

Lecture 03: Data Types

DATA 351: Data Management with SQL

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This lecture covers the data types.

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0.1 Outline

Understanding PostgreSQL data types:

- Numeric types
- Text types
- Date/time types
- Other types

1 Understanding PostgreSQL data types

1.1 Why Data Types Matter

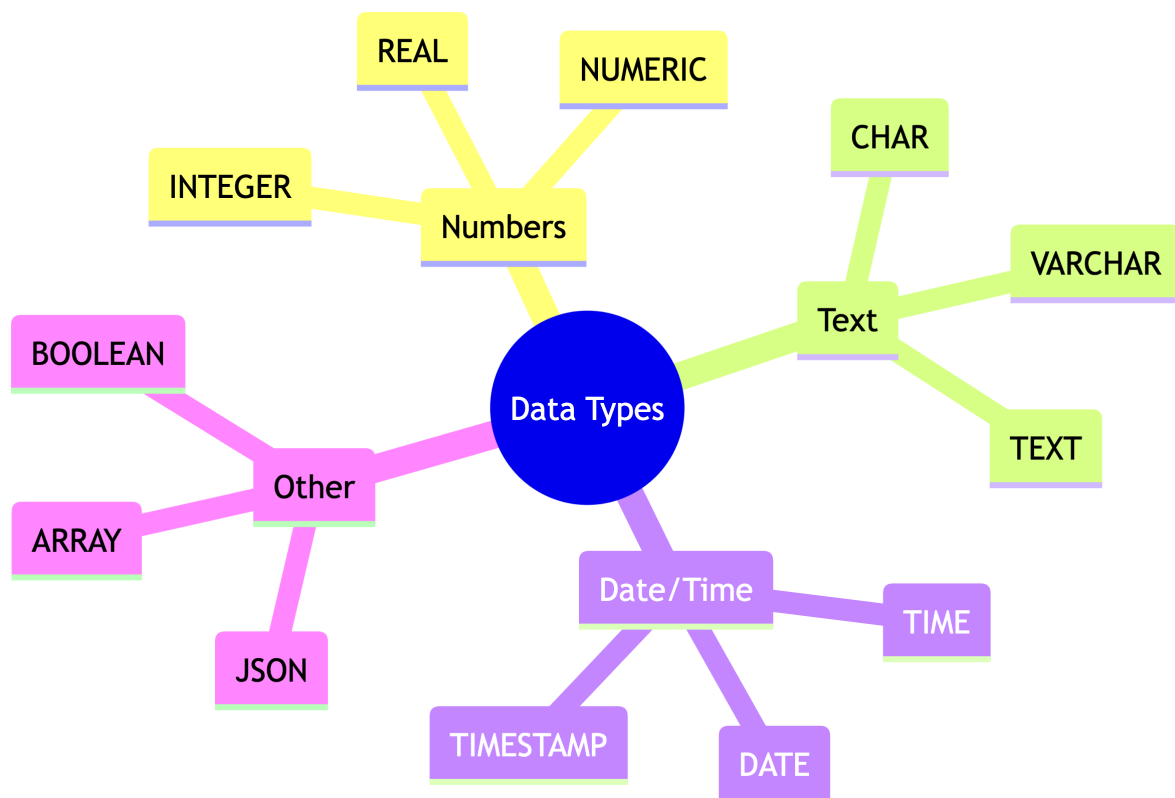
Consider this question: What is '10' + '5'?

- In some languages: '105' (string concatenation)
- In math: 15 (addition)

Warning

Data types tell PostgreSQL how to interpret and operate on your data.
Wrong data type = wrong results, wasted storage, or errors.

1.2 PostgreSQL Data Type Categories



1.3 Numeric Types: The Big Three

Type	Description	Example
INTEGER	Whole numbers	42, -7, 1000000
NUMERIC(p,s)	Exact decimals	75000.00, 3.14159
REAL	Approximate decimals	Scientific calculations

When to use each:

- **INTEGER:** Counts, IDs, quantities
- **NUMERIC:** Money, precise measurements
- **REAL:** Scientific data where approximation is OK

1.4 NUMERIC(precision, scale) Explained

```
1 salary_usd NUMERIC(10,2)
```

- **Precision (10):** Total digits allowed
- **Scale (2):** Digits after decimal point

Value	Valid for NUMERIC(10,2)?
75000.00	Yes (7 digits total)
123456789.99	No (11 digits total)
75000.001	Rounded to 75000.00

1.5 Quick Check: Our Employee Table

Look at how we defined numeric columns:

```
1 salary_usd          NUMERIC(10,2)    -- Up to 99,999,999.99
2 performance_rating  NUMERIC(2,1)     -- 0.0 to 9.9
3 commission_rate     NUMERIC(3,2)     -- 0.00 to 9.99
4 years_experience     INTEGER          -- Whole years only
```

Question: Why not use INTEGER for salary?

Because we want cents! \$75,000.00 not \$75000

1.6 Text Types: Three Flavors

Type	Description	Use Case
CHAR(n)	Fixed length, padded	Codes like state abbreviations
VARCHAR(n)	Variable length, max n	Names, emails with limits
TEXT	Unlimited length	Long descriptions, notes

Note

In practice: TEXT and VARCHAR are equally fast in PostgreSQL.
I generally use TEXT unless I have a specific length constraint.

1.7 Date and Time Types

Type	Stores	Example
DATE	Year, month, day	'2026-01-15'
TIME	Hour, minute, second	'09:30:00'
TIMESTAMP	Both date and time	'2026-01-15 09:30:00'

Our table uses:

```
1 hire_date DATE      -- Just the date they started
2 last_login TIMESTAMP -- Date AND time of login
```

1.8 Boolean: True or False

The BOOLEAN type stores TRUE or FALSE.

PostgreSQL accepts multiple formats:

True Values	False Values
TRUE, 't', 'yes', '1'	FALSE, 'f', 'no', '0'

```
1 SELECT full_name, is_manager
2 FROM employees
3 WHERE is_manager = TRUE;
```

full_name	is_manager
Michael Scott	t

1.9 NULL: The Absence of Data

NULL means “unknown” or “not applicable.”

Look at our data for commissions:

```
1 SELECT full_name, commission_rate, last_login
2 FROM employees
3 WHERE commission_rate IS NULL;
```

full_name	commission_rate	last_login
Michael Scott	NULL	2026-01-15 09:12:00
Pam Beesly	NULL	NULL
Angela Martin	NULL	2026-01-15 07:45:00

Note

Pam has no commission (not in sales) AND no last_login (maybe she uses paper).

1.10 NULL Gotchas

NULL is not equal to anything, not even itself!

```
1 -- This finds NOTHING:
2 SELECT * FROM employees WHERE commission_rate = NULL;
3
4
5 -- This works:
6 SELECT * FROM employees WHERE commission_rate IS NULL;
```

1.11 NULL Gotchas: Math with NULL

Math with NULL returns NULL

```
1 SELECT 100 + NULL; -- Returns NULL
2 SELECT NULL * 5;   -- Returns NULL
```

Note

We will learn to handle this with COALESCE and NULLIF later.

1.12 Exercise: Data Type Detective

Look at this data and choose the best PostgreSQL data type:

1. Social Security Number: '123-45-6789'
2. Product price: \$29.99
3. Is item in stock: yes or no
4. Number of items in warehouse: 1,547
5. Customer review text: 'Great product! Would buy again...'

Take 2 minutes to decide, then we discuss.

1.13 Exercise: Data Type Answers

1. **SSN:** CHAR(11) or VARCHAR(11) - It is text, not a number (leading zeros, dashes)
2. **Price:** NUMERIC(10,2) - Money needs exact precision
3. **In stock:** BOOLEAN - True/false value
4. **Warehouse count:** INTEGER - Whole numbers only
5. **Review text:** TEXT - Variable length, potentially long

1.14 Questions?

We covered:

- Numeric, text, and date/time types
- Boolean and NULL behavior
- Choosing types that fit your data

What questions do you have?