Meet NULL the UNKNOWN

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Agenda

- Definitions boolean logic
- Quizz!

Definitions

Null

Every data type includes a special value, called the null value, sometimes denoted by the keyword NULL.

Special value that is used to indicate the absence of any data value

ISO/IEC 9075-1:2016, Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)

Null is not

- An empty string
- A string with only spaces
- The string 'NULL'
- 0

ON THE HOOK

THIS GUY GOT THE LICENSE PLATE "NULL" AND IT WAS A TOTAL DISASTER

Unknown

Value of the Boolean data type is either true or false.
The truth value of unknown is sometimes represented by the null value.

ISO/IEC 9075-1:2016, Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)

So, a boolean can take 4 different values

- true
- false
- unknown
- null

```
test=> create table test (test boolean);
CREATE TABLE
test=> insert into test values
(true),(false),(unknown),(null) ;

2019-10-14 18:08:52.088 CEST [5688] ERROR: column "unknown"
does not exist at character 41

2019-10-14 18:08:52.088 CEST [5688] STATEMENT: insert into
test values (true),(false),(unknown),(null);
ERROR: column "unknown" does not exist LINE 1: insert into
test values (true),(false),(unknown), (null);
```

```
test=> insert into test values (true),(false),(null),
(null);
INSERT 0 4

test=> select * from test;
 test
------
 t
 f


(4 rows)
```

Psql by default displays NULLs as empty strings

Displaying null

```
test=# \pset null 'Ada
Lovelace'
Null display is "Ada Lovelace".

test=# select * from test;
     test
--------------
 t
 f
 Ada Lovelace
 Ada Lovelace
(4 rows)
```

Feature T031 of teh SQL standard

```
<boolean literal> ::=
    TRUE
  | FALSE
  | UNKNOWN
```

Is Postgres still compliant?

This specification does not make a distinction between the null value of the boolean data type and the truth value Unknown that is the result of an SQL predicate, search condition, or boolean value expression; they may be used interchangeably to mean exactly the same thing.

ISO/IEC 9075-2:2016, Information technology — Database languages — SQL — Part 2: Framework (SQL/Framework)

Boolean logic

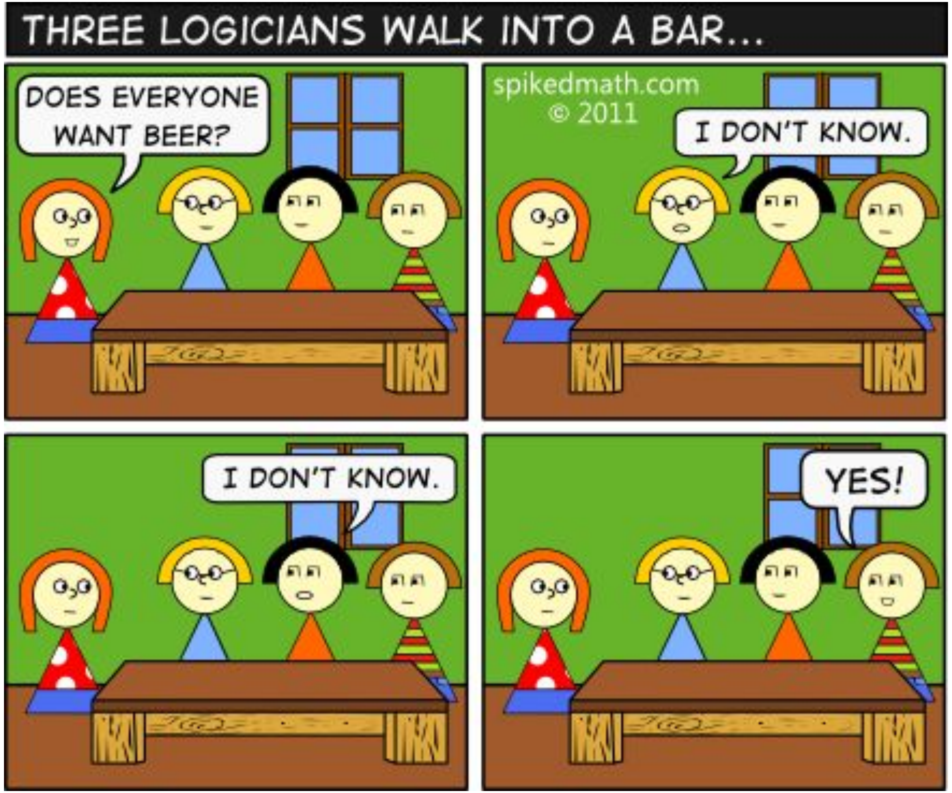
Writing a truth table in SQL

```
select
  coalesce(ros.a::text,'unknown') as and_truth_table,
  ros.a and cols.a as t,
  ros.a and cols.b as f,
  ros.a and cols.c as unknown
from (values(true, false, null::boolean)) as cols (a,b,c),
  (values (true),(false),(null)) as ros (a)
```

Writing a truth table in SQL

```
 and_truth_table |      t       | f |   unknown
-----------------+--------------+---+--------------
 true            | t            | f | Ada Lovelace
 false           | f            | f | f
 unknown         | Ada Lovelace | f | Ada Lovelace
(3 rows)
```

3 logicians walk into a bar…



Joke and Image from Mike http://spikedmath.com

4-value logic?

- 3-value logic is far from being well-known and understood yet
- Do we want to add complexity?
- What goal would that reach?
- What would be the result of `null and unknown`?

Quizz!

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
    (2, 'bb'),
    (3, null)) as t (a,b)
where null
```

- 0
- 1
- 3
- [Aminata Sana Congo]

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where null
```

```
 a | b
---+-----
(0 rows)
```

Null in a where clause is treated as false.

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
     (2, 'bb'),
     (3, null)) as t (a,b)
where t.b <> 'aa'
```

- 0
- 1
- 2
- Maria Mitchel

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where t.b <> 'aa'
```

```
 a | b
---+-----
 2 | bb
(1 row)
```

Inequality or equality operations are null when one of the operand is null

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
    (2, 'bb'),
    (3, null)) as t (a,b)
where t.b is distinct from 'aa'
```

- 0
- 1
- 2
- Nicole-Reine Étable de la Brière Lepaute

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where t.b is distinct from 'aa'
```

```
 a | b
---+-----
 2 | bb
 3 |
(2 rows)
```

is distinct means "are not identical". For SQL standard, identical for null value is :

If V1 and V2 are both the null value, then V1 is identical to V2.

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
    (2, 'bb'),
    (3, null)) as t (a,b)
where t.b in ('aa',null)
```

- 0
- 1
- 2
- Annie Jump Cannon

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where t.b in ('aa',null)
```

```
 a | b
---+----
 1 | aa
(1 row)
```

t.b in ('aa',null) is equivalent to t.b = 'aa' or t.b = null

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
    (2, 'bb'),
    (3, null)) as t (a,b)
where t.b not in ('aa',null)
```

- 0
- 1
- 2
- Alice Lee

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where t.b not in ('aa',null)
```

```
 a | b
---+---
(0 row)
```

t.b not in ('aa',null) is equivalent to not t.b in ('aa',null). So it's equivalent to 'aa' <> 'aa' and null <> null.

How many rows will this query return ?

```
select a, b
from (values (1, 'aa'),
    (2, 'bb'),
    (3, null)) as t (a,b)
where t.a between 1 and null
```

- 0
- 1
- 2
- Jaime Levy

```
select a, b
from (values (1, 'aa'),
             (2, 'bb'),
             (3, null)) as t (a,b)
where t.b between 1 and null
```

```
 a | b
---+---
(0 row)
```

“X BETWEEN Y AND Z” is equivalent to
“X>=Y AND X<=Z”

How many rows will this query return ?

```
select a, b
from (values (1, true),
    (2, false),
    (3, null)) as t (a,b)
where t.b < true
```

- 0
- 1
- 2
- Rear admiral Grace Hopper

```
select a, b
from (values (1, true),
             (2, false),
             (3, null)) as t (a,b)
where t.b < true
```

```
 a | b
---+---
 2 | f
(1 row)
```

The value True is greater than the value False, and any comparison involving the null value or an Unknown truth value will return an Unknown result.

How many rows will this query return ?

```
select (null=1)
  or (1=1) as "Annie Easley"
```

- true
- false
- null
- Annie Easley

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LEWIS RESEARCH CENTER
NATIONAL AERONAUTICS & SPACE ADMINISTRATION

```
select (null=1)
  or (1=1) as "Annie Easley"
```

```
 Annie Easley
--------------
 t
(1 row)
```

null or true is true

How many rows will this query return ?

```
select null is null is null
       is null is null
       as "Margaret Hamilton"
```

- true
- false
- null
- Margaret Hamilton

```
select null is null is null
         is null is null
         as "Margaret Hamilton"
```

```
 Margaret Hamilton
-------------------
 f
(1 row)
```

The first one is true, all the others are false

How many rows will this query return ?

```
select row(null) is null
```

- true
- false
- null
- Radia Perlman

```
select row(null) is null
```

```
 ?column?
-----------
 t
(1 row)
```

Let R be the row value predicand and let V be the value of R.

If the value of every field of V is the null value, then [the value of “R IS NULL” is] True.

How many rows will this query return ?

```
select row(row(null)) is null
```

- true
- false

- null
- Brenda Laurel

```
select row(row(null)) is null
```

```
  ?column?
----------
 f
(1 row)
```

The value of the first field is not the null value but row(null), so it's false!

How many rows will this query return ?

```
select nullif('null','null')
```

- 0
- 1

- 'null'
- Ada Lovelace

```
select nullif('null','null')
```

```
    nullif
---------------
 Ada Lovelace
(1 row)
```

Nullif returns true if both values are equal and returns the first value if not.

Psql is set to display null values as 'Ada Lovelace' (see Slide 11: Displaying null).

Fun fact: fixed char datatype and null

```
select value, '[' || (coalesce(value, ' ')) || ']'
from (values (null::char(1)),
             (' '::char(1))) as t(value);
```

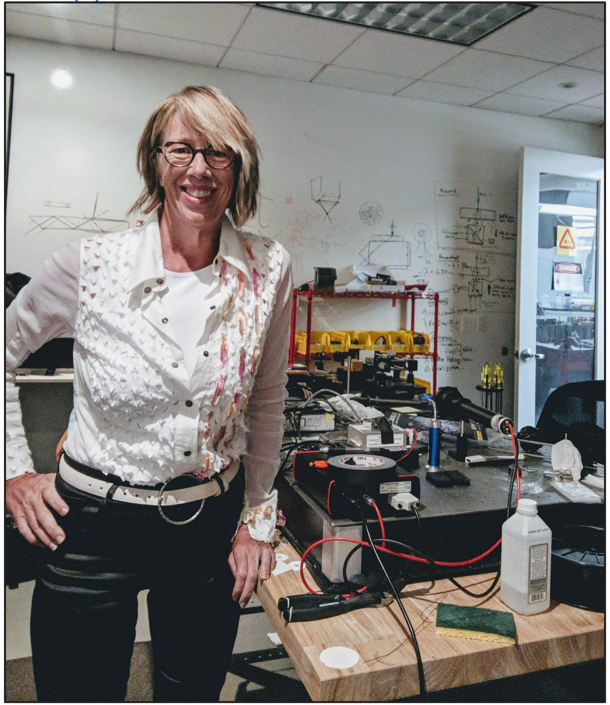
```
 ?column?
----------
 [ ]
 []
```

Any value entered as a fixed char datatype is padded to match the fixed size constraint.

How many rows will this query return ?

```
select 'Mary Lou ' ||
  a || 'Jepsen'
from (values (null)) as t (a)
```

-
- Mary Lou a Jepsen
- Mary Lou Jepsen
- Ada Lovelace



```
select 'Mary Lou ' ||
  a || 'Jepsen'
from (values (null)) as t (a)
```

```
  ?column?
---------------
 Ada Lovelace
(1 row)
```

Concatenation with null is always null