More SQL

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Quiz

sqlitebrowser demo & SQLite reference

Keys

name	addr	phone	job
remy	...	123	UCLA
zifan	...	234	UCLA
vincent	...	345	UCLA
remy	...	123	UW
dan	...	456	UW
magda	...	567	UW

name	addr
UCLA	LA
UW	seattle

Keys

name	addr	phone	job
remy	...	123	UCLA
zifan	...	234	UCLA
vincent	...	345	UCLA
remy	...	123	UW
dan	...	456	UW
magda	...	567	UW

Primary Key

name	addr
UCLA	LA
UW	seattle

Keys

Foreign Key

name	addr	phone	job
remy	...	123	UCLA
zifan	...	234	UCLA
vincent	...	345	UCLA
remy	...	123	UW
dan	...	456	UW
magda	...	567	UW

Primary Key

name	addr
UCLA	LA
UW	seattle

PK **determines** all other columns

FK **references** a PK in another table

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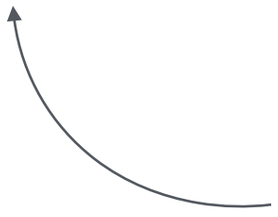
FK **references** a PK in another table



```
PRAGMA foreign_keys = ON

CREATE TABLE employers (
  name  TEXT PRIMARY KEY,
  addr  TEXT
);

CREATE TABLE people (
  name  TEXT,
  addr  TEXT,
  phone TEXT,
  job   TEXT,
  FOREIGN KEY(job) REFERENCES
employers(name)
);
```

Q: join T with itself on PK?

Q: check FK w/ SQL?

```
SELECT name FROM people
  EXCEPT
SELECT name FROM people, employers
 WHERE people.job = employers.name
```

People with both cats & dogs?

name	breed	age	origin	kind	person
casa	tabby	8	seattle	cat	remy
kira	tuxedo	6	hawaii	cat	remy
toby	border collie	17	seattle	dog	remy
maya	husky	10	LA	dog	sam

Q: pet kind w/ average age > 10?

sql	python
WITH	local var
CREATE TABLE	global var
CREATE VIEW	helper function
MATERIALIZED VIEW	N/A

Q: average age of each kind?

Q: average age of cats?

Q: avg. each kind, no group by?

SQL: the ugly parts...

Q: does this return R?

```
SELECT r1.x
  FROM R as r1, R as r2
 WHERE r1.x = r2.x
```

Q: does this return R?

```
SELECT *
  FROM R
 WHERE R.x = R.x
```

Q: does this return R?

```
SELECT *
  FROM R
 WHERE R.x = R.x
    OR R.x <> R.x
```


THE DATABASE MANAGER
WHEN THE COMPANY
HIRES JOHN NULL
imgflip.com

0 vs NULL


NULL IS STRANGE
BUT NULL = NULL
IS TRUE, RIGHT?
RIGHT?
imgflip.com

Q: does this return R?

```
SELECT *
  FROM R
 WHERE null = null
```

Q: does this return R?

```
SELECT *
  FROM R
 WHERE null <> null
```

Q: does this return R?

```
SELECT *
  FROM R
 WHERE not null <> null
```

2 kinds of values in SQL

data values
256
10.33
04-08-2025
"UCLA"
NULL

logical values
T
F
UKNOWN

a.k.a. NULL in SQLite 💀

3 kinds of operators in SQL

data operators:

3 kinds of operators in SQL

predicates:

3 kinds of operators in SQL

logical connectives:

logical value → true AND false ← logical value

logical value

3 kinds of operators in SQL

op. kind	**example**	**input→output**
data	+ - * /	data→data
predicate	> < =	data→logic
logical	AND OR NOT	logic→logic

rules for NULL

op. kind	example	output w/null
data	+ - * /	
predicate	> < =	
logical	AND OR NOT	

To check if x is NULL: x IS NULL

rules for NULL

op. kind	example	output w/null
data	+ - * /	NULL
predicate	> < =	
logical	AND OR NOT	

To check if x is NULL: x IS NULL

rules for NULL

op. kind	example	output w/null
data	+ - * /	NULL
predicate	> < =	UNKNOWN
logical	AND OR NOT	

To check if x is NULL: x IS NULL

rules for NULL

op. kind	example	output w/null
data	+ - * /	NULL
predicate	> < =	UNKNOWN
logical	AND OR NOT	**3 valued logic**

To check if x is NULL: x IS NULL

3 valued logic

AND	T	F	U
T	T	F	
F	F	F	
U			U

OR	T	F	U
T	T	T	
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	
U			U

OR	T	F	U
T	T	T	
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U			U

OR	T	F	U
T	T	T	
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**		U

OR	T	F	U
T	T	T	
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	**T**
F	T	F	
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	**T**
F	T	F	**U**
U			U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	**T**
F	T	F	**U**
U		**U**	U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	**T**
F	T	F	**U**
U	**T**	**U**	U

not U =

3 valued logic

AND	T	F	U
T	T	F	**U**
F	F	F	**F**
U	**U**	**F**	U

OR	T	F	U
T	T	T	**T**
F	T	F	**U**
U	**T**	**U**	U

not U = U

```
SELECT *
  FROM R
 WHERE x < y
```

Only return rows where x < y is **TRUE**

Let's revisit the examples

outer joins

name	addr	phone	job
remy	...	123	UCLA
zifan	...	234	UCLA
vincent	...	345	UCLA
remy	...	123	UW
dan	...	456	UW
remy	...	123	**USC**

name	addr
UCLA	LA
UW	seattle

← Pad w/ NULLs

```
SELECT * FROM p LEFT OUTER JOIN e
                ON p.job = e.name
```

Aggregates ignore NULLs, but...

Q: how many offices?

name	addr	phone	job
remy	...	123	UCLA
zifan	...	234	UCLA
vincent	...	345	UCLA
remy	...	123	UW
dan	...	456	UW
remy	...	123	**USC**
seymour	...	367	**USC**

name	addr
UCLA	LA
UW	seattle

The witness problem (*argmax*):

Q: who's the oldest cat?

The ORDER BY trick

Multiple oldest cats?

Replace nesting with join

Challenge

inner product w/ frequencies