UFCD 10788- Fundamentos da linguagem SQL

Introdução às bases de dados

- O que é uma base de dados?
  - conjunto de dados organizados e estruturados
  - os dados podem relacionar-se de forma a ser acessados e manipulados
  - O termo base de dados refere-se aos ficheiros onde se encontram os dados
  - Os dados são geridos por um Sistema de Gestão de Base de Dados (SGBD)

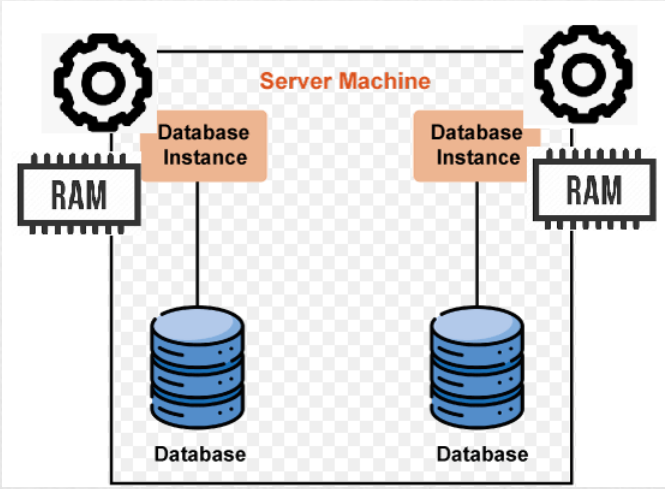
Tipos de bases de dados

- Bases de dados relacionais (RDBMS)
  - Utilizam tabelas organizadas com linhas e colunas para armazenar dados
  - As tabelas podem estar relacionadas
  - Exemplos: MySQL, PostgreSQL, SQL Server, Oracle, SQLite
- Bases de dados não relacionais (NoSQL)
  - São usadas para dados não estruturados ou semi-estruturados, como documentos JSON, gráficos ou grandes volumes de dados não tabulares
  - Exemplos: MongoDB, Cassandra, Redis
- Bases de dados em nuvem
  - Armazenam dados na nuvem, permitindo acesso remoto e escalabilidade fácil
  - Exemplos: Google Cloud, AWS RDS, Azure SQL.

Tipos de bases de dados

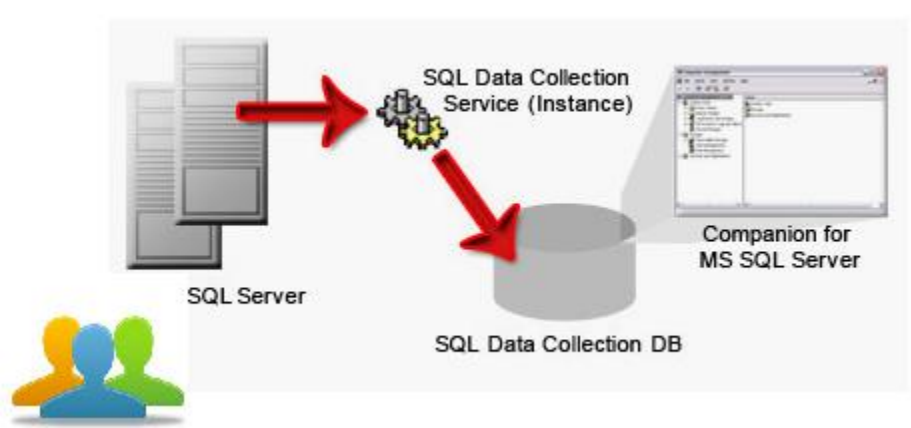
Como funcionam as bases de dados

- Instância de um Sistema de Gerenciamento de Bases de Dados (SGBD)
  - A instância de um SGBD refere-se ao conjunto de processos e de memória que são responsáveis pela gestão de uma ou mais bases de dados



Como funcionam as bases de dados

- Instância de um Sistema de Gerenciamento de Bases de Dados (SGBD)
  - A instância do SGBD executa processos que são responsáveis pela execução das operações no banco de dados (inserção, consulta, atualização e exclusão de dados)



Como funcionam as bases de dados

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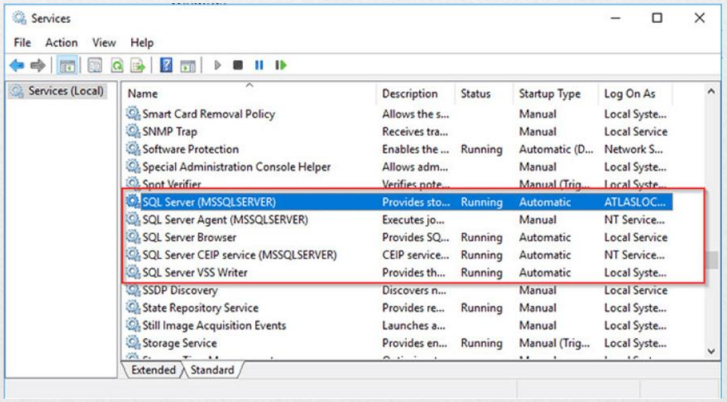
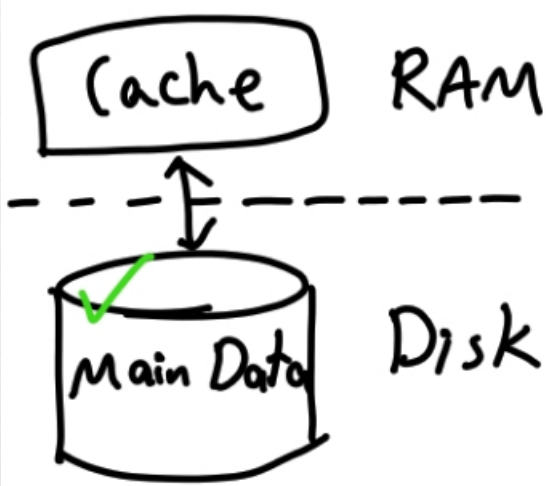
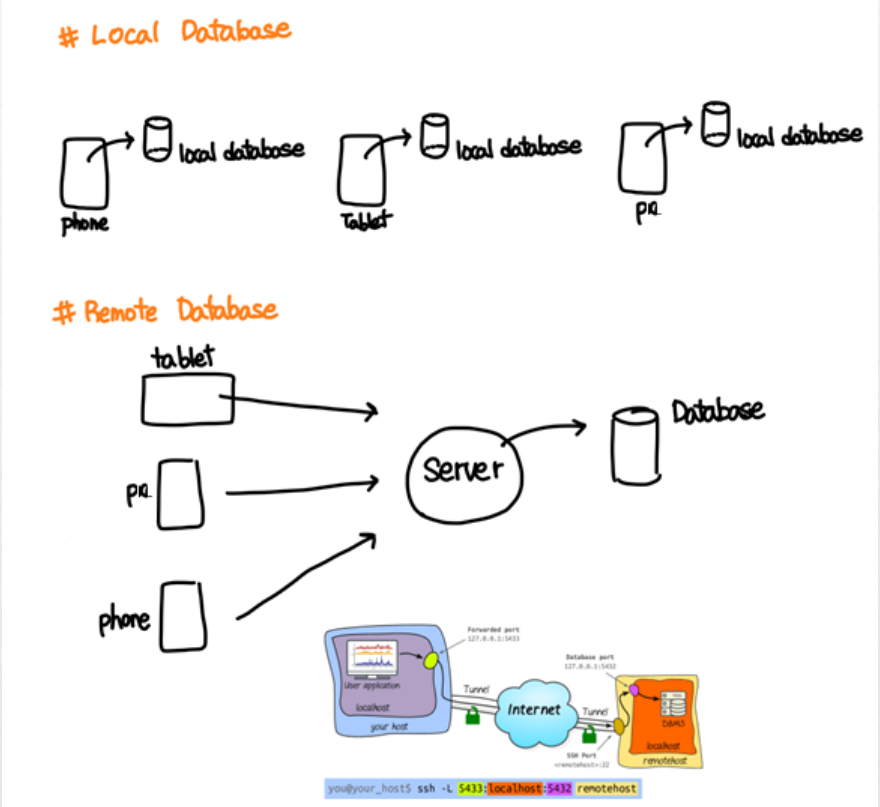


Como funcionam as bases de dados

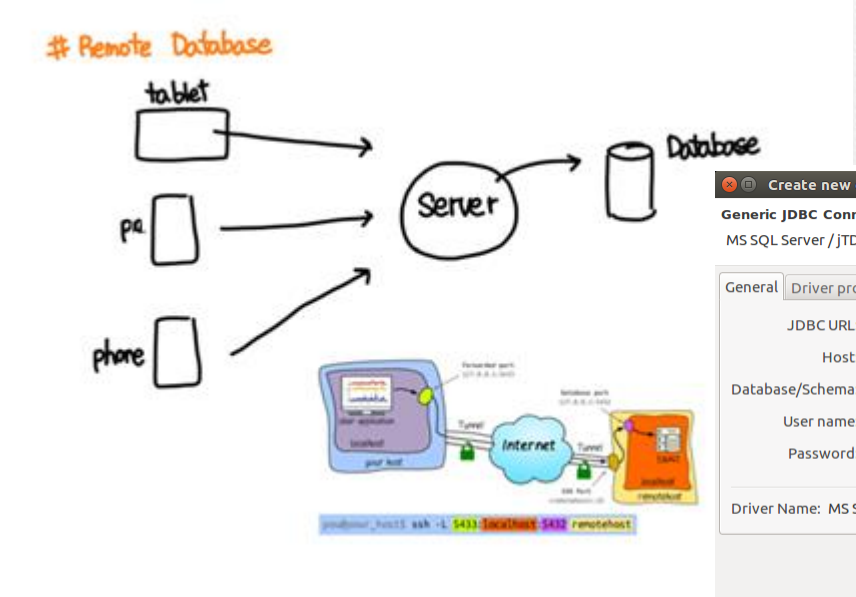
- Sistema de Gerenciamento de Bases de Dados (SGBD)
  - A instância do SGBD aloca e efetua a gestão de memória para otimizar o acesso aos dados, como a *cache* de dados e *buffers* para melhorar a performance das consultas.

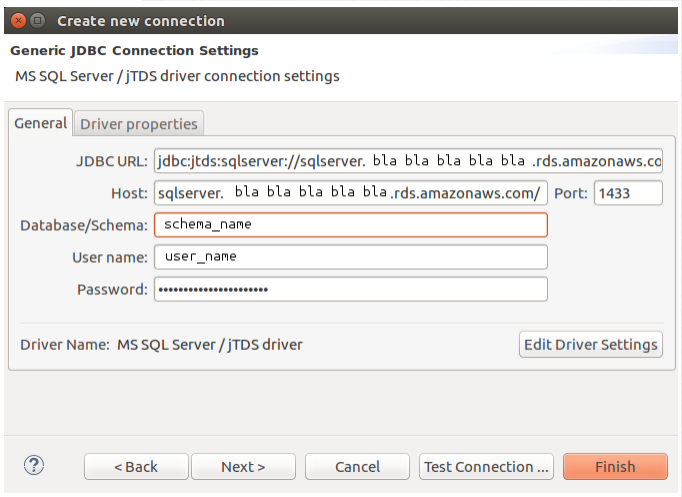


Como funcionam as bases de dados

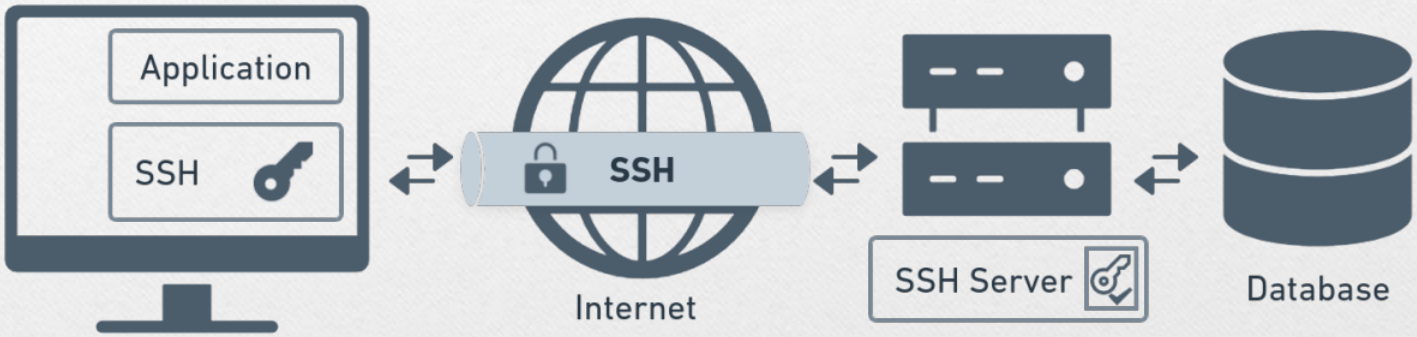


Como funcionam as bases de dados



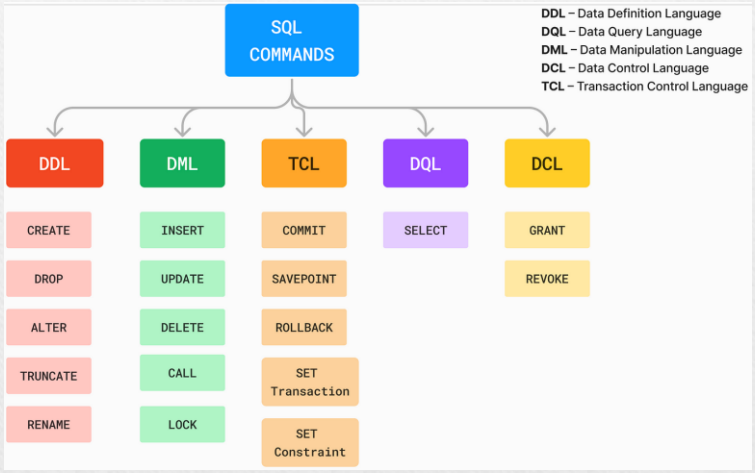


Como funcionam as bases de dados

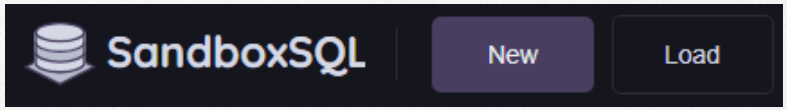


Como funcionam as bases de dados

- Consultas em bases de dados
  - As consultas e manipulação de dados são feitas em SQL (*Structured Query Language*)



IDE de desenvolvimento



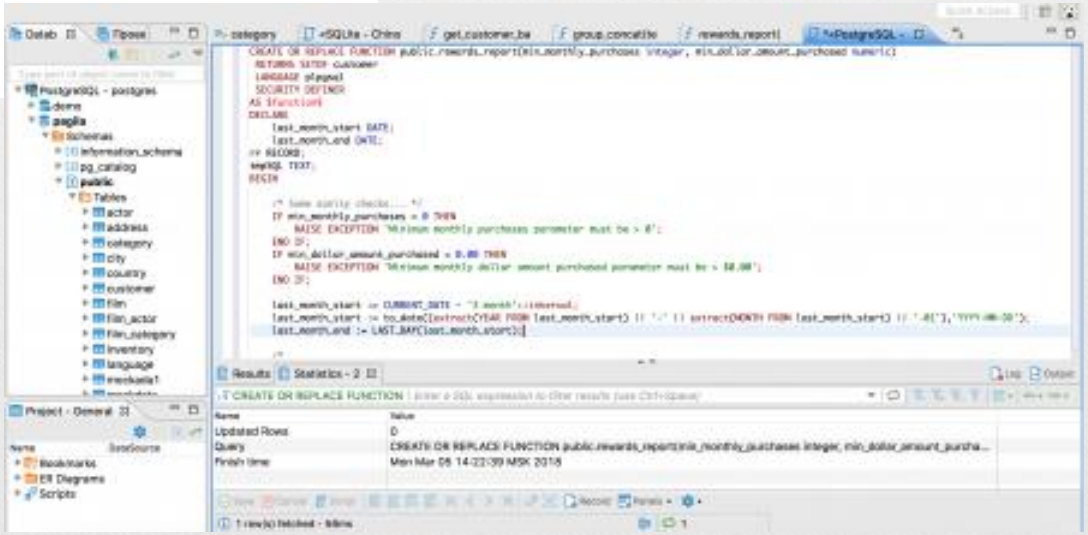
www.sandboxsql.com

Google Colab

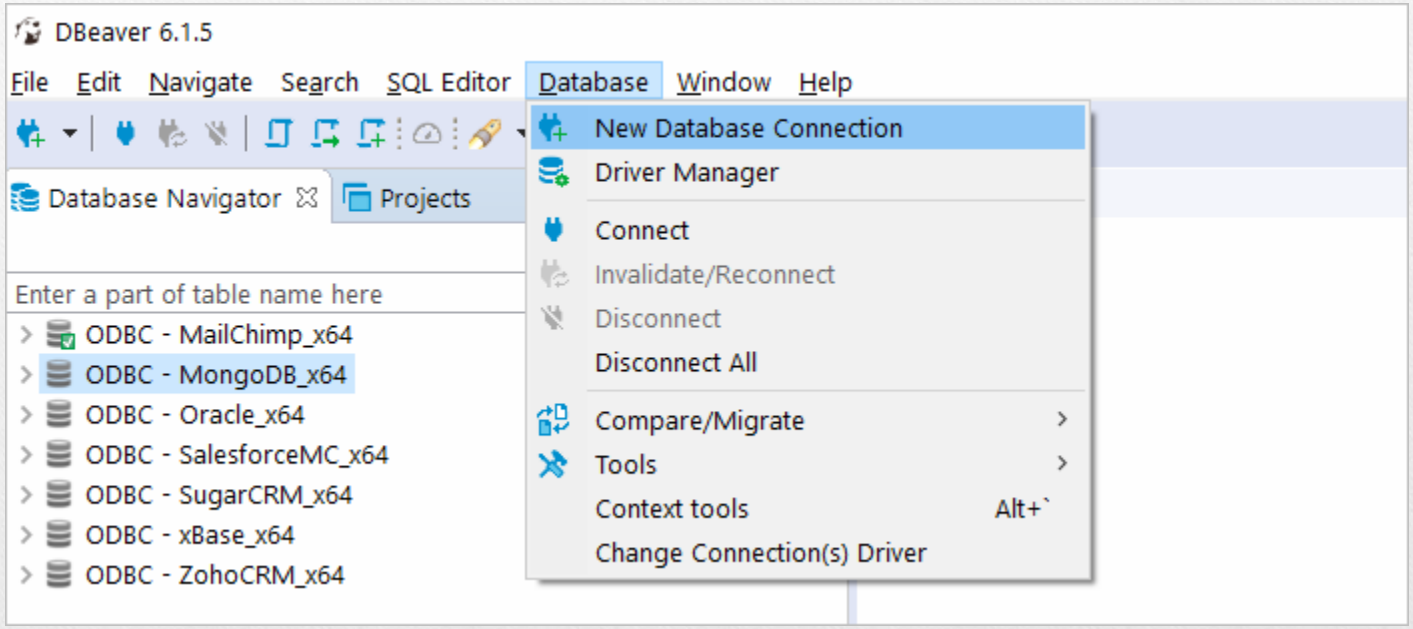
Jupyter Notebook

IDE de desenvolvimento

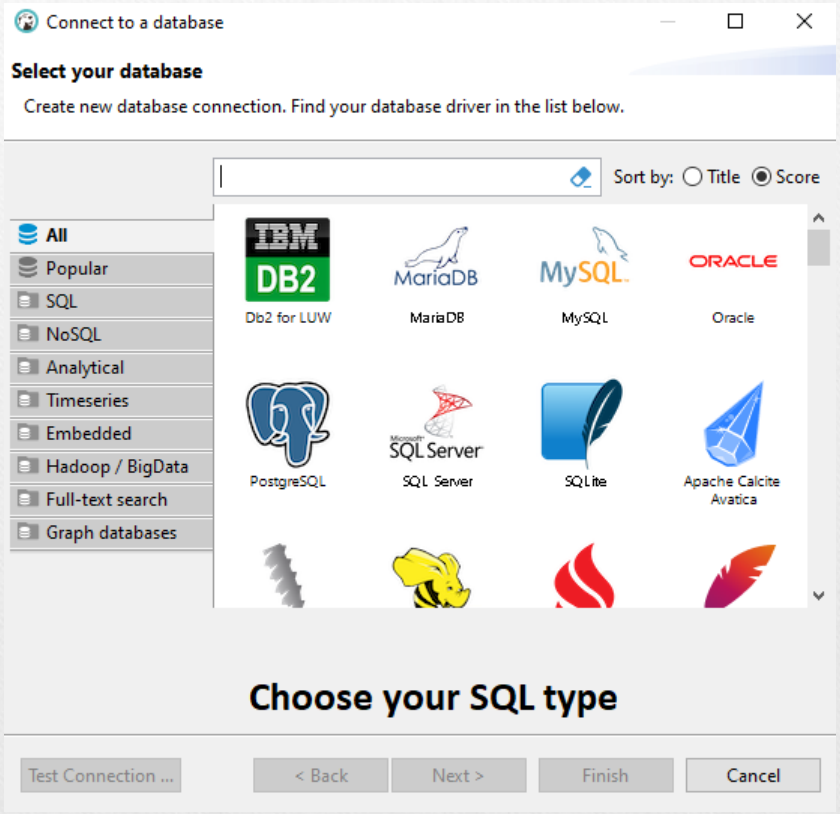
DBeaver



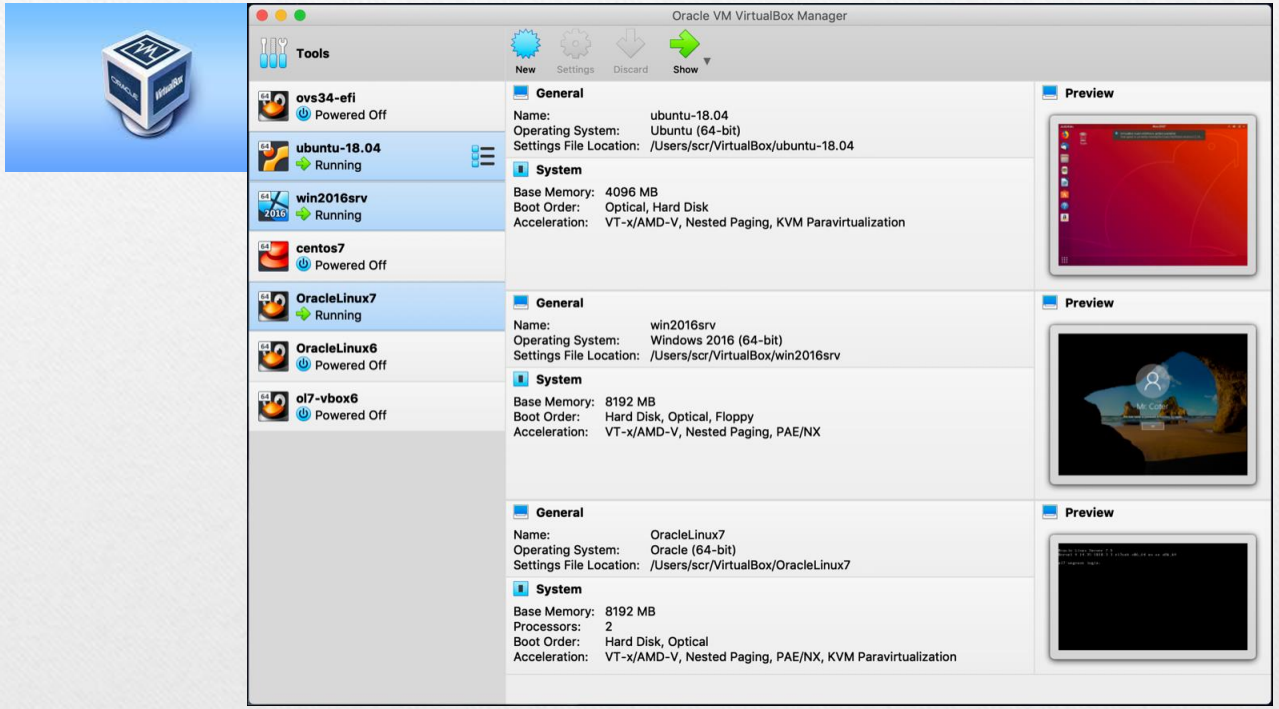
Conexão a uma base de dados SQLite



Conexão a uma base de dados SQLite



IDE de desenvolvimento



SQL

Google Colab

```
[ ] !pip install jupysql
```

Mostrar saída oculta

```
[ ] %load_ext sql
```

```
[ ] %sql sqlite:///Hospital.sqlite
```

Mostrar saída oculta

```
%%sql
SELECT * FROM Patient
```

Running query in 'sqlite:///Hospital.sqlite'

SSN	Name	Address	Phone	InsuranceID	PCP
100000001	John Smith	42 Foobar Lane	555-0256	68476213	1
100000002	Grace Ritchie	37 Snafu Drive	555-0512	36546321	2
100000003	Random J. Patient	101 Omgbbq Street	555-1204	65465421	2
100000004	Dennis Doe	1100 Foobaz Avenue	555-2048	68421879	3

SQL

- Data Definition Language (DDL)
  - *Create/alter/delete* tabelas e respetivos atributos
- Data Manipulation Language (DML)
  - *Insert/delete/Update* linhas nas tabelas

SQL

	A	B	C	D	E	F	G	H	I
1	Sales Representative	Location	Region	Customer	Order Date	Item	Quantity	Price	Total Sale Amount
2	Sara Snyder	New York	East	Phyllis Johnston	2016-10-30	Things	1	17.83	17.83
3	Sara Snyder	New York	East	Kimberly Little	2016-05-23	Junk	3	12.42	37.26
4	Frances Warren	Massachusetts	East	Justin Dixon	2016-09-27	Widgets	4	53.35	213.4
5	Sara Snyder	Massachusetts	East	Shirley Rivera	2016-02-12	Junk	5	12.42	62.1
6	Diane Gonzalez	Oregon	West	Marilyn Franklin	2016-02-14	Things	8	17.83	142.64
7	Patrick Graham	Washington	West	Henry Sanders	2016-04-11	Widgets	4	53.35	213.4
8	Sara Snyder	Connecticut	East	Benjamin Phillips	2016-09-02	Junk	4	12.42	49.68
9	Frances Warren	New Jersey	East	Theresa Torres	2016-11-26	Junk	4	12.42	49.68
10	Patrick Graham	Oregon	West	Roger Bell	2016-07-13	Junk	10	12.42	124.2
11	Sara Snyder	New Jersey	East	Harold Matthews	2016-06-02	Junk	3	12.42	37.26
12	Frances Warren	New York	East	Roy Young	2016-06-02	Widgets	8	53.35	426.8
13	Sara Snyder	New York	East	Debra Allen	2016-02-20	Things	1	17.83	17.83
14	Randy Watson	Connecticut	East	Alan Dean	2016-06-07	Junk	7	12.42	86.94
15	Randy Watson	Massachusetts	East	Robin Matthews	2016-10-31	Stuff	5	16.32	81.6
16	Randy Watson	New York	East	Randy Burton	2016-03-13	Stuff	4	16.32	65.28
17	Patrick Graham	Washington	West	Terry Nguyen	2016-02-10	Widgets	10	53.35	533.5

SQL


Overview
Balance
$ 5,786.00
Transactions
Shopping
06 Oct
- $ 200
Internet
01 Oct
- $ 15
Transportation
28 Jul
- $ 12
Fitness
15 Jul
- $ 40
Pay
Transfer
Statistic
Date
Income
$ 160
Jun
Jul
Aug
Sept
Nov
$ 8,122.99
Balance
$ 5,786.00
Hannah
Chen
Adam
Miller Jr
Card One
Amount
Send money to Hannah
$ 100
$ 25
$ 50
$ 100
$ 200
Description (Optional)
Next Step

Estrutura de uma Base de Dados Relacional

- Os dados são armazenados em tabelas
- As chaves estrangeiras são usadas para relacionar tabelas
- Uma das propriedades das bases de dados relacionais é a integridade referencial, que garante que os dados sejam consistentes.
- O uso do SQL oferece uma grande flexibilidade para consultar, filtrar e agregar dados de variadas formas

Estrutura de uma Base de Dados Relacional

- Tabelas: Armazenam dados de forma organizada, com cada tabela representando uma entidade ou objeto.
- Colunas: Representam os atributos ou características dos dados
- Linhas: Cada linha contém um registo de dados (exemplo: um cliente ou produto).
- Chave primária (*Primary Key*): Uma coluna ou conjunto de colunas que identifica de forma única cada registo de uma tabela.
- Chave estrangeira (*Foreign Key*): Estabelece uma relação entre duas tabelas, ligando uma chave primária de uma tabela a outra tabela.

Estrutura de uma Base de Dados Relacional

Tabelas no SQL

Tabela

Atributos

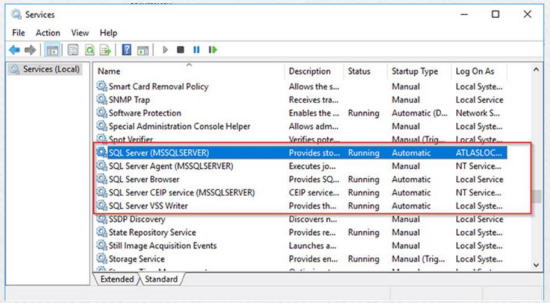
Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Tuplos/Registos/Linhas

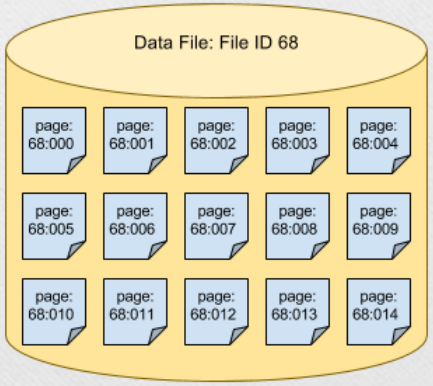
Estrutura de uma Base de Dados Relacional

	A	B	C	D	E	F
1	Employee Table					
2	Id	Name	Salary	Age	Gender	Dept
3	1	Anne	95000	43	Female	Sales
4	2	Claire	80000	35	Female	Analytics
5	3	David	70000	45	Male	Operations
6	4	Phil	85000	37	Male	Sales
7	5	Ray	90000	45	Female	Analytics
8	6	Rachel	60000	27	Female	Sales
9	7	Bob	80000	34	Male	Operations



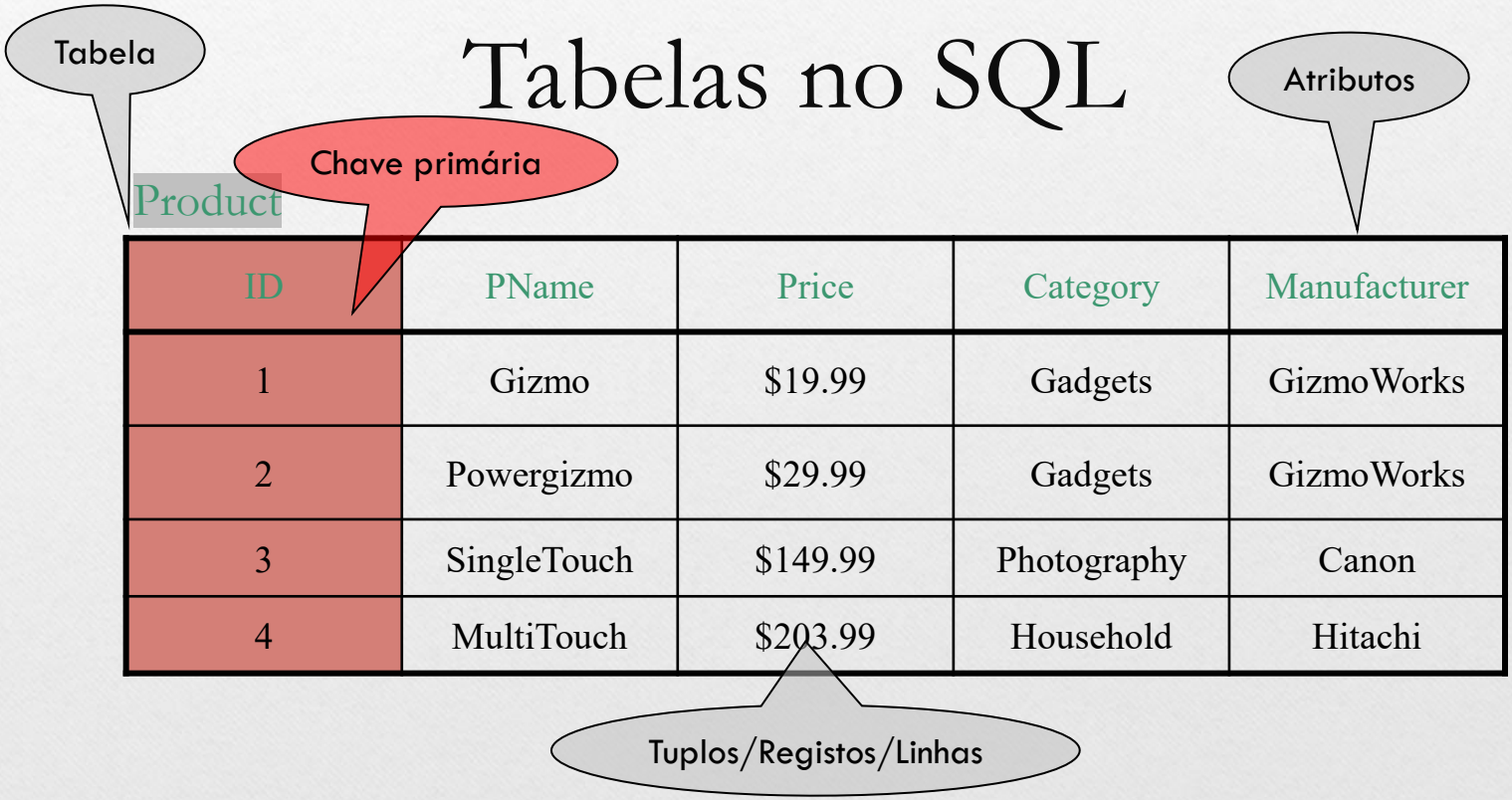

```
SELECT  *
FROM Employee
WHERE Gender='Female'
```

Id	Name	Salary	Age	Gender	Dept
1	Anne	95000	43	Female	Sales
2	Claire	80000	35	Female	Analytics
5	Ray	90000	45	Female	Analytics
6	Rachel	60000	27	Female	Sales



Estrutura de uma Base de Dados Relacional

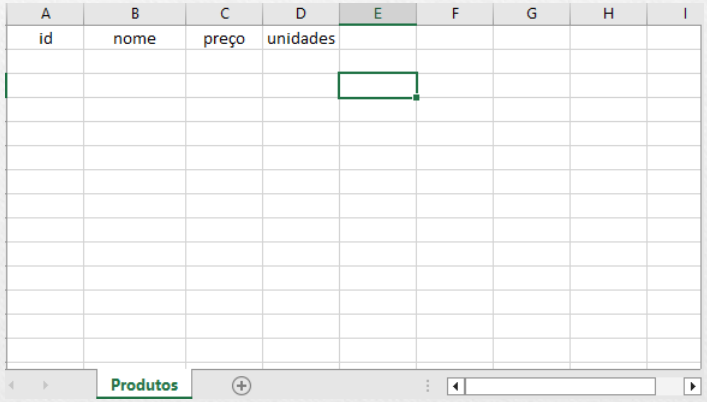
Tabelas no SQL



ID	PName	Price	Category	Manufacturer
1	Gizmo	$19.99	Gadgets	GizmoWorks
2	Powergizmo	$29.99	Gadgets	GizmoWorks
3	SingleTouch	$149.99	Photography	Canon
4	MultiTouch	$203.99	Household	Hitachi

Definição da tabela

```
CREATE TABLE products (
    ID          INT,
    Pname       VARCHAR(128),
    price       DECIMAL(10,2),
    category    VARCHAR(32),
    Pname       VARCHAR(128)
);
```



Eliminação da tabela

```
DROP TABLE products
```

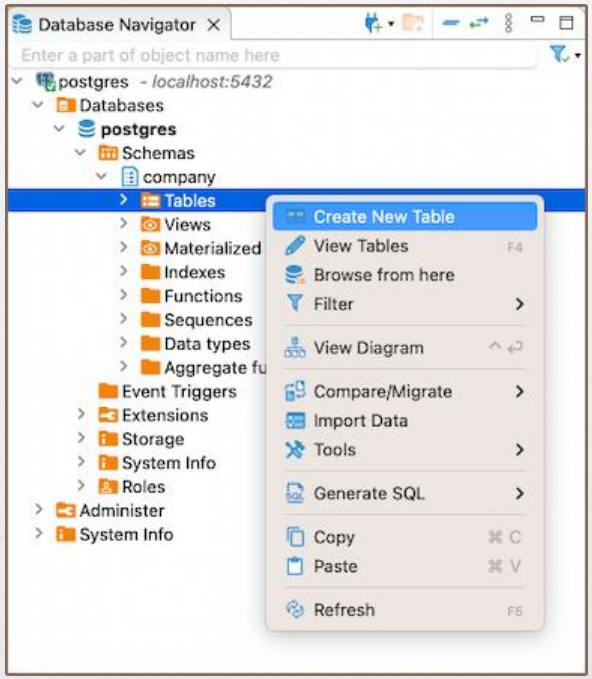
Definição de chave primária

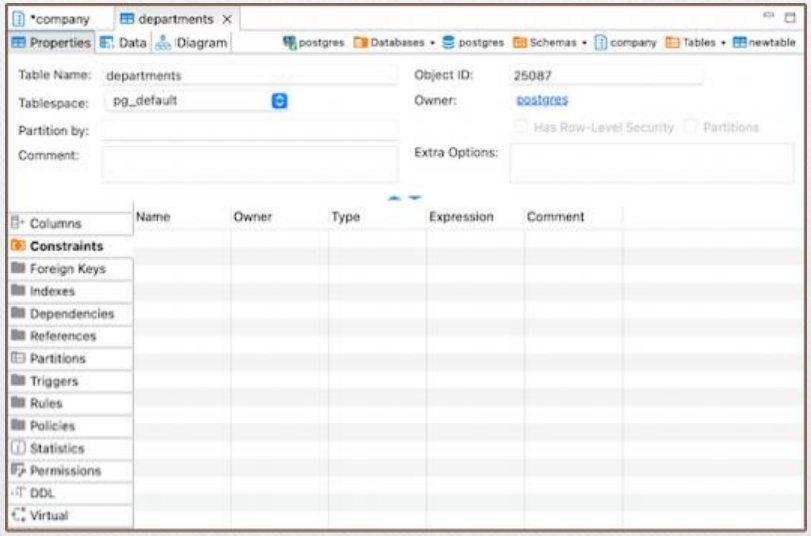
```
CREATE TABLE products (
    ID INT AUTO_INCREMENT PRIMARY KEY,
    Pname    VARCHAR(128),
    price       DECIMAL(10,2),
    category VARCHAR(32),
    Pname     VARCHAR(128)
);
```

- O *AUTO_INCREMENT* cria automaticamente valores únicos e sequenciais para a chave primária, evitando conflitos de ID
- A chave primária também poderia ser definida através do campo *Pname*

Definição de chave primária

- DBeaver Documentation





SQL

- Data Definition Language (DDL)
  - *create*/*alter*/*delete* tabelas e respetivos atributos
- Data Manipulation Language (DML)
  - *insert*/*delete*/*update* linhas nas tabelas

Consulta/*Query* SQL

```
SELECT  <attributes>
FROM     <one or more relations>
WHERE  <conditions>
```

```
SELECT  Name, Units, Price, discount
FROM    Produts
WHERE   units = 100
    AND price = 50
    AND rate > 5
```

Eliminações(*delete*)

```
DELETE    FROM    PURCHASE
WHERE     seller = 'Joe'    AND
                  product = 'Brooklyn Bridge'
```

- Usar a cláusula WHERE corretamente para evitar apagar registos acidentalmente
- Também é possível uso de *sub-queries* para identificar os registos a eliminar

Atualizações(update)

```
UPDATE   PRODUCT
SET      price = price/2, units=100
WHERE    Product.name  ='Xbox'
```

- Usar a cláusula WHERE corretamente para evitar alterar registos acidentalmente
- É possível atualizar mais do que uma coluna na mesma instrução

Inserções(*insert*)

```
INSERT INTO R(A1,…., An) VALUES (v1,…., vn)
```

Exemplo: Inserção de um nova compra:

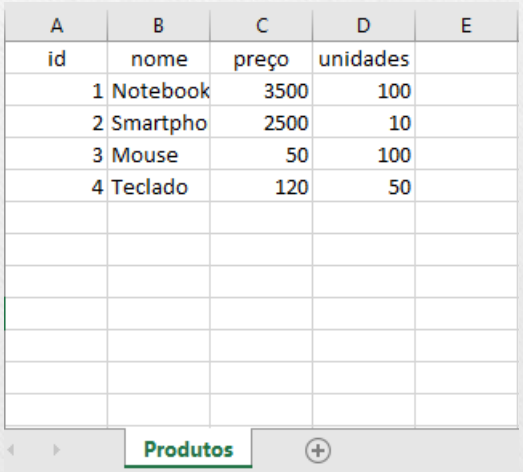
```
INSERT INTO Purchase(buyer, seller, product, store)
        VALUES ('Joe', 'Fred', 'wakeup-clock-espresso-machine',
                'The Sharper Image')
```

- Aos atributos não especificados é assignado o valor NULL
- Não existe qualquer ordem para a especificação dos atributos

Inserções(*insert*)

```
[8] %%sql
    INSERT INTO produtos (numero,nome, preco, unidades) VALUES (1,'Notebook', 3500.00, 10);
    INSERT INTO produtos (numero,nome, preco, unidades) VALUES (2,'Smartphone', 2500.00, 20);
    INSERT INTO produtos (numero,nome, preco, unidades) VALUES (3,'Mouse', 50.00, 100);
    INSERT INTO produtos (numero,nome, preco, unidades) VALUES (4,'Teclado', 120.00, 50);
```

numero	nome	preco	unidades
1	Notebook	3500.0	10
2	Smartphone	2500.0	20
3	Mouse	50.0	100
4	Teclado	120.0	50
1	Notebook	3500.0	10
2	Smartphone	2500.0	20
3	Mouse	50.0	100
4	Teclado	120.0	50



	A	B	C	D	E
1	id	nome	preço	unidades	
2	1	Notebook	3500	100	
3	2	Smartpho	2500	10	
4	3	Mouse	50	100	
5	4	Teclado	120	50	

Produtos

Consultas com uma tabela

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

```
SELECT  *
FROM    Product
WHERE   category='Gadgets'
```

"seleção"

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks

Consultas com uma tabela

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

```
SELECT   PName, Price, Manufacturer
FROM     Product
WHERE    Price > 100
```

"seleção" e "projeção"

PName	Price	Manufacturer
SingleTouch	$149.99	Canon
MultiTouch	$203.99	Hitachi

Chaves primárias e chaves estrangeiras

Company

CName	StockPrice	Country
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

Chave

Chave estrangeira

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Valores distintos

```
SELECT   DISTINCT category
FROM     Product
```

Category
Gadgets
Photography
Household

```
SELECT   category
FROM     Product
```

Category
Gadgets
Gadgets
Photography
Household

Valores Null(“nulos”)

- Sempre que não existe valor pode ser definida o NULL
- Pode ter vários significados:
  - O valor não existe
  - O valor existe mas é desconhecido
  - O valor não é aplicável
- Em cada atributo é especificado se pode ser nulo (atributo anulável) ou não
- Como o SQL lida com tabelas que possuem valores NULLs?

Valores Null("nulos")

- x IS NULL
- x IS NOT NULL

```
SELECT *
FROM    Person
WHERE  age < 25  OR  age >= 25 OR age IS
NULL
```

Valores Null("nulos")

- x IS NULL
- x IS NOT NULL

```
SELECT *
FROM    Person
WHERE  age < 25  OR  age >= 25 OR age IS
NULL
```

Funções SQL

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

```
SELECT   COUNT(*) as Contagem
FROM     Product
WHERE    Price > 100
```

Contagem
2

COUNT(*) : efetua a contagem de registos/linhas na tabela

Funções SQL

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

```
SELECT  MAX(Price) as Preco_maximo,
        MIN(Price) as Preco_minimo
FROM    Produot
```

Preco_maximo	Preco_minimo
$203.99	$19.99

- **MAX(Price)** : calcula o valor máximo da coluna "Price"
- **MIN(Price)** : calcula o valor minmo da coluna "Price"

O operador *LIKE*

```
SELECT   *
FROM     Products
WHERE    PName LIKE '%gizmo%'
```

- s **LIKE** p: correspondência de padrões em *strings*
- p pode conter dois símbolos especiais:
  - % = qualquer sequência de caracteres
  - _ = um único caracter

O operador *LIKE*

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

```
SELECT  Pname,Price
FROM    Product
WHERE Pname LIKE '%h'
```

SingleTouch	$149.99
MultiTouch	$203.99

```
SELECT  Pname,Price
FROM    Product
WHERE Pname LIKE '%iz%'
```

Gizmo	$19.99
Powergizmo	$29.99

```
SELECT  Pname,Price
FROM    Product
WHERE Pname LIKE '%m_'
```

Gizmo	$19.99
Powergizmo	$29.99

Junções

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT  *
FROM    Product, Company
WHERE   Manufacturer = CName
```

Gizmo	$19.99	Gadgets	GizmoWorks
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

GizmoWorks	100	Canada
GizmoWorks	25	USA
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

Junções

Product

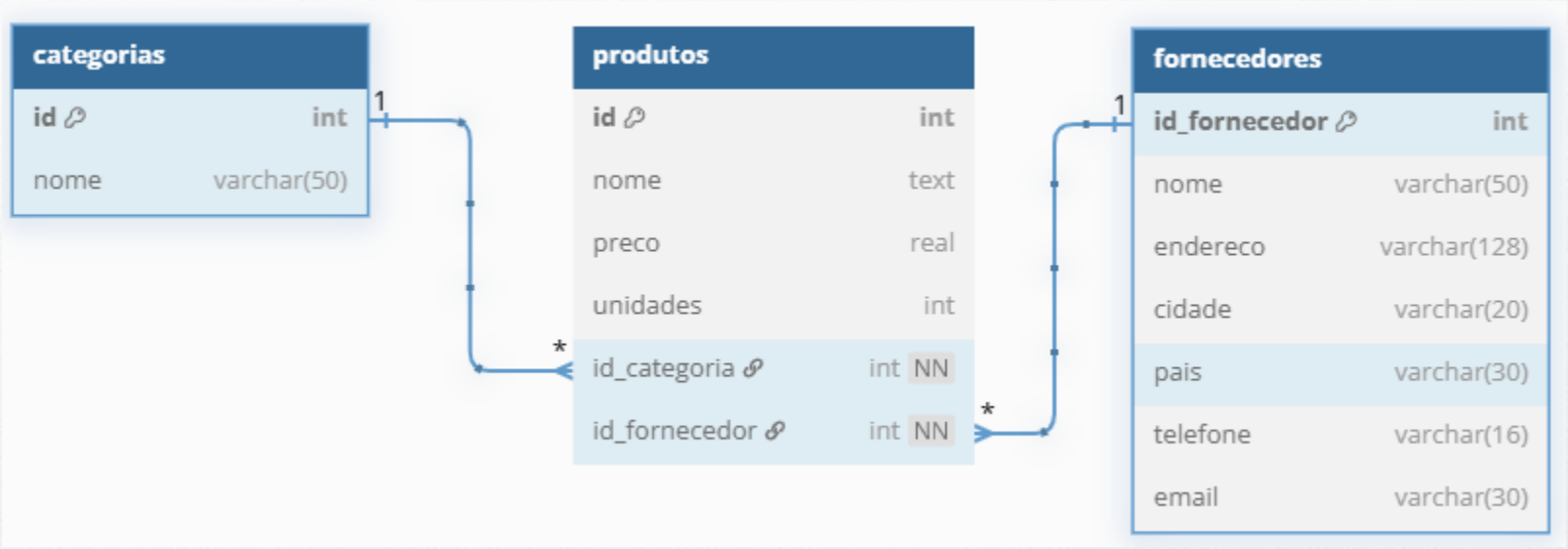
PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT  *
FROM    Product, Company
WHERE   Manufacturer = CName
```

Modelo de dados “Produto”



dbdiagram.io

draw.io

Junções

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT   PName, Price
FROM     Product, Company
WHERE    Manufacturer=CName AND Country='Japan'
         AND Price <= 200
```

PName	Price
SingleTouch	$149.99

Junções

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
Canon	65	Japan
Hitachi	15	Japan

```
SELECT  *
FROM    Product, Company
WHERE   Manufacturer = CName
```

Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

GizmoWorks	100	Canada
GizmoWorks	100	Canada
Canon	65	Japan
Hitachi	15	Japan

Notação SQL-89 e SQL-92

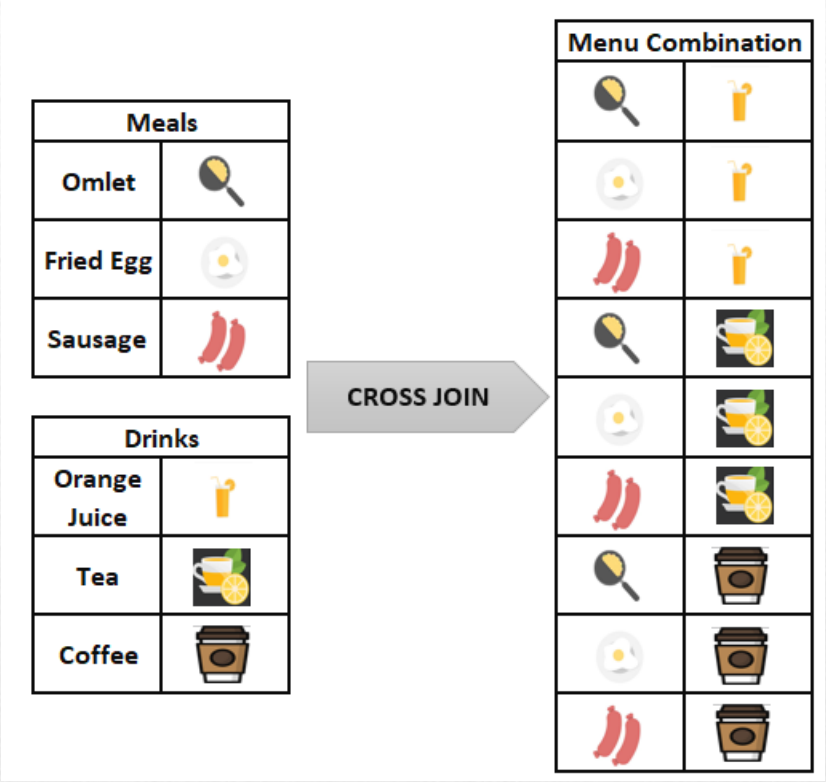
Antigo(SQL-89)	Moderno (Apartir do SQL-92)
SELECT l.titulo, a.nome FROM livros l, autores a WHERE l.autor_id = a.id AND a.cidade='Madrid'	SELECT l.titulo, a.nome FROM livros l JOIN autores a ON l.autor_id = a.id WHERE a.cidade='Madrid'

Antigo(SQL-89)	Moderno (Apartir do SQL-92)
SELECT l.titulo, a.nome FROM livros l, autores a WHERE l.autor_id = a. autor_id AND a.cidade='Madrid'	SELECT l.titulo, a.nome FROM livros l NATURAL JOIN autores WHERE a.cidade='Madrid' (esta opção faz *join* através das colunas que têm a mesma designação)

Notação SQL-89 e SQL-92

Antigo(SQL-89)	Moderno (Apartir do SQL-92)
SELECT l.titulo, a.nome FROM livros l, autores a WHERE l.autor_id = a. autor_id AND a.cidade='Madrid'	SELECT l.titulo, a.nome FROM livros l USING(autor_id) WHERE a.cidade='Madrid' (esta opção faz *join* através da coluna *autor_id* de ambas as tabelas)

Produto cartesiano




```
SELECT m.*,d.*
FROM meals m, drink d
```

```
SELECT m.*,d.*
FROM meals m
CROSS JOIN drink d
```

Ordenação dos resultados

```
SELECT   pname, price, manufacturer
FROM     Product
WHERE    category='gizmo' AND price > 50
ORDER BY  price, pname DESC
```

- No caso de valores idênticos, é necessário a utilização de outro atributo no *ORDER BY coluna1, coluna2 etc.*
- Por defeito a ordenação é ascendente
- Caso seja pretendida uma ordenação descendente é necessário utilizar *DESC*

Agrupamentos("group by")

- O "group by" serve para agrupar dados e aplicar funções de agregação sobre esse agrupamentos
- Mecanismo de agregação relacional que reduz múltiplas linhas numa única linha por grupo, baseado em critérios

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi

Agrupamentos(“group by”)

1. Agrupar dados por uma(s) coluna(s)

   Exemplo: agrupar vendas por vendedor, ou alunos por curso.

2. Transforma linhas em grupos

   Cada valor único da coluna agrupada é um grupo.

3. Utilização das funções de agregação

   Como SUM(), AVG(), COUNT(), MAX(), MIN() — que trabalham sobre grupos.

1. Agrupa antes de filtrar com HAVING."

   WHERE filtra linhas; HAVING filtra grupos

Agrupamentos

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category
FROM   Product
GROUP BY category
```

Category
Gadgets
Photography
Household

Agrupamentos

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category,COUNT(*)
FROM  Product
GROUP BY category
```

Category	Count(*)
Gadgets	2
Photography	1
Household	2

Agrupamentos

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category,COUNT(*),MIN(Price)
FROM  Product
GROUP BY category
```

Category	Count(*)	Min(Price)
Gadgets	2	$19.99
Photography	1	$149.99
Household	2	$203.99

Cláusula "*having*"

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category, COUNT(*), MIN(Price)
FROM   Product
GROUP BY category

HAVING COUNT(*) > 1
```

Category	Count(*)	Min(Price)
Gadgets	2	$19.99
~~Photography~~	~~1~~	~~$149.99~~
Household	2	$203.99

Cláusula "*having*"

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category, COUNT(*), MIN(Price)
FROM   Product
GROUP BY category

HAVING MIN(Price) > 20
```

Category	Count(*)	Min(Price)
~~Gadgets~~	~~2~~	~~$19.99~~
Photography	1	$149.99
Household	2	$203.99

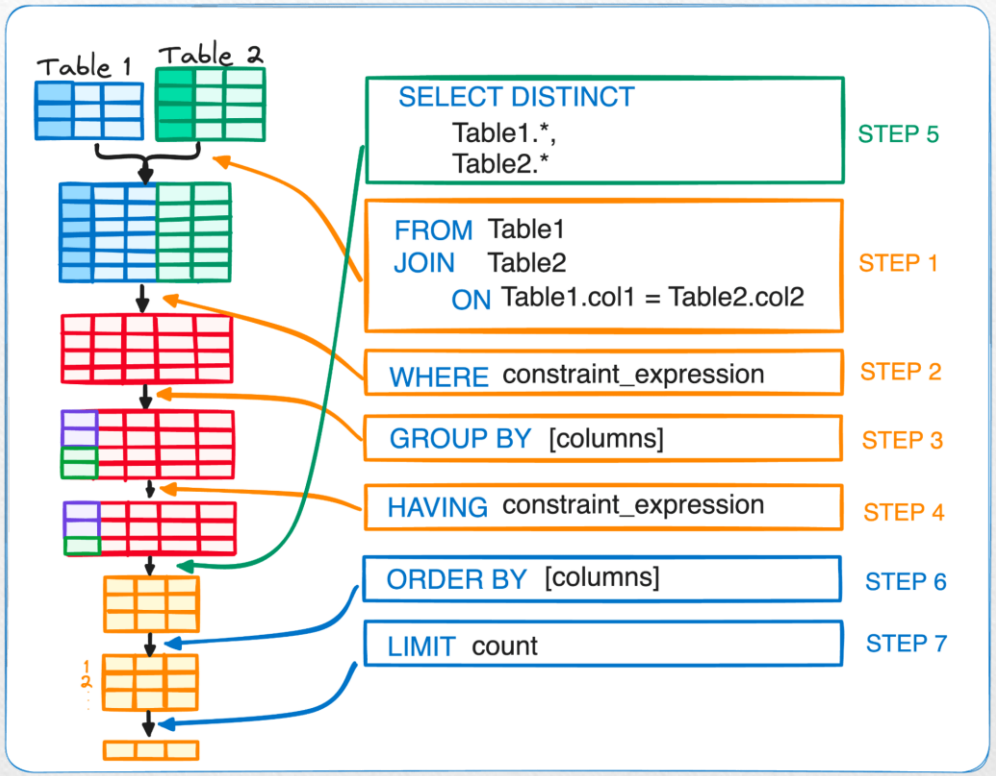
Cláusula "*having*"

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
Multi 2.0	$499.99	Household	Hitachi
MultiTouch	$203.99	Household	Hitachi


```
SELECT category, COUNT(*), MIN(Price)
FROM   Product

WHERE Price > 19.99
GROUP BY category

HAVING MIN(Price) > 20
```

Category	Count(*)	Min(Price)
Gadgets	1	$29.99
Photography	1	$149.99
Household	2	$203.99

Ordem da execução da consulta



Sub-queries "IN"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Product
WHERE Manufacturer In (
```

Canon
Hitachi

```
)
```

SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Sub-queries "IN"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

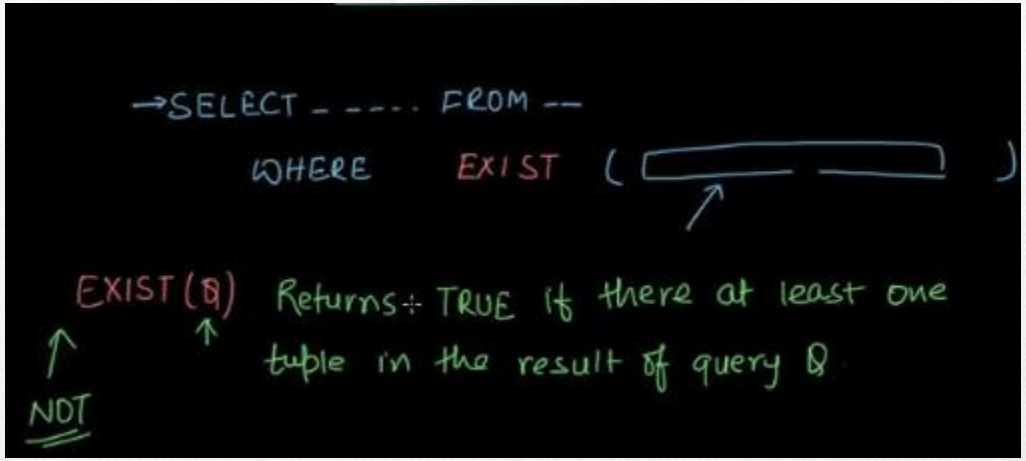
Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Product
WHERE Manufacturer In (SELECT Cname FROM Company WHERE Cname='Japan')
```

SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Sub-queries "EXISTS"




```
SELECT  *
FROM  Company c
WHERE  c.Cname In (SELECT manufacturer FROM Produts )
```

```
SELECT  *
FROM Company c
WHERE  EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

Sub-queries "EXISTS"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

GizmoWorks	100	Canada

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = 'GizmoWorks')
```

True

Sub-queries "EXISTS"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

GizmoWorks	25	USA

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = 'GizmoWorks')
```

True

Sub-queries "EXISTS"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

Canon	65	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = 'Canon')
```

True

Sub-queries "EXISTS"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon

Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

Hitachi	15	Japan

```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = 'Hitachi')
```

False

Sub-queries "EXISTS"

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon

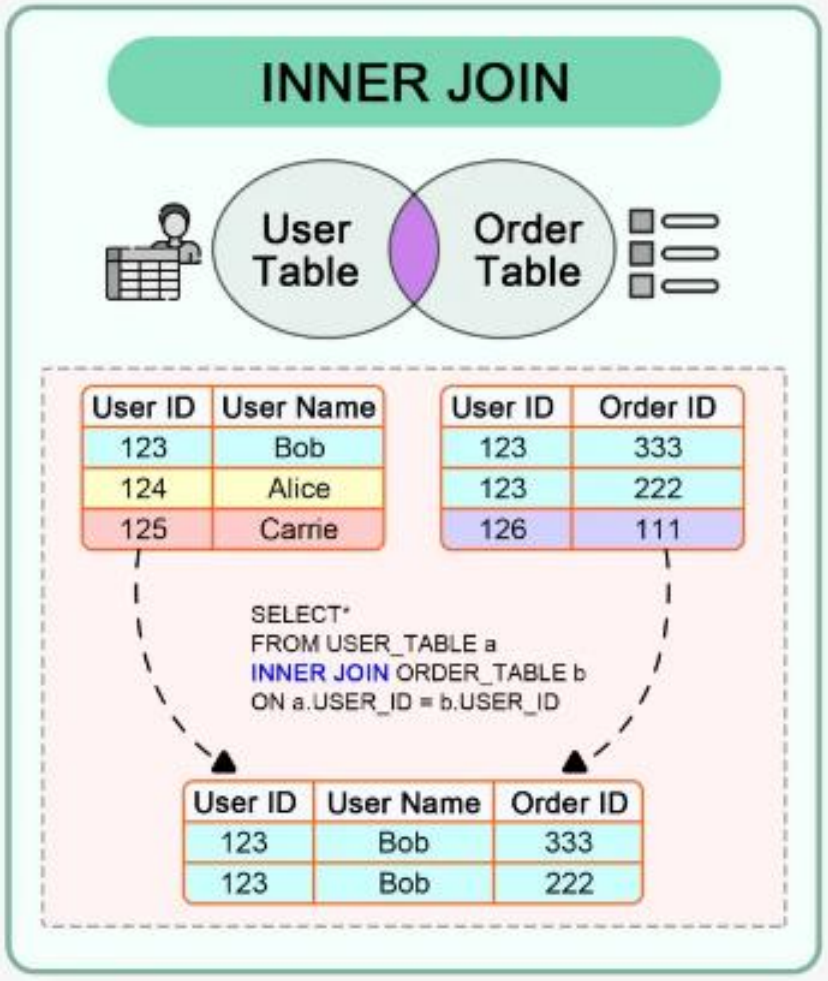
Company

Cname	StockPrice	Country
GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan
Hitachi	15	Japan

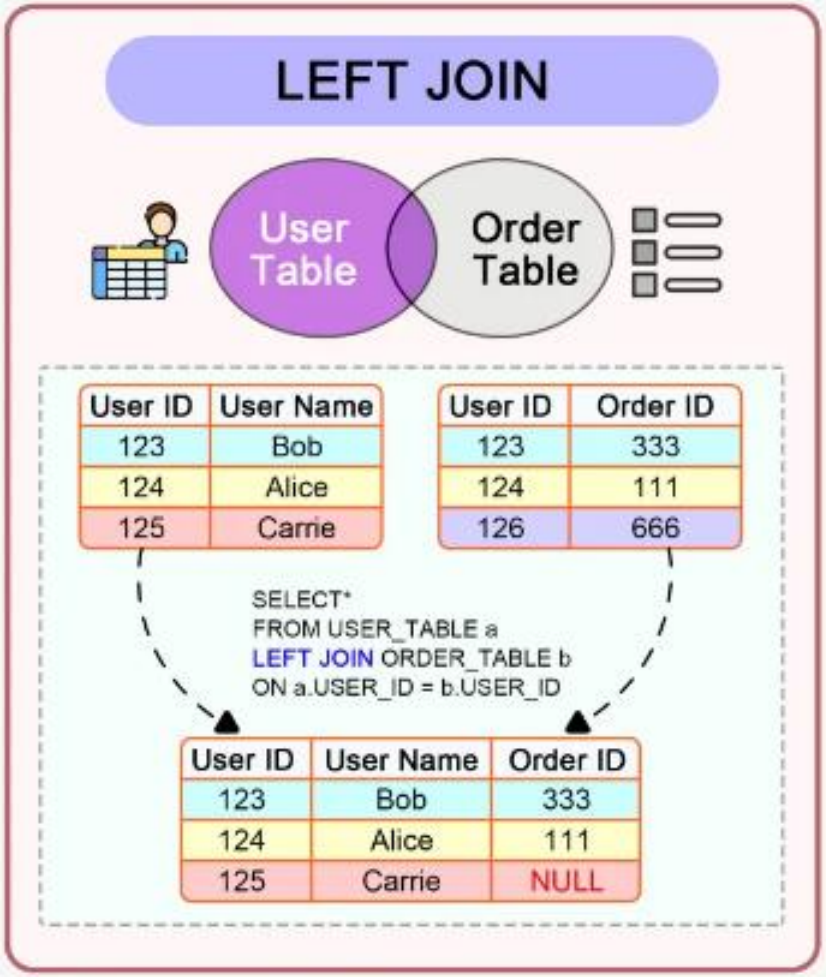
```
SELECT *
FROM Company c
WHERE EXISTS (SELECT * FROM Product p WHERE p. Manufacturer = c.Cname)
```

GizmoWorks	100	Canada
GizmoWorks	25	USA
Canon	65	Japan

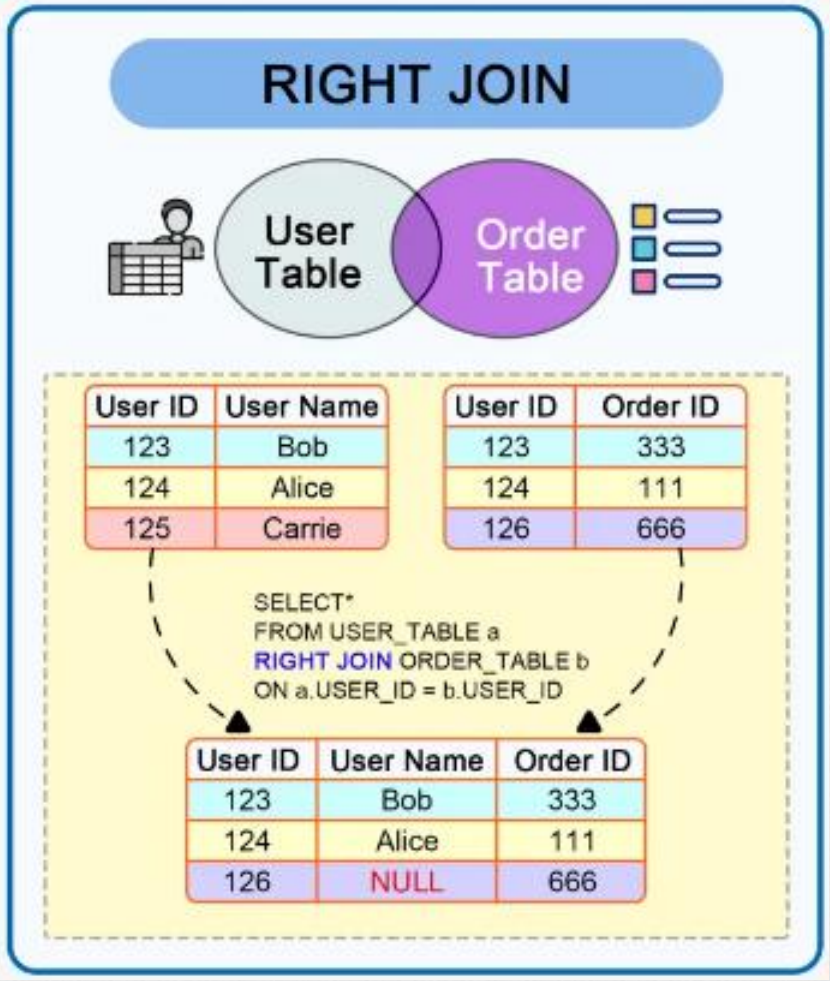
Outer join


INNER JOIN
User Table
Order Table
User ID
User Name
123
Bob
124
Alice
125
Carrie
User ID
Order ID
123
333
123
222
126
111
SELECT*
FROM USER_TABLE a
INNER JOIN ORDER_TABLE b
ON a.USER_ID = b.USER_ID
User ID
User Name
Order ID
123
Bob
333
123
Bob
222

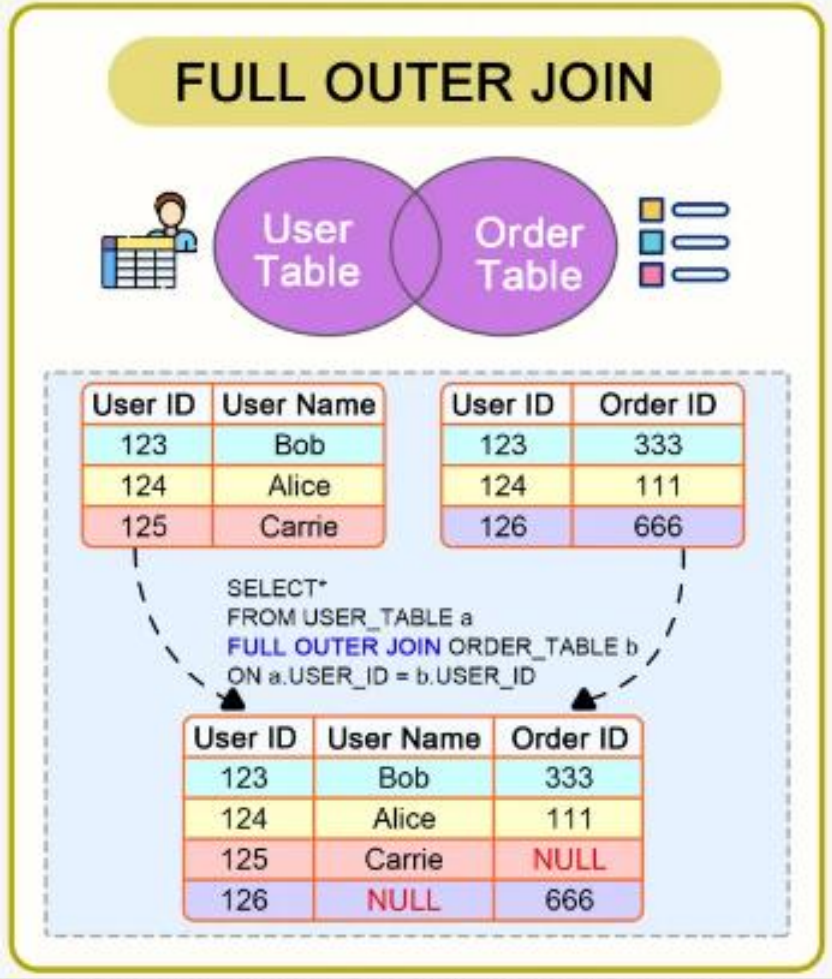
Outer join


LEFT JOIN
User Table
Order Table
User ID
User Name
123
Bob
124
Alice
125
Carrie
User ID
Order ID
123
333
124
111
126
666
SELECT*
FROM USER_TABLE a
LEFT JOIN ORDER_TABLE b
ON a.USER_ID = b.USER_ID
User ID
User Name
Order ID
123
Bob
333
124
Alice
111
125
Carrie
NULL

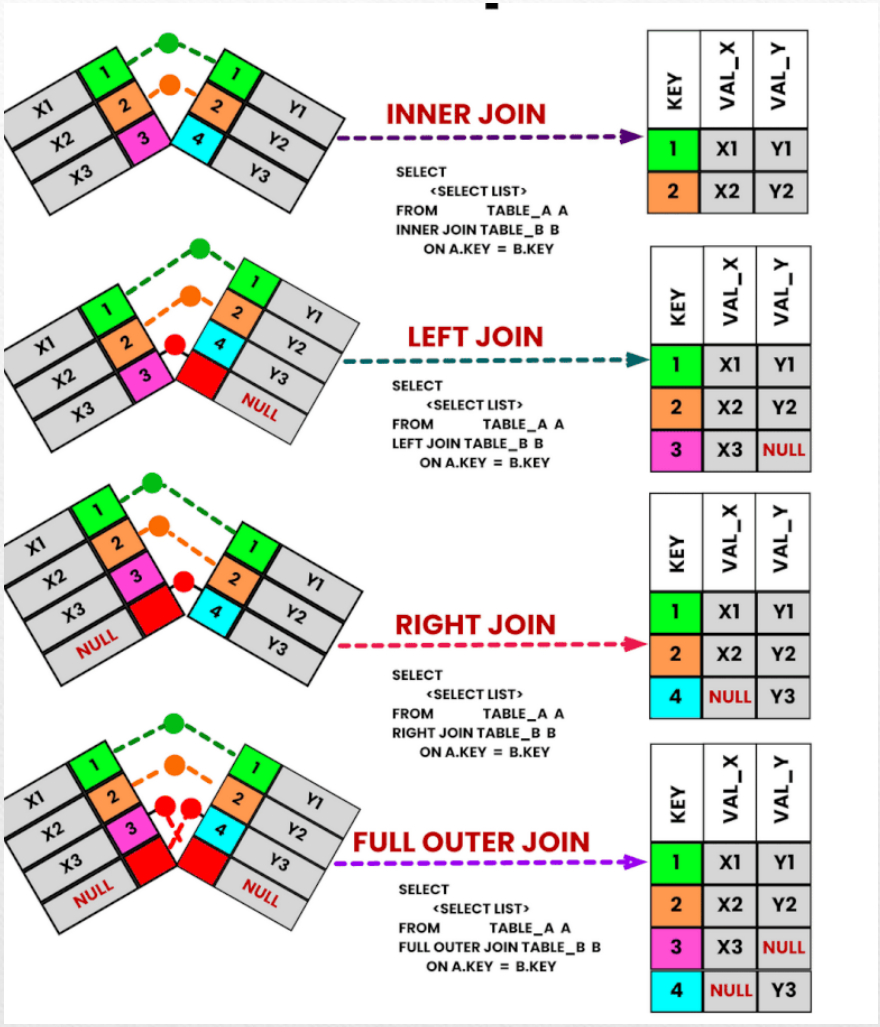
Outer join


RIGHT JOIN
User Table
Order Table
User ID
User Name
123
Bob
124
Alice
125
Carrie
User ID
Order ID
123
333
124
111
126
666
SELECT*
FROM USER_TABLE a
RIGHT JOIN ORDER_TABLE b
ON a.USER_ID = b.USER_ID
User ID
User Name
Order ID
123
Bob
333
124
Alice
111
126
NULL
666

Outer join

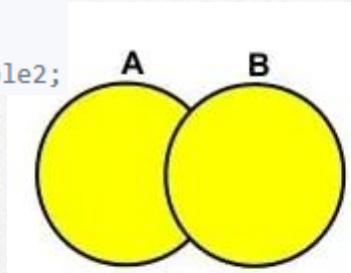

FULL OUTER JOIN
User Table
Order Table
User ID | User Name
123 | Bob
124 | Alice
125 | Carrie
User ID | Order ID
123 | 333
124 | 111
126 | 666
SELECT*
FROM USER_TABLE a
FULL OUTER JOIN ORDER_TABLE b
ON a.USER_ID = b.USER_ID
User ID | User Name | Order ID
123 | Bob | 333
124 | Alice | 111
125 | Carrie | NULL
126 | NULL | 666

Outer join


INNER JOIN
SELECT
<SELECT LIST>
FROM TABLE_A A
INNER JOIN TABLE_B B
ON A.KEY = B.KEY
KEY VAL_X VAL_Y
1 X1 Y1
2 X2 Y2
LEFT JOIN
SELECT
<SELECT LIST>
FROM TABLE_A A
LEFT JOIN TABLE_B B
ON A.KEY = B.KEY
KEY VAL_X VAL_Y
1 X1 Y1
2 X2 Y2
3 X3 NULL
RIGHT JOIN
SELECT
<SELECT LIST>
FROM TABLE_A A
RIGHT JOIN TABLE_B B
ON A.KEY = B.KEY
KEY VAL_X VAL_Y
1 X1 Y1
2 X2 Y2
4 NULL Y3
FULL OUTER JOIN
SELECT
<SELECT LIST>
FROM TABLE_A A
FULL OUTER JOIN TABLE_B B
ON A.KEY = B.KEY
KEY VAL_X VAL_Y
1 X1 Y1
2 X2 Y2
3 X3 NULL
4 NULL Y3

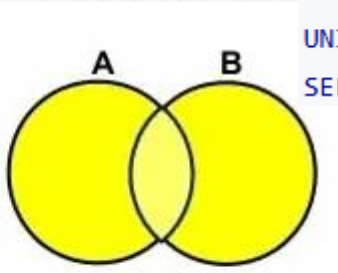
Operadores de grupo

```
SELECT * FROM Table1
UNION
SELECT * FROM Table2;
```

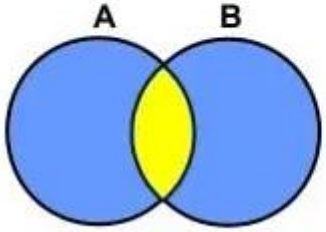


UNION

```
SELECT * FROM Table1
UNION ALL
SELECT * FROM Table2;
```

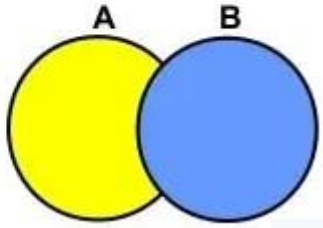


UNION ALL



INTERSECT

```
SELECT * FROM Table1
INTERSECT
SELECT * FROM Table2;
```



EXCEPT/MINUS

```
SELECT * FROM Table1
MINUS
SELECT * FROM Table2;
```

Operadores de grupo

Intersect

customers

CUSTOMER_ID	NAME
1	Amelia
2	Isla
3	Jessica
4	Lily

contacts

CONTACT_ID	NAME
1	Amelia
2	Olivia
3	Isla
4	Emily

```
SELECT name
FROM  Customers
intersect

SELECT name
FROM  Contacts
```

NAME
Amelia
Isla

Operadores de grupo

Except

customers

CUSTOMER_ID	NAME
1	Amelia
2	Isla
3	Jessica
4	Lily

contacts

CONTACT_ID	NAME
1	Amelia
2	Olivia
3	Isla
4	Emily

```
SELECT name
FROM  Customers
except

SELECT name
FROM  Contacts
```

NAME
Jessica
Lily

Operadores de grupo

Intersect

customers

CUSTOMER_ID	NAME
1	Amelia
2	Isla
3	Jessica
4	Lily

contacts

CONTACT_ID	NAME
1	Amelia
2	Olivia
3	Isla
4	Emily

```
SELECT name
FROM  Customers
union

SELECT name
FROM  Contacts
```

NAME
Amelia
Emily
Isla
Jessica
Lily
Olivia

Operadores de grupo

Intersect

customers

CUSTOMER_ID	NAME
1	Amelia
2	Isla
3	Jessica
4	Lily

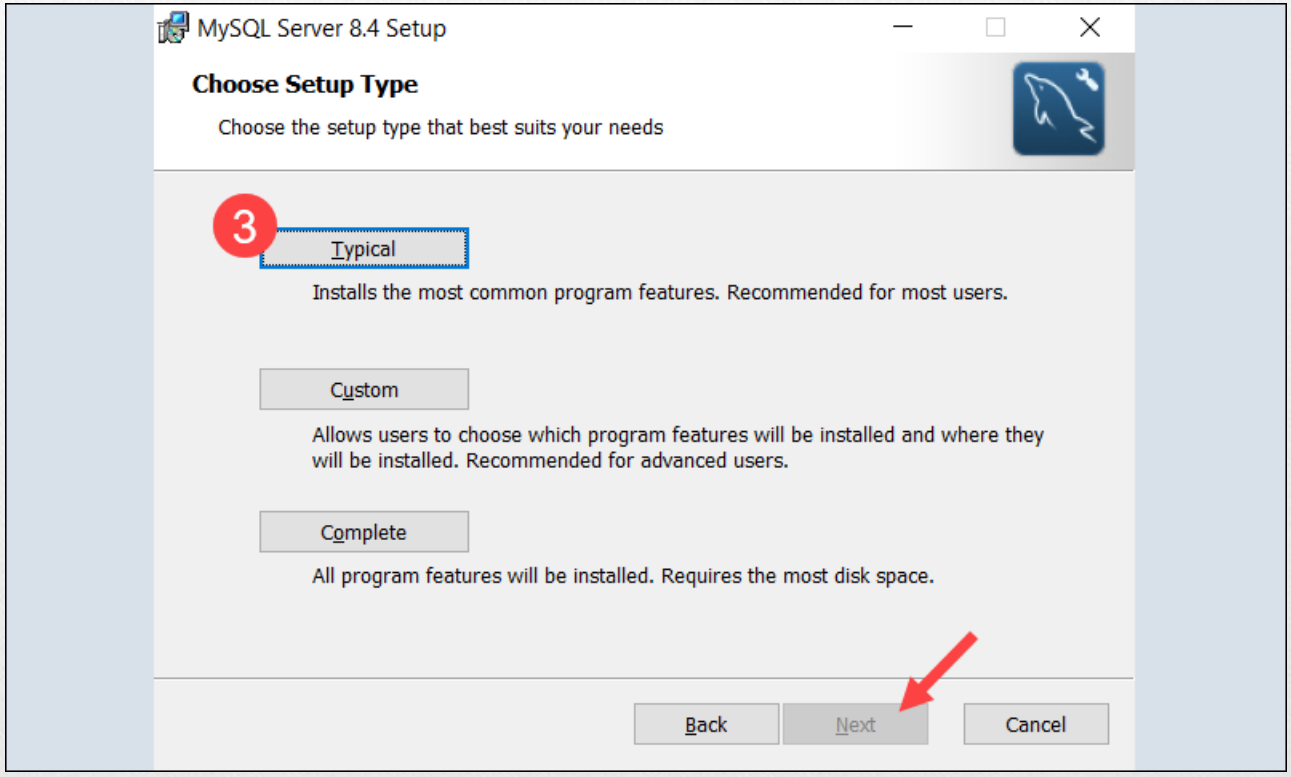
contacts

CONTACT_ID	NAME
1	Amelia
2	Olivia
3	Isla
4	Emily

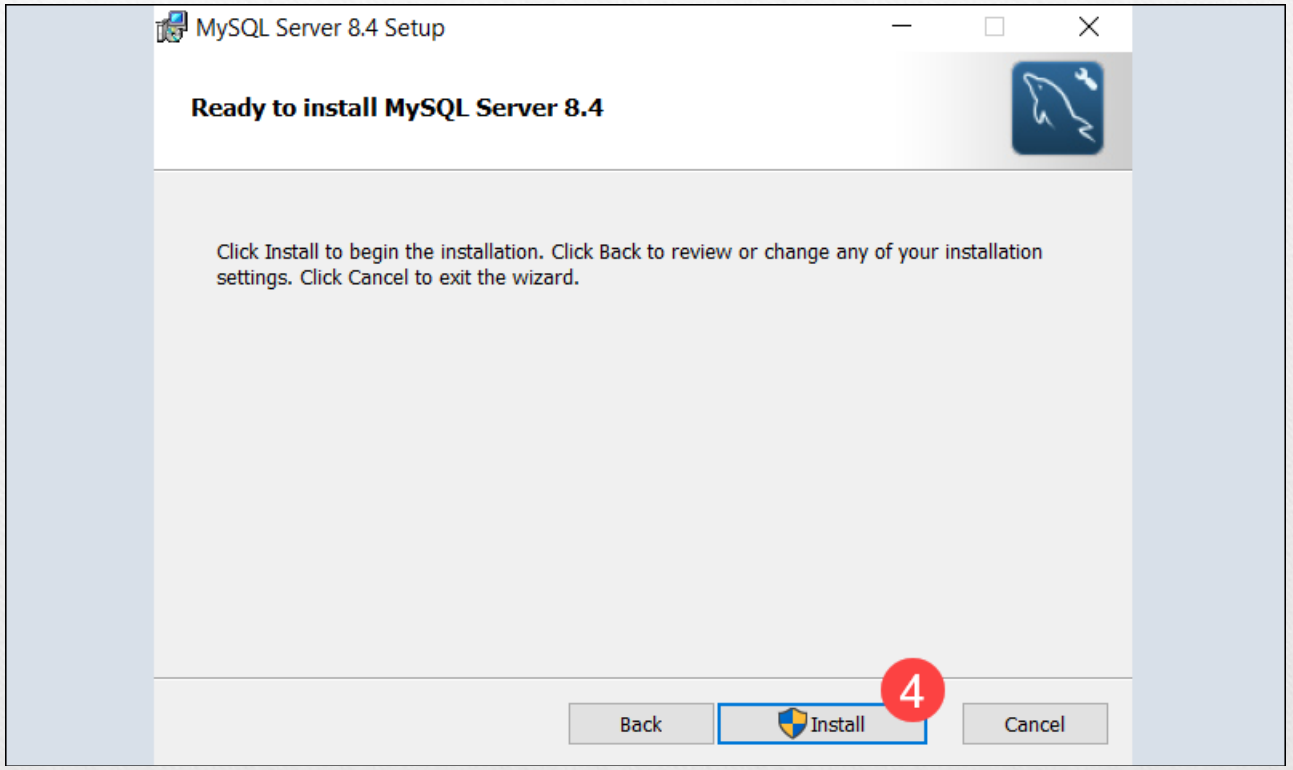
```
SELECT name
FROM  Customers
union all

SELECT name
FROM  Contacts
```

NAME
Amelia
Amelia
Emily
Isla
Isla
Jessica
Lily
Olivia

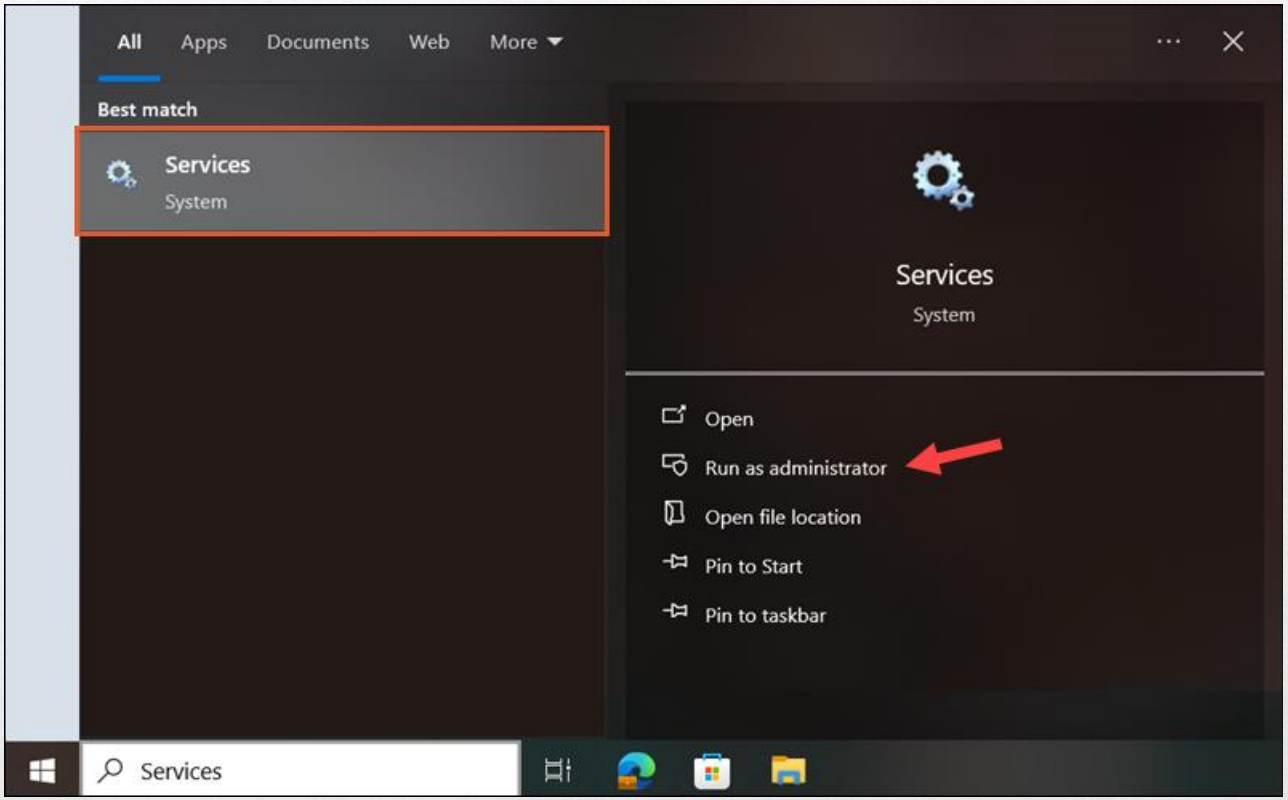
Instalação MySQL-Windows



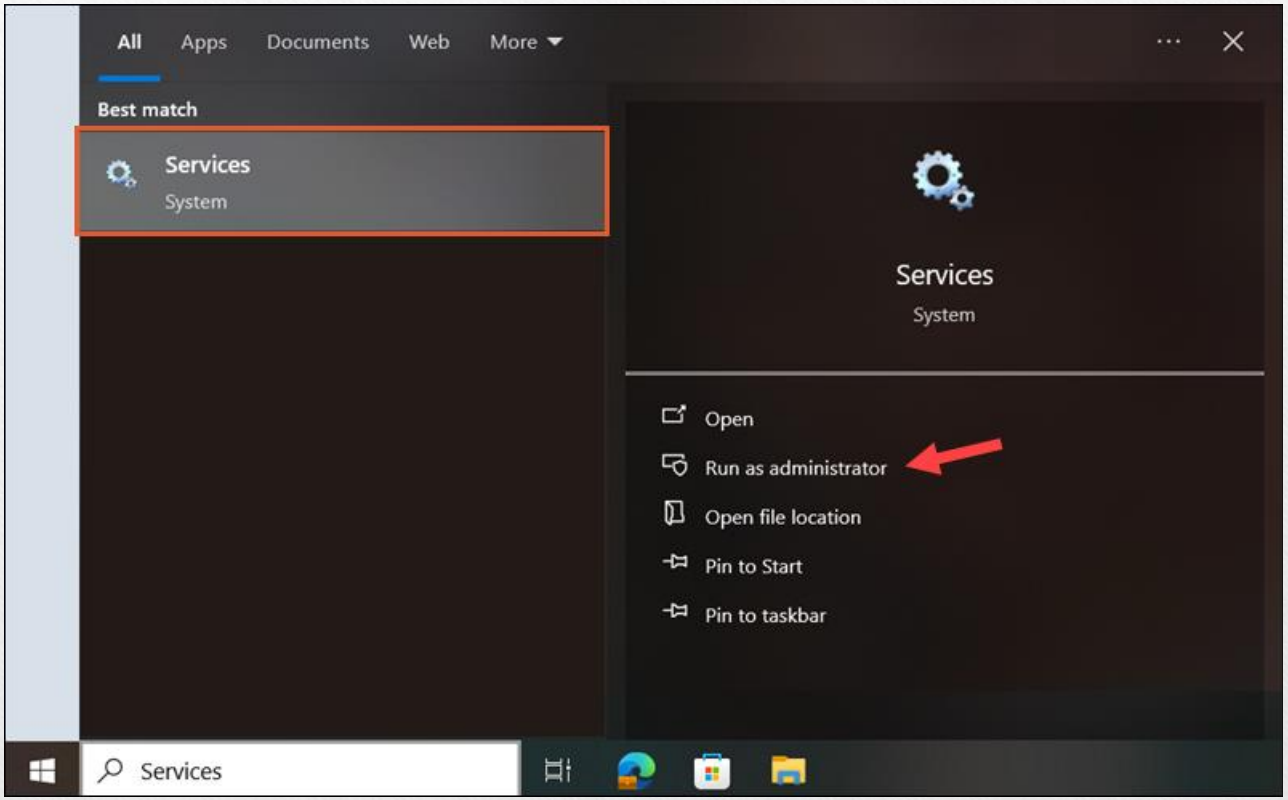
Instalação MySQL-Windows



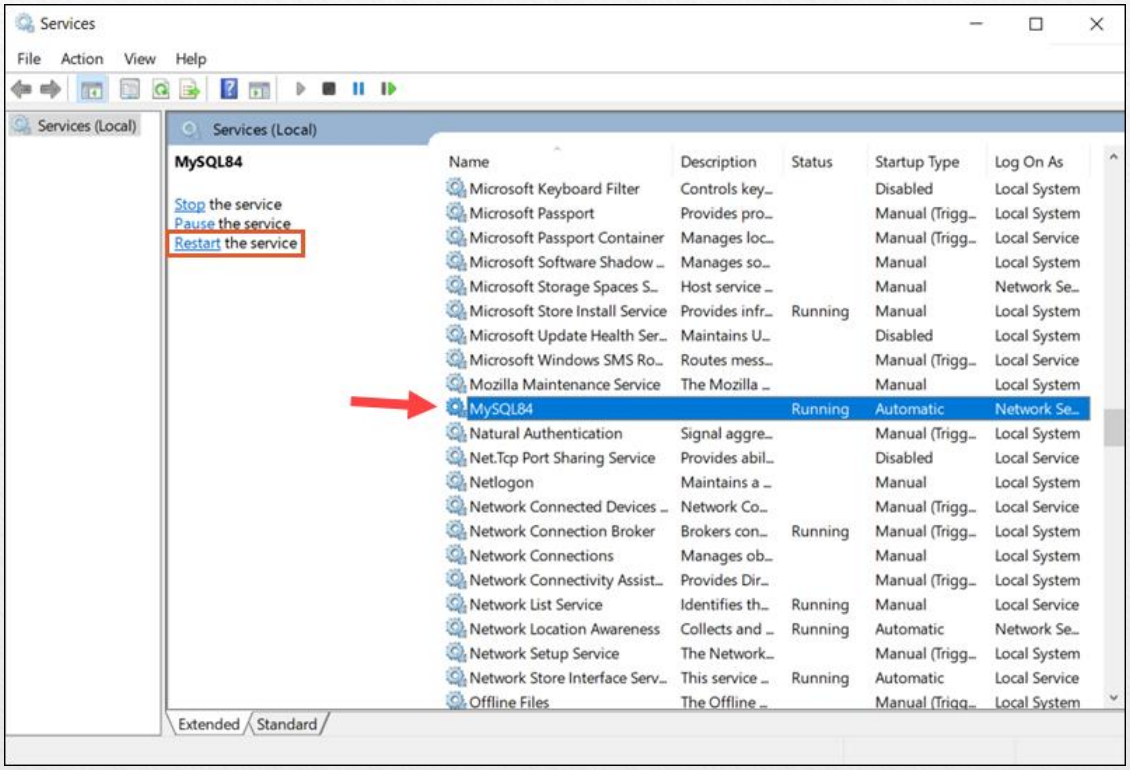
Instalação MySQL-Windows



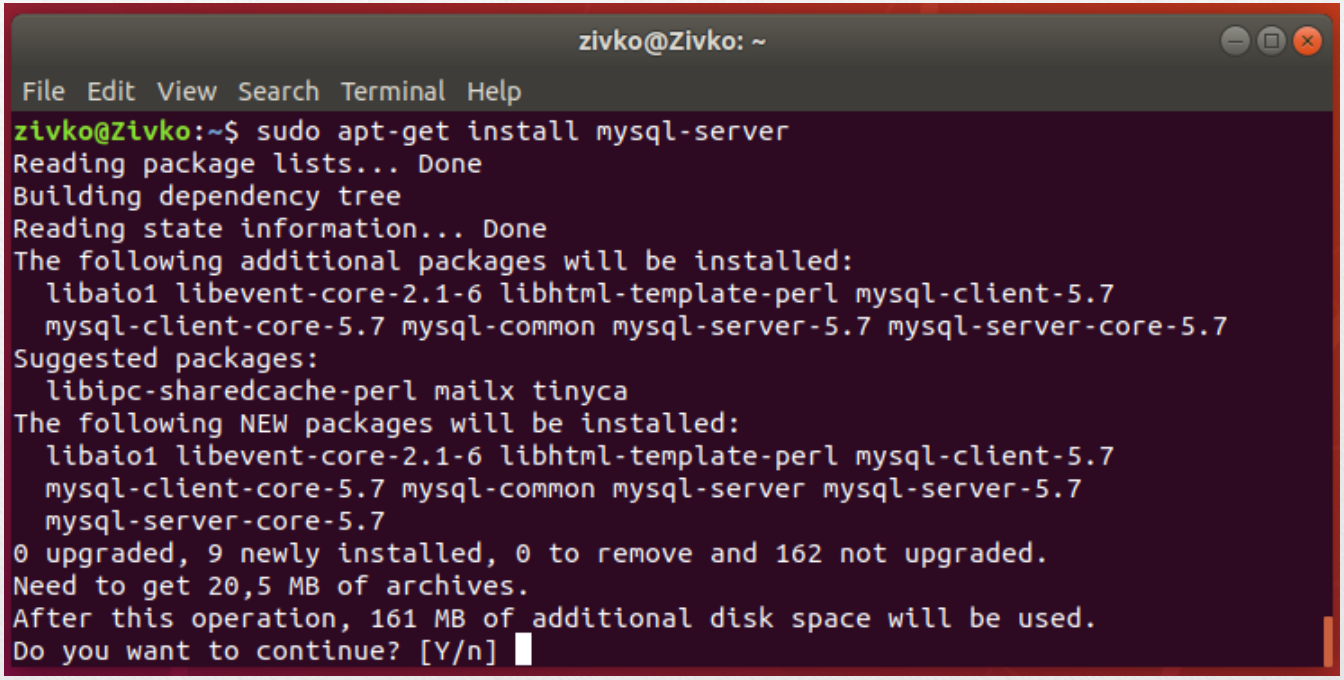
Instalação MySQL-Windows



Instalação MySQL-Windows



Instalação MySQL-Linux



Instalação MySQL-Linux