

UNIVERSIDAD NACIONAL  
AUTÓNOMA DE MÉXICO

FUNDAMENTOS DE BASES DE  
DATOS

Tarea 4: Álgebra Relacional

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## Ejercicio 1

- a) Toda la información de los usuarios que tienen una página, pero no incluyen blog.  
 $r = \pi_{\text{user, pagina, titulo\_blog}} (\text{Usuario} \bowtie \text{Página} \bowtie \text{Blog})$   
 $p = \text{user} \gamma \text{ count}(\text{pagina}) \rightarrow \text{num\_p} (r)$   
 $b = \text{user} \gamma \text{ count}(\text{titulo\_blog}) \rightarrow \text{num\_b} (r)$   
 $Q = p \bowtie b$   
 $t = \pi_{\text{user}} (\sigma_{\text{num\_b} = 0 \wedge \text{num\_p} > 0} (Q))$   
 $\pi_{\text{user}} * (\text{User} \bowtie t)$
- b)  $\gamma \text{ user; count}(\text{id\_fotografía}) \rightarrow \text{total\_fotos} (\text{Subir})$
- c)  $r = \gamma \text{ user; count}(\text{user}) \rightarrow \text{numero} (\text{Comentario-foto})$   
 $s = \gamma ; \text{max}(\text{numero}) \rightarrow \text{numero} (r)$   
 $r \bowtie s$
- d) Un reporte que muestre por usuario y por álbum (galería) el total de fotos que haya subido al sitio.  
 $r = \pi_{\text{user, título\_galería, id\_fotografía}} (\text{Usuario} \bowtie \text{Galería} \bowtie \text{Fotografía})$   
 $s = \text{usuario, } \gamma(\text{count}(\text{id\_fotografía}) \rightarrow \text{num\_fotos}) (\text{Fotografía})$   
 $\pi_{\text{user, título\_galería, s}} (\text{Usuario} \bowtie \text{Galería})$
- e)  $\pi_{\text{modelo, velocidad, ram, hd\_nuevo} \leftarrow \text{hd} * 1.15, \text{pantalla, precio}} (s)$

## Ejercicio 2

- a)  $r = \gamma \text{ id\_fotografía; count}(\text{user}) \rightarrow \text{megustas} (\text{calificar})$   
 $s = \pi_{\text{user, id\_fotografía, megustas}} (\text{Subir} \bowtie r)$   
 $t = \gamma \text{ user; max}(\text{megustas}) \rightarrow \text{max\_megustas} (s)$   
 $\pi_{\text{user, id\_fotografía}} (s \bowtie t)$
- b) ¿Qué fabricantes producen computadoras portátiles con un disco duro de menos 100 GB?

The screenshot shows the 'relational algebra calculator 0.19.1' interface. On the left, there's a 'Database System' sidebar with a tree view showing tables: Product, PC, Laptop, and Printer. The main area displays a query in SQL: `1. pi maker (sigma (hd <= 100) (Product join Laptop))`. Below the query, there's a green 'ejecutar consulta' button. To the right of the button is a 'descargar' button and a 'historia' dropdown. Below the query, an execution plan is shown as a tree diagram. The root node is  $\pi_{\text{maker}}$ , which connects to  $\sigma_{\text{hd} \leq 100}$ , which then connects to a join node  $\bowtie$ . The join node has two children: 'Product' and 'Laptop'. Below the diagram, the SQL query is repeated:  $\pi_{\text{maker}} (\sigma_{\text{hd} \leq 100} (\text{Product} \bowtie \text{Laptop}))$ . At the bottom, there's a table header 'Product.maker' with columns A, E, and F.

- c) Encontrar el número de modelo y el precio de todos los productos (de cualquier tipo) fabricados por el fabricante B.

$r = \sigma_{\text{fabricante} = 'B'} (\text{Producto})$

$s = \pi_{\text{modelo, precio}} (\text{Laptop}) \cup \pi_{\text{modelo, precio}} (\text{PC}) \cup \pi_{\text{modelo, precio}} (\text{Impresora})$

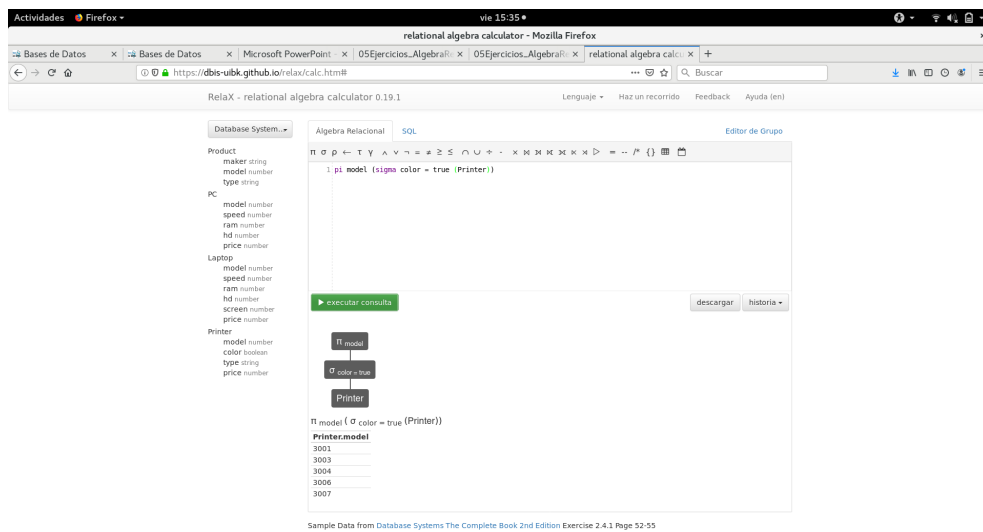
$\pi_{\text{modelo, precio}} (s \bowtie r)$

The screenshot shows the 'relational algebra calculator 0.19.1' interface. On the left, there's a 'Database System' sidebar with a tree view showing tables: Printer, Laptop, PC, and Product. The main area displays a query in SQL: `1. pi model, price ((sigma maker = 'B' (Product)) join ((pi model, price (Laptop) union pi model, price (PC) union pi model, price (Printer))))`. Below the query, there's a green 'ejecutar consulta' button. To the right of the button is a 'descargar' button and a 'historia' dropdown. Below the query, an execution plan is shown as a tree diagram. The root node is  $\pi_{\text{model, price}}$ , which connects to a join node  $\bowtie$ . The join node has two children:  $\sigma_{\text{maker} = 'B'}$  (which connects to 'Product') and a union node  $\cup$ . The union node has three children:  $\pi_{\text{model, price}}$  (which connects to 'Laptop'),  $\pi_{\text{model, price}}$  (which connects to 'PC'), and  $\pi_{\text{model, price}}$  (which connects to 'Printer'). Below the diagram, the SQL query is repeated:  $\pi_{\text{model, price}} ((\sigma_{\text{maker} = 'B'} (\text{Product})) \bowtie ((\pi_{\text{model, price}} (\text{Laptop}) \cup \pi_{\text{model, price}} (\text{PC}) \cup \pi_{\text{model, price}} (\text{Printer}))))$ . At the bottom, there's a table header 'Laptop.model Laptop.price' with columns model and price. The table contains the following data:

Laptop.model	Laptop.price
2007	1429
1004	649
1005	630
1006	1049

- d)

- e) Encontrar los números de modelo de todas las impresoras láser a color.



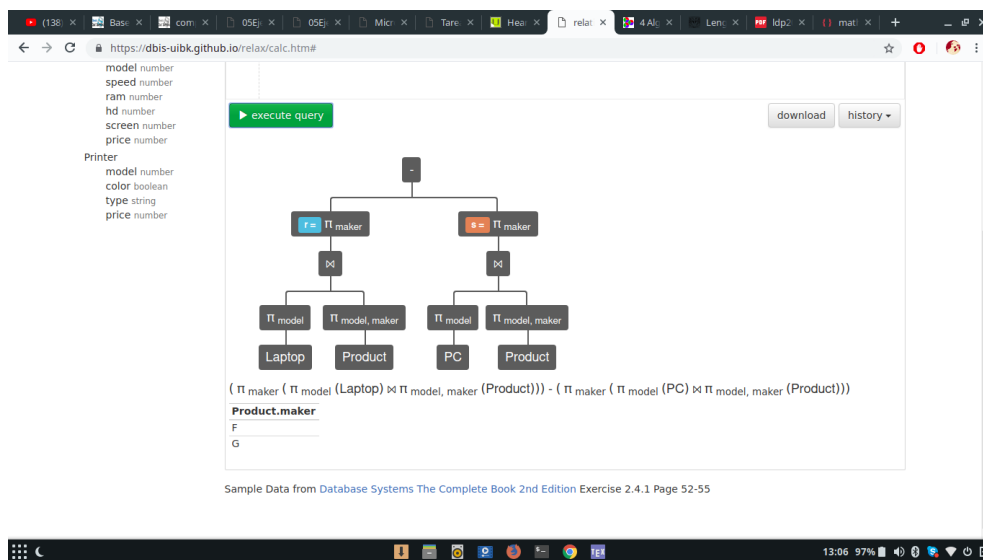
f) Encontrar toda la información de los fabricantes que venden laptops pero no PCs.

$r = \pi \text{ modelo, fabricante (Producto)}$

$s = \pi \text{ fabricante } (\pi \text{ modelo (Laptop)} \bowtie r)$

$t = \pi \text{ fabricante } (\pi \text{ modelo (PC)} \bowtie r)$

$s - t$



g)

h) Encontrar toda la información de las PCs que tienen la misma velocidad y RAM.

The screenshot shows a web-based relational algebra calculator. On the left, there is a schema definition for a database with tables: Product, PC, Laptop, and Printer. The main area displays a query in relational algebra notation:  $\pi_{\text{speed}, \text{ram}} \sigma_{\text{speed} \geq 2.8} \text{PC}$ . Below the query, there is a button to execute the query. The result is shown as a table with columns: PC.model, PC.speed, PC.ram, PC.hd, PC.price. The table contains 10 rows of data.

PC.model	PC.speed	PC.ram	PC.hd	PC.price
1003	1.42	512	80	478
1011	1.86	2048	160	959
1009	2	1024	250	650
1002	2.1	512	250	995
1007	2.2	1024	200	510
1008	2.2	2048	250	770
1001	2.66	1024	250	2114
1004	2.8	1024	250	649
1012	2.8	1024	160	649
1010	2.8	2048	300	770
1013	3.06	512	80	529
1005	3.2	512	250	630
1006	3.2	1024	320	1049

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- i) Encontrar aquellos fabricantes de mínimo dos computadoras diferentes (PC o laptops) con velocidades de al menos 2.80 GHz
- $r = \pi_{\text{modelo}} (\sigma_{\text{velocidad} \geq 2.8} (\text{PC}))$
- $s = \pi_{\text{modelo}} (\sigma_{\text{velocidad} \geq 2.8} (\text{Laptop}))$
- $\pi_{\text{fabricante}} ((r \cup s) \bowtie \text{Producto})$

The screenshot shows a web-based relational algebra calculator. On the left, there is a schema definition for a database with tables: screen number, price number, Printer, model number, color boolean, type string, and price number. The main area displays a query in relational algebra notation:  $\pi_{\text{maker}} (((\pi_{\text{model}} (\sigma_{\text{speed} \geq 2.8} (\text{PC}))) \cup (\pi_{\text{model}} (\sigma_{\text{speed} \geq 2.8} (\text{Laptop})))) \bowtie \text{Product})$ . Below the query, there is a button to execute the query. The result is shown as a table with columns: Product.maker. The table contains 3 rows of data.

Product.maker
B
D
E

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- j)
- k) Encontrar los fabricantes de PC con al menos tres velocidades diferentes.

The screenshot shows the 'relational algebra calculator' interface. On the left, there is a schema definition for 'Product' (maker string, model number, type string), 'PC' (model number, speed number, ram number, hd number, price number), 'Laptop' (model number, speed number, ram number, hd number, screen number, price number), and 'Printer' (model number, color boolean, type string, price number). The main area displays a query:  $\pi \text{ maker } (\sigma \text{ velocidades} \geq 3 \{ \text{Y maker, COUNT(speed)} \rightarrow \text{velocidades (r)} \})$ . Below the query, a flow diagram shows the execution steps:  $\pi \text{ maker}$ ,  $\sigma \text{ velocidades} \geq 3$ ,  $\text{Y maker, COUNT(speed)} \rightarrow \text{velocidades}$ ,  $\pi \text{ maker, speed}$ , and finally  $\pi \text{ maker}$ . The result is shown as a table with columns 'Product' and 'PC'. The final SQL query is:  $\pi \text{ maker } (\sigma \text{ velocidades} \geq 3 \{ \text{Y maker, COUNT(speed)} \rightarrow \text{velocidades (} \pi \text{ maker, speed (Product} \bowtie \text{PC))} \})$ . The output table is titled 'Product.maker' and has columns A, D, and E.

- l) Encontrar los fabricantes que venden exactamente tres modelos diferentes de PC.

$r = \pi \text{ modelo, fabricante (Producto} \bowtie \text{PC)}$

$s = \text{Y fabricante; count(modelo)} \rightarrow \text{numproductos (r)}$

$\pi \text{ fabricante } (\sigma \text{ numproductos} = 3 \text{ (s)})$

The screenshot shows the 'relational algebra calculator' interface. On the left, there is a schema definition for 'Printer' (screen number, price number), 'Printer' (model number, color boolean, type string, price number), and 'Printer' (model number, color boolean, type string, price number). The main area displays a query:  $\pi \text{ maker } (\sigma \text{ num\_products} = 3 \{ \text{Y maker, COUNT(model)} \rightarrow \text{num\_products (r)} \})$ . Below the query, a flow diagram shows the execution steps:  $\pi \text{ maker}$ ,  $\sigma \text{ num\_products} = 3$ ,  $\text{Y maker, COUNT(model)} \rightarrow \text{num\_products}$ ,  $\pi \text{ model, maker}$ , and finally  $\pi \text{ maker}$ . The result is shown as a table with columns 'Product' and 'PC'. The final SQL query is:  $\pi \text{ maker } (\sigma \text{ num\_products} = 3 \{ \text{Y maker, COUNT(model)} \rightarrow \text{num\_products (} \pi \text{ model, maker (Product} \bowtie \text{PC))} \})$ . The output table is titled 'Product.maker' and has columns A, B, D, and E.

m)

- n) Crear un reporte que muestre por fabricante, el número de productos que tiene de cada tipo.

relational algebra calculator - Mozilla Firefox

1.  $r = \pi \text{ maker, model, type (Product)}$   
 2.  $g = \gamma \text{ maker, type; count(model) } \rightarrow \text{tipo (r)}$   
 3.  $\pi \text{ maker, type, tipo g}$

Product.maker Product.type tipo

A	pc	3
A	laptop	3
B	pc	4
C	pc	1
D	pc	3
D	printer	2
E	pc	3
E	laptop	3
E	printer	3
F	laptop	2
G	laptop	1
H	printer	2

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ñ) Incrementar en un 15 % el tamaño del disco duro de las laptops del fabricante E que sean menores a 200 GB.

$r = \pi \text{ modelo } (\sigma \text{ fabricante} = 'E' (\text{Producto})) \bowtie \text{Laptop}$

$s = \sigma \text{ hd} < 200 (r)$

$t = \pi \text{ modelo, velocidad, ram, hd\_nuevo} \leftarrow \text{hd} * 1.15, \text{ pantalla, precio (s)}$

t

execute query

Product.model Laptop.speed Laptop.ram new\_hd Laptop.screen Laptop.price

2002	1.73	1024	92	17	949
2003	1.8	512	69	15.4	549

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o)

p) Borrar las impresoras de inyección de tinta.

Firefox browser window showing the Relational Algebra Calculator (RelaX) interface. The URL is <https://dbis-uibk.github.io/relax/calc.htm#>.

The interface includes a sidebar with a database schema (Product, PC, Laptop, Printer) and a main area for entering relational algebra queries. The query entered is:

```
 $\pi_{1, \text{model}, \text{color}, \text{type}, \text{price}} (\sigma_{\text{type} = \text{'ink-jet'}} (\text{Printer}))$ 
```

The result is displayed as a tree diagram and a table:

Tree Diagram:

```
graph TD
    Root[" $\pi_{1, \text{model}, \text{color}, \text{type}, \text{price}}$ "] --> Join[" $\sigma_{\text{type} = \text{'ink-jet'}}$ "]
    Join --> Printer1["Printer"]
    Join --> Printer2["Printer"]
```

Table:

Printer.model	Printer.color	Printer.type	Printer.price
3002	false	laser	239
3003	true	laser	899
3005	false	laser	120
3007	true	laser	200

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q)