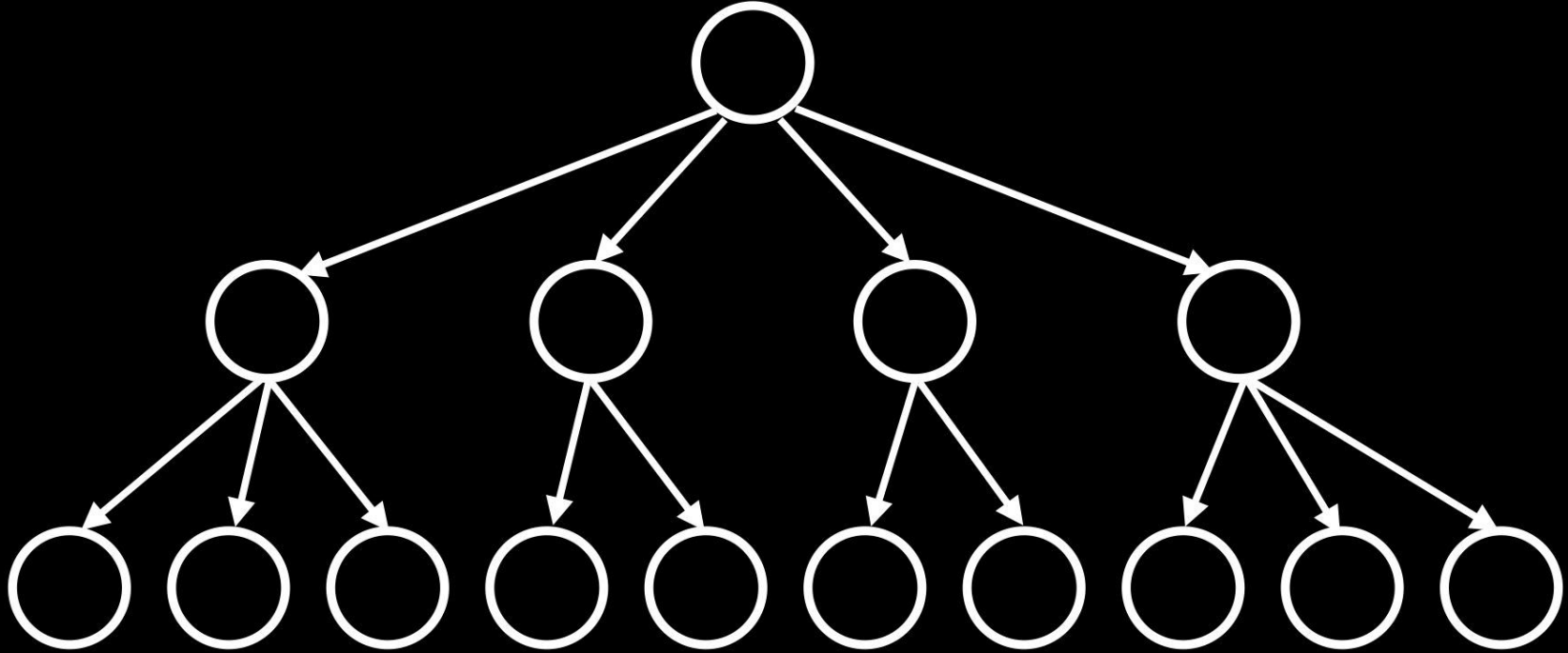
JOIN

...

indexes

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

B-trees



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

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

PRIMARY KEY

FOREIGN KEY

UNIQUE

INDEX

AUTOINCREMENT

NOT NULL

Customers

- ...

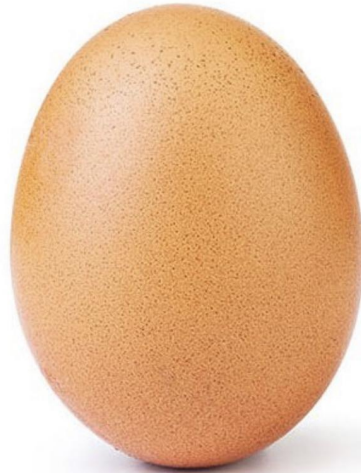
race conditions



Photo



world_record_egg



```
likes = SELECT likes FROM posts WHERE id = 123  
UPDATE posts SET likes = likes + 1 WHERE id = 123
```

BEGIN TRANSACTION

COMMIT

ROLLBACK

```
BEGIN TRANSACTION
```

```
likes = SELECT likes FROM posts WHERE id = 123
```

```
UPDATE posts SET likes = likes + 1 WHERE id = 123
```

```
COMMIT
```

SQL injection attacks

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 >](#)

```
SELECT * FROM users
WHERE username = '{username}'
AND password = '{password}'
```

```
SELECT * FROM users
WHERE username = '{username}'
AND password = '{password}'
```

```
SELECT * FROM users
WHERE username = 'malan@harvard.edu'--'
AND password = '{password}'
```

```
SELECT * FROM users
WHERE username = 'malan@harvard.edu' -- '
AND password = '{password}'
```

```
SELECT * FROM users
WHERE username = 'malan@harvard.edu\ '-- '
AND password = '{password}'
```

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

PL PASIŃKOWSKI D 114 8 8000 3 700 4 201 07 948

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.

Assignment 7

Office Hours

CS50 for MBAs

Databases