The Mother of All Query Languages: SQL in Modern Times

SEQUEL: A STRUCTURED ENGLISH QUERY LANGUAGE

by

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http://www.almaden.ibm.com/cs/people/chamberlin/sequel-1974.pdf

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Jose, California

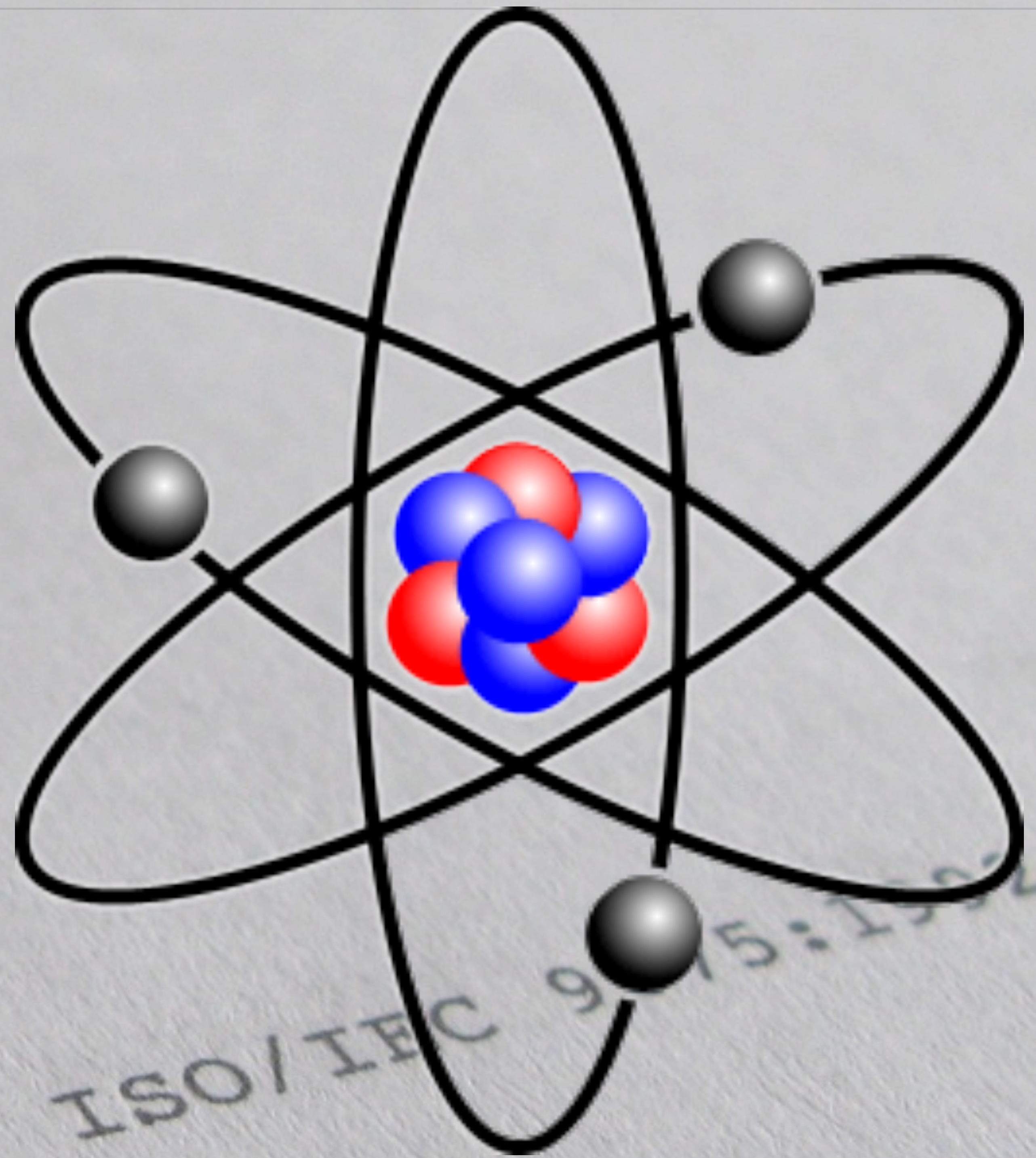
1974

1992

SQL-92 — Tied to the Relational Idea

Relational Data Model

- “Atomic” types (domain)



(Second Informal Review Draft) ISO/IEC 9075:1992, Database Language SQL- July 30, 1992

Atom image: https://commons.wikimedia.org/wiki/File:Stylised_atom_with_three_Bohr_model_orbits_and_stylised_nucleus.png

SQL-92 — Tied to the Relational Idea

Relational Data Model

- “Atomic” types (domain)

A	B	C
⚛	⚛	⚛
⚛	⚛	
⚛	⚛	⚛

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SQL-92 — Tied to the Relational Idea

Relational Data Model

- “Atomic” types (domain)
- Schema independent of processing purposes
  - “Normalization”

A	B	C
⚛	⚛	⚛
⚛	⚛	
⚛	⚛	⚛

C	D
⚛	⚛
⚛	⚛

B	E
⚛	⚛
⚛	⚛

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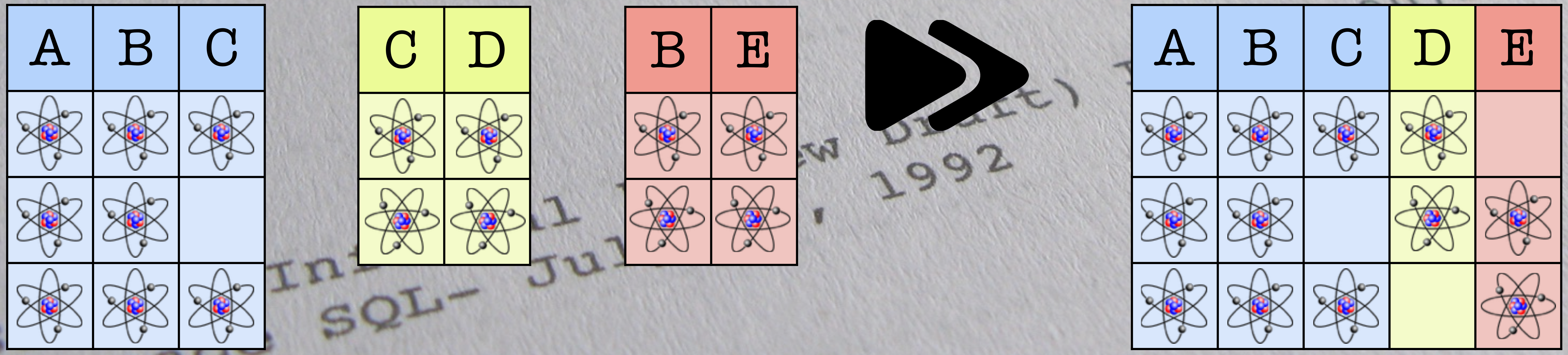
Relational Operations

- Transform data for each particular processing purposes
  - JOIN, UNION, nesting, …



A	B	C
⚛	⚛	⚛
⚛	⚛	
⚛	⚛	⚛

C	D
⚛	⚛
⚛	⚛

B	E
⚛	⚛
⚛	⚛

▶▶

A	B	C	D	E
⚛	⚛	⚛	⚛	
⚛	⚛		⚛	⚛
⚛	⚛	⚛		⚛

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⚛	⚛	⚛
⚛	⚛	
⚛	⚛	⚛

C	D
⚛	⚛
⚛	⚛

B	E
⚛	⚛
⚛	⚛

▶▶

A	B	C	D	E
⚛	⚛	⚛	⚛	
⚛	⚛		⚛	⚛
⚛	⚛	⚛		⚛

A	B	E
⚛	⚛	⚛
⚛	⚛	⚛

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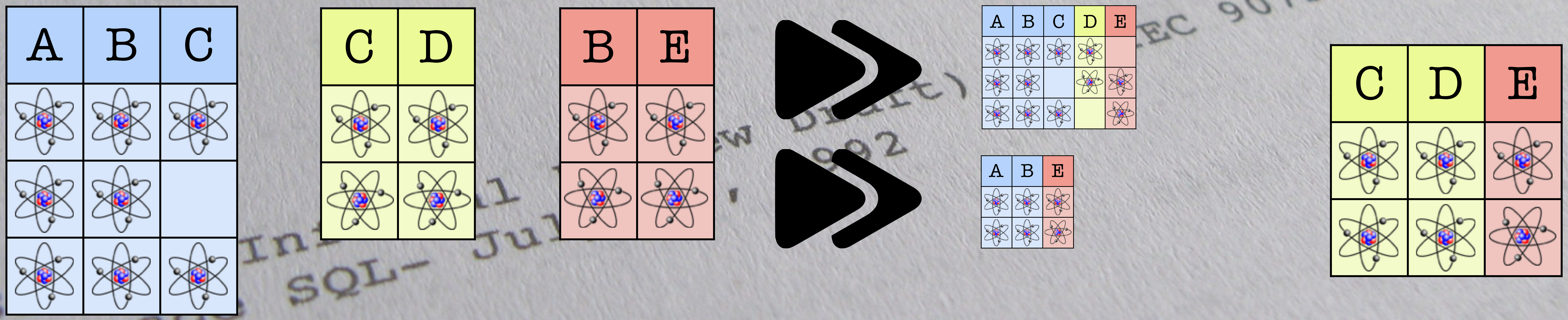

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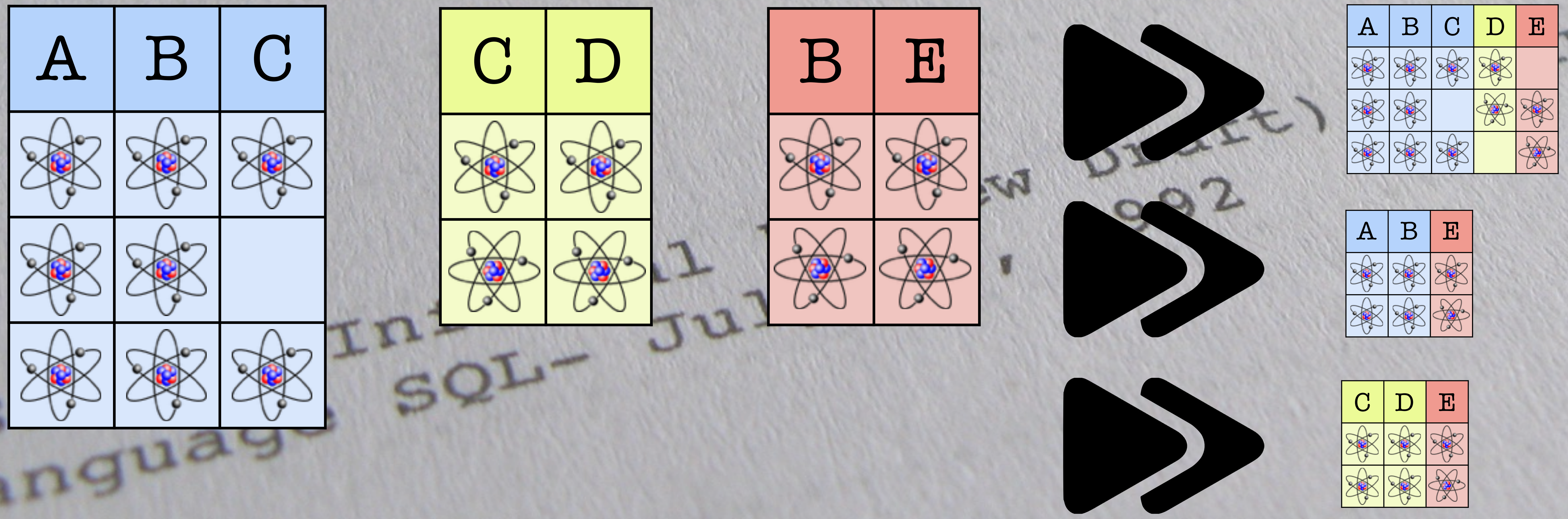

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Whitemarsh
Information Systems Corporation

Great News,
The Relational Data Model is Dead!

https://www.wiscorp.com/DBMS_-_GreatNews-TheRelationalModelIsDead_-_paper_-_sam.pdf

SQL:1999 — Escaping the Relational Cage

To say that these SQL:1999 extensions are mere "extended interpretations" of the relational data model is like saying that an intercontinental ballistic missile is merely an "extended interpretation" of a spear.

With SQL/99 you can get the best of both worlds and of course, you can get the worst of both worlds. It's up to the database practitioners to do the right thing.

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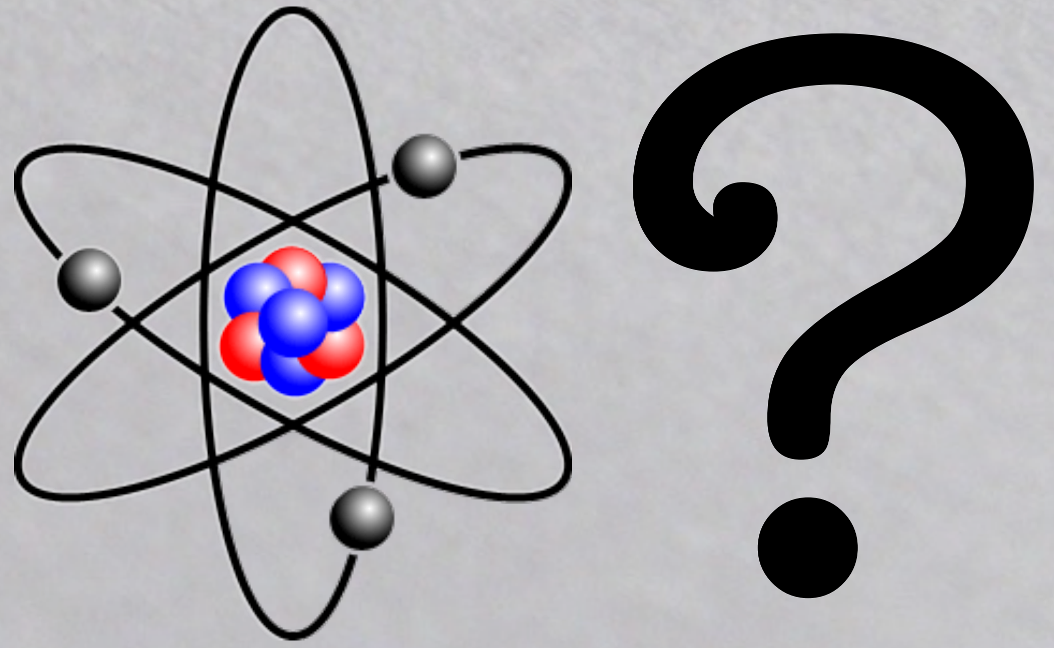
Relational Model?



I was as confused as anyone else

Date on Database: Writings 2000-2006

Chris Date

SQL:1999 — Escaping the Relational Cage

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By the early 1990s, however,
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Domains Can Contain Anything!

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Relational Model?

- Introduced rich types

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SQL:1999 — Escaping the Relational Cage

Relational Model?

- Introduced rich types
  - arrays

A	B
⚛	[⚛,⚛]
⚛	[⚛]
⚛	[]

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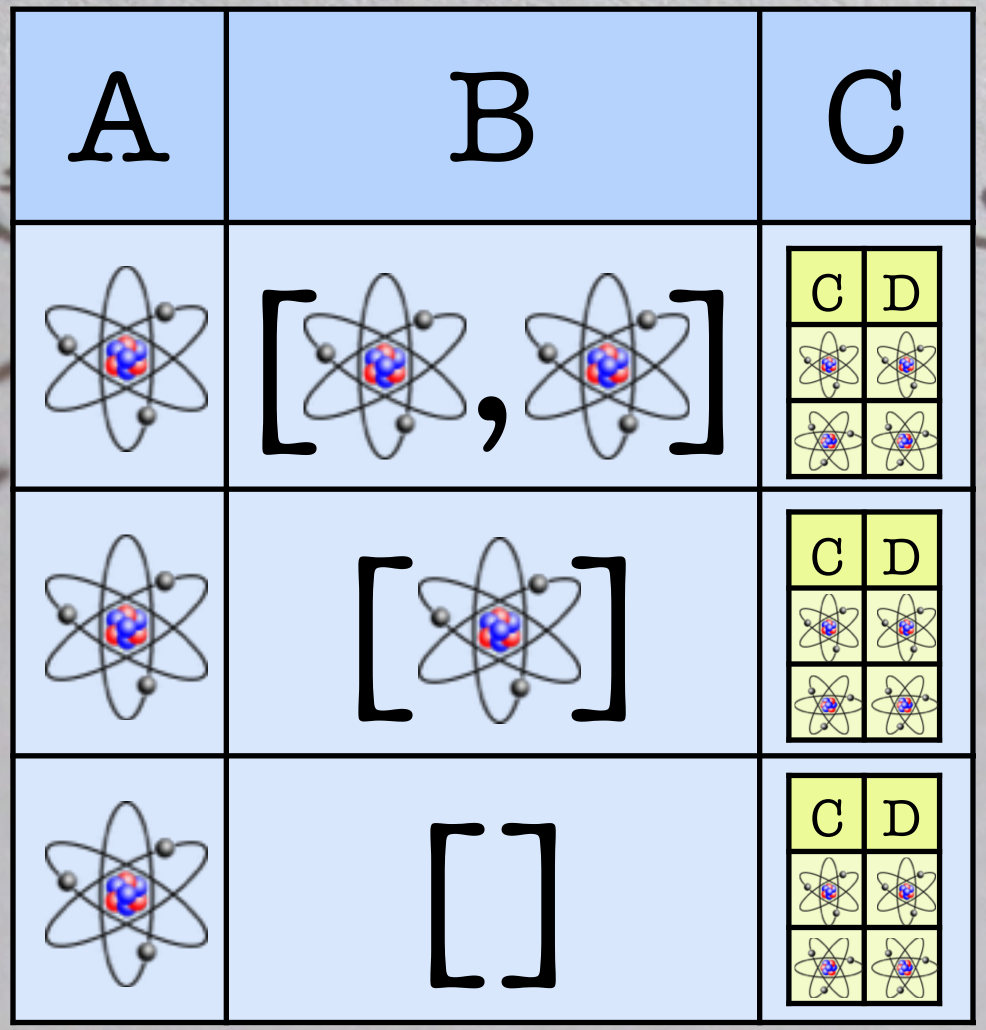
  - Nested tables (multiset)



A	B	C
⚛	[⚛,⚛]	C D ⚛ ⚛ ⚛ ⚛
⚛	[⚛]	C D ⚛ ⚛ ⚛ ⚛
⚛	[]	C D ⚛ ⚛ ⚛ ⚛

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Relational Model?

- Introduced rich types
  - arrays
  - Nested tables (multiset)
  - composite types (objects)

A	B	C	D
⚛	[⚛,⚛]	C D ⚛ ⚛ ⚛ ⚛	{x: ⚛, y: ⚛}
⚛	[⚛]	C D ⚛ ⚛ ⚛ ⚛	{x: ⚛, y: ⚛}
⚛	[]	C D ⚛ ⚛ ⚛ ⚛	{x: ⚛, y: ⚛}

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  - arrays
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Non-Relational Operations

- Introduced recursive queries that process their own output
  - Transitive closure

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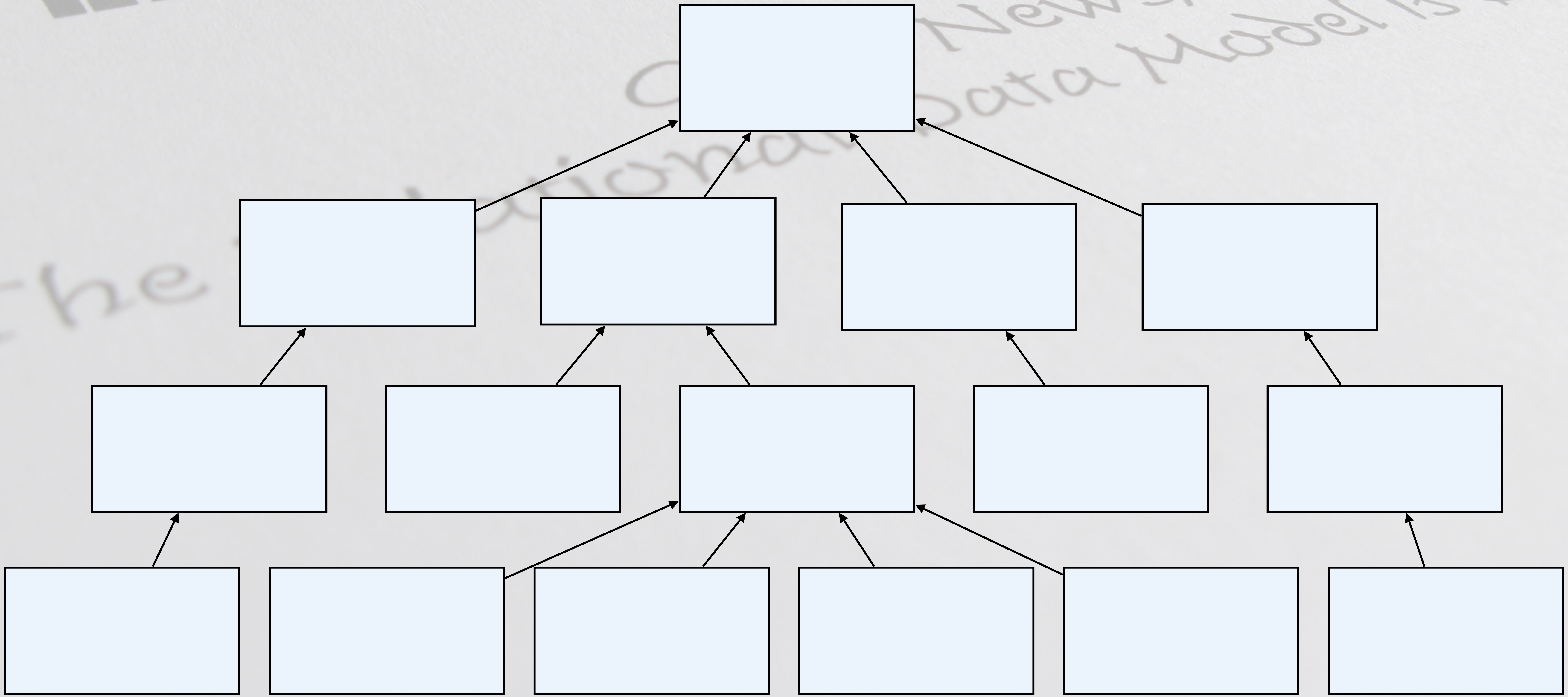
SQL:1999 — Recursion



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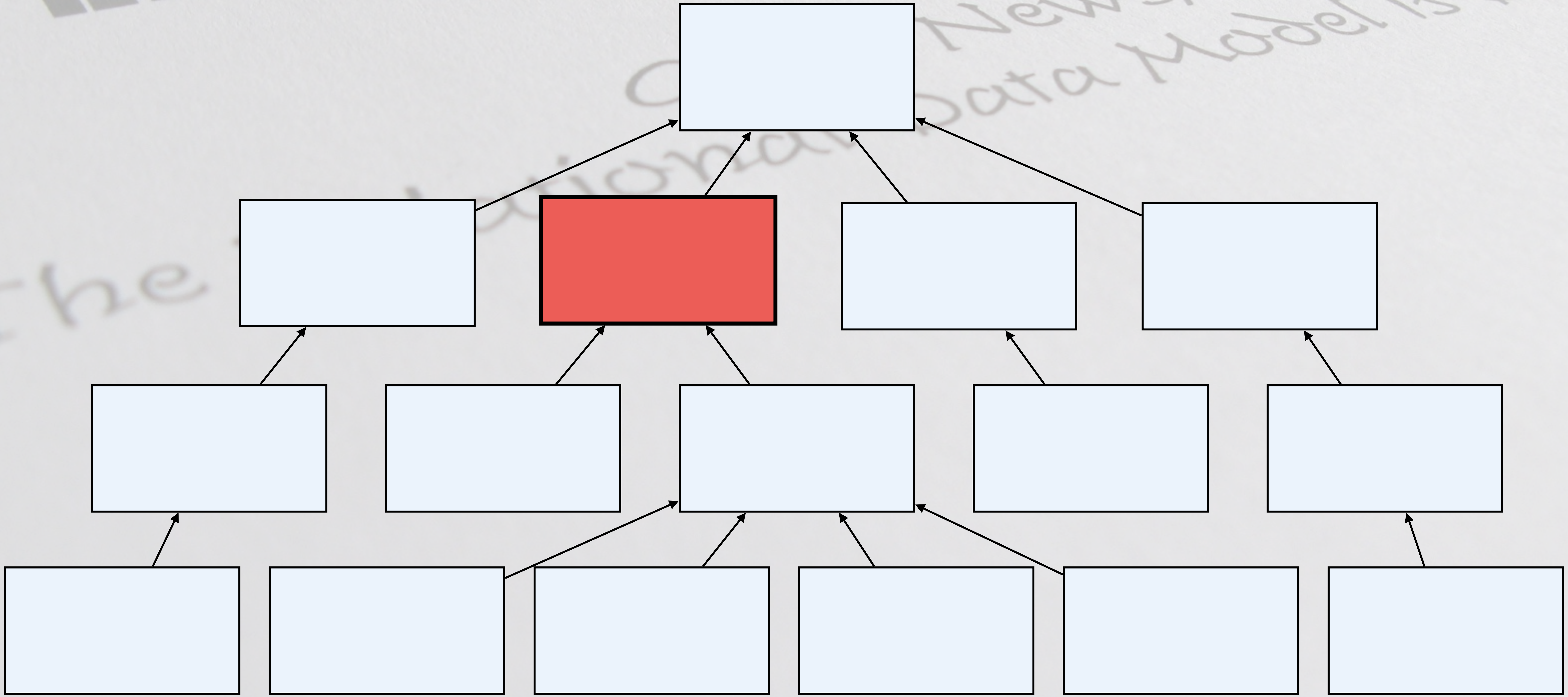

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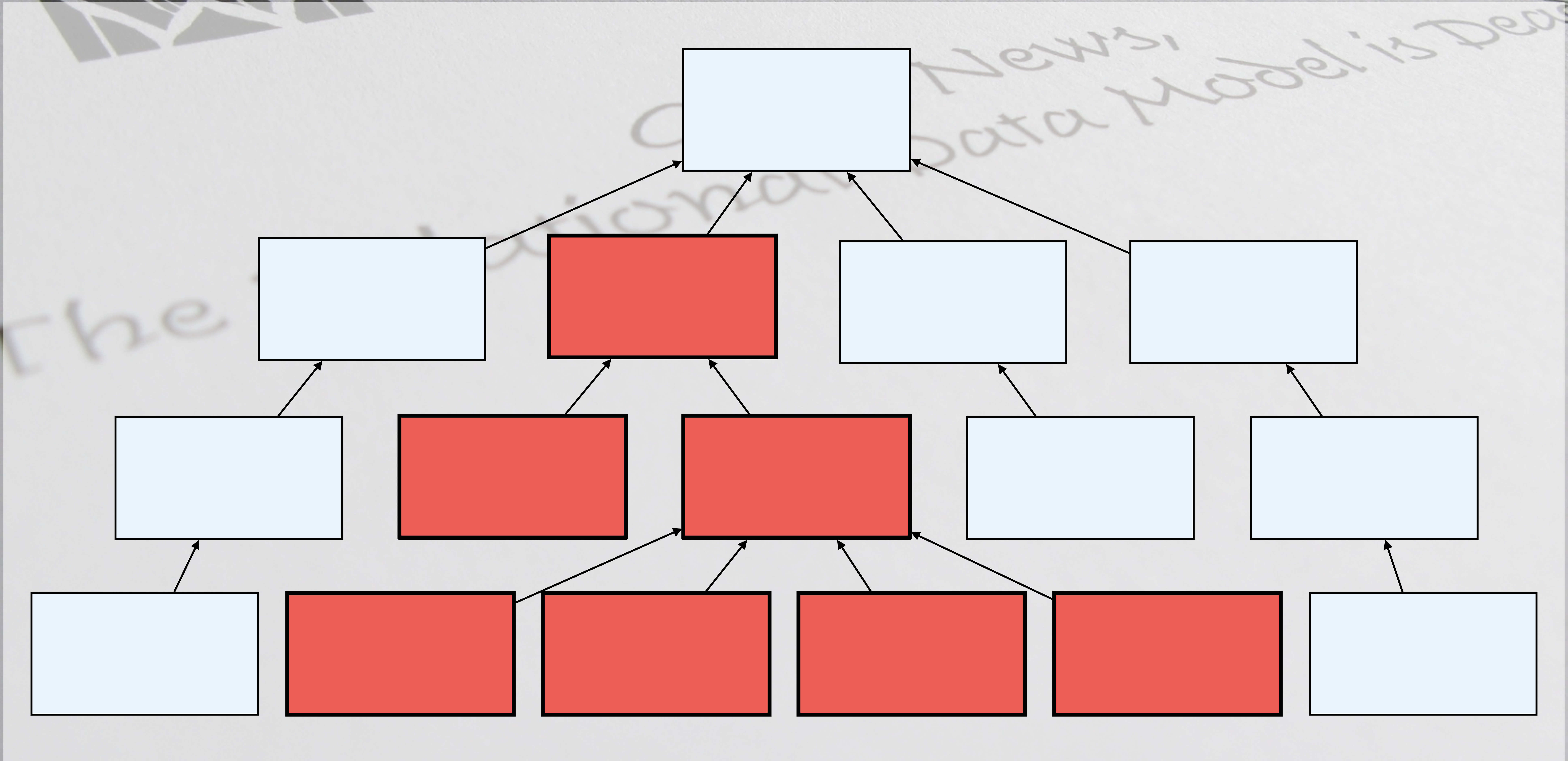
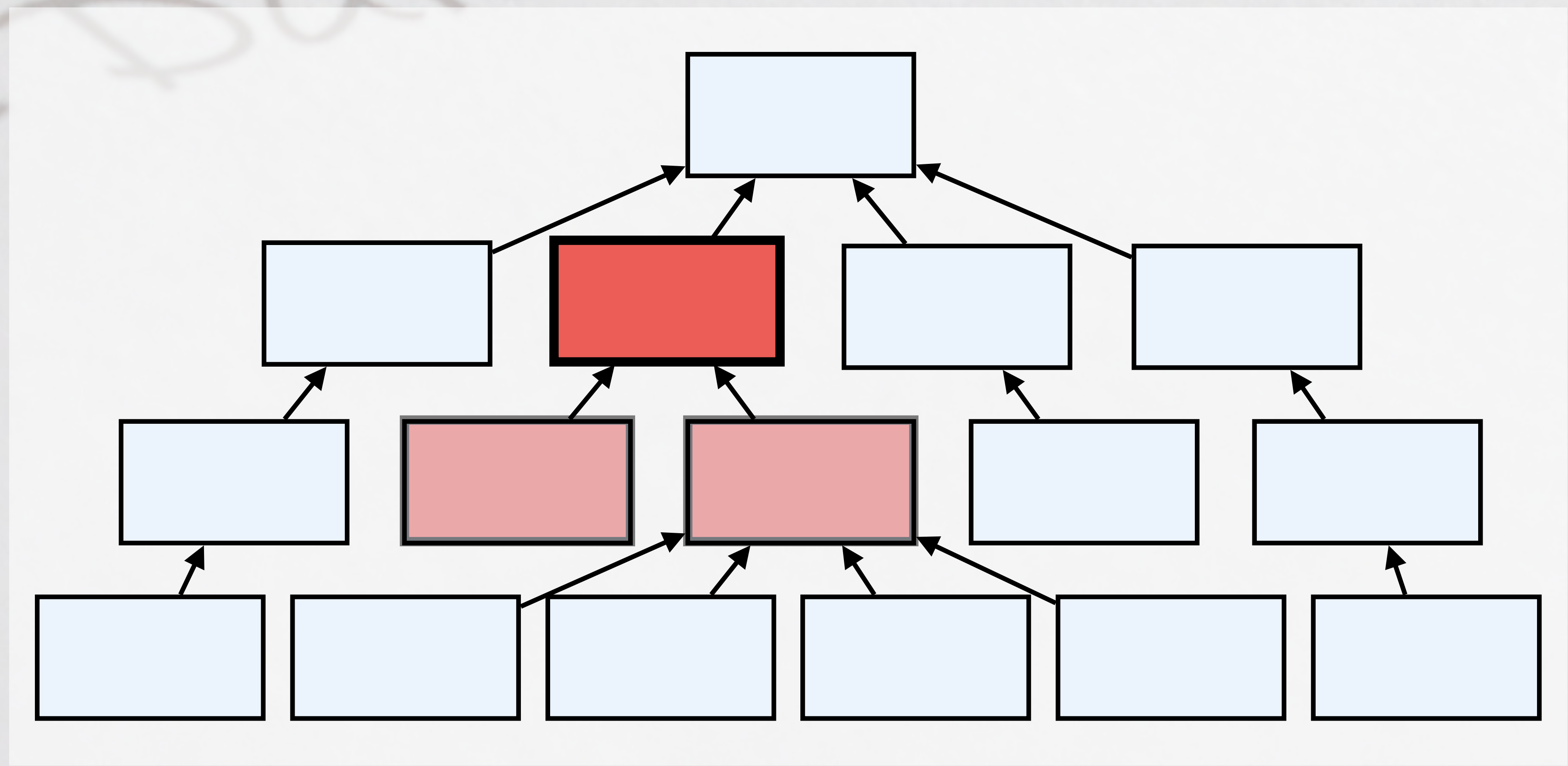


SQL:1999 — Recursion

```
  SELECT t.id, t.parent
    FROM t
   WHERE t.id = ?
UNION ALL
  SELECT t.id, t.parent
    FROM t
   WHERE t.parent = ?
```



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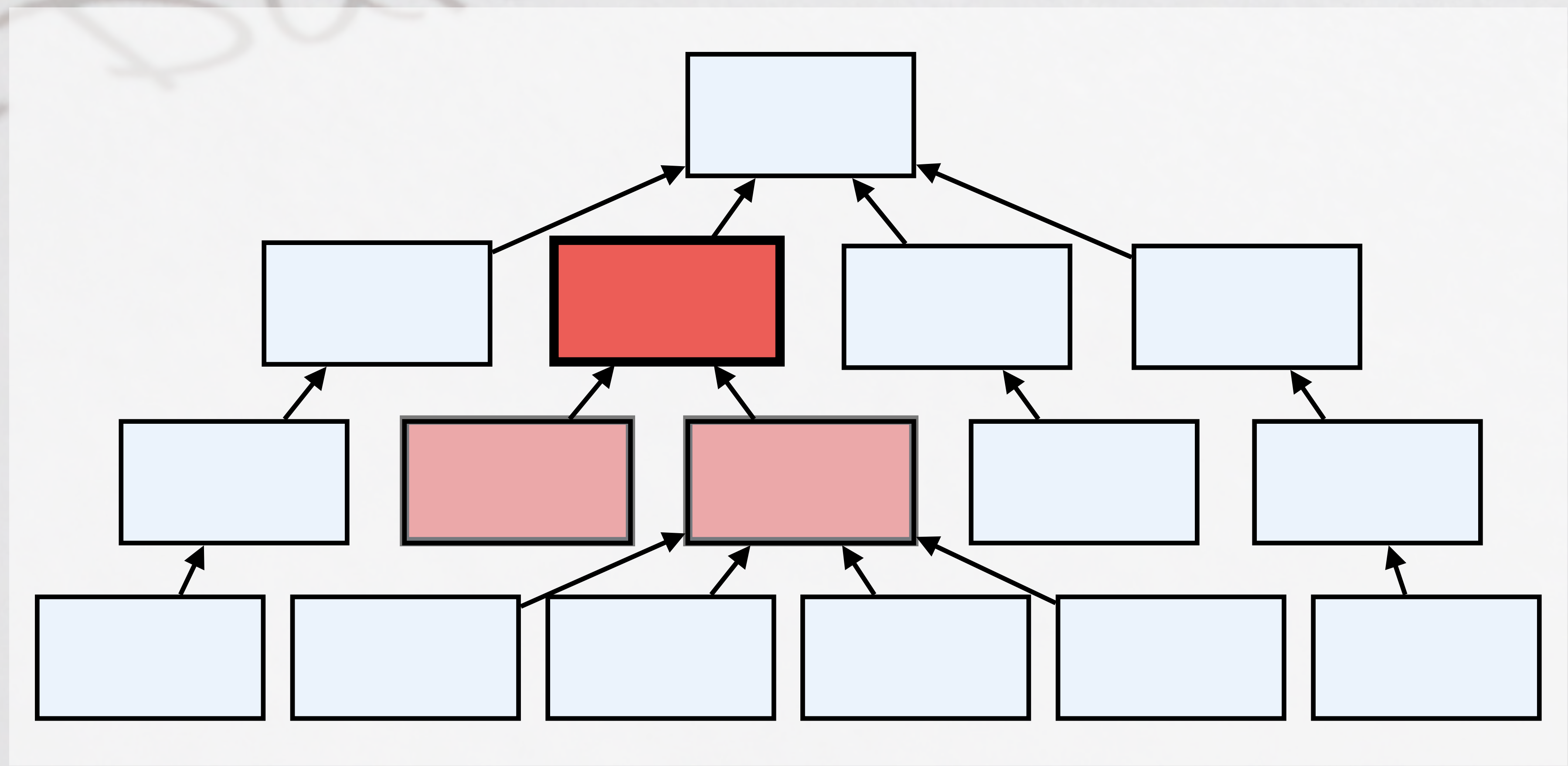

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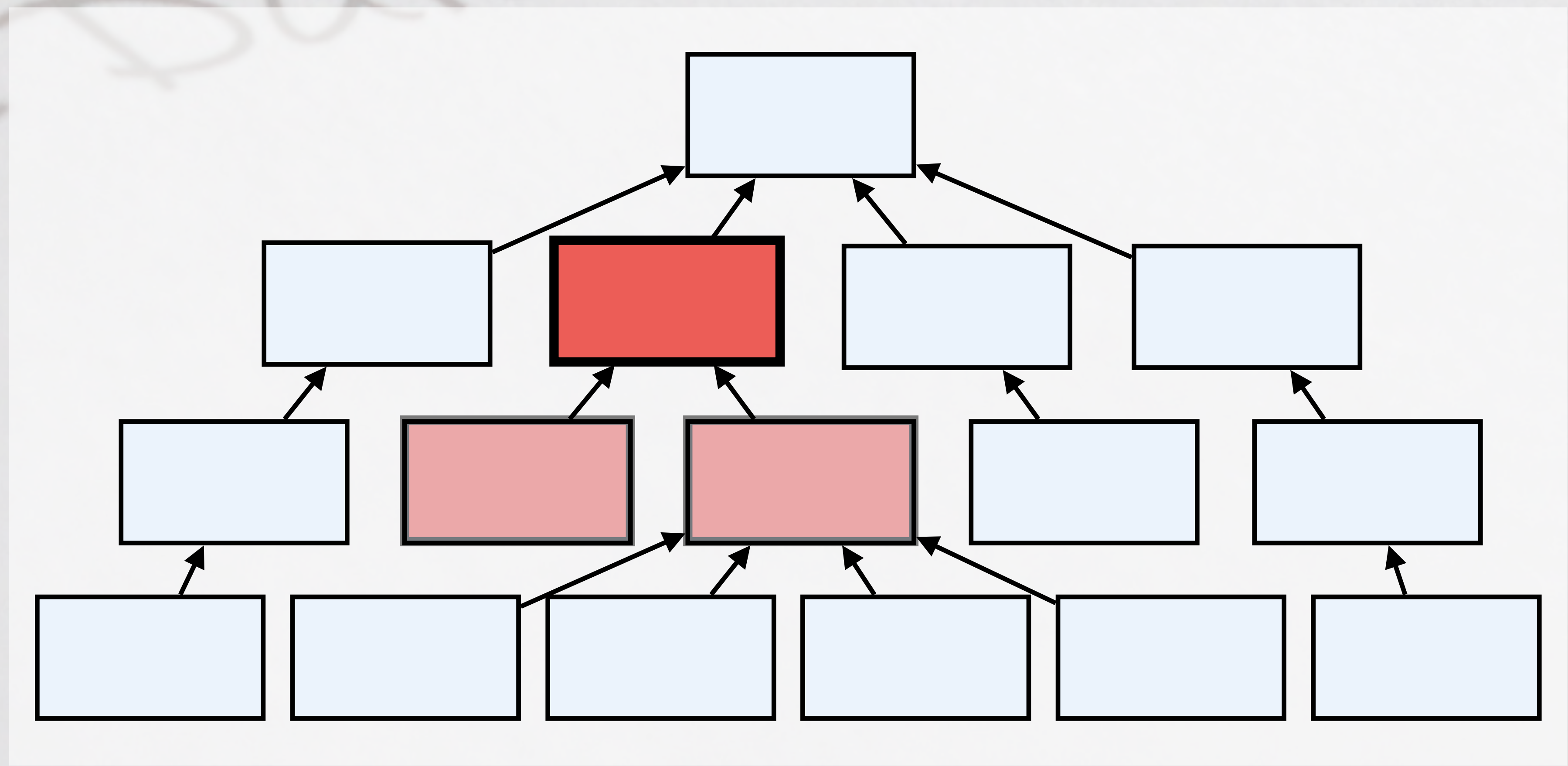
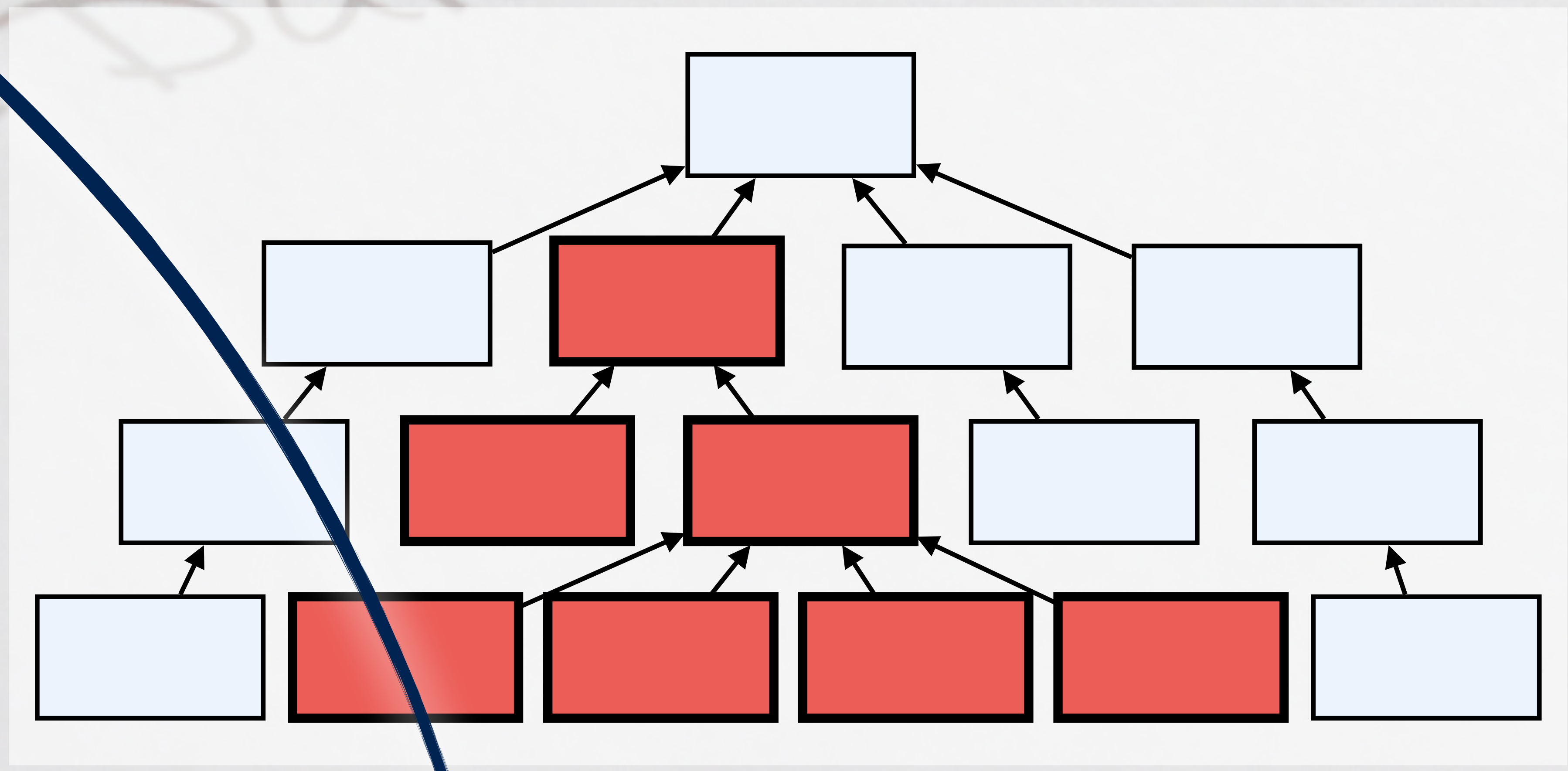


SQL:1999 — Recursion

```
WITH RECURSIVE prev (id, parent) AS (
  SELECT t.id, t.parent
    FROM t
   WHERE t.id = ?
UNION ALL
  SELECT t.id, t.parent
    FROM t
    JOIN prev ON t.parent = prev.id
)
SELECT * FROM prev
```



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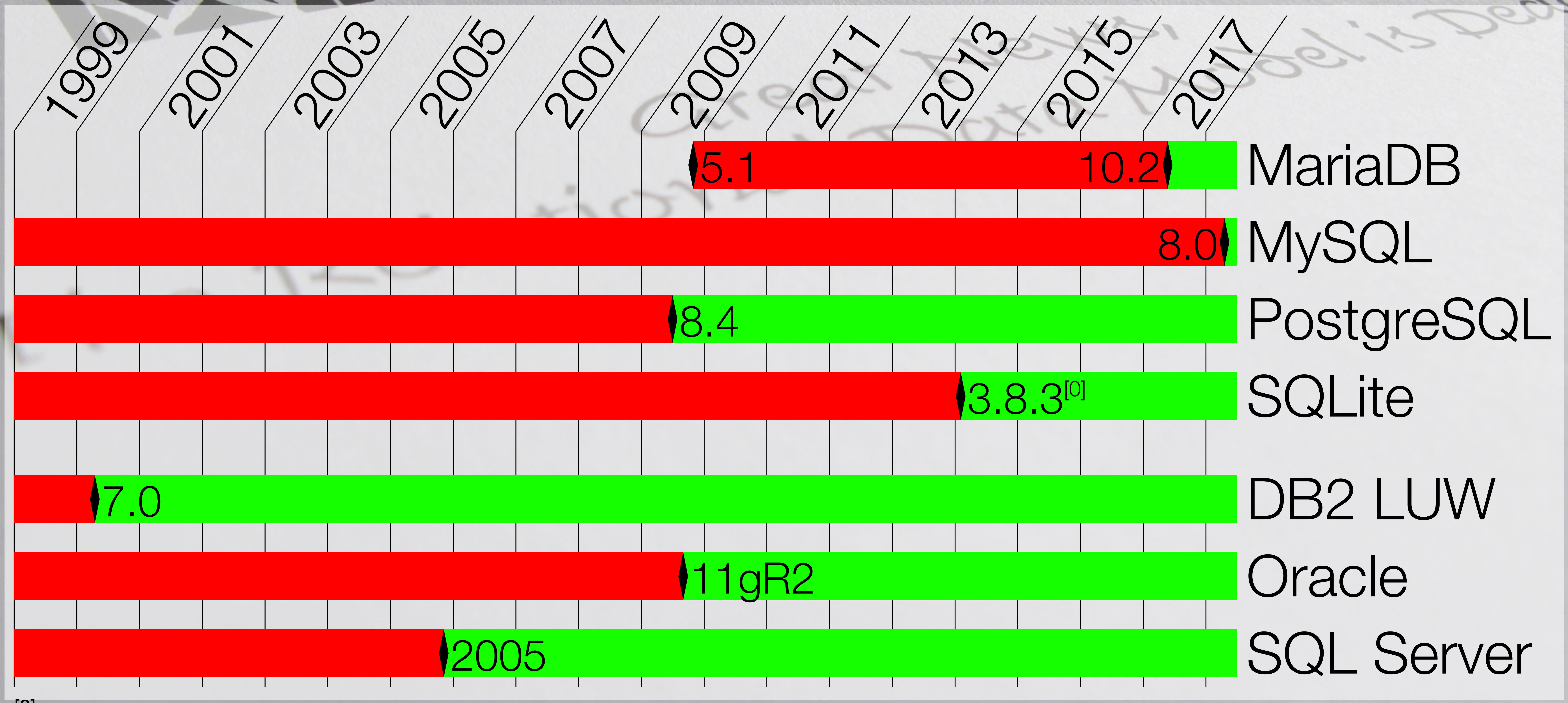

[0]Only for top-level SELECT statements

Whitemarsh

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G[illegible]at News,

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1999 ⏩ 2016

SQL:2016 — JSON

TECHNICAL REPORT

Information technology — Database languages — SQL Technical Reports —

Part 6:

SQL support for JavaScript Object Notation (JSON)

nologies de l'information — Langages de base de donn

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http://standards.iso.org/ittf/PubliclyAvailableStandards/c067367_ISO_IEC_TR_19075-6_2017.zip

SQL:2016 — JSON

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Technologies de l'information — Langages de base de donn — techniques — Part de SQL pour JavaScript Object No

```
[
  {
    "id": 42,
    "a1": "foo"
  },
  {
    "id": 43,
    "a1": "bar"
  }
]
```

id	a1
42	foo
43	bar

http://standards.iso.org/ittf/PubliclyAvailableStandards/c067367_ISO_IEC_TR_19075-6_2017.zip

SQL:2016 — JSON

```
SELECT *
  FROM tbl
     , JSON_TABLE
       ( jsoncol
       , '$[*]'
         COLUMNS
         ( id INT            PATH '$.id'
         , a1 VARCHAR(…) PATH '$.a1'
         )
       ) r
```

```
[
  {
    "id": 42,
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  },
  {
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```

SQL/JSON Path

- Query language to select elements from a JSON document
- Defined in the SQL standard

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42	foo
43	bar

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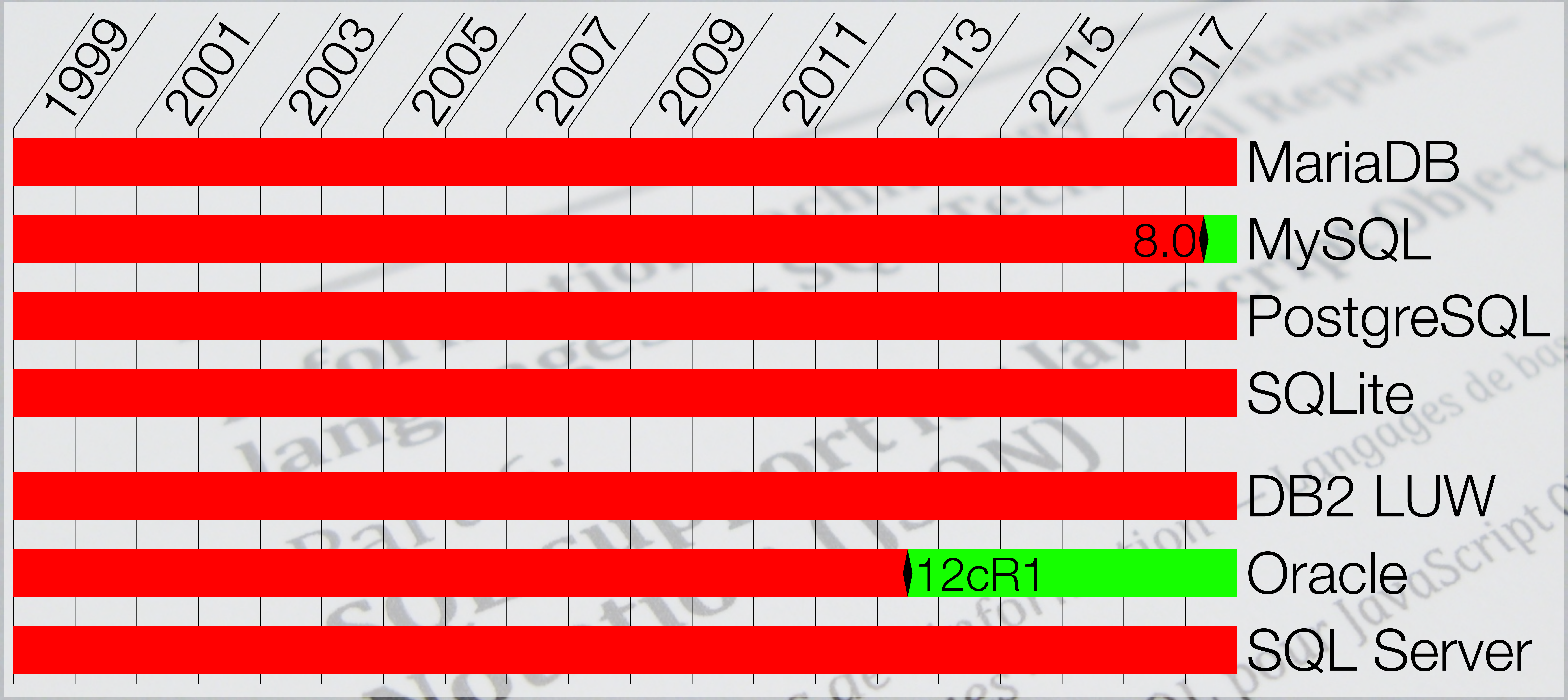

A **lot** has happened since SQL-92

SQL has evolved **beyond** the relational idea

If you use SQL for **CRUD** operations only, you are doing it wrong

modern SQL

https://modern-sql.com

@ModernSQL by @MarkusWinand