This is CS50
cs50.ly/favorites
Favorites

* Required

language *
Which is your favorite language?

- Scratch
- C
- Python
flat-file database
CSV
relational database
SQL
CREATE, INSERT
SELECT
UPDATE
DELETE, DROP
...

CREATE TABLE table (column type, ...);
.mode csv
.import FILE TABLE
SELECT columns FROM table;
...

AVG
COUNT
DISTINCT
LOWER
MAX
MIN
UPPER
...
INSERT INTO table (column, ...) VALUES(value, ...);
UPDATE table SET column = value WHERE condition;
DELETE FROM table WHERE condition;
IMDb
PRIMARY KEY
FOREIGN KEY
JOIN
...

people
- id
- name
- birth

shows
- id
- title
- year
- episodes

stars
- show_id
- person_id
JOIN

...
JOIN

...
indexes
CREATE INDEX name ON table (column, ...);
B-trees
from cs50 import SQL
cs50.readthedocs.io/libraries/cs50/python/#cs50.SQL
race conditions
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")
SQL injection attacks
Central Authentication Service

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NetID

Password

Forgot My Password

SIGN IN

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Sign In

Email Address

Password

SIGN IN

FORGOT YOUR PASSWORD?
Sign In

Email Address

malan@harvard.edu

Password

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

if rows:
    ...

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

if rows:
    ...

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

if rows:
    ...

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

if rows:
    ...

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

if rows:
    ...

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

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

if rows:
    ...

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

if rows:
    ...

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