

Banco de Dados

Centro Universitário Senac

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Onde estávamos

- Conceitos Fundamentais de Banco de Dados
- SGBD
- Projeto Lógico – MER
- Introdução ao SQL (implementação do Modelo Físico)
 - ESTRUTURA: CREATE, ALTER
 - CRUD (INSERT, SELECT, UPDATE, DELETE)
 - CLAUSULA WHERE 😊
- Normalização

Pra onde vamos...

- Introdução a álgebra relacional...

Aviso Rápido...

- Base de Dados de Estudo disponibilizado no Midiateca
- Passo a passo
- Script SQL
- MySQL

Álgebra Relacional

- Uma **base de dados relacional** pode ser definida como uma coleção de tabelas de duas dimensões.
- Existem quatro conceitos básicos: tabelas, colunas, linhas, campos.
- O modelo relacional tem como base o ramo da matemática conhecido como álgebra relacional. Este modelo envolve:
 - uma coleção de objetos conhecidos como relações;
 - um conjunto de operadores que agem nestas relações produzindo novas relações.
 - Coleção de operações usadas para manipular relações inteiras.
 - O resultado dessas operações é uma nova relação, que por sua vez pode ser manipulada pelas operações da álgebra relacional.

Álgebra Relacional

- Aplicação:
 - Técnicas para Otimização de Consultas
 - Otimização através de Regras heurísticas
 - Otimização sistemática usando estimativas de custo
 - Decomposição de consulta
 - Fragmentação Vertical em Banco de Dados Distribuídos

Álgebra Relacional

- Dois grupos de operações:
 - Operações da Teoria Matemática dos Conjuntos:
 - UNIÃO
 - INTERSEÇÃO
 - DIFERENÇA
 - PRODUTO CARTESIANO
 - Operações desenvolvidas especificamente para BD relacionais:
 - SELEÇÃO
 - PROJEÇÃO
 - JUNÇÃO
 - Funções agregadas

Álgebra Relacional

– Operações desenvolvidas especificamente para BD relacionais:

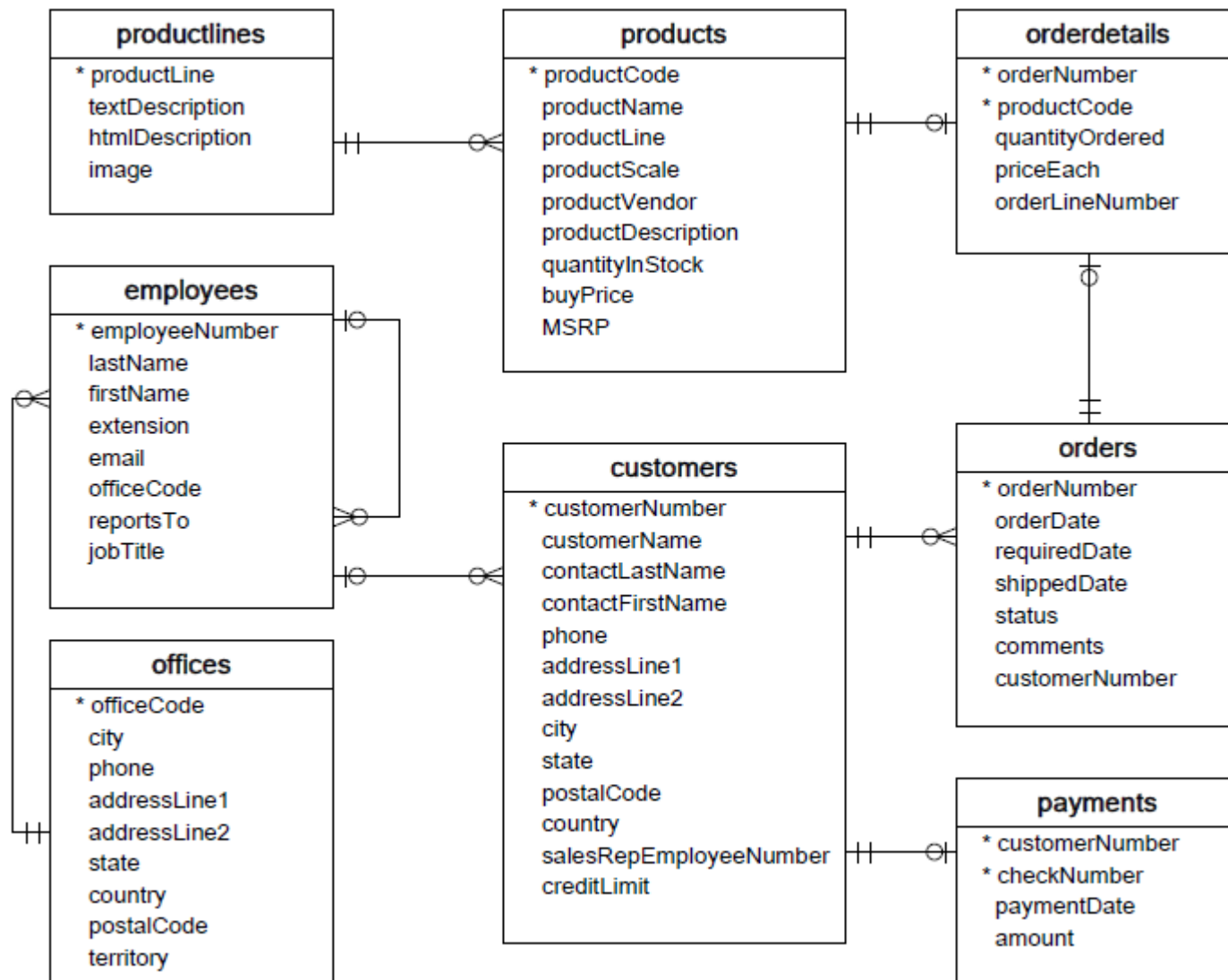
- SELEÇÃO

Representação

$\sigma_{\langle \text{condição de seleção} \rangle}(R)$

Seleciona todas as tuplas de uma relação R que satisfazem a condição de seleção.

Álgebra Relacional



Álgebra Relacional

Limit to 1000 rows

```
1 • select * from classicmodels.employees
```

Result Grid

	employeeNumber	lastName	firstName	extension	email	officeCode	reportsTo	jobTitle
▶	1002	Murphy	Diane	x5800	dmurphy@classicmodelcars.com	1	NULL	President
	1056	Patterson	Mary	x4611	mpatterso@classicmodelcars.com	1	1002	VP Sales
	1076	Firrelli	Jeff	x9273	jfirrelli@classicmodelcars.com	1	1002	VP Marketing
	1088	Patterson	William	x4871	wpatterson@classicmodelcars.com	6	1056	Sales Manager (APAC)
	1102	Bondur	Gerard	x5408	gbondur@classicmodelcars.com	4	1056	Sale Manager (EMEA)
	1143	Bow	Anthony	x5428	abow@classicmodelcars.com	1	1056	Sales Manager (NA)
	1165	Jennings	Leslie	x3291	ljennings@classicmodelcars.com	1	1143	Sales Rep
	1166	Thompson	Leslie	x4065	lthompson@classicmodelcars.com	1	1143	Sales Rep
	1188	Firrelli	Julie	x2173	jfirrelli@classicmodelcars.com	2	1143	Sales Rep

employees 1 x

Apply Revert

Álgebra Relacional

The screenshot shows a database query tool interface. At the top, there is a toolbar with various icons and a text input field containing the SQL query:

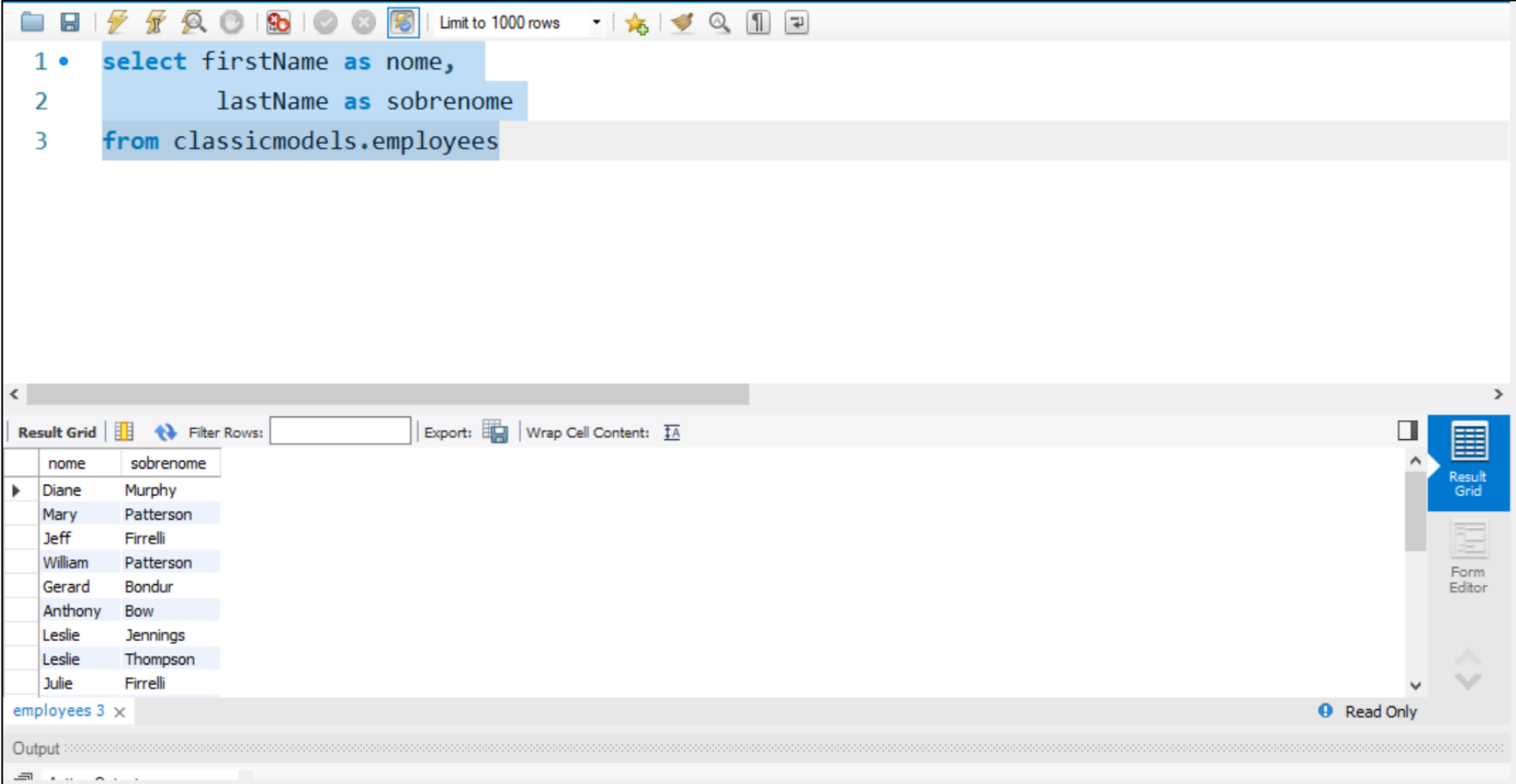
```
1 • select firstName, lastName  
2 from classicmodels.employees
```

Below the query editor, there is a section for the results. It includes a "Result Grid" tab, a "Filter Rows" input field, and an "Export" button. The results are displayed in a table with two columns: "firstName" and "lastName".

firstName	lastName
Diane	Murphy
Mary	Patterson
Jeff	Firrelli
William	Patterson
Gerard	Bondur
Anthony	Bow
Leslie	Jennings
Leslie	Thompson
Julie	Firrelli

At the bottom of the interface, there is a tab labeled "employees 2" and a "Read Only" status indicator.

Álgebra Relacional



The screenshot shows a database query tool interface. At the top, there is a toolbar with various icons and a "Limit to 1000 rows" dropdown. Below the toolbar, a SQL query is entered in a text area:

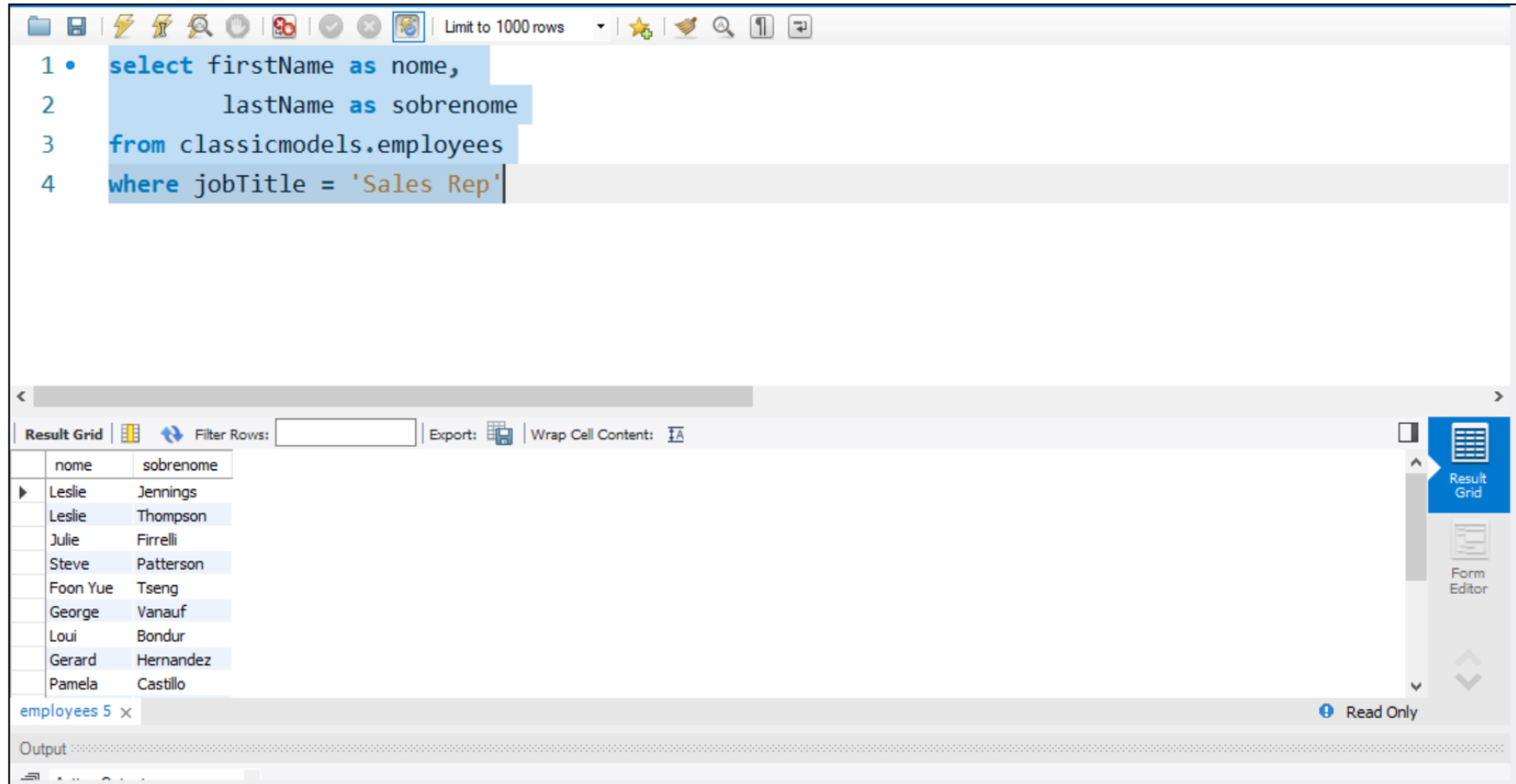
```
1 • select firstName as nome,  
2     lastName as sobrenome  
3 from classicmodels.employees
```

Below the query editor, there is a "Result Grid" section. It includes a "Filter Rows:" input field, an "Export:" button, and a "Wrap Cell Content:" checkbox. The result grid displays the following data:

	nome	sobrenome
▶	Diane	Murphy
	Mary	Patterson
	Jeff	Firrelli
	William	Patterson
	Gerard	Bondur
	Anthony	Bow
	Leslie	Jennings
	Leslie	Thompson
	Julie	Firrelli

At the bottom of the result grid, there is a tab labeled "employees 3" and a "Read Only" status indicator. Below the result grid, there is an "Output" section.

Álgebra Relacional



The screenshot displays a database query editor interface. At the top, a toolbar includes icons for file operations, execution, and a 'Limit to 1000 rows' dropdown. The main text area contains a SQL query:

```
1 • select firstName as nome,  
2     lastName as sobrenome  
3 from classicmodels.employees  
4 where jobTitle = 'Sales Rep'
```

Below the query editor, the 'Result Grid' tab is active, showing a table with two columns: 'nome' and 'sobrenome'. The table contains ten rows of employee data. To the right of the grid, there are buttons for 'Filter Rows', 'Export', and 'Wrap Cell Content'. A vertical sidebar on the right side of the window contains a 'Result Grid' button and a 'Form Editor' button. At the bottom, there is an 'Output' pane and a 'Read Only' status indicator.

nome	sobrenome
Leslie	Jennings
Leslie	Thompson
Julie	Firrelli
Steve	Patterson
Foon Yue	Tseng
George	Vanauf
Loui	Bondur
Gerard	Hernandez
Pamela	Castillo

Álgebra Relacional

Limit to 1000 rows

```
1 • select firstName as nome,  
2     lastName as sobrenome  
3 from classicmodels.employees  
4 where jobTitle like 'Presid%'
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

nome	sobrenome
Diane	Murphy

employees 6 x

Output

Limit to 1000 rows

```
1 • select firstName as nome,  
2     lastName as sobrenome  
3 from classicmodels.employees  
4 where jobTitle like '%sal%'
```

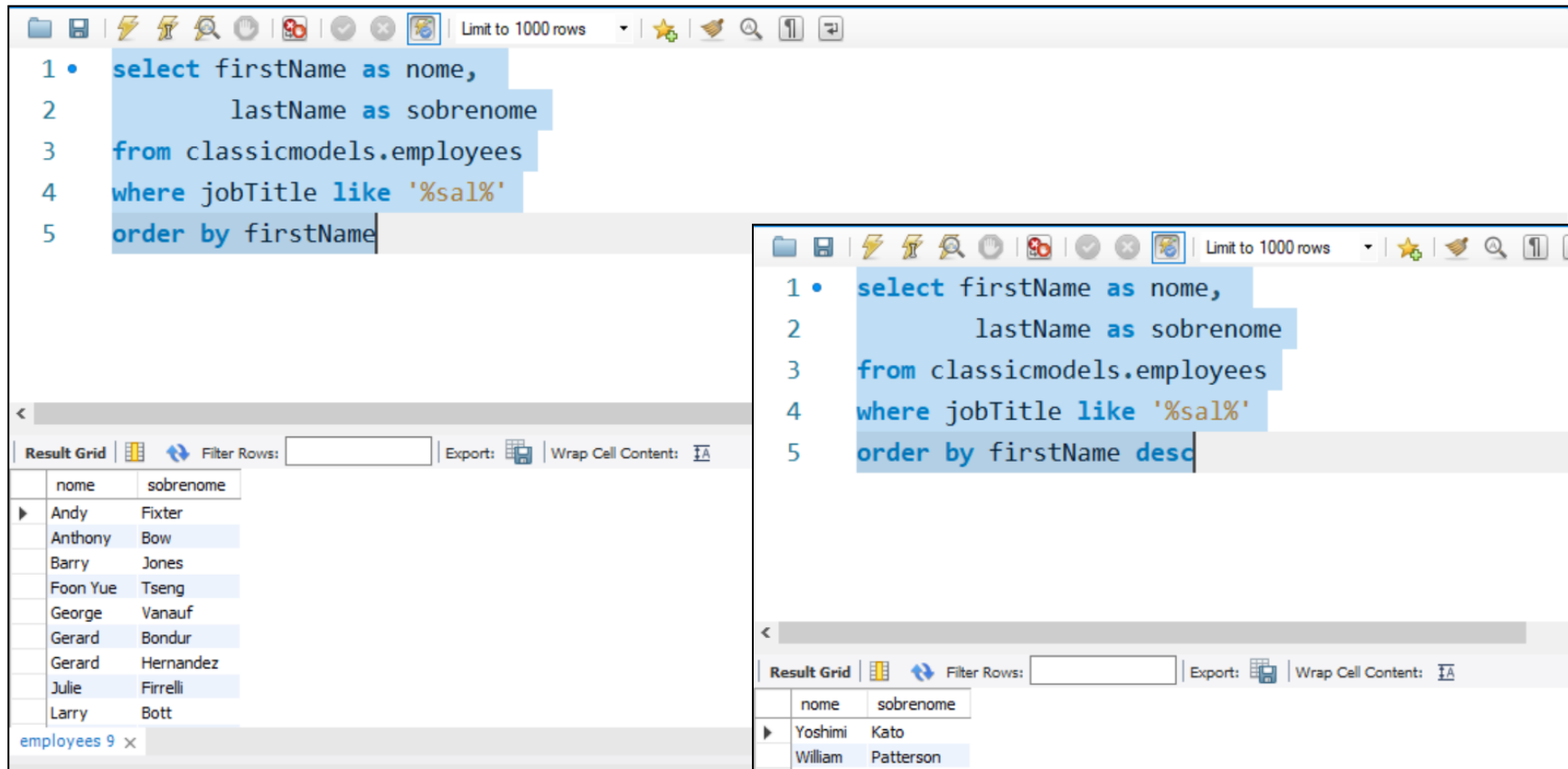
Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

nome	sobrenome
Mary	Patterson
William	Patterson
Gerard	Bondur
Anthony	Bow
Leslie	Jennings
Leslie	Thompson
Julie	Firrelli
Steve	Patterson
Foon Yue	Tseng

employees 8 x

Output

Álgebra Relacional

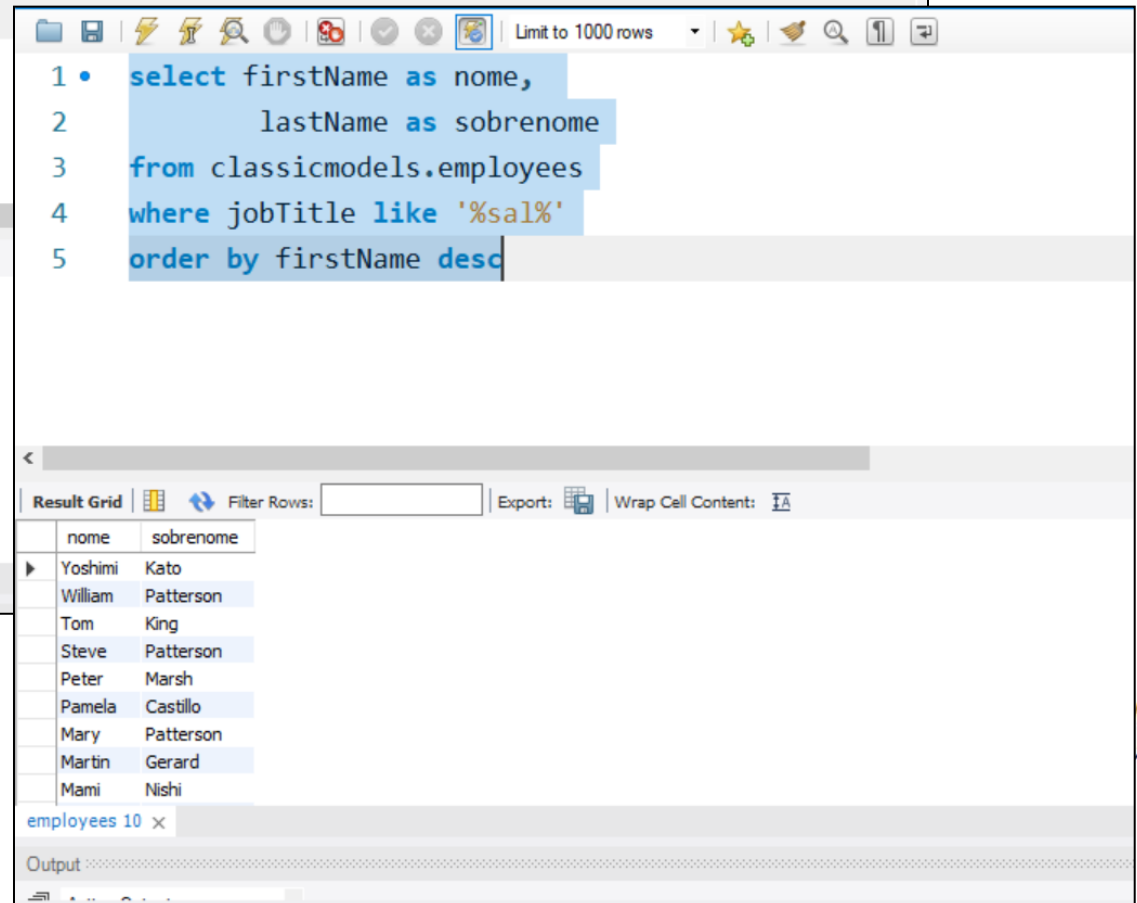


1 • `select firstName as nome,`
2 `lastName as sobrenome`
3 `from classicmodels.employees`
4 `where jobTitle like '%sal%'`
5 `order by firstName`

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

nome	sobrenome
Andy	Fixter
Anthony	Bow
Barry	Jones
Foon Yue	Tseng
George	Vanauf
Gerard	Bondur
Gerard	Hernandez
Julie	Firrelli
Larry	Bott

employees 9 x



1 • `select firstName as nome,`
2 `lastName as sobrenome`
3 `from classicmodels.employees`
4 `where jobTitle like '%sal%'`
5 `order by firstName desc`

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

nome	sobrenome
Yoshimi	Kato
William	Patterson
Tom	King
Steve	Patterson
Peter	Marsh
Pamela	Castillo
Mary	Patterson
Martin	Gerard
Mami	Nishi

employees 10 x

Output

Álgebra Relacional

– Operações desenvolvidas especificamente para BD relacionais:

- PROJEÇÃO

Representação

$$\pi_{\langle \text{lista de atributos} \rangle} (R)$$

Produz uma nova relação com somente alguns dos atributos de R e remove possíveis tuplas duplicadas

Álgebra Relacional

The screenshot shows a database query editor interface. At the top, there is a toolbar with various icons and a dropdown menu set to "Limit to 1000 rows". Below the toolbar, the SQL query is entered in a text area:

```
1 • select Distinct(firstName)
2   from classicmodels.employees
3
```

Below the query editor, there is a "Result Grid" section. It includes a "Filter Rows:" input field, an "Export:" button, and a "Wrap Cell Content:" checkbox. The "Result Grid" displays the following data:

firstName
Diane
Mary
Jeff
William
Gerard
Anthony
Leslie
Julie
Steve

At the bottom of the interface, there is a "Result 11" tab and an "Output" section. The "Read Only" status is indicated in the bottom right corner.

Álgebra Relacional

– Operações da Teoria Matemática dos Conjuntos:

- UNIÃO

$$R_1 \cup R_2$$

R1 e R2 tem o mesmo tipo de tupla: mesmo número de atributos e os atributos correspondentes tem o mesmo domínio.

O resultado da UNIÃO é o conjunto de todas as tuplas de R1 e R2, sem repetição.

Álgebra Relacional

– Operações da Teoria Matemática dos Conjuntos:

- INTERSEÇÃO

$$R_1 \cap R_2$$

R1 e R2 tem o mesmo tipo de tupla. Produz uma relação que inclui as tuplas comuns a R1 e R2.

– Operações da Teoria Matemática dos Conjuntos:

- DIFERENÇA

$$R_1 - R_2$$

R1 e R2 tem o mesmo tipo de tupla.

Produz uma relação que inclui todas as tuplas de R1 que não estejam em R2.

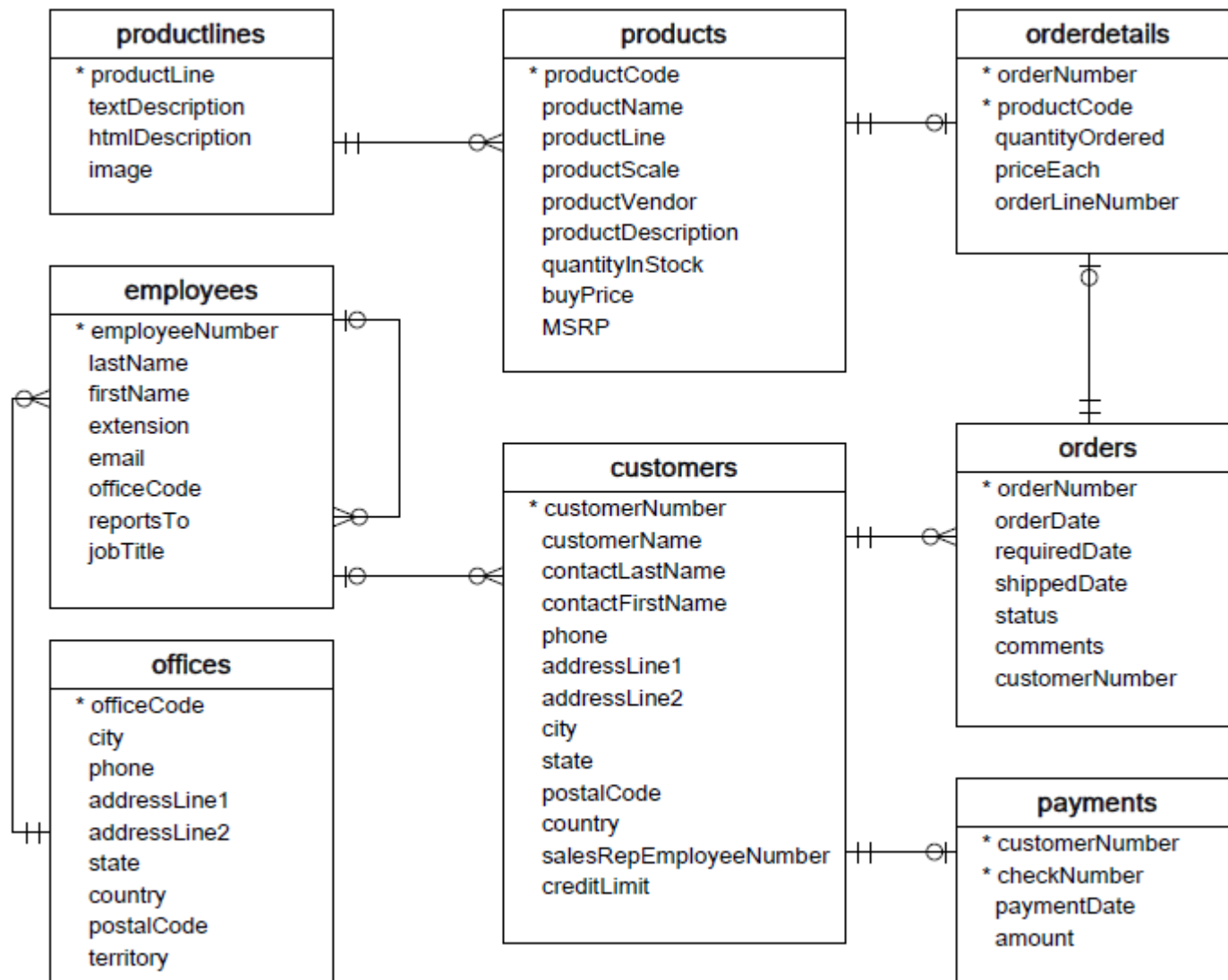
– Operações da Teoria Matemática dos Conjuntos:

- PRODUTO CARTESIANO

$$R_1 \times R_2$$

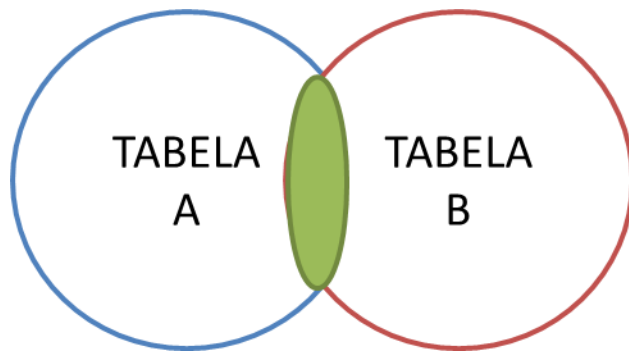
Produz uma relação que tem os atributos de R1 e R2, e inclui como tuplas todas as possíveis combinações de tuplas de R1 e R2.

Álgebra Relacional



Álgebra Relacional

- SQL
- **INNER JOIN**



- **SELECT** <campos>
FROM TabelaA **AS** A
INNER JOIN TabelaB **AS** B
ON A.Chave = B.Chave

Álgebra Relacional

The screenshot shows a database query editor interface. At the top, there is a toolbar with various icons and a dropdown menu set to "Limit to 1000 rows". Below the toolbar, a SQL query is entered in a text area:

```
1 • select *
2 from classicmodels.products p
3 inner join classicmodels.orderdetails o on p.productCode = o.productCode
```

Below the query editor, the "Result Grid" is displayed, showing a table with 10 columns: productCode, productName, productLine, productScale, productVendor, productDescription, quantityInStock, and buyPrice. The table contains 10 rows of data, representing different classic car models and their details.

productCode	productName	productLine	productScale	productVendor	productDescription	quantityInStock	buyPrice
S18_1749	1917 Grand Touring Sedan	Vintage Cars	1:18	Welly Diecast Productions	This 1:18 scale replica of the 1917 Grand Tourin...	2724	86
S18_2248	1911 Ford Town Car	Vintage Cars	1:18	Motor City Art Classics	Features opening hood, opening doors, openin...	540	33
S18_4409	1932 Alfa Romeo 8C2300 Spider Sport	Vintage Cars	1:18	Exoto Designs	This 1:18 scale precision die cast replica feature...	6553	43
S24_3969	1936 Mercedes Benz 500k Roadster	Vintage Cars	1:24	Red Start Diecast	This model features grille-mounted chrome horn...	2081	21
S18_2325	1932 Model A Ford J-Coupe	Vintage Cars	1:18	Autoart Studio Design	This model features grille-mounted chrome horn...	9354	58
S18_2795	1928 Mercedes-Benz SSK	Vintage Cars	1:18	Gearbox Collectibles	This 1:18 replica features grille-mounted chrom...	548	72
S24_1937	1939 Chevrolet Deluxe Coupe	Vintage Cars	1:24	Motor City Art Classics	This 1:24 scale die-cast replica of the 1939 Che...	7332	22
S24_2022	1938 Cadillac V-16 Presidential Limousine	Vintage Cars	1:24	Classic Metal Creations	This 1:24 scale precision die cast replica of the ...	2847	20
S18_1342	1937 Lincoln Berline	Vintage Cars	1:18	Motor City Art Classics	Features opening engine cover, doors, trunk, a...	8693	60
S18_1367	1936 Mercedes-Benz 500K Special Roadster	Vintage Cars	1:18	Studio M Art Models	This 1:18 scale replica is constructed of heavy d...	8635	24
S10_1949	1952 Alpine Renault 1300	Classic Cars	1:10	Classic Metal Creations	Turnable front wheels; steering function; detail...	7305	98
S10_4862	1962 Lancia Delta 16V	Classic Cars	1:10	Second Gear Diecast	Features include: Turnable front wheels; steeri...	6701	10

Below the table, there is a "Result Grid" tab and a "Form Editor" tab. The "Result Grid" tab is active, showing the table data. The "Form Editor" tab is also visible, showing a form with fields for "productCode", "productName", "productLine", "productScale", "productVendor", "productDescription", "quantityInStock", and "buyPrice".

Álgebra Relacional

Limit to 1000 rows

```
1 • select p.*
2 from classicmodels.products p
3 inner join classicmodels.orderdetails o on p.productCode = o.productCode
```

Result Grid

productCode	productName	productLine	productScale	productVendor	productDescription	quantityInStock	buyPrice	MSRP
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70

Result 14 x

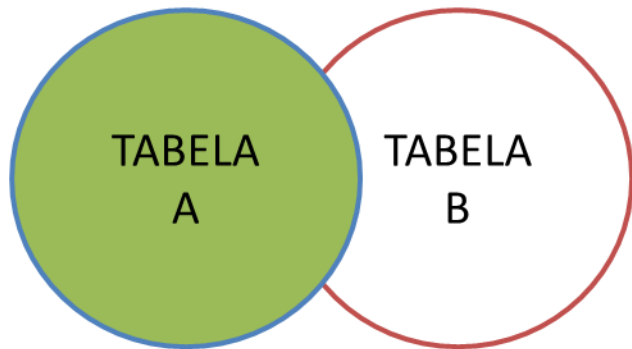
Output

Read Only

Álgebra Relacional

- SQL

- **LEFT JOIN**



- **SELECT** <campos>
FROM TabelaA **AS** A
LEFT JOIN TabelaB **AS** B
ON A.Chave = B.Chave

Álgebra Relacional

The screenshot shows a database query editor interface. At the top, there is a toolbar with various icons and a dropdown menu set to "Limit to 1000 rows". Below the toolbar, the SQL query is entered in a text area:

```
1 • select *
2 from classicmodels.products p
3 left join classicmodels.orderdetails o on p.productCode = o.productCode
```

Below the query editor, the "Result Grid" tab is active, displaying a table of results. The table has 10 columns: productCode, productName, productLine, productScale, productVendor, productDescription, quantityInStock, buyPrice, and MSRP. The results show 10 identical rows for the product "1969 Harley Davidson Ultimate Chopper" from the "Motorcycles" line, with a product scale of "1:10" and a vendor of "Min Lin Diecast". The quantity in stock is 7933, the buy price is 48.81, and the MSRP is 95.70.

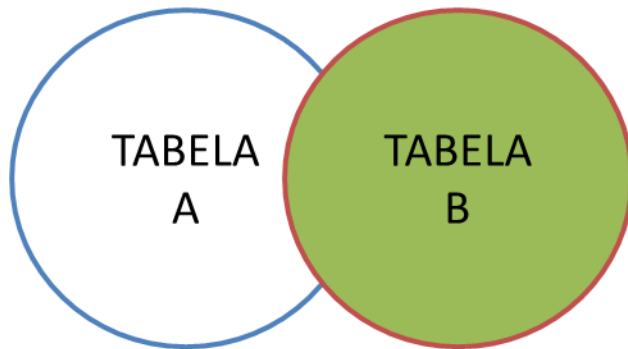
productCode	productName	productLine	productScale	productVendor	productDescription	quantityInStock	buyPrice	MSRP
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70
S10_1678	1969 Harley Davidson Ultimate Chopper	Motorcycles	1:10	Min Lin Diecast	This replica features working kickstand, front su...	7933	48.81	95.70

At the bottom of the interface, there is a "Result 16" tab and an "Output" section.

Álgebra Relacional

- SQL

- **RIGHT JOIN**



- **SELECT** <campos>
FROM TabelaA **AS** A
RIGHT JOIN TabelaB **AS** B
ON A.Chave = B.Chave

Álgebra Relacional

Limit to 1000 rows

```
1 • select *
2 from classicmodels.products p
3 right join classicmodels.orderdetails o on p.productCode = o.productCode
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: | Fetch rows:

	productCode	productName	productLine	productScale	productVendor	productDescription	quantityInStock	bu
▶	S18_1749	1917 Grand Touring Sedan	Vintage Cars	1:18	Welly Diecast Productions	This 1:18 scale replica of the 1917 Grand Tourin...	2724	86
	S18_2248	1911 Ford Town Car	Vintage Cars	1:18	Motor City Art Classics	Features opening hood, opening doors, openin...	540	33
	S18_4409	1932 Alfa Romeo 8C2300 Spider Sport	Vintage Cars	1:18	Exoto Designs	This 1:18 scale precision die cast replica feature...	6553	43
	S24_3969	1936 Mercedes Benz 500k Roadster	Vintage Cars	1:24	Red Start Diecast	This model features grille-mounted chrome horn...	2081	21
	S18_2325	1932 Model A Ford J-Coupe	Vintage Cars	1:18	Autoart Studio Design	This model features grille-mounted chrome horn...	9354	58
	S18_2795	1928 Mercedes-Benz SSK	Vintage Cars	1:18	Gearbox Collectibles	This 1:18 replica features grille-mounted chrom...	548	72
	S24_1937	1939 Chevrolet Deluxe Coupe	Vintage Cars	1:24	Motor City Art Classics	This 1:24 scale die-cast replica of the 1939 Che...	7332	22
	S24_2022	1938 Cadillac V-16 Presidential Limousine	Vintage Cars	1:24	Classic Metal Creations	This 1:24 scale precision die cast replica of the ...	2847	20
	S18_1342	1937 Lincoln Berline	Vintage Cars	1:18	Motor City Art Classics	Features opening engine cover, doors, trunk, a...	8693	60
	S18_1367	1936 Mercedes-Benz 500K Special Roadster	Vintage Cars	1:18	Studio M Art Models	This 1:18 scale replica is constructed of heavy d...	8635	24
	S10_1949	1952 Alpine Renault 1300	Classic Cars	1:10	Classic Metal Creations	Turnable front wheels; steering function; detail...	7305	98
	S10_4062	1967 Landia Delta 16V	Classic Cars	1:10	Second Gear Diecast	Features include: Turnable front wheels; steeri...	6701	10

Result 17 x

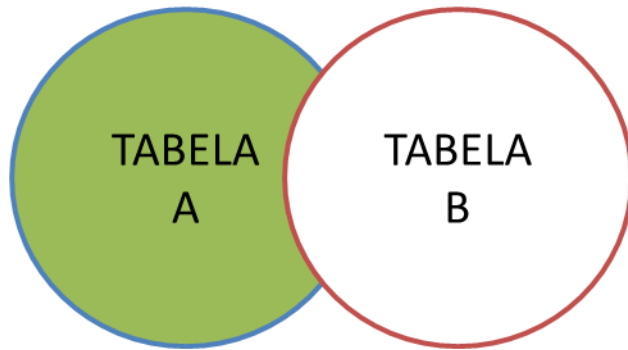
Output

Read Only

Álgebra Relacional

- SQL

- **LEFT EXCLUDING JOIN**

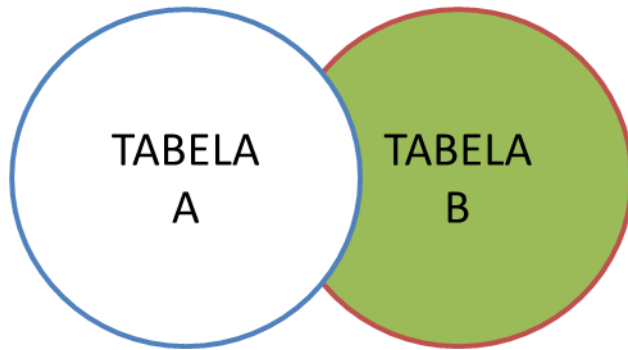


- **SELECT** <campos>
FROM TabelaA **AS** A
LEFT JOIN TabelaB **AS** B
ON A.Chave = B.Chave
WHERE B.Chave **IS NULL**

Álgebra Relacional

- SQL

- **RIGHT EXCLUDING JOIN**



- **SELECT** <campos>
FROM TabelaA **AS** A
RIGHT JOIN TabelaB **AS** B
ON A.Chave = B.Chave
WHERE A.Chave **IS NULL**

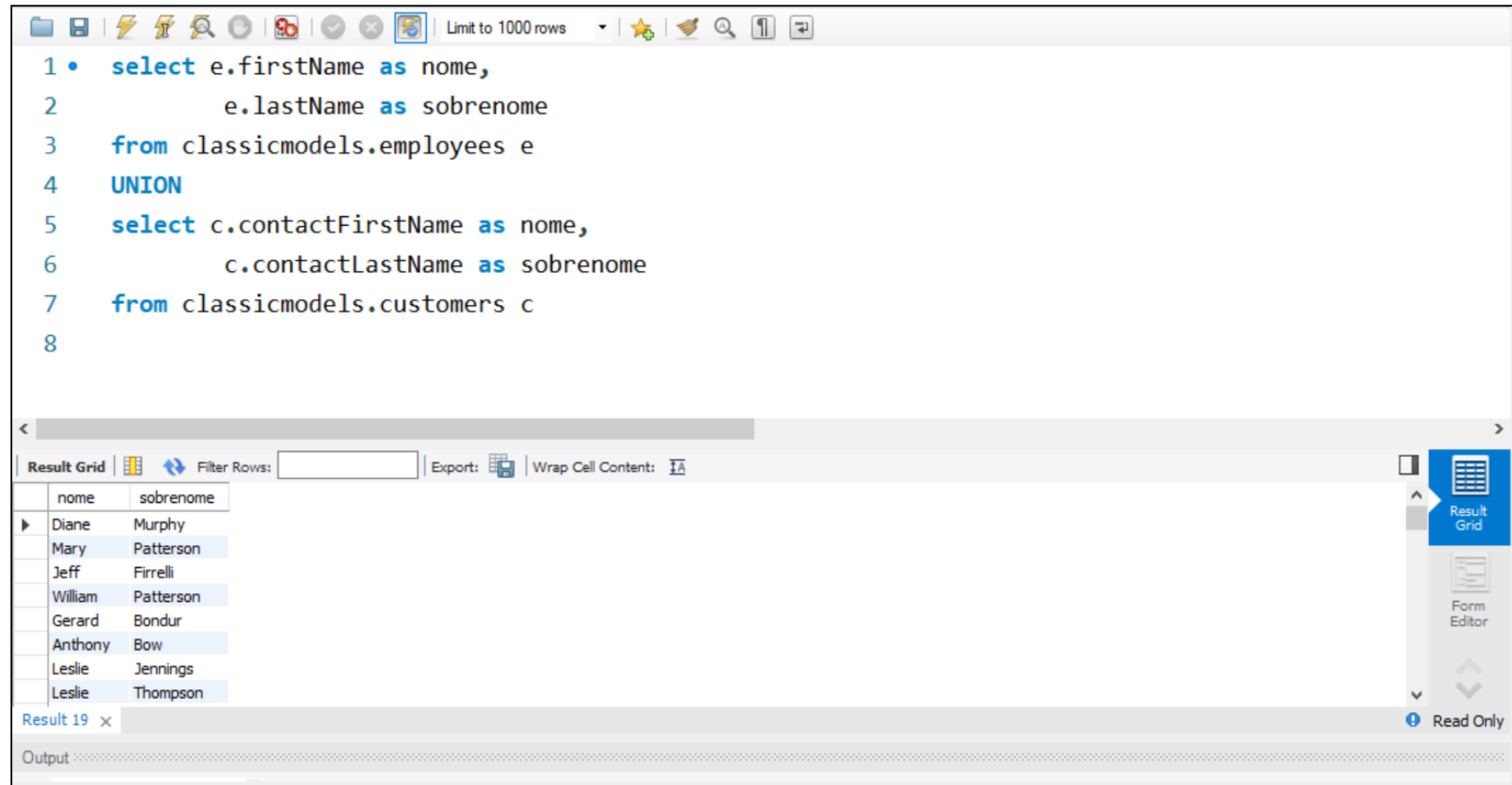
Álgebra Relacional

- SQL
- **INNER JOIN**



- **SELECT** <campos>
FROM TabelaA
UNION
SELECT <campos>
FROM TabelaB

Álgebra Relacional



The screenshot shows a database query editor interface. The top toolbar includes icons for file operations, execution, and a 'Limit to 1000 rows' dropdown. The query text is as follows:

```
1 • select e.firstName as nome,  
2       e.lastName as sobrenome  
3 from classicmodels.employees e  
4 UNION  
5 select c.contactFirstName as nome,  
6       c.contactLastName as sobrenome  
7 from classicmodels.customers c  
8
```

Below the query editor, the 'Result Grid' tab is active, displaying the following data:

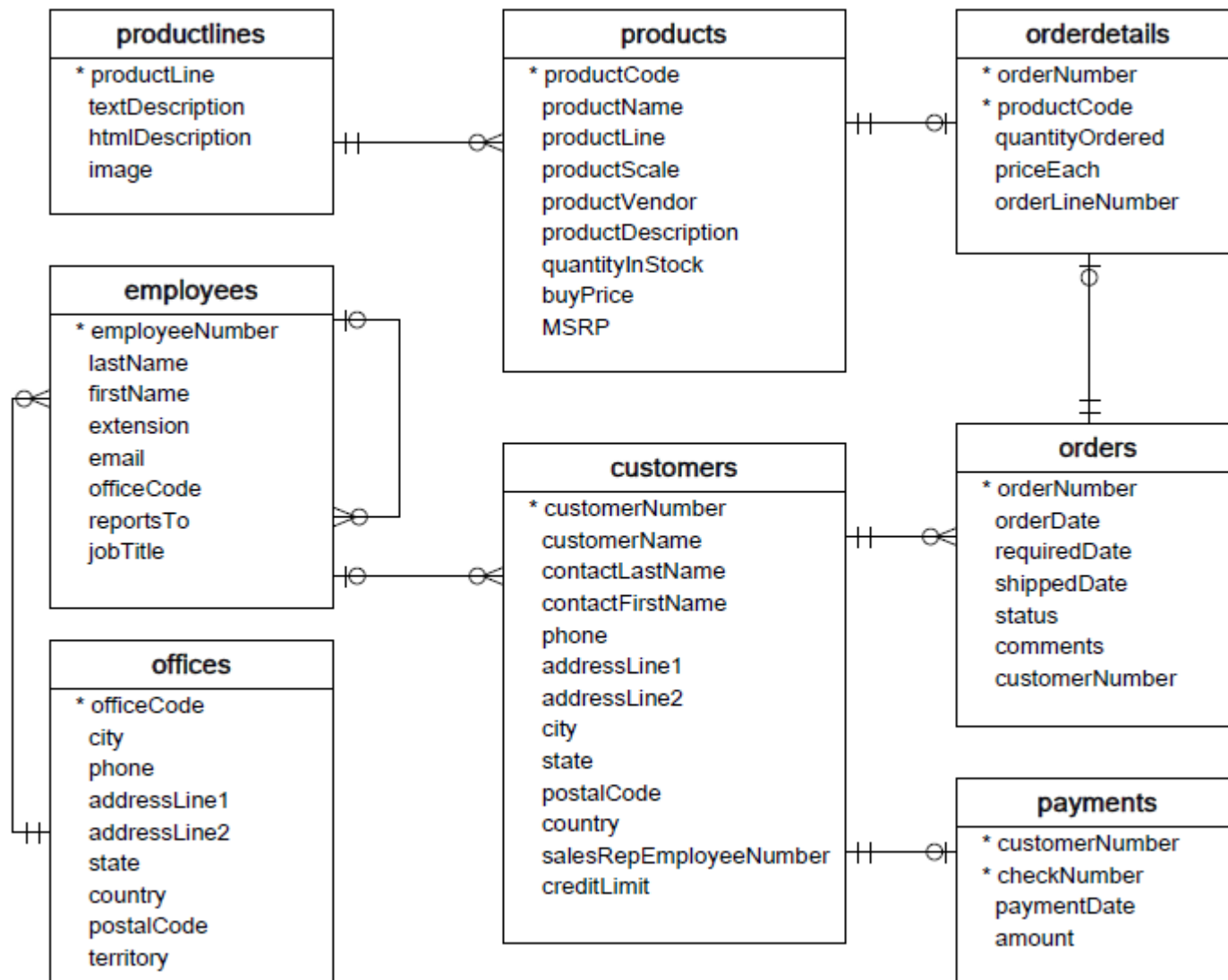
	nome	sobrenome
▶	Diane	Murphy
	Mary	Patterson
	Jeff	Firrelli
	William	Patterson
	Gerard	Bondur
	Anthony	Bow
	Leslie	Jennings
	Leslie	Thompson

The interface also includes a 'Filter Rows' input field, an 'Export' button, and a 'Wrap Cell Content' checkbox. On the right side, there are buttons for 'Result Grid', 'Form Editor', and a 'Read Only' status indicator.

Álgebra Relacional

- Funções Agregadas
- Algumas consultas comuns em BD não podem ser executadas com as operações da álgebra relacional
- A maioria das linguagens de consulta dos SGBDs relacionais inclui capacidade de executar consultas que envolvem funções matemáticas agregadas sobre coleções de valores do banco de dados
- As mais usuais são:
 - SOMA - **SUM**
 - MÉDIA - **AVG**
 - MÁXIMO - **MAX**
 - MÍNIMO - **MIN**
 - CONTAGEM (de tuplas) - **COUNT**

Álgebra Relacional



Álgebra Relacional

```
1 • select count(*)
2   from classicmodels.products
3
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

count(*)
110

```
1 • select max(buyPrice)
2   from classicmodels.products
3
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

max(buyPrice)
103.42

```
1 • select min(buyPrice)
2   from classicmodels.products
3
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

min(buyPrice)
15.91

```
1 • select avg(buyPrice)
2   from classicmodels.products
3
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

avg(buyPrice)
54.395182

Álgebra Relacional

- **GROUP BY**

- Utilizado para agrupamento de resultados
- Utilizado em conjunto com funções agregadas (Count, Sum...)

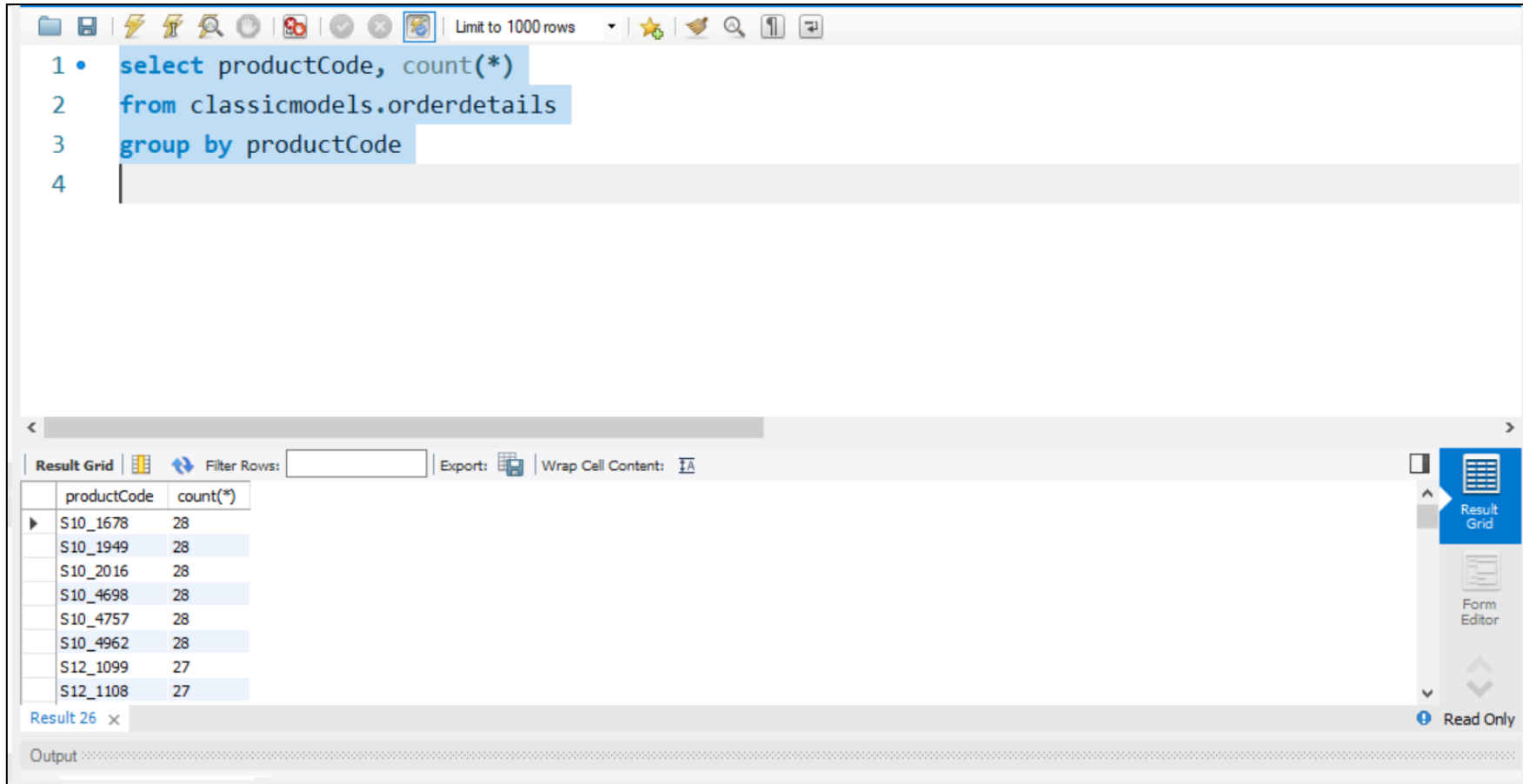
- Exemplo: Quantas vendas foram feitas ?

SELECT COUNT(*) FROM Vendas

- Exemplo: Quantas vendas foram feitas POR VENDEDOR?

SELECT NomeVendedor, **COUNT(*)**
FROM Vendas
GROUP BY NomeVendedor

Álgebra Relacional



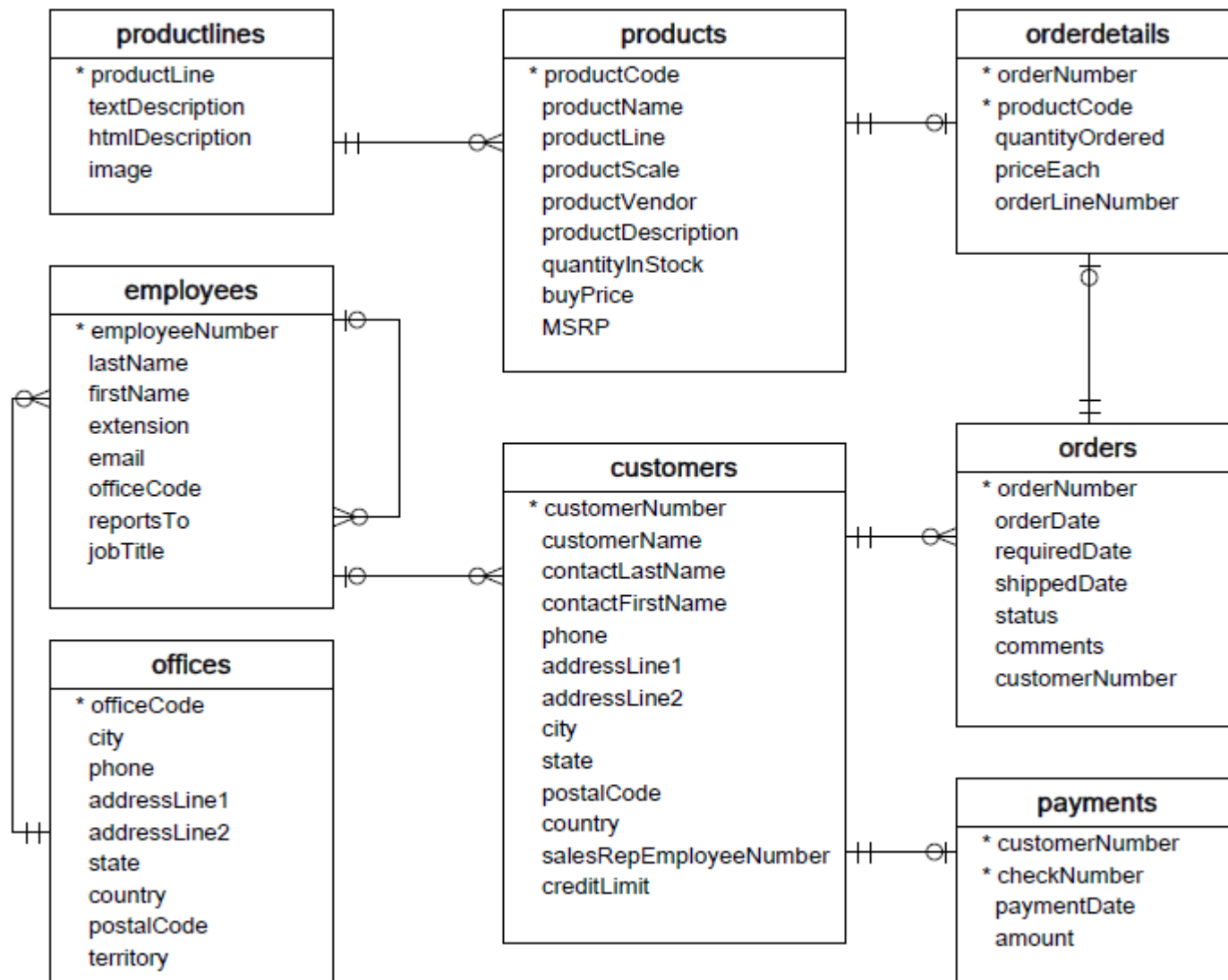
The screenshot shows a database query tool interface. At the top, there is a toolbar with various icons and a dropdown menu set to "Limit to 1000 rows". Below the toolbar, a SQL query is entered in a text area:

```
1 • select productCode, count(*)  
2   from classicmodels.orderdetails  
3   group by productCode  
4
```

Below the query editor, the "Result Grid" tab is active, displaying the results of the query. The results are shown in a table with two columns: "productCode" and "count(*)". The table contains 8 rows of data. On the right side of the interface, there are buttons for "Result Grid", "Form Editor", and "Read Only". At the bottom, there is a tab labeled "Result 26" and an "Output" section.

productCode	count(*)
S10_1678	28
S10_1949	28
S10_2016	28
S10_4698	28
S10_4757	28
S10_4962	28
S12_1099	27
S12_1108	27

Álgebra Relacional



- 1) Listar o nome, sobrenome e email de todos os funcionários
- 2) Listar o nome, sobrenome e email de todos os funcionários que são representantes de vendas
- 3) Listar todos os cargos (sem repetir)
- 4) Listar todas as cidades (sem repetir) em que a empresa possui escritórios
- 5) Listar o nome, sobrenome e email , cidade, país e telefone do escritório do presidente da empresa
- 6) Listar o produto com o maior preço
- 7) Listar o produto com menor preço
- 8) Listar o produto com menor quantidade em estoque
- 9) Listar o produto com maior quantidade em estoque
- 10) Listar produto e quantidade de vendas daquele produto



**ARE YOU UP FOR THE
CHALLENGE?**

- 1) Listar os clientes com maior quantidade de vendas. Exibir: Nome, Sobrenome, Cidade e Estado do Cliente e a quantidade de vendas dele
- 2) Listar os produtos com maior quantidade de vendas. Exibir: Nome do Produto, Descrição da Linha do Produto, Preço do Produto e Quantidade de Vendas
- 3) Listar os empregados que venderam mais (em quantidade). Exibir: Nome do funcionário, sobrenome, email e o superior dele.
- 4) Listar os clientes que mais gastaram (\$). Exibir: Nome, Sobrenome, Cidade e Estado do Cliente e o limite de créditos deles
- 5) Montar um relatório em que conste todos os dados dos empregados (inclusive do escritório em que eles pertencem) e os clientes que esses atendem (inclua neste relatório também todos os dados dos clientes).