Exam Topics:

- Sub-queries in SQL (incl. understanding joins and aggregates) ✓
- Recursion in SQL ✓
- Database Design Principles
- Space filling curves
- ER Diagram and Model
- Indexes (Ordered, hash, tree based)

Exam Format:
- Bunch of MCQ
- some T/F
- Bunch of short answer questions (on SQL, indexes, ER, etc.)

Subquery Practice:

1978. Employees whose Manager Left the Company

- Find ID's of employees whose salary is strictly less than $30000

AND

- Find ID of those whose manager left the company

Employees:

employee_id	name	manager_id	salary
3	Mila Antonella	9	60301
12		null	31000
13	Emery	null	67084
1	Kalel	11	21241
9	Mikaela	null	30937
11	Joziah	6	28485

```
SELECT employee_id
FROM Employees
WHERE salary < 30000
AND manager_id NOT IN
(SELECT employee_id FROM Employees)
ORDER BY employee_id
```

Recursion in SQL

- Write recursive query in SQL to generate numbers from 1 to 10.

```
WITH RECURSIVE cte AS (
    SELECT 1 AS N
    UNION ALL
    SELECT N+1
    FROM cte
    WHERE N < 10
)
```

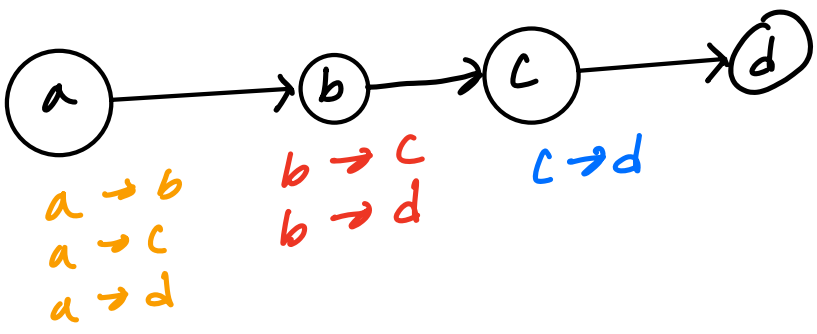
- Write recursive factorial query in SQL

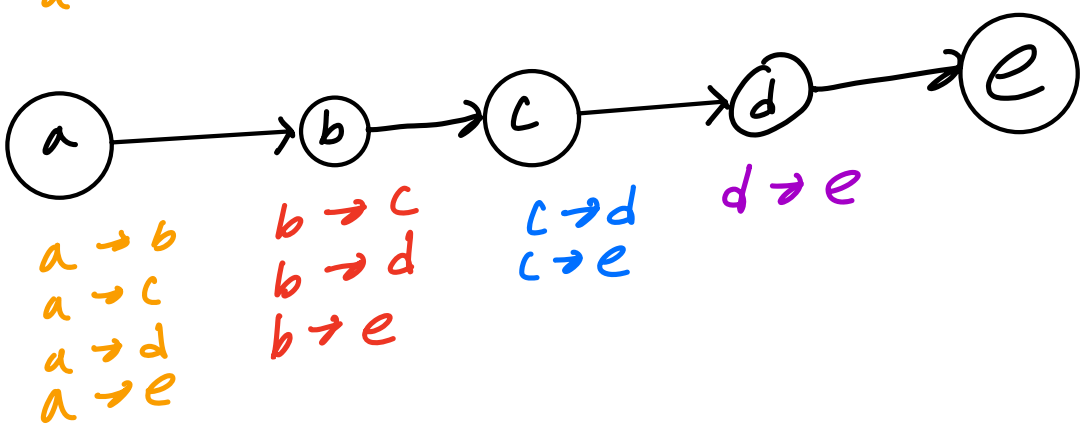
```
WITH RECURSIVE cteFact AS (
    SELECT 1 AS N, 1 AS fact
    UNION ALL
    SELECT N+1, (N+1) * fact
    FROM cteFact
    WHERE N < 10
);

SELECT N, fact
FROM cteFact
```

Transitive Closure Review

- For a chain graph with n nodes, come up with a closed-form formula for the total # of edges in the transitive closure of the chain graph.





Closed Form:

$$\frac{N(N-1)}{2}$$

Ex: $\frac{5 \cdot (5-1)}{2} = 10$

Space Filling Curves

- Consider a 2D image of resolution 8x8.
Compute Morton code (z-order code) for the following 2D points:

. $(5_y, 5_x) = 51$

. $(3_y, 2_x)$

Using $(\overset{y}{5}, \overset{x}{5})$:

- Since it is an 8x8 grid, we will represent the numbers as 3-bit.

$5 = 101_{x2\ x1\ x0}$

$5 = 101_{y2\ y1\ y0}$

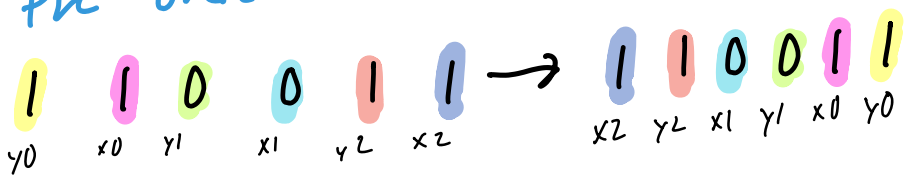
- Combine them in the order of:

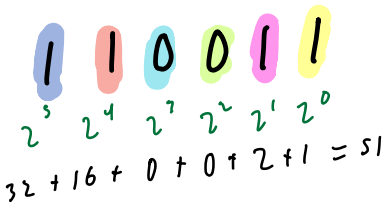
$(y0, x0, y1, x1, y2, x2)$

$1\ 1\ 0\ 0\ 1\ 1$

- Since the 0th bit in binary starts all the way at the right, reverse

the order.





Using (3, 2): (Y X)

- Since it is an 8×8 grid, we will represent the numbers as 3-bit.

$3 = 011$ ($y_2\ y_1\ y_0$) (011, 010)

$2 = 010$ ($x_2\ x_1\ x_0$)

- Combine them in the order of:

(y0, x0, y1, x1, y2, x2)

1 0 1 1 0 0

- Since the 0th bit in binary starts all the way at the right, reverse the order.