

SQL

Evaluation

- 10% évaluation continue
 - Système de participation active
 - Interro
- 30% projet
- 60% janvier
- 100% septembre

Matière

- Syllabus
- Cours théorique
- Séances d'exercices
 - PostgreSQL

PostgreSQL

- Un des leaders de l'open-source
 - L'autre : MySQL
 - Niches : SQLite, HSQLDB, Derby, ...
- <http://www.postgresql.org/>
 - On utilise la version **9.3** dans le cours
- <http://docs.postgresqlfr.org/9.3/>

PostgreSQL à la maison

<http://www.enterprisedb.com/products-services-training/pgdownload#windows>

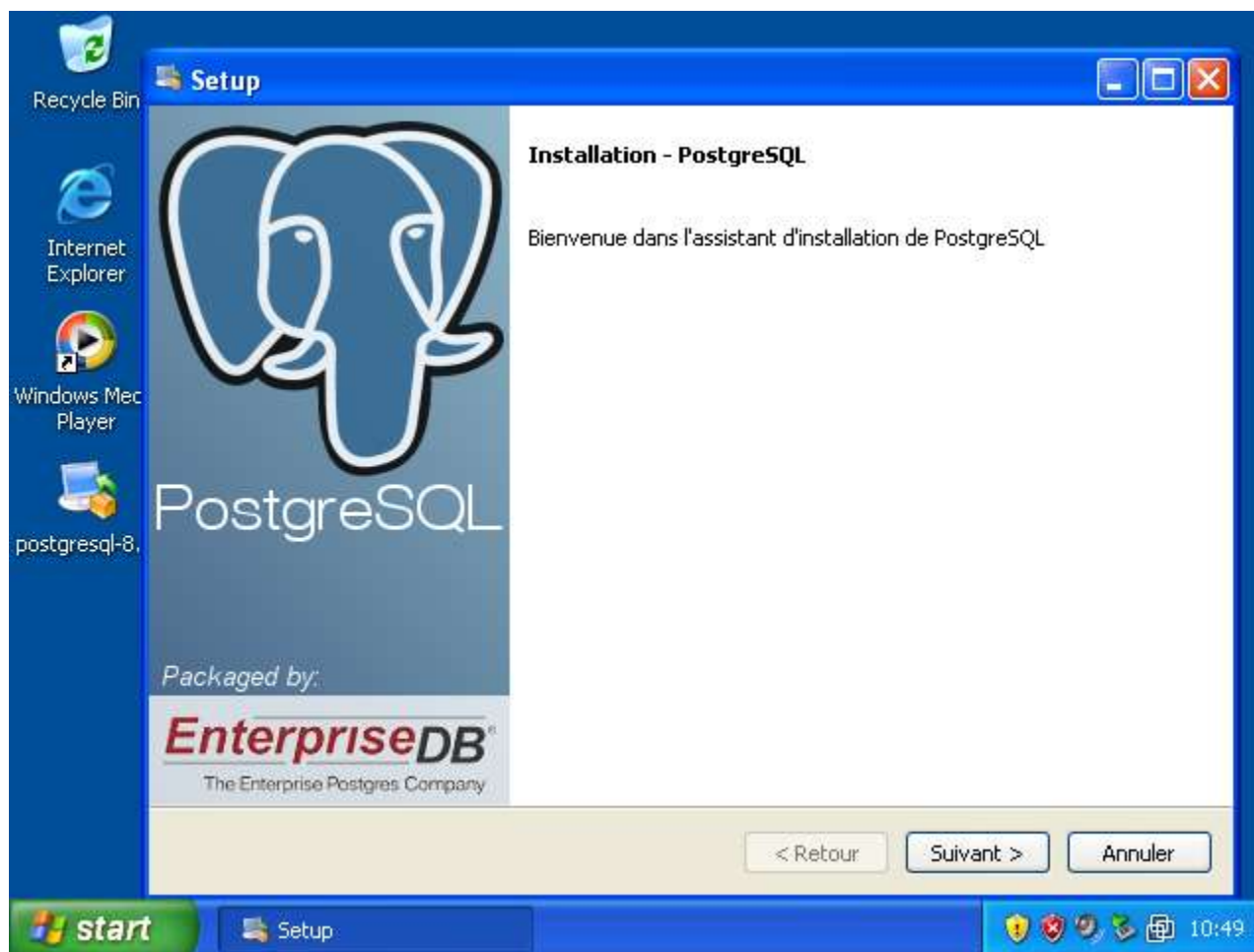
Download PostgreSQL

Please Note: Cookies should be enabled for the download process to function correctly

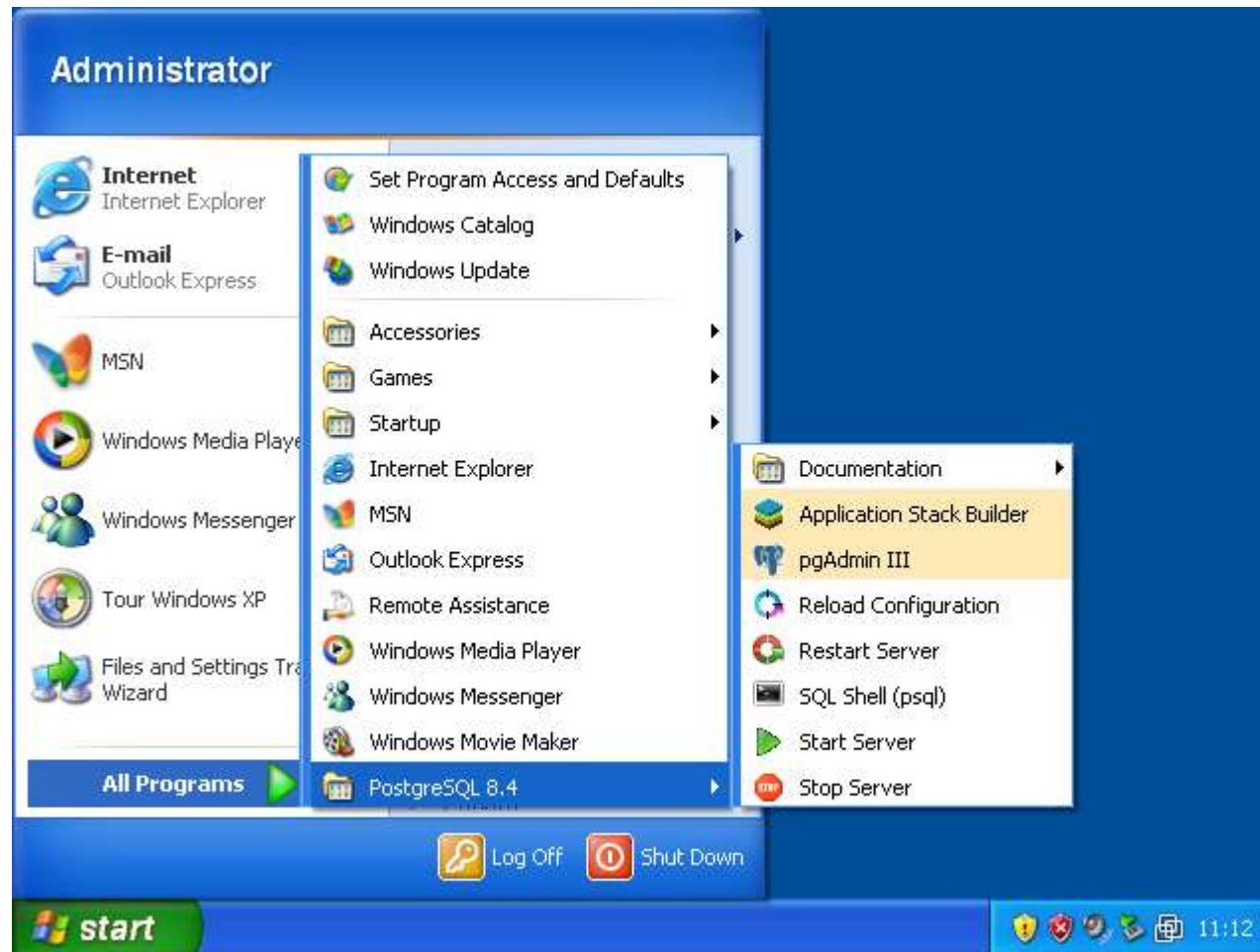
Installer version **Version 9.3.5.1**

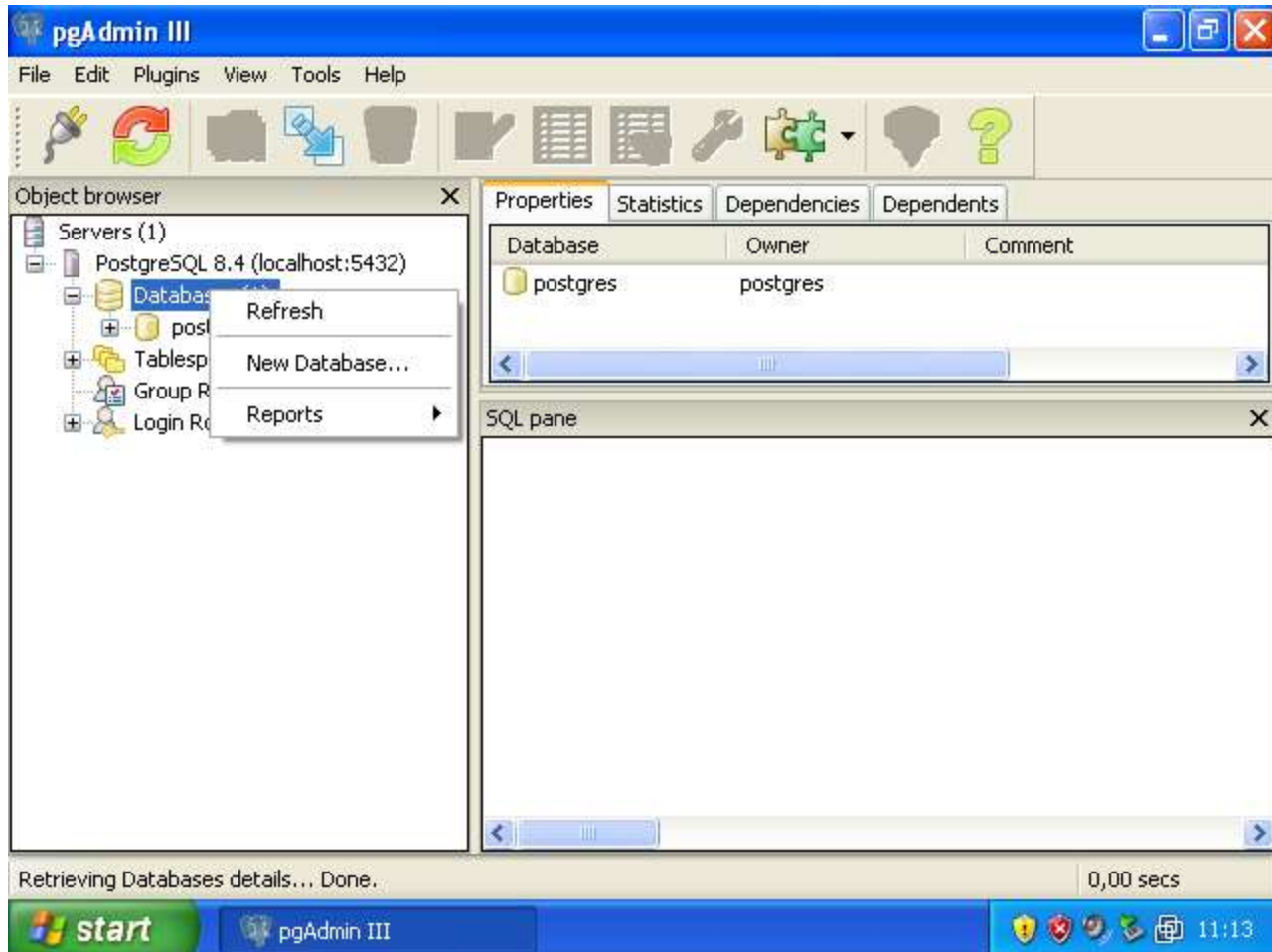


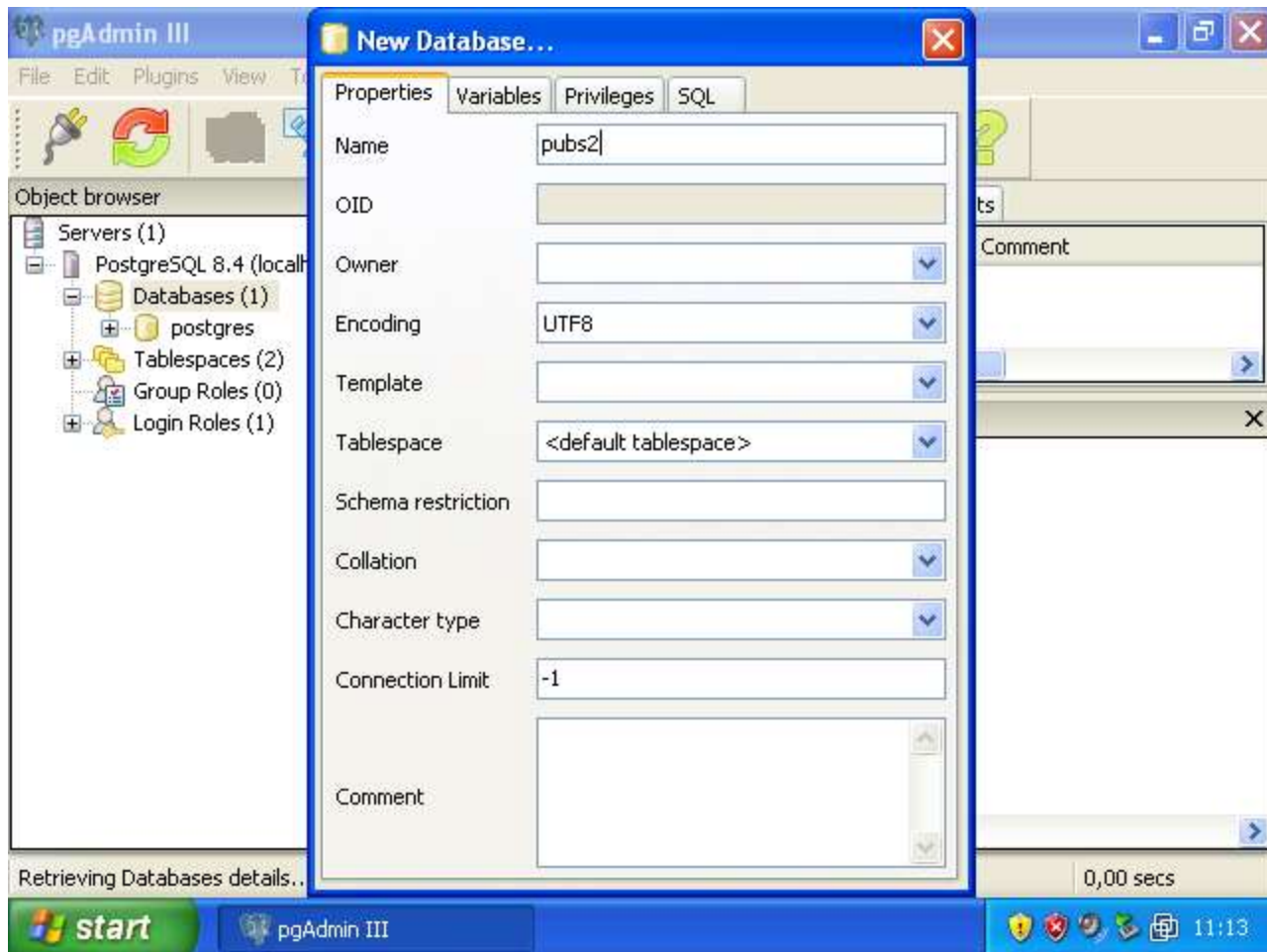
PostgreSQL à la maison

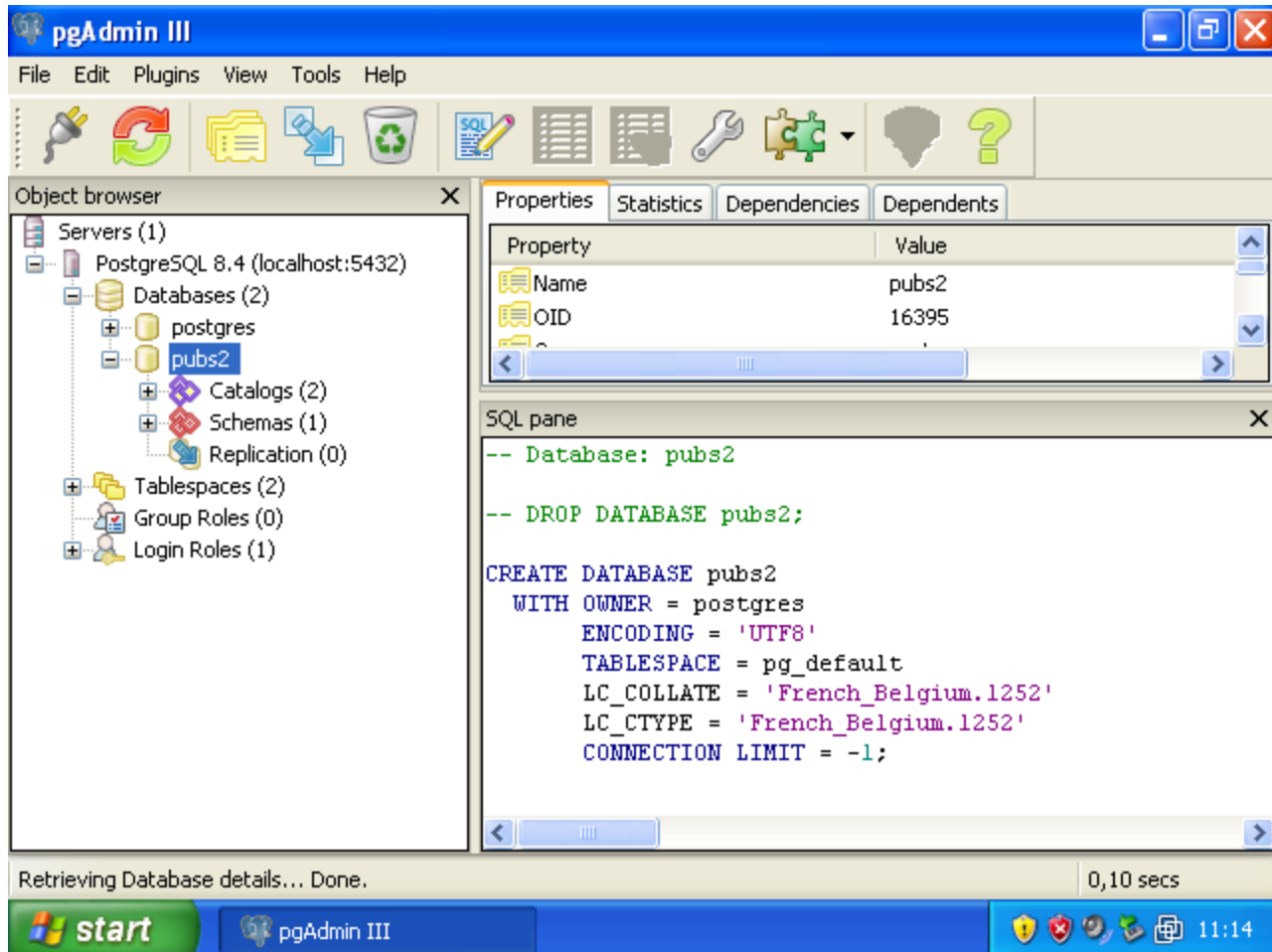


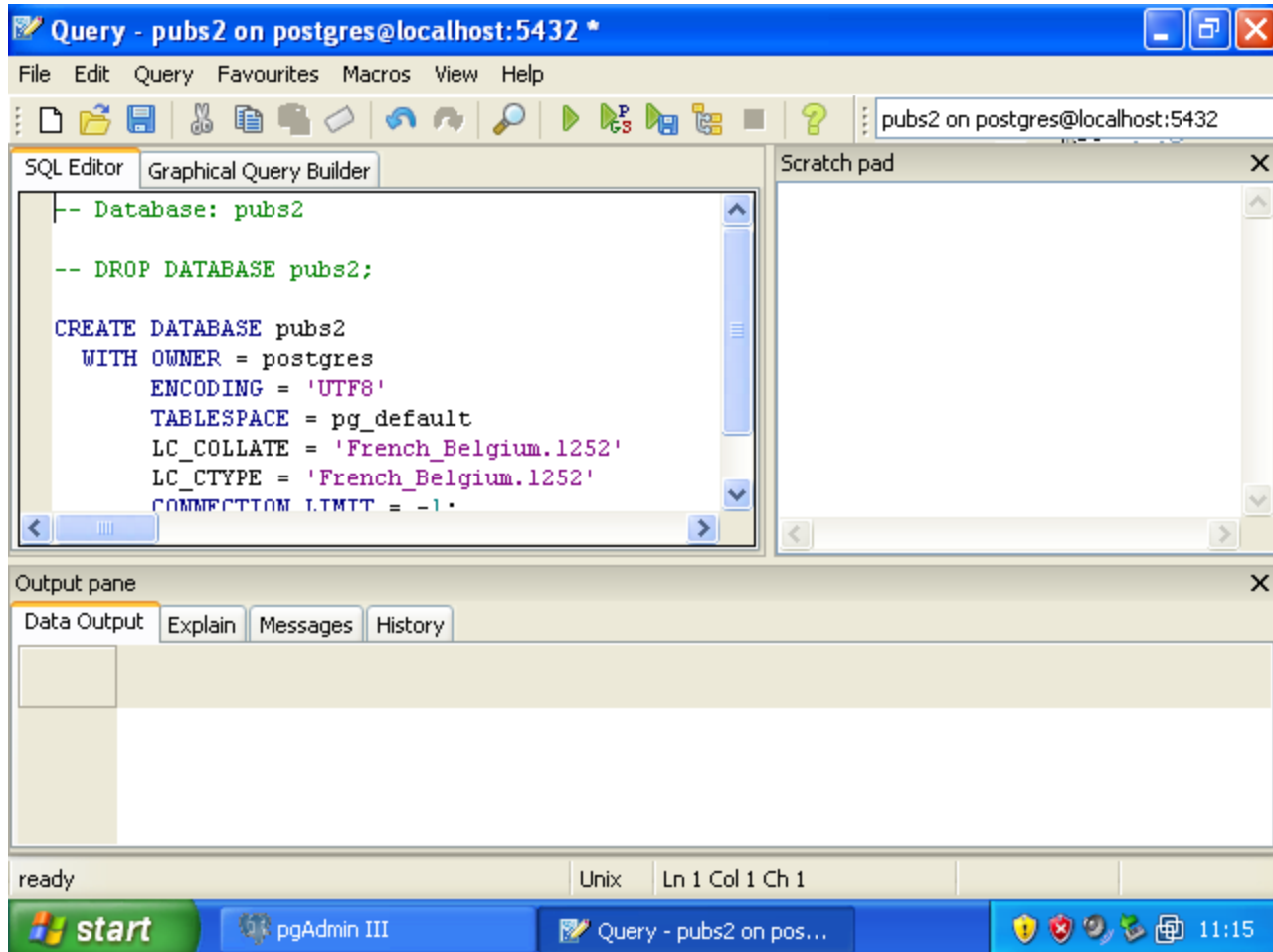
Quelques 'Suivant' plus tard...









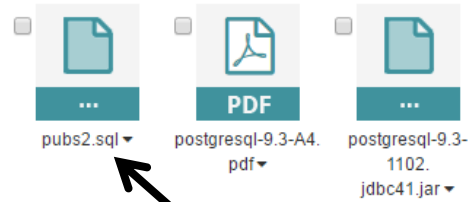


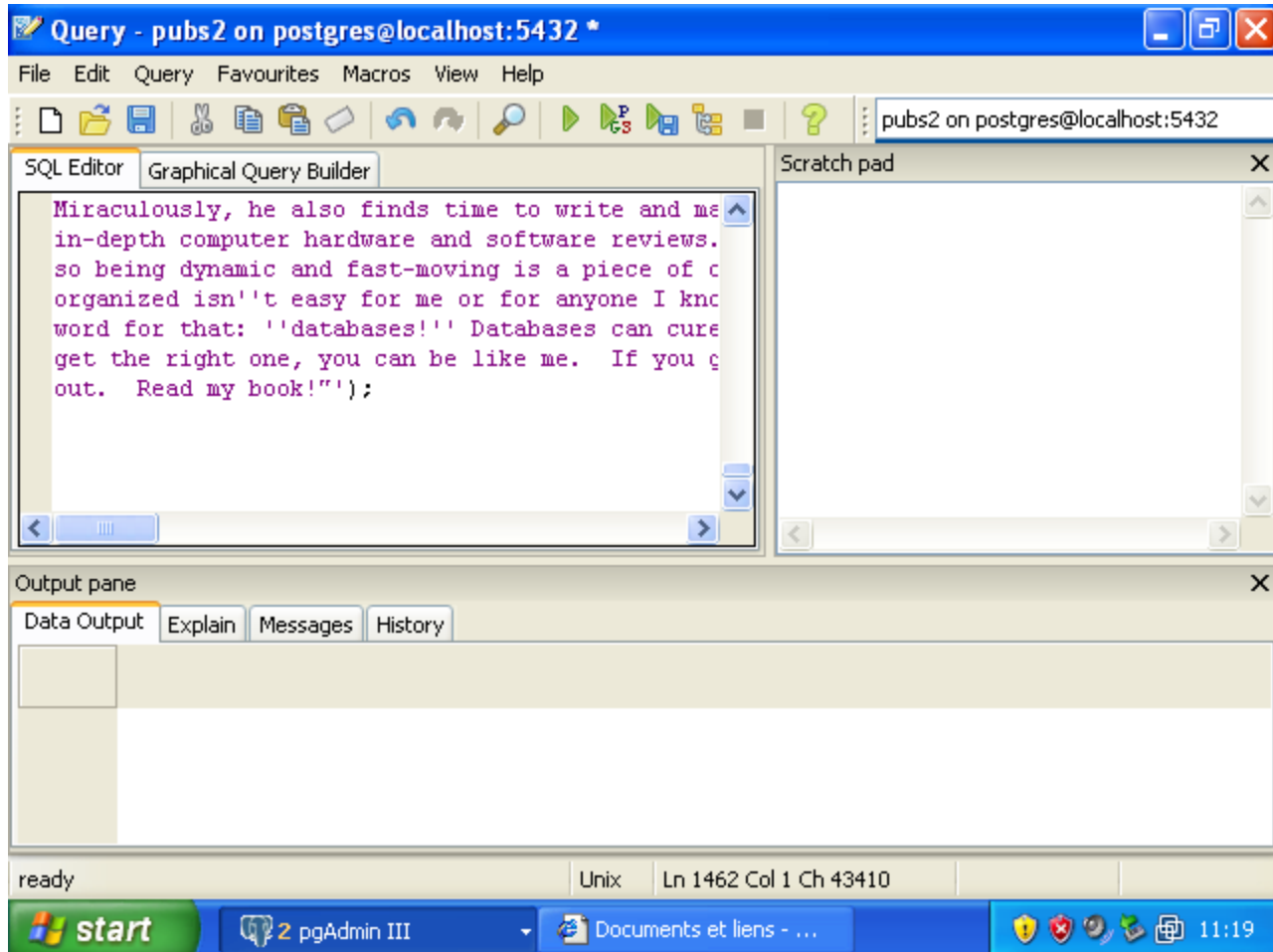
Mes espaces d'activités / 6I - Gestion des Données (6I2040) / Ressources / Bases de données : Langage de requêtes et de programmation (DBLRP)
/ PostgreSQL

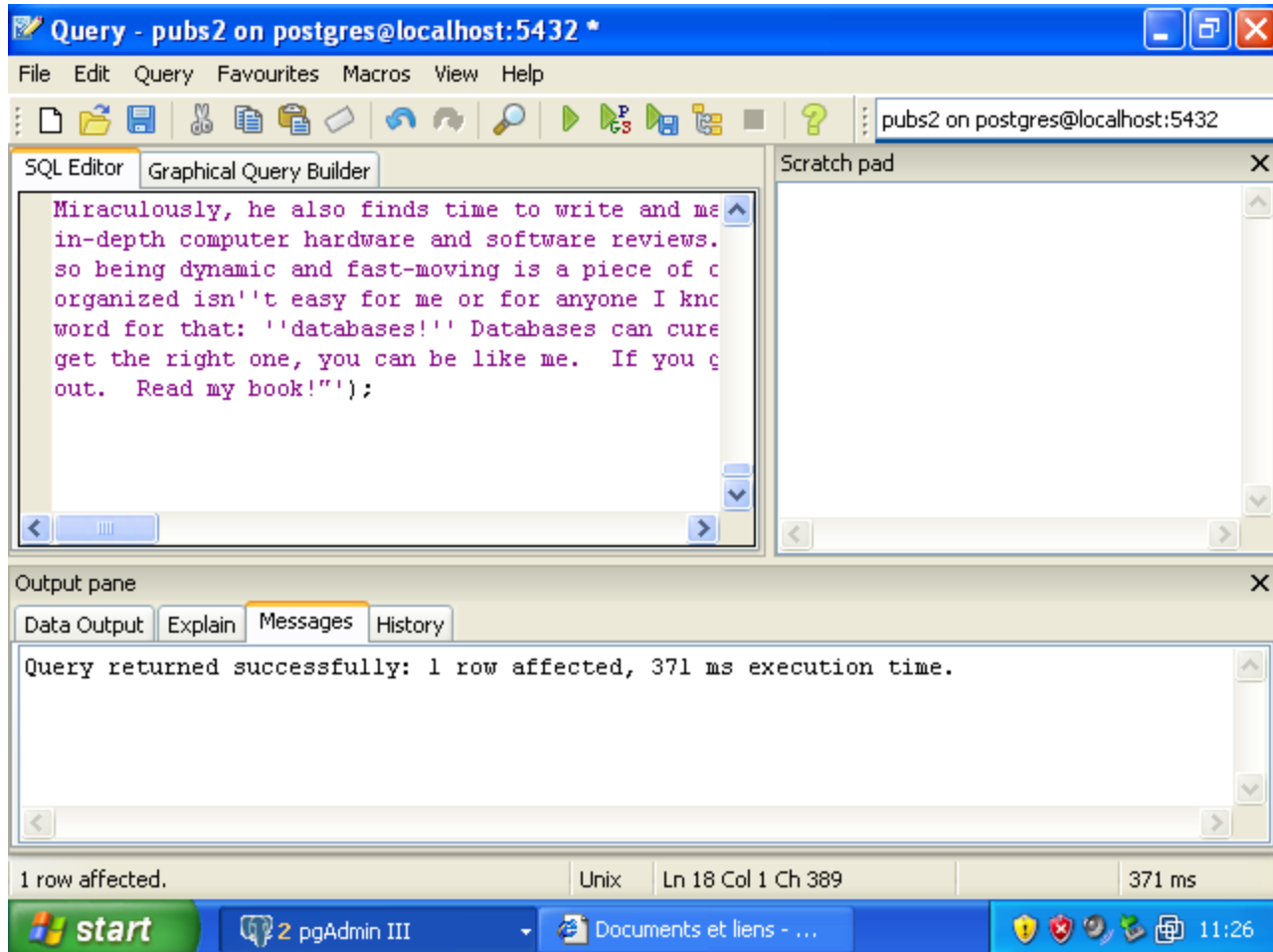
Ressources

Ajouter ▾ ✂ 📄 📁 🗑️ ⬇️ ↺ ↻ 🔍 ▾ ☐ Vue en liste ☐ Tout sélectionner

Rechercher







Et voilà

Query - pubs2 on postgres@localhost:5432 - [C:\Documents and Settings\Administrat...]

File Edit Query Favourites Macros View Help

pubs2 on postgres@localhost:5432

SQL Editor Graphical Query Builder

```
SELECT * FROM authors;
```

Scratch pad

Output pane

Data Output Explain Messages History

| | au_id character var | au_lname character var | au_fname character var | phone character(12) | address character var | city character var | state character(2) |
|---|------------------------|---------------------------|---------------------------|------------------------|--------------------------|-----------------------|-----------------------|
| 1 | 409-56-7008 | Bennet | Abraham | 415 658-9932 | 6223 Bateman S | Berkeley | CA |
| 2 | 213-46-8915 | Green | Marjorie | 415 986-7020 | 309 63rd St. #4 | Oakland | CA |
| 3 | 238-95-7766 | Carson | Cheryl | 415 548-7723 | 589 Darwin Ln. | Berkeley | CA |

OK. Unix Ln 1 Col 23 Ch 23 23 rows. 10 ms

start pgAdmin III Documents et liens - ... 11:28

Et maintenant...

Le cours !

Qu'est-ce que SQL ?

- Structured Query Language
- Emerge d'un besoin
 - Fin des années 60
 - Stocker les données, les organiser, les interroger, les faire évoluer d'une manière consistante
- Edgar F. Codd en 1970 (IBM research) :
 - A Relational Model of Data for Large Shared Data Banks

Pourquoi SQL

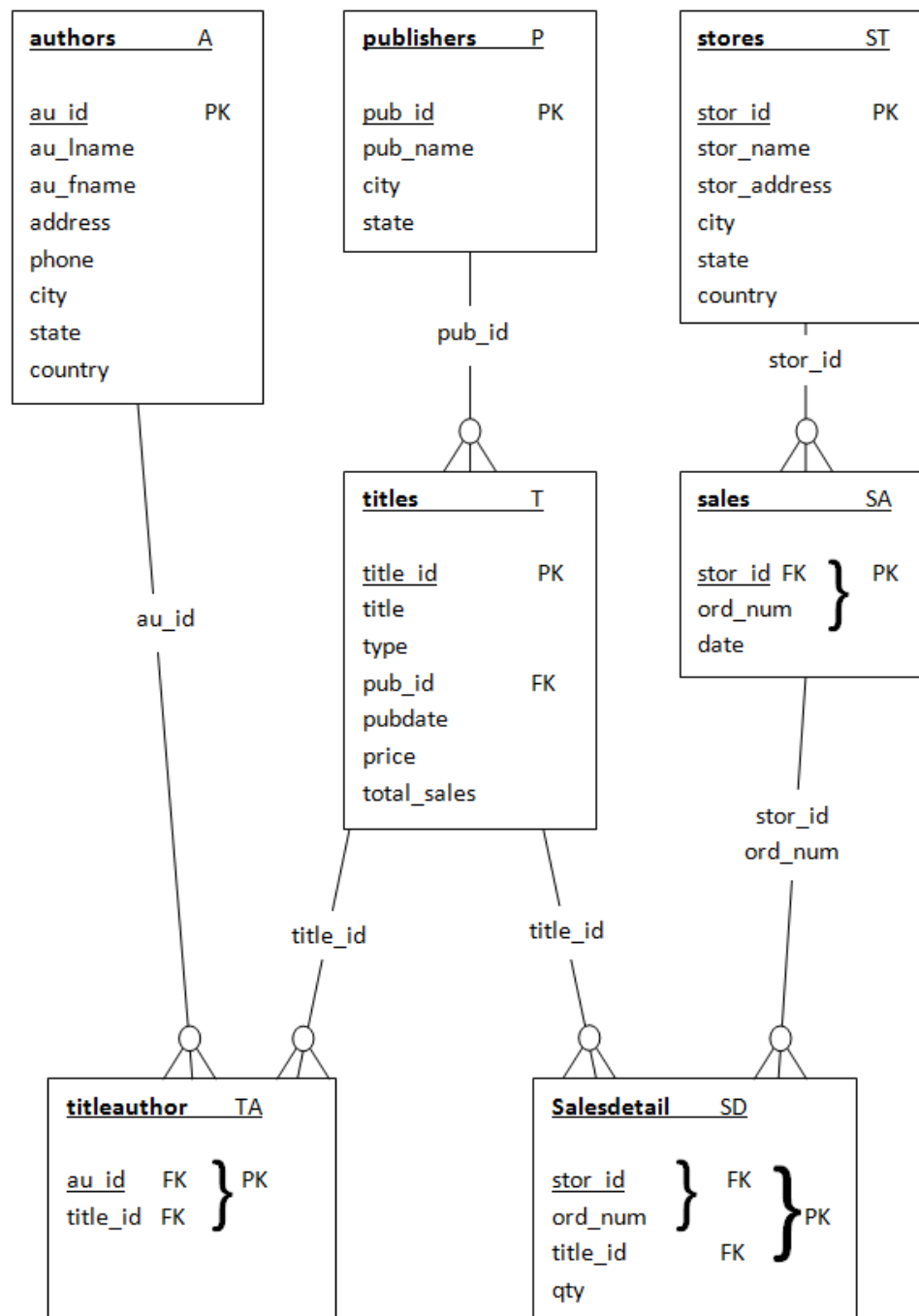
- Naissance d'un langage spécifique à un domaine.
- Devenu le standard du marché, omniprésent dès qu'il y a persistance des données.
 - Microsoft SQL Server
 - Oracle Database
 - Sybase
 - MySQL
 - **PostgreSQL**

Monde SQL

- RDBMS : Relational Database Management Systems
 - Système de base de données
 - Basée sur le modèle relationnel
- Avec un langage d'interrogation et manipulation : SQL

RDBMS

- Ensemble de tables
 - Colonnes avec un nom
 - Tuples = lignes
 - Chaque tuple est unique !
 - Il n'y a pas de notion d'ordre entre les tuples
- Ensemble de relations entre les tables
- Définition des tables et des relations = schéma de la base de donnée



Relations

- Clef primaire
 - Identifiant unique pour un tuple
 - Peut être une combinaison de plusieurs colonnes
- Clef étrangère
 - Référence à une clef primaire d'une autre table
 - Prend la valeur de la clef primaire à laquelle on fait référence

Opération : Union

R

| Nom | Destination | Code-dépl |
|--------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |

S

| Nom | Destination | Code-dépl |
|----------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 588 |
| Janssens | Prague | 322 |

$R \cup S$

| Nom | Destination | Code-dépl |
|----------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |
| Durand | Paris | 588 |
| Janssens | Prague | 322 |

Opération : Différence

R

| Nom | Destination | Code-dépl |
|--------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |

S

| Nom | Destination | Code-dépl |
|----------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 588 |
| Janssens | Prague | 322 |

R-S

| Nom | Destination | Code-dépl |
|--------|-------------|-----------|
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |

Opération : Produit Cartésien

R

| Nom | Destination | Code-dépl |
|--------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |

T

| Nom | Rembours |
|----------|----------|
| Dufour | 2 |
| Dutoit | 4 |
| Janssens | 0 |
| Albrecht | 2 |
| Fanuel | 3 |

R x T

| R.Nom | Destination | Code-dépl | T.Nom | Rembours |
|--------|-------------|-----------|----------|----------|
| Dufour | Paris | 321 | Dufour | 2 |
| Dufour | Paris | 321 | Dutoit | 4 |
| Dufour | Paris | 321 | Janssens | 0 |
| Dufour | Paris | 321 | Albrecht | 2 |
| Dufour | Paris | 321 | Fanuel | 3 |
| Dufour | Milan | 325 | Dufour | 2 |
| ... | ... | ... | ... | ... |
| Dutoit | Oslo | 319 | Fanuel | 3 |

Opération : Projection

R

| Nom | Destination | Code-dépl |
|--------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 360 |
| Dutoit | Paris | 322 |
| Dutoit | Paris | 312 |
| Dutoit | Oslo | 319 |

$\pi_{\text{Nom, Destination}}(R)$

| Nom | Destination |
|--------|-------------|
| Dufour | Paris |
| Dufour | Milan |
| Dutoit | Paris |
| Dutoit | Paris |
| Dutoit | Oslo |

Opération : Sélection

T

| Nom | Rembours |
|----------|----------|
| Dufour | 2 |
| Dutoit | 4 |
| Janssens | 0 |
| Albrecht | 2 |
| Fanuel | 3 |

$\sigma_{\text{Rembours} < 3}(T)$

| Nom | Rembours |
|----------|----------|
| Dufour | 2 |
| Janssens | 0 |
| Albrecht | 2 |

Quelles sont les destinations des personnes avec au moins 2 Rembours ?

T

| Nom | Rembours |
|----------|----------|
| Dufour | 2 |
| Dutoit | 4 |
| Janssens | 0 |
| Albrecht | 2 |
| Fanuel | 3 |

$\sigma_{\text{Rembours} \geq 2}(T)$

| Nom | Destination |
|----------|-------------|
| Dufour | 2 |
| Dutoit | 4 |
| Albrecht | 2 |
| Fanuel | 3 |

Quelles sont les destinations des personnes avec au moins 2 Rembours ?

$\sigma_{\text{Rembours} \geq 2}(T)$

| Nom | Rembours |
|----------|----------|
| Dufour | 2 |
| Dutoit | 4 |
| Albrecht | 2 |
| Fanuel | 3 |

S

| Nom | Destination | Code-dépl |
|----------|-------------|-----------|
| Dufour | Paris | 321 |
| Dufour | Milan | 325 |
| Durand | Paris | 588 |
| Janssens | Prague | 322 |

$\sigma_{\text{Rembours} \geq 2}(T) \times S$

| S.Nom | Destination | Code-dépl | σ .Nom | σ .Rembours |
|----------|-------------|-----------|---------------|--------------------|
| Dufour | Paris | 321 | Dufour | 2 |
| Dufour | Paris | 321 | Dutoit | 4 |
| Dufour | Paris | 321 | Albrecht | 2 |
| Dufour | Paris | 321 | Fanuel | 3 |
| ... | ... | ... | ... | ... |
| Janssens | Prague | 322 | Dutoit | 4 |
| Janssens | Prague | 322 | Albrecht | 2 |
| Janssens | Prague | 322 | Fanuel | 3 |

Quelles sont les destinations des personnes avec au moins 2 Rembours ?

$\sigma_{\text{Rembours} \geq 2}(\text{T}) \times \text{S}$

| S.Nom | Destination | Code-dépl | σ .Nom | σ .Rembours |
|----------|-------------|-----------|---------------|--------------------|
| Dufour | Paris | 321 | Dufour | 2 |
| Dufour | Paris | 321 | Dutoit | 4 |
| Dufour | Paris | 321 | Albrecht | 2 |
| Dufour | Paris | 321 | Fanuel | 3 |
| ... | ... | ... | ... | ... |
| Janssens | Prague | 322 | Dutoit | 4 |
| Janssens | Prague | 322 | Albrecht | 2 |
| Janssens | Prague | 322 | Fanuel | 3 |

$\sigma_{\text{S.Nom}=\sigma.\text{Nom}}(\sigma_{\text{Rembours} \geq 2}(\text{T}) \times \text{S})$

| S.Nom | Destination | Code-dépl | σ .Nom | σ .Rembours |
|--------|-------------|-----------|---------------|--------------------|
| Dufour | Paris | 321 | Dufour | 2 |
| Dufour | Milan | 325 | Dufour | 2 |

$\pi_{\text{Destination}}(\sigma_{\text{S.Nom}=\sigma.\text{Nom}}(\sigma_{\text{Rembours} \geq 2}(\text{T}) \times \text{S}))$

| Destination |
|-------------|
| Paris |
| Milan |

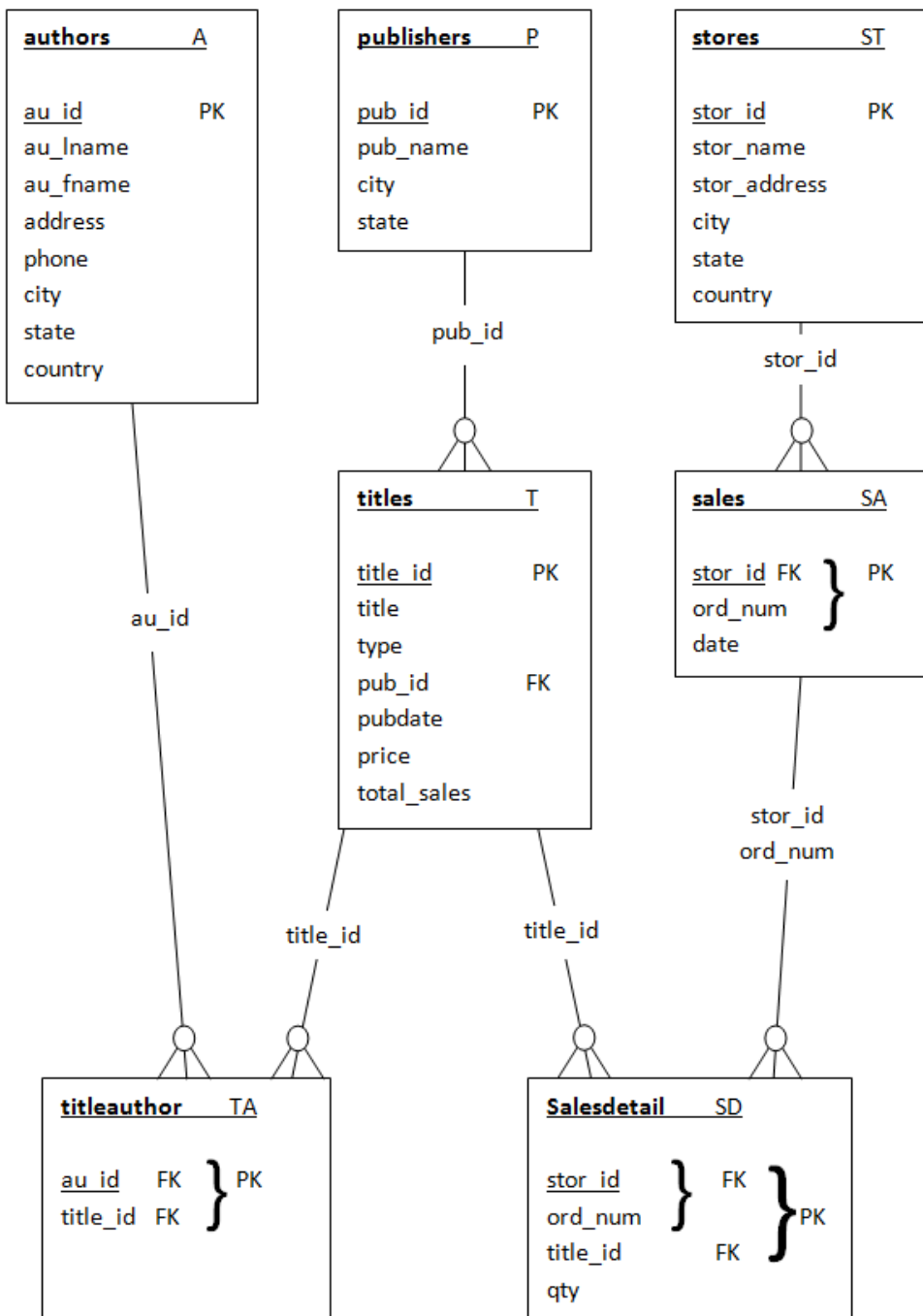
En SQL

SELECT Destination ← Projection
FROM S,T ← Produit cartésien
WHERE S.Nom = T.Nom ← Sélections
AND T.Rembours >= 2 ← Sélections

The diagram illustrates the mapping of SQL query components to database operations. Blue arrows point from the labels on the right to the corresponding parts of the SQL query on the left. 'Projection' points to 'Destination', 'Produit cartésien' points to 'S,T', and 'Sélections' points to both the 'WHERE' clause and the condition '>= 2'.

Interrogation : SELECT

```
SELECT [ ALL | DISTINCT [ ON ( nom_colonne [, ...] ) ] ]  
      * | nom_colonne [ [ AS ] nom_d_affichage ] [, ...]  
      [ FROM nom_table ]  
      [ WHERE condition ]  
      [ ORDER BY nom_colonne [ ASC | DESC ] [, ...] ]
```

Lister la table des auteurs

SELECT *

FROM authors;

SELECT authors.*

FROM authors;

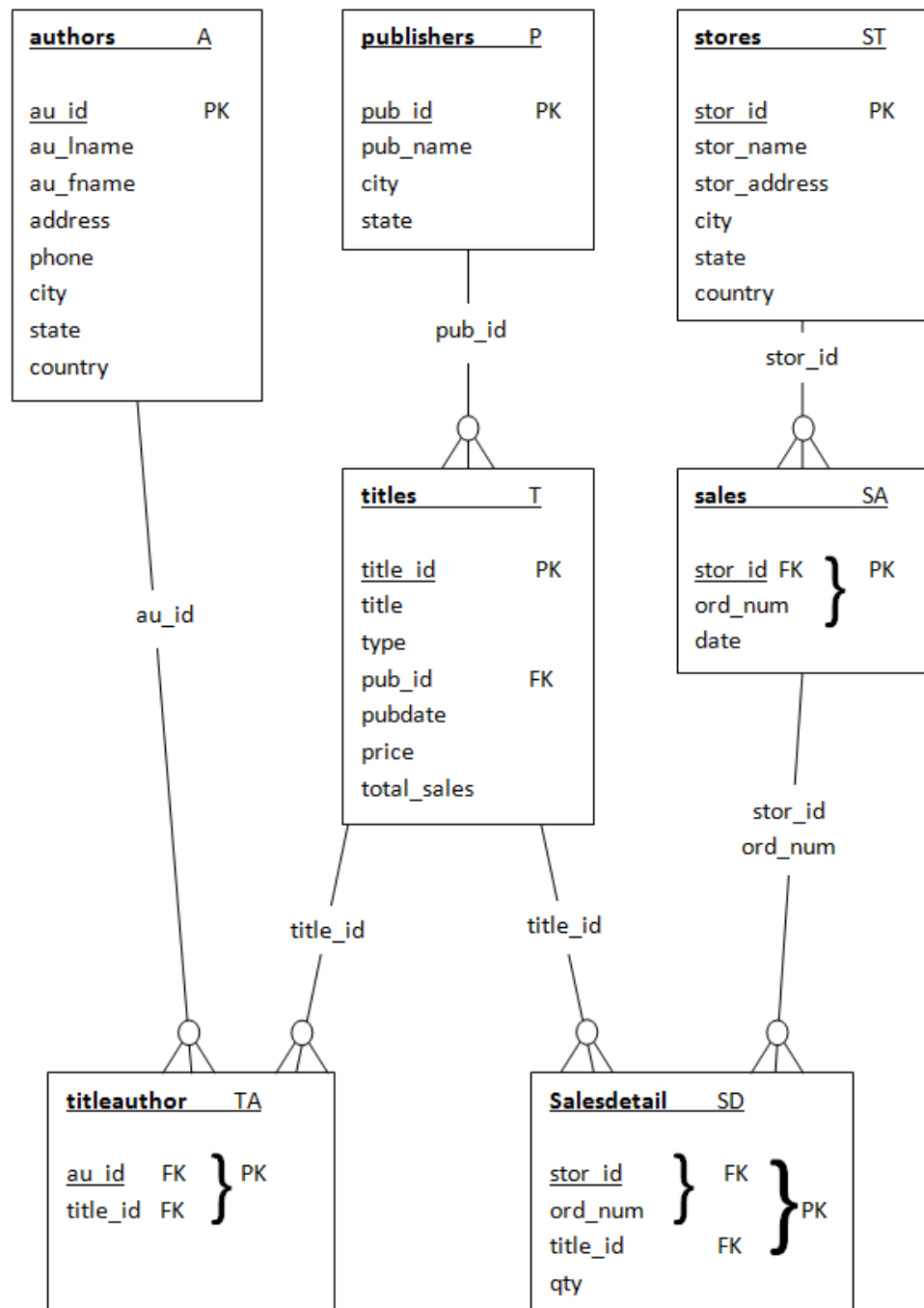
SELECT au_id, au_lname,
au_fname, address,
phone, city, state,
country

FROM authors;

Lister la table des auteurs

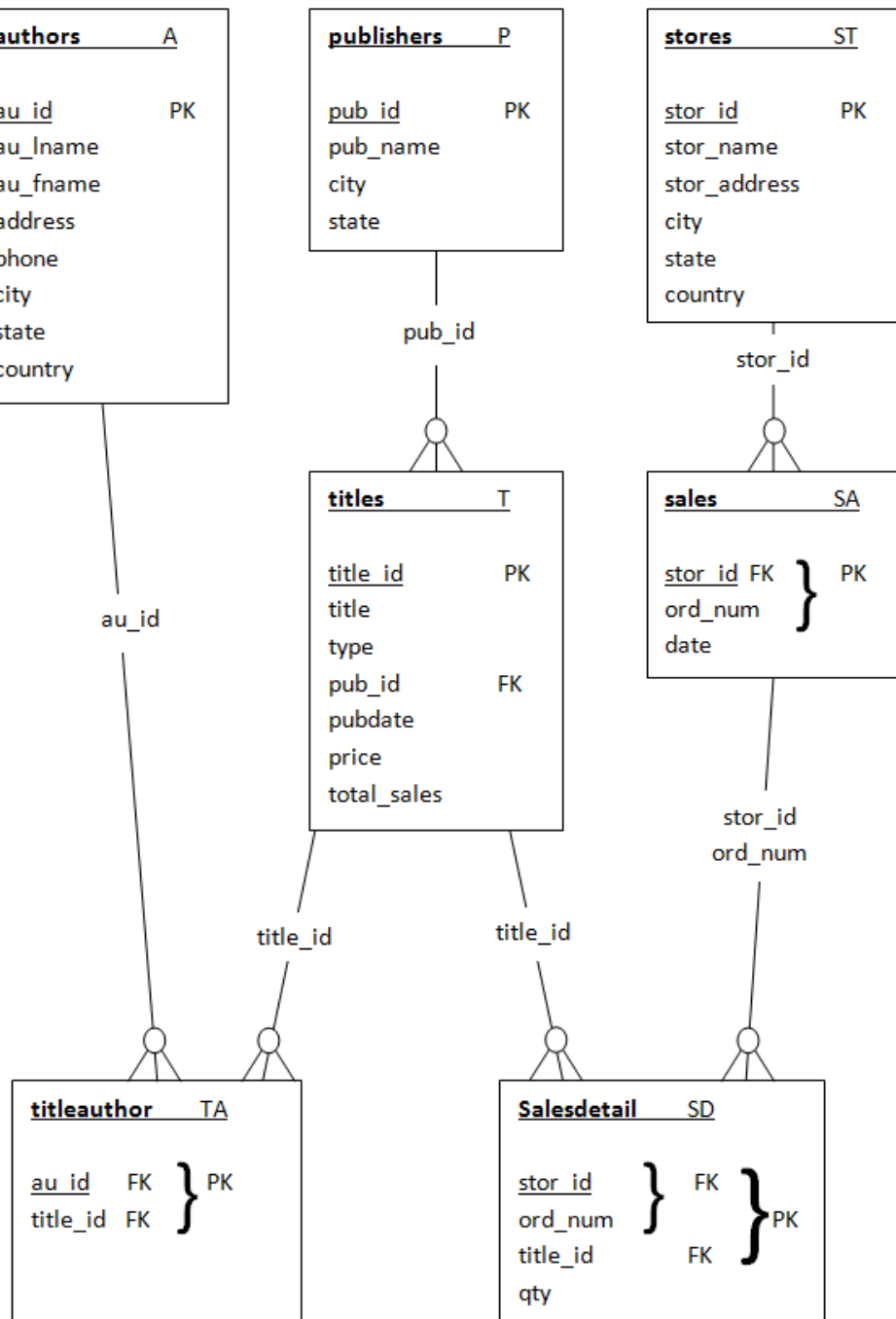
```
SELECT a.au_id,  
       a.au_lname,  
       a.au_fname, a.address,  
       a.phone, a.city, a.state,  
       a.country
```

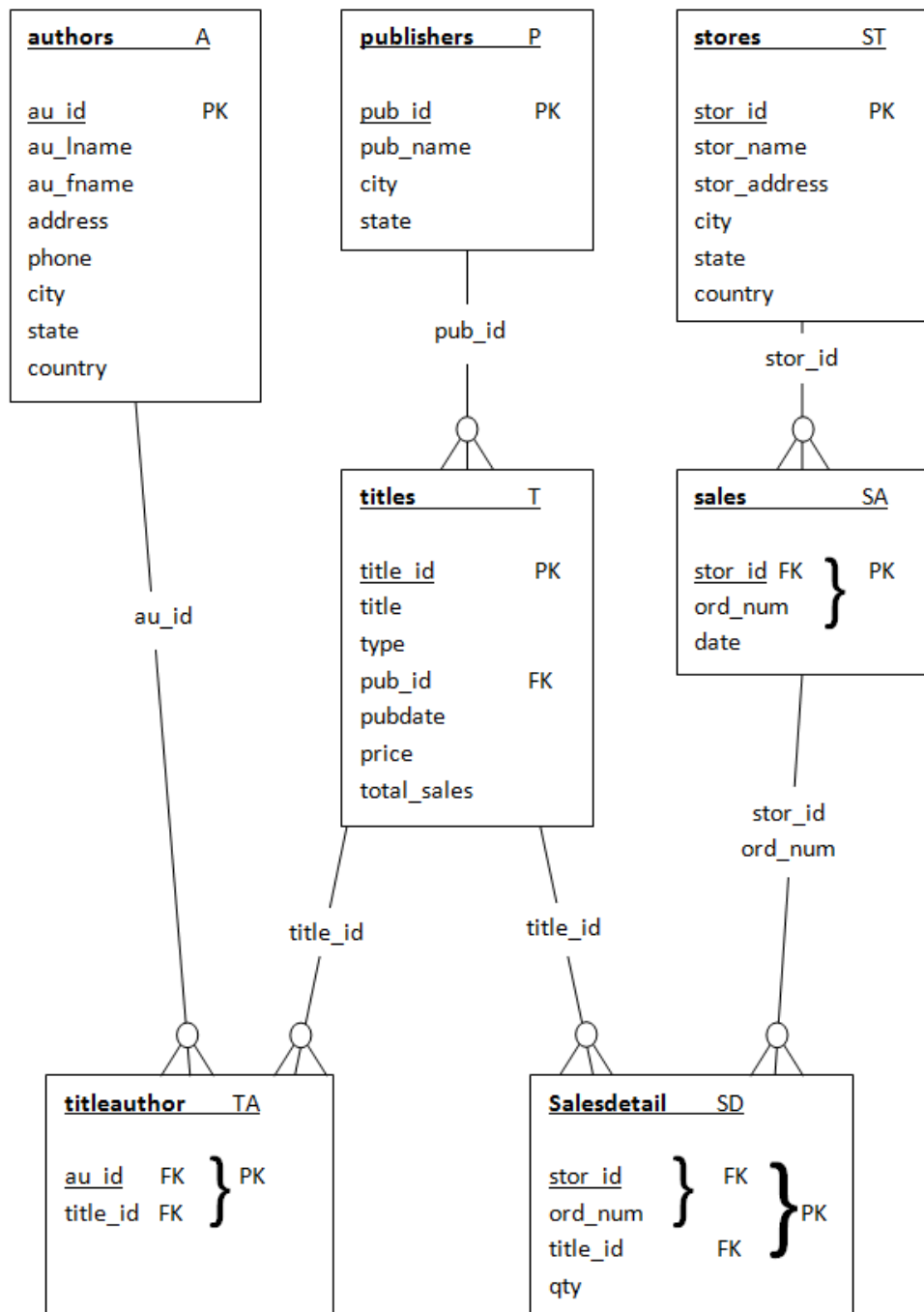
```
FROM authors a;
```



Lister les noms et prénoms
des auteurs californiens

```
SELECT a.au_lname,  
       a.au_fname  
FROM authors a  
WHERE a.state = 'CA';
```



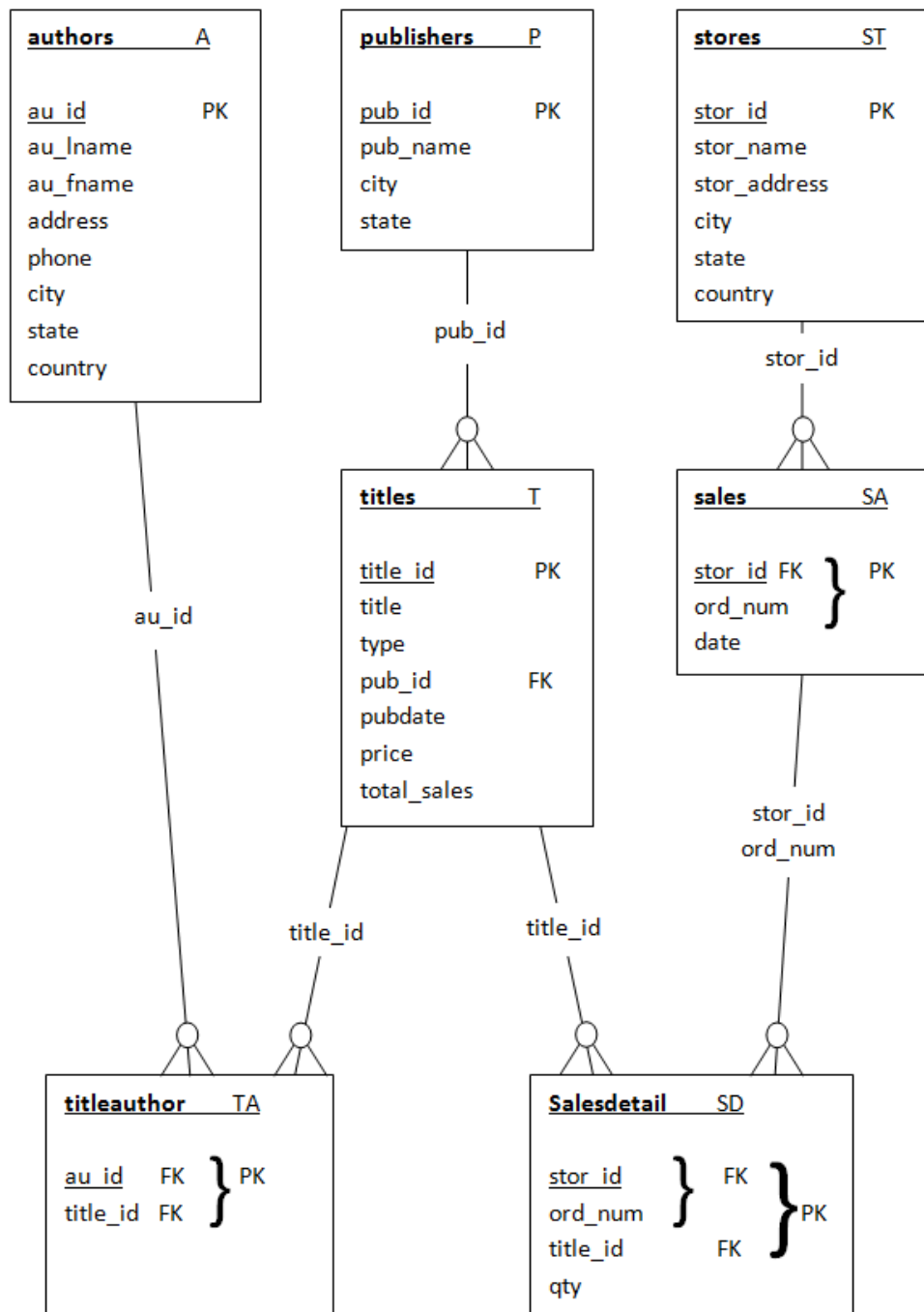


Lister les noms et prénoms
des auteurs dont la seconde
lettre du nom est e

SELECT a.au_lname,
 a.au_fname

FROM authors a

WHERE a.au_lname LIKE
 '_e%';

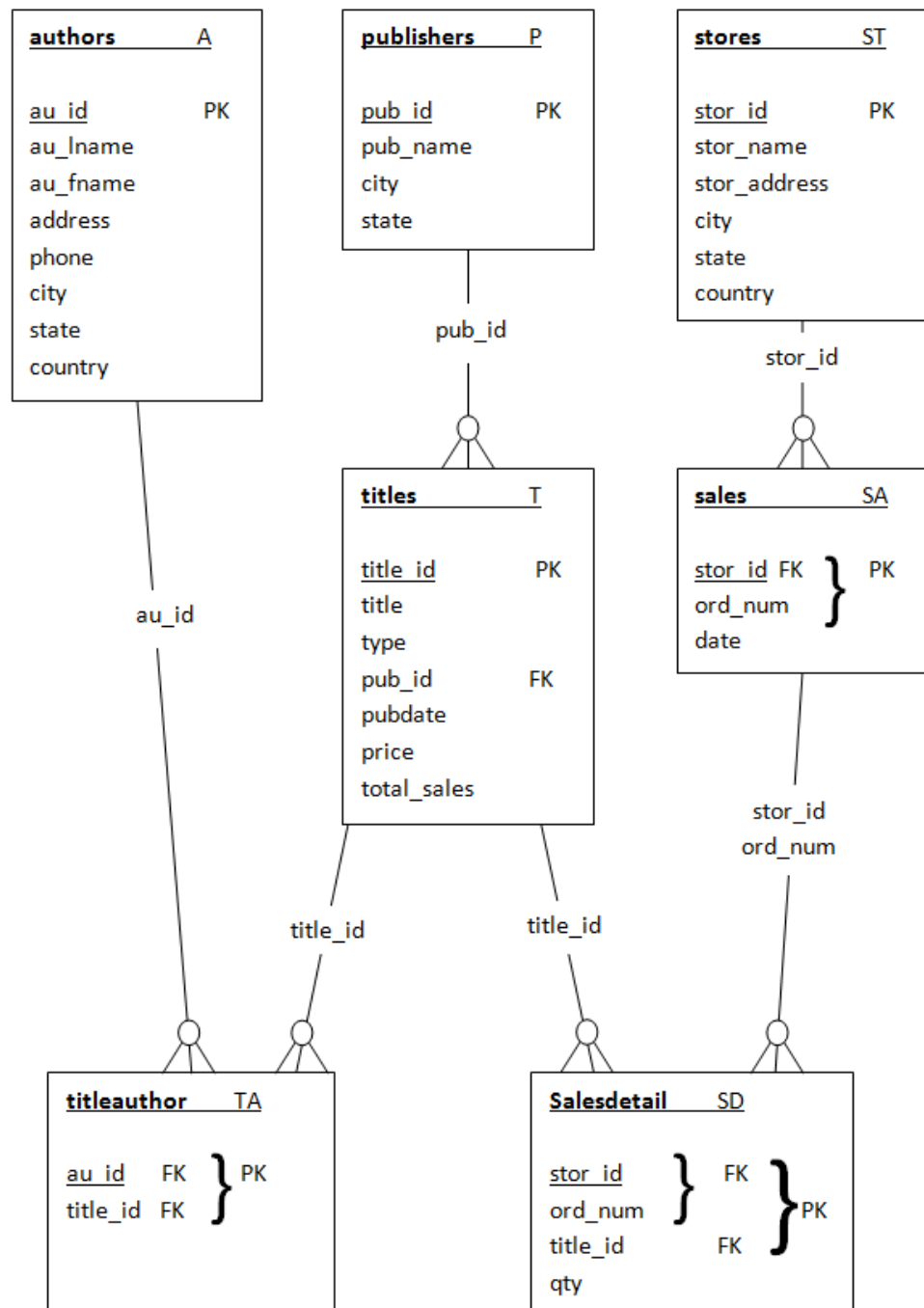


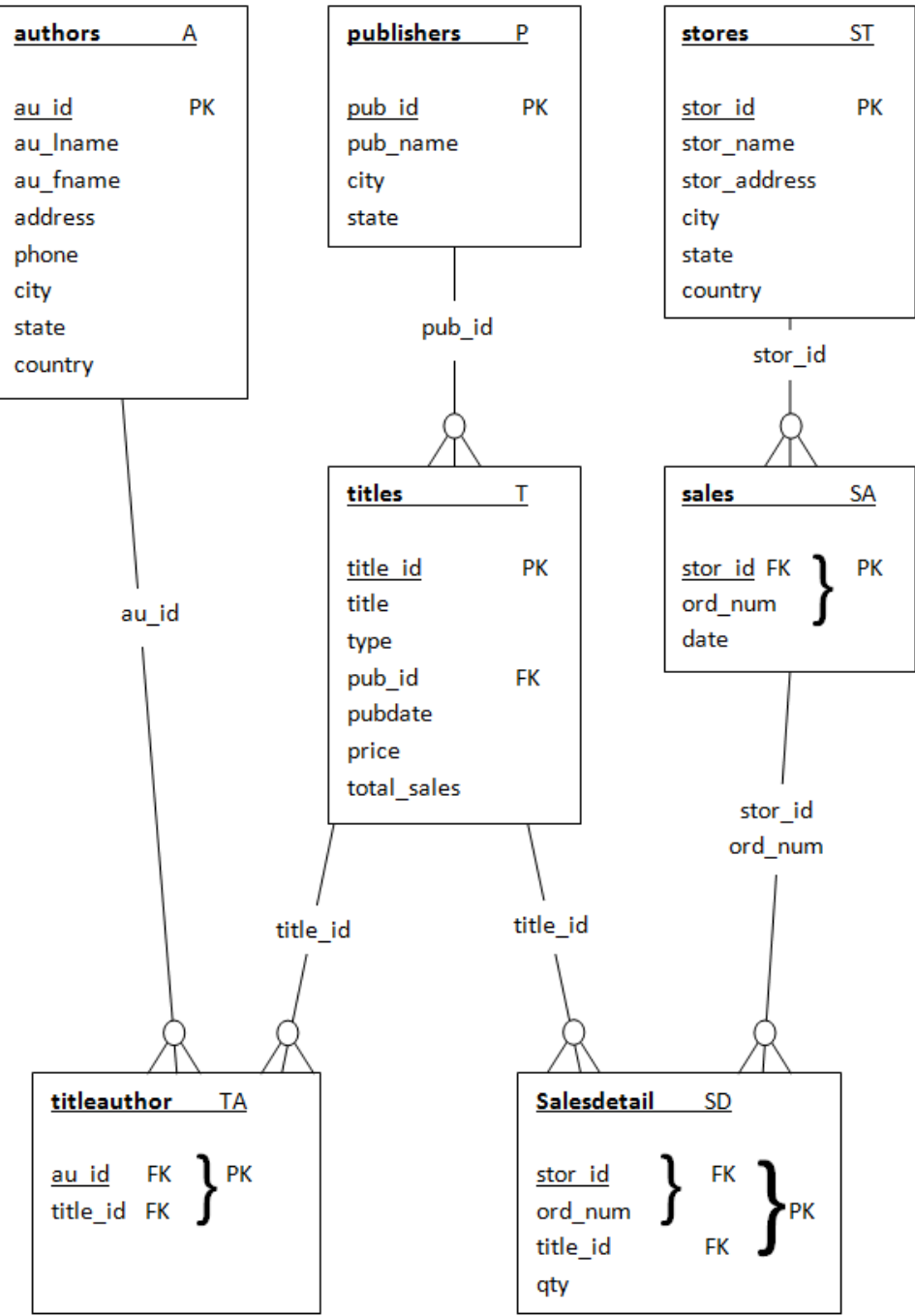
Lister les noms et prénoms
des auteurs dont le nom
commence par d

```
SELECT a.au_lname,  
       a.au_fname  
FROM authors a  
WHERE a.au_lname  
      SIMILAR TO '[dD]%';
```

Lister les noms et prénoms
des auteurs triés par ordre
alphabétique

```
SELECT a.au_lname,  
       a.au_fname  
FROM authors a  
ORDER BY a.au_lname  
        ASC, a.au_fname ASC;
```





Lister les noms des auteurs dont
le nom termine par er

```
SELECT a.au_lname  
FROM authors a  
WHERE a.au_lname LIKE '%er'
```

Ringer
Ringer
Stringer
MacFeather
Hunter
MacFeather
Stringer
Hunter
Ringer

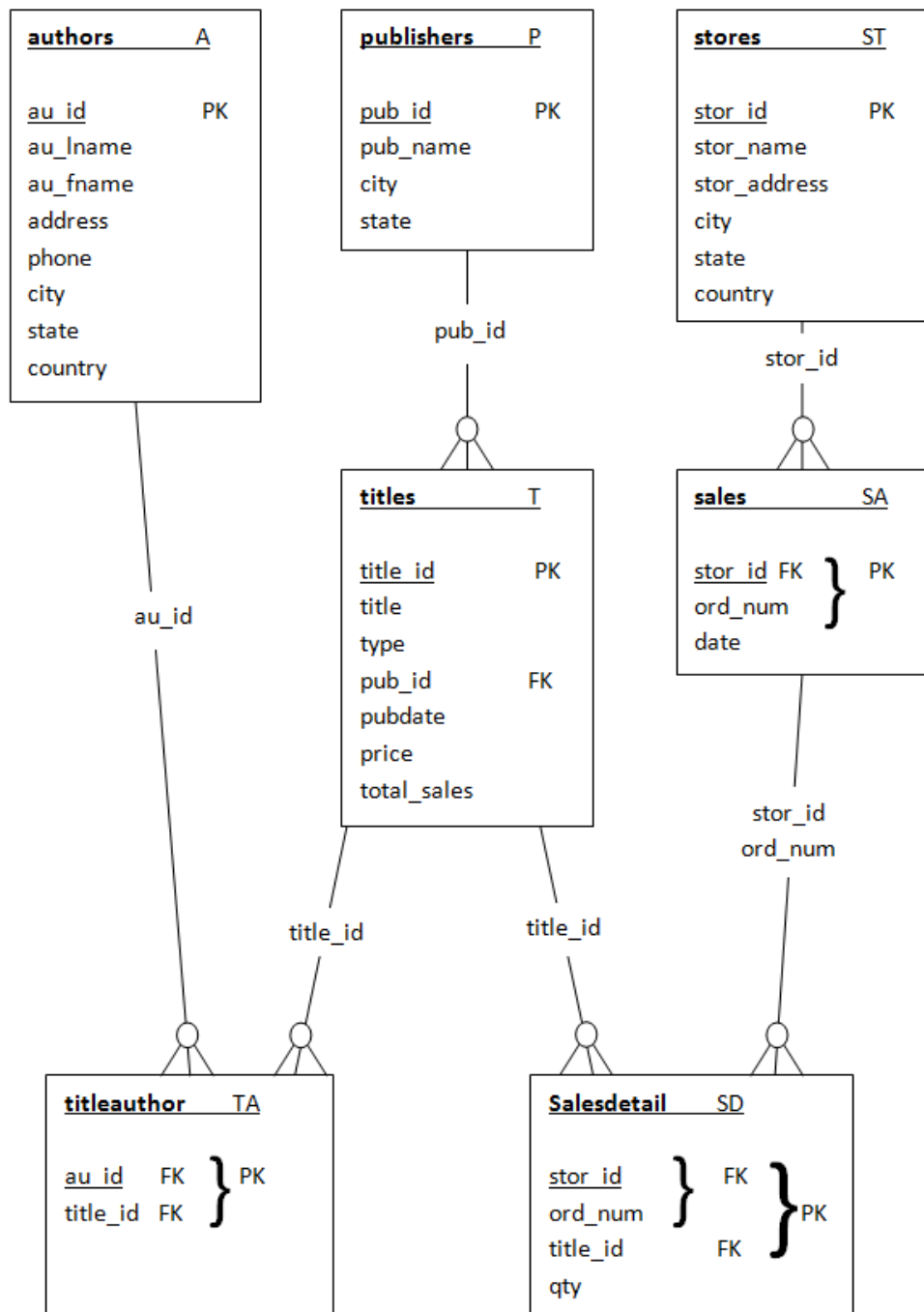
```
SELECT DISTINCT a.au_lname  
FROM authors a  
WHERE a.au_lname LIKE '%er'
```

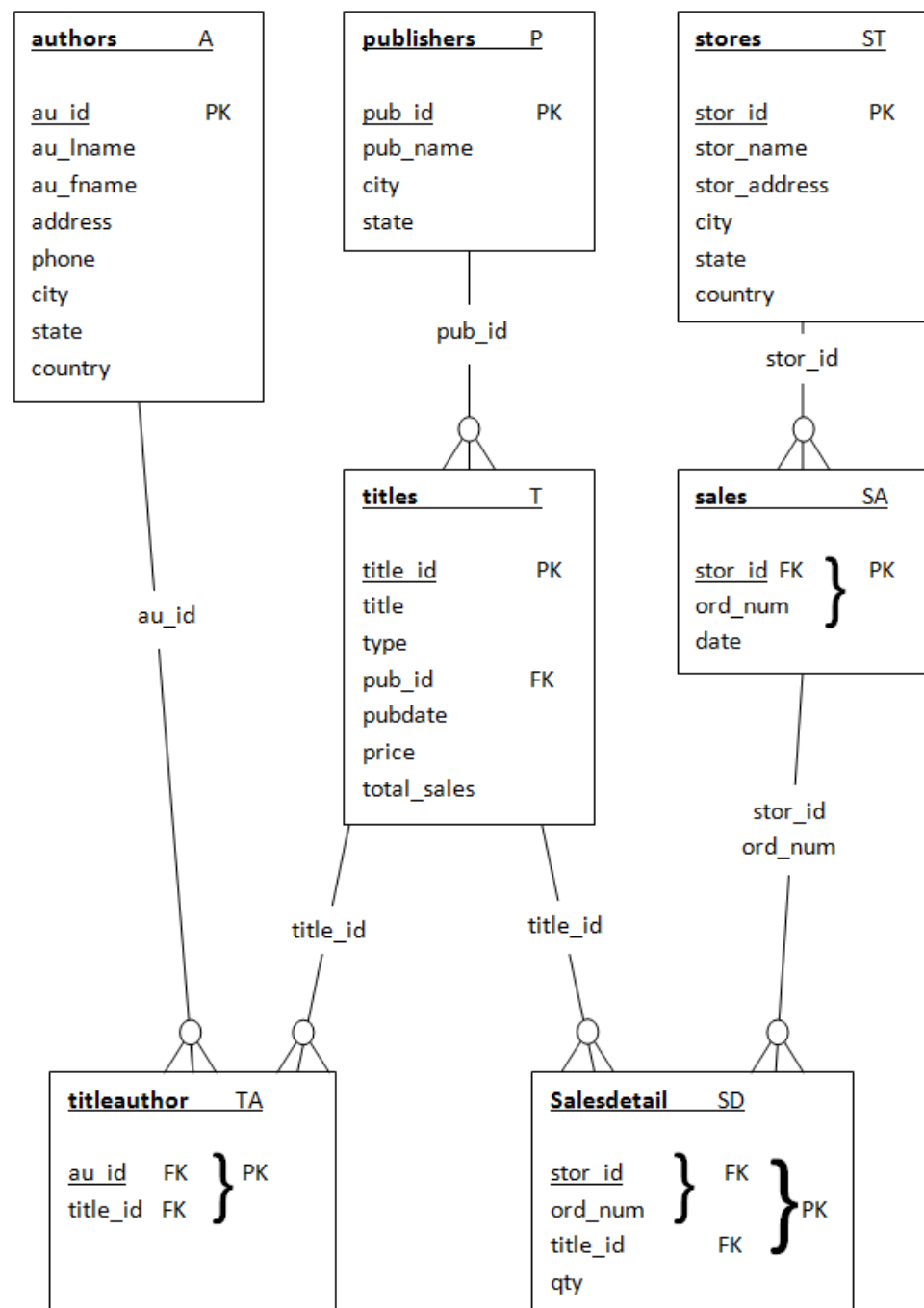
Jointure

```
SELECT [ ALL | DISTINCT [ ON ( expression [, ...] ) ] ]  
      * | expression [ [ AS ] nom_d_affichage ] [, ...]  
[ FROM éléments_from [, ...] ]  
[ WHERE condition ]  
[ ORDER BY expression [ ASC | DESC ] [, ...] ]
```


Lister les livres et leurs éditeurs

```
SELECT t.title,p.pub_name  
FROM titles t, publishers p  
WHERE t.pub_id=p.pub_id
```



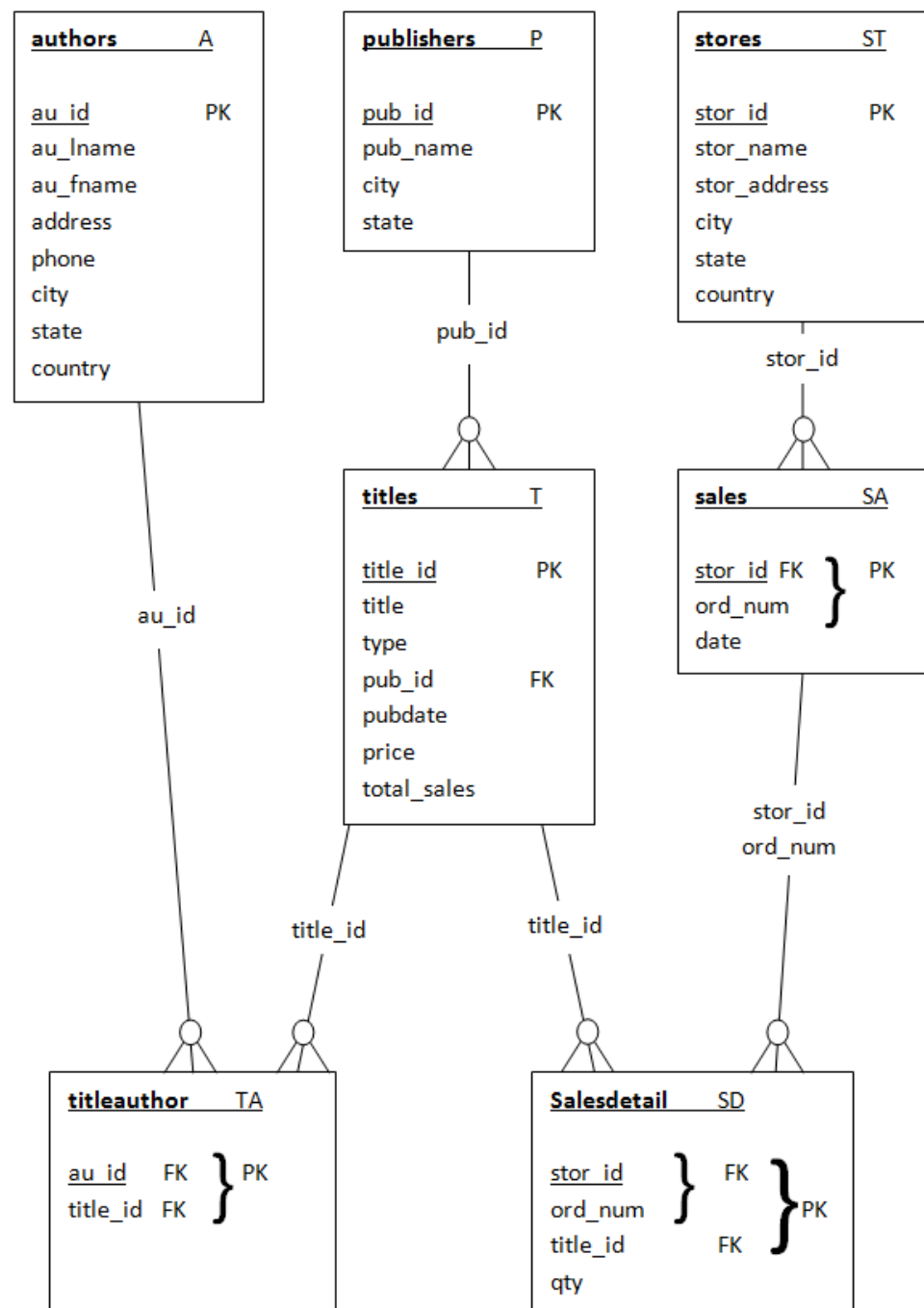


Lister les auteurs habitant la même ville qu'un autre auteur

```

SELECT a.au_lname,
       a.au_fname
FROM authors a
WHERE a.city = a.city
  
```

Ne marche évidemment pas !



Lister les auteurs habitant la même ville qu'un autre auteur

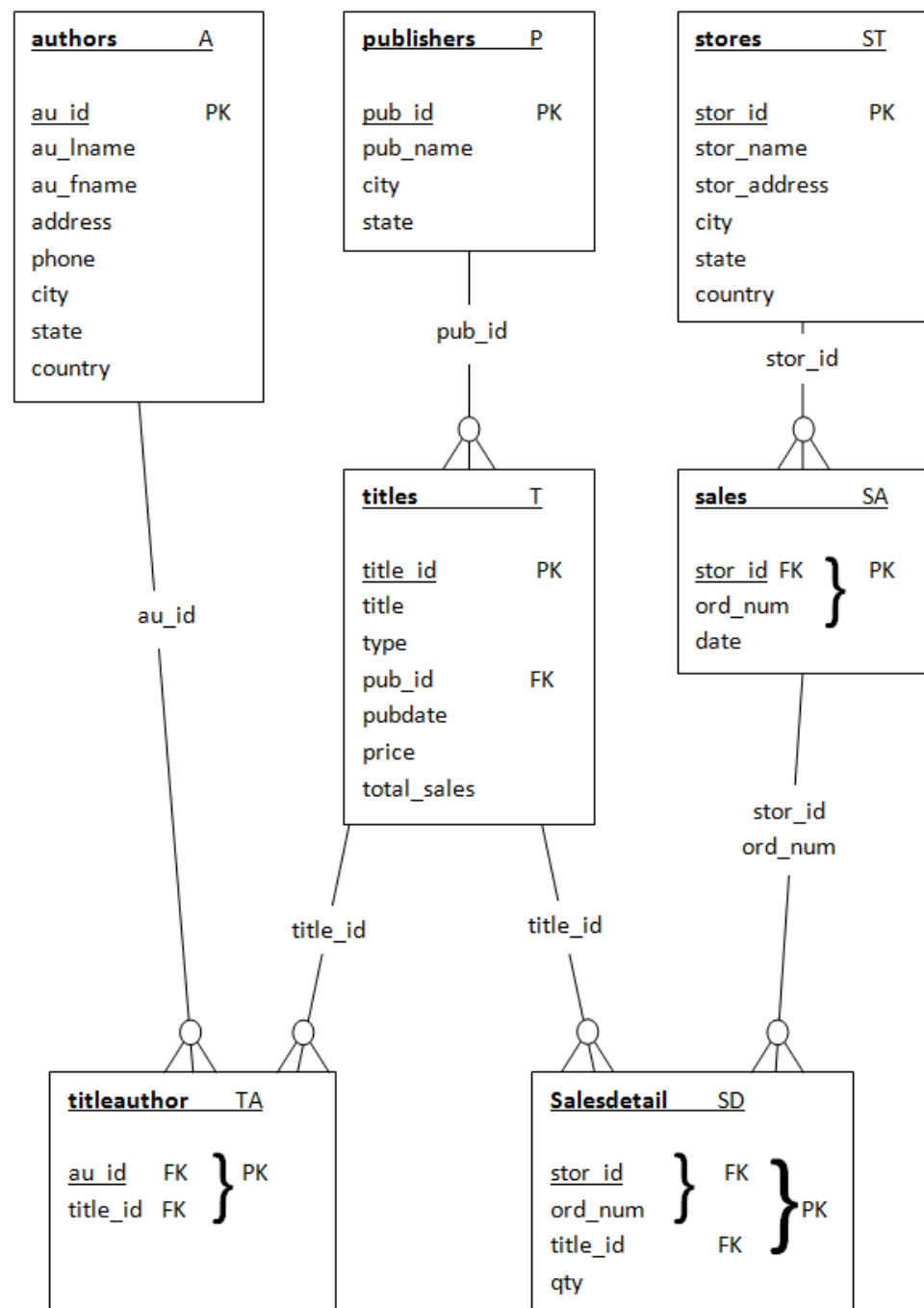
On a besoin de regarder deux fois la table authors !

SELECT a1.au_lname,
a1.au_fname

FROM authors a1, authors a2

WHERE a1.city = a2.city

Ne marche toujours pas !



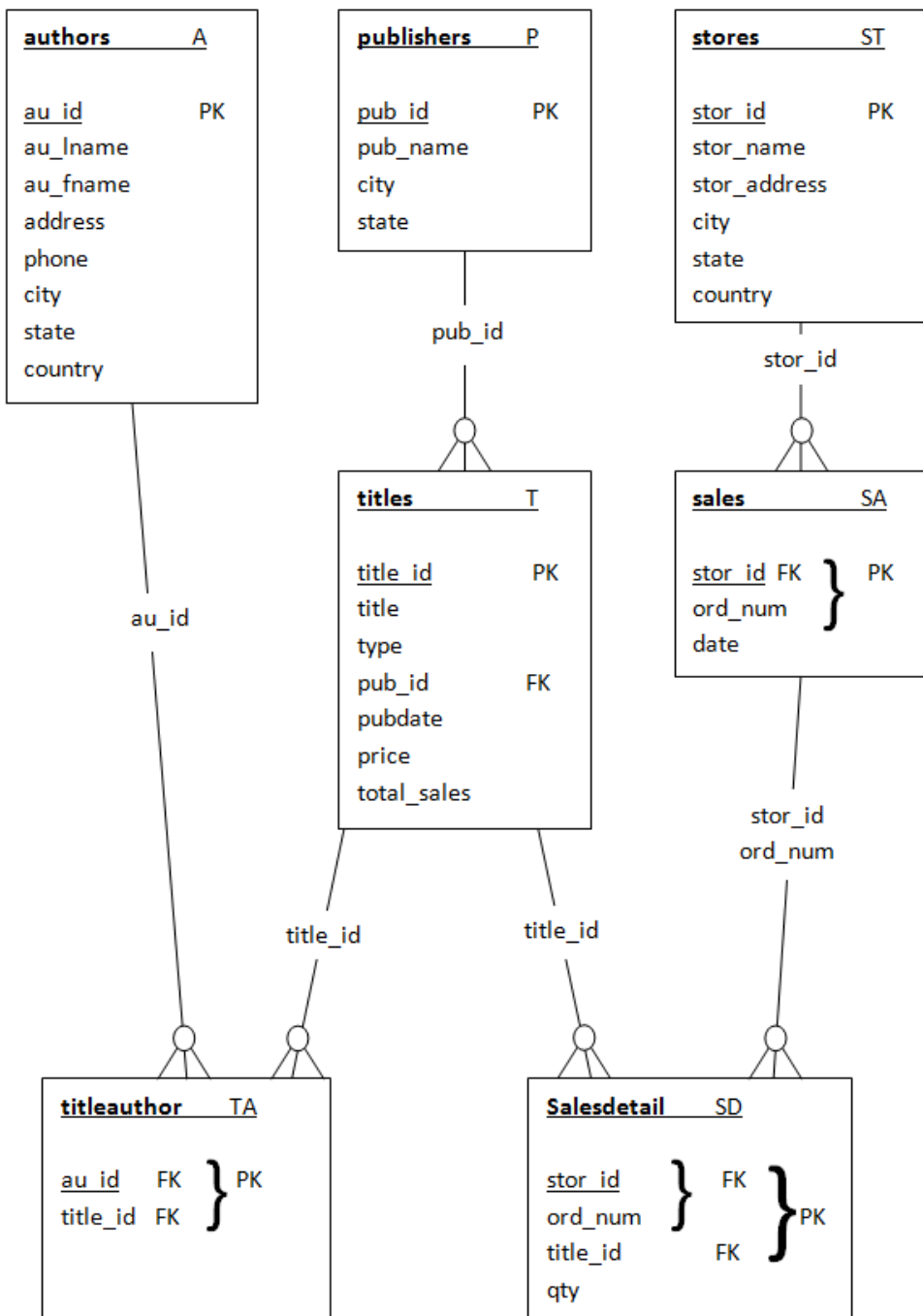
Lister les auteurs habitant la même ville qu'un autre auteur

SELECT a1.au_lname,
a1.au_fname,
a2.au_lname,
a2.au_fname

FROM authors a1, authors
a2

WHERE a1.city= a2.city
AND a1.au_id<>a2.au_id

Attention aux
doublons!



Lister les auteurs habitant la même ville qu'un autre auteur

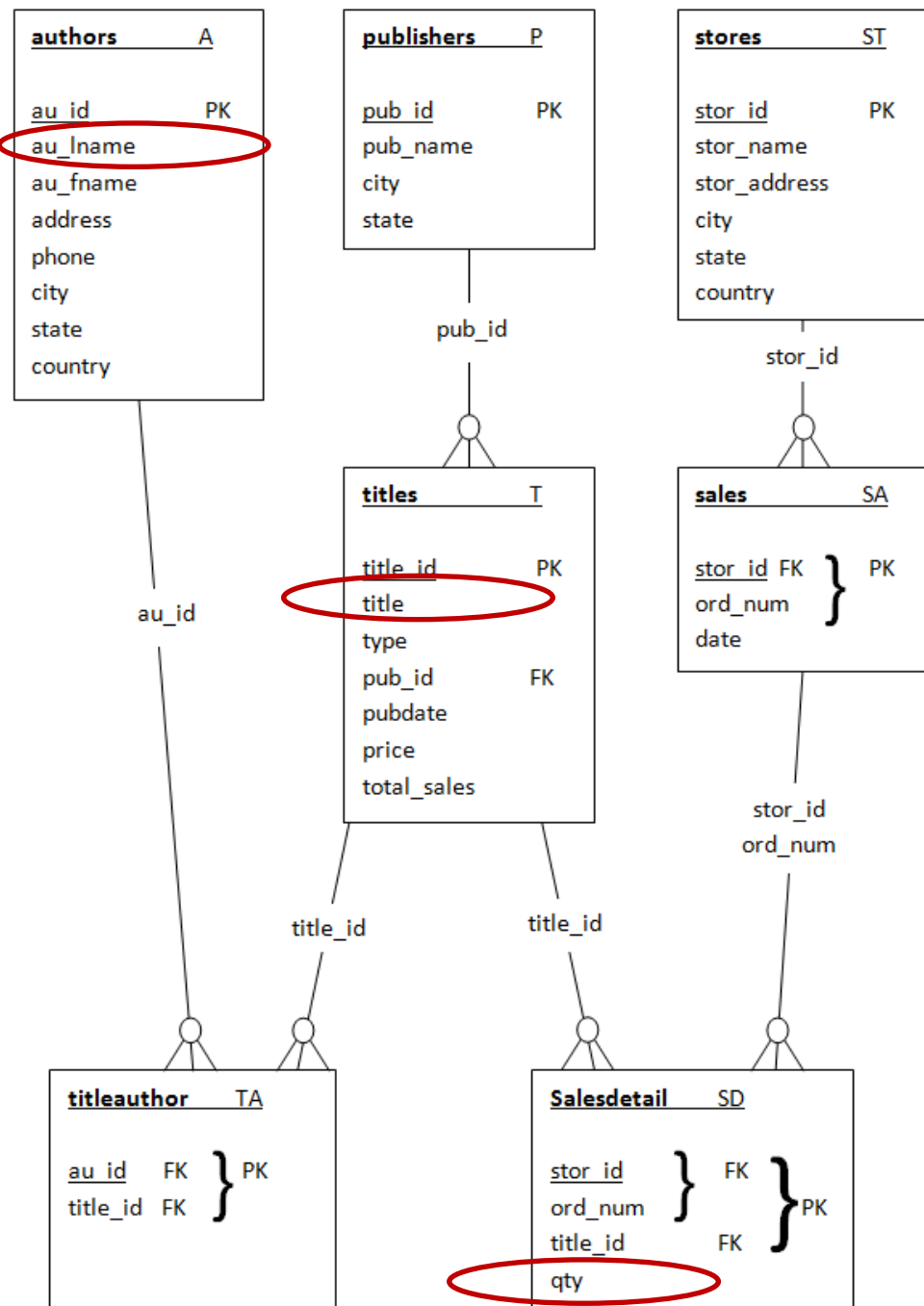
SELECT a1.au_lname,
a1.au_fname,
a2.au_lname,
a2.au_fname

FROM authors a1, authors
a2

WHERE a1.city= a2.city
AND a1.au_id<a2.au_id

Quels sont les livres
vendus par Green, et en
quelle quantité ?

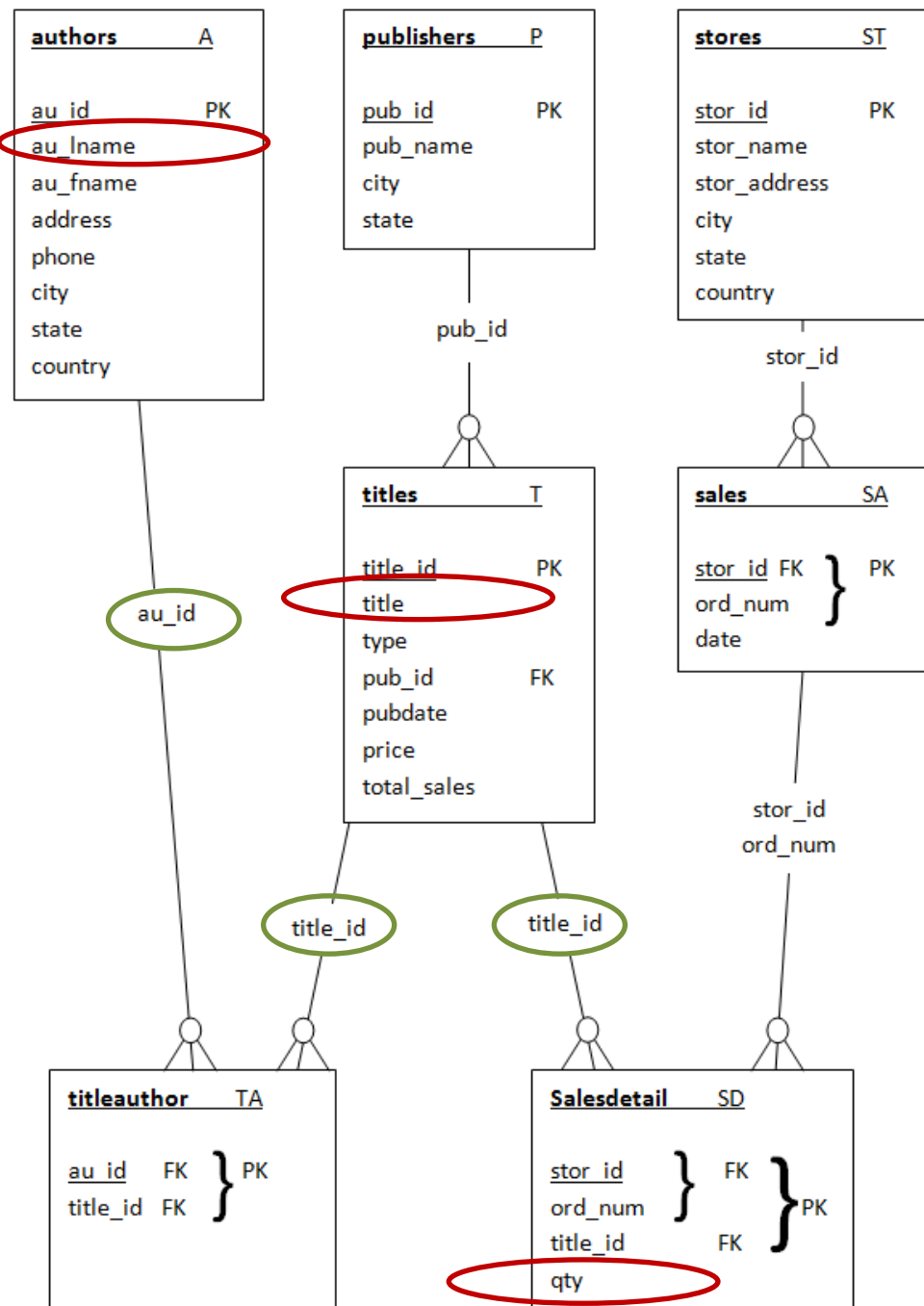
Etape 1 : quels sont les
champs dont on a
besoin ?



Quels sont les livres
vendus par Green, et en
quelle quantité ?

Etape 1 : quels sont les
champs dont on a
besoin ?

Etape 2 : comment les
mettre en relation ?

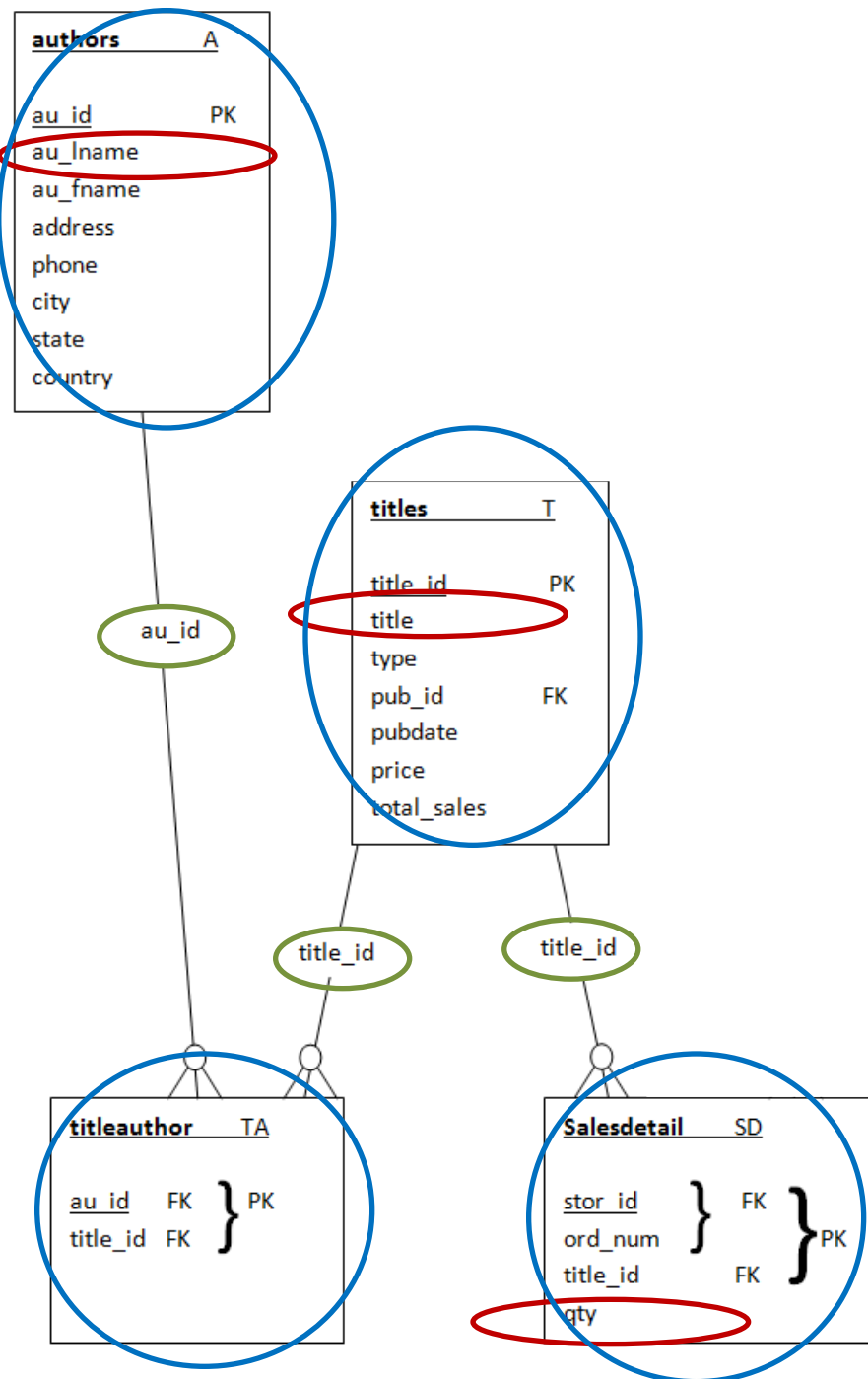


Quels sont les livres
vendus par Green, et en
quelle quantité ?

Etape 1 : quels sont les
champs dont on a
besoin ?

Etape 2 : comment les
mettre en relation ?

=> jointures + tables



Quels sont les livres
vendus par Green, et en
quelle quantité ?

SELECT t.title,sd.qty

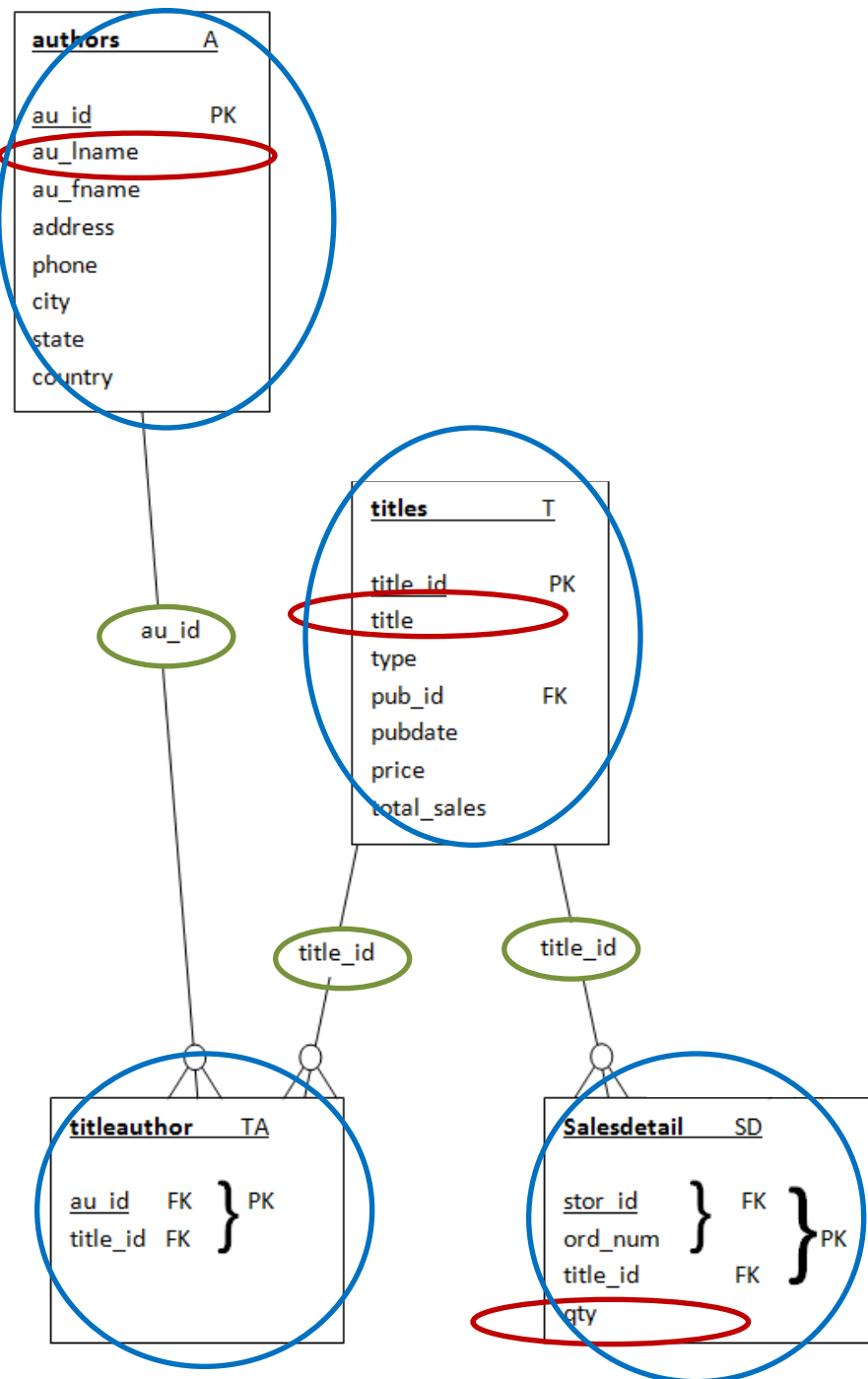
FROM authors a, titleauthor ta,
salesdetail sd, titles t

WHERE a.au_lname LIKE
'Green'

AND a.au_id=ta.au_id

AND ta.title_id=t.title_id

AND ta.title_id=sd.title_id



| | |
|-------------------------------------|------|
| The Busy Executive's Database Guide | 320 |
| The Busy Executive's Database Guide | 136 |
| The Busy Executive's Database Guide | 345 |
| The Busy Executive's Database Guide | 94 |
| The Busy Executive's Database Guide | 1500 |
| The Busy Executive's Database Guide | 300 |
| The Busy Executive's Database Guide | 200 |
| The Busy Executive's Database Guide | 1000 |
| The Busy Executive's Database Guide | 200 |
| You Can Combat Computer Stress! | 135 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 4000 |
| You Can Combat Computer Stress! | 230 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 30 |
| You Can Combat Computer Stress! | 35 |
| You Can Combat Computer Stress! | 42 |
| You Can Combat Computer Stress! | 2200 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 2000 |
| You Can Combat Computer Stress! | 150 |
| You Can Combat Computer Stress! | 500 |

Pas très utile comme
information !

GROUP BY HAVING

```
SELECT [ ALL | DISTINCT [ ON ( expression [, ...] ) ] ]  
      * | expression [ [ AS ] nom_d_affichage ] [, ...]  
[ FROM éléments_from [, ...] ]  
[ WHERE condition ]  
[ GROUP BY expression [, ...] ]  
[ HAVING condition [, ...] ]  
[ ORDER BY expression [ ASC | DESC ] [, ...] ]
```

| | |
|-------------------------------------|------|
| The Busy Executive's Database Guide | 320 |
| The Busy Executive's Database Guide | 136 |
| The Busy Executive's Database Guide | 345 |
| The Busy Executive's Database Guide | 94 |
| The Busy Executive's Database Guide | 1500 |
| The Busy Executive's Database Guide | 300 |
| The Busy Executive's Database Guide | 200 |
| The Busy Executive's Database Guide | 1000 |
| The Busy Executive's Database Guide | 200 |
| You Can Combat Computer Stress! | 135 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 4000 |
| You Can Combat Computer Stress! | 230 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 30 |
| You Can Combat Computer Stress! | 35 |
| You Can Combat Computer Stress! | 42 |
| You Can Combat Computer Stress! | 2200 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 2000 |
| You Can Combat Computer Stress! | 150 |
| You Can Combat Computer Stress! | 500 |

GROUP BY t.title

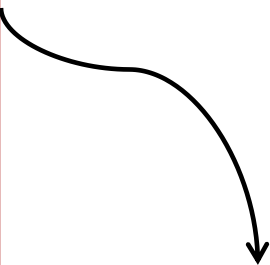
Chaque groupe doit
être réduit à un seul
élément dans la sortie
du SELECT

| | |
|-------------------------------------|------|
| The Busy Executive's Database Guide | 320 |
| The Busy Executive's Database Guide | 136 |
| The Busy Executive's Database Guide | 345 |
| The Busy Executive's Database Guide | 94 |
| The Busy Executive's Database Guide | 1500 |
| The Busy Executive's Database Guide | 300 |
| The Busy Executive's Database Guide | 200 |
| The Busy Executive's Database Guide | 1000 |
| The Busy Executive's Database Guide | 200 |
| You Can Combat Computer Stress! | 135 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 4000 |
| You Can Combat Computer Stress! | 230 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 30 |
| You Can Combat Computer Stress! | 35 |
| You Can Combat Computer Stress! | 42 |
| You Can Combat Computer Stress! | 2200 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 2000 |
| You Can Combat Computer Stress! | 150 |
| You Can Combat Computer Stress! | 500 |

```

SELECT t.title,SUM(sd.qty)
FROM authors a, titleauthor ta,
salesdetail sd, titles t
WHERE a.au_lname LIKE 'Green'
      AND a.au_id=ta.au_id
      AND ta.title_id=sd.title_id
      AND t.title_id=ta.title_id
GROUP BY t.title

```



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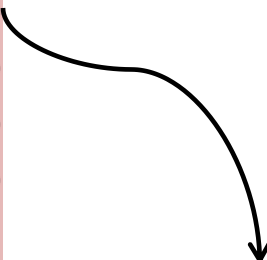
Que se passe-t-il si deux livres portent le même titre ?

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| The Busy Executive's Database Guide | 320 |
| The Busy Executive's Database Guide | 136 |
| The Busy Executive's Database Guide | 345 |
| The Busy Executive's Database Guide | 94 |
| The Busy Executive's Database Guide | 1500 |
| The Busy Executive's Database Guide | 300 |
| The Busy Executive's Database Guide | 200 |
| The Busy Executive's Database Guide | 1000 |
| The Busy Executive's Database Guide | 200 |
| You Can Combat Computer Stress! | 135 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 4000 |
| You Can Combat Computer Stress! | 230 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 30 |
| You Can Combat Computer Stress! | 35 |
| You Can Combat Computer Stress! | 42 |
| You Can Combat Computer Stress! | 2200 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 2000 |
| You Can Combat Computer Stress! | 150 |
| You Can Combat Computer Stress! | 500 |

```

SELECT t.title,SUM(sd.qty)
FROM authors a, titleauthor ta,
salesdetail sd, titles t
WHERE a.au_lname LIKE 'Green'
      AND a.au_id=ta.au_id
      AND ta.title_id=sd.title_id
      AND t.title_id=ta.title_id
GROUP BY t.title_id

```



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C'est la PK qui garantit l'identité
du livre, pas son titre !

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| You Can Combat Computer Stress! | 230 |
| You Can Combat Computer Stress! | 200 |
| You Can Combat Computer Stress! | 30 |
| You Can Combat Computer Stress! | 35 |
| You Can Combat Computer Stress! | 42 |
| You Can Combat Computer Stress! | 2200 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 3000 |
| You Can Combat Computer Stress! | 2000 |
| You Can Combat Computer Stress! | 150 |
| You Can Combat Computer Stress! | 500 |

```

SELECT t.title,SUM(sd.qty)
FROM authors a, titleauthor ta,
salesdetail sd, titles t
WHERE a.au_lname LIKE 'Green'
      AND a.au_id=ta.au_id
      AND ta.title_id=sd.title_id
      AND t.title_id=ta.title_id
GROUP BY t.title_id
HAVING SUM(sd.qty)>5000

```

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Opérateurs d'aggrégation

```
COUNT ( [ ALL | DISTINCT ] expression ) |  
SUM   ( [ ALL | DISTINCT ] expression ) |  
MIN   ( [ ALL | DISTINCT ] expression ) |  
MAX   ( [ ALL | DISTINCT ] expression ) |  
AVG   ( [ ALL | DISTINCT ] expression ) |  
COUNT ( * )
```