

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.

$r = \pi_{\text{user, pagina, titulo\_blog}} (\text{Usuario} \bowtie \text{Página} \bowtie \text{Blog})$

$p = \text{user} \rightarrow \text{count}(\text{pagina}) \rightarrow \text{num\_p} (r)$

$b = \text{user} \rightarrow \text{count}(\text{titulo\_blog}) \rightarrow \text{num\_b} (r)$

$Q = p \bowtie b$

$t = \pi_{\text{user}} (\sigma_{\text{num\_b} = 0 \wedge \text{num\_p} > 0} (Q))$

$\pi_i * (\text{User} \bowtie t)$

- b)  $\text{Y user; count(id\_fotografía)} \rightarrow \text{total\_fotos (Subir)}$

- c)  $r = \gamma_{\text{user; count(user)} \rightarrow \text{numero (Comentario-foto)}}$

$s = \gamma ; \max(\text{numero}) \rightarrow \text{numero} (r)$

$r \bowtie s$

- d) Un reporte que muestre por usuario y por álbum (galería) el total de fotos que haya subido al sitio.

$r = \pi_{\text{user, título\_galería, id\_fotografía}} (\text{Usuario} \bowtie \text{Galería} \bowtie \text{Fotografía})$

$s = \text{usuario, } \gamma(\text{count(id\_fotografía)} \rightarrow \text{num\_fotos}) (\text{Fotografía})$

$\pi_{\text{user, título\_galería, s}} (\text{Usuario} \bowtie \text{Galería})$

- e)

## Ejercicio 2

- a)  $r = \text{Y id\_fotografía; count(user)} \rightarrow \text{megustas (calificar)}$

$s = \pi_{\text{user, id\_fotografía, megustas}} (\text{Subir} \bowtie r)$

$t = \text{Y user; max(megustas)} \rightarrow \text{max\_megustas (s)}$

$\pi_{\text{user, id\_fotografía}} (s \bowtie t)$

- 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 tables: Product, PC, Laptop, and Printer. The main area displays a query in SQL: `pi maker (sigma (hd <= 100) (Product join Laptop))`. Below the query, there's a green 'ejecutar consulta' button. The execution plan shows a join of Product and Laptop, followed by a selection operation  $\sigma_{hd \leq 100}$ , and finally a projection operation  $\pi_{maker}$ . The SQL text at the bottom is: `pi maker ( sigma ( hd <= 100 ) ( Product x Laptop ) )`. Below this, 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.

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

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

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

The screenshot shows the 'relational algebra calculator 0.19.1' interface. On the left, there's a 'Database System' sidebar with tables: Product, PC, Laptop, and Printer. The main area displays a query in SQL: `pi model, price ((pi model, price (Laptop) union pi model, price (PC) union pi model, price (Printer)) x (sigma maker = 'B' (Product)))`. Below the query, there's a green 'ejecutar consulta' button. The execution plan shows a join of the union of Laptop, PC, and Printer with the selection operation  $\sigma_{maker = 'B'}$  applied to Product. The SQL text at the bottom is: `pi model, price (( pi model, price ( Laptop ) union pi model, price ( PC ) union pi model, price ( Printer ) ) x ( sigma maker = 'B' ( Product ) ) )`. Below this, there's a table header 'Laptop.model Laptop.price' with columns 2007, 1004, 1005, and 1006.

- d)

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



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:  $\pi_{\text{speed}, \text{ram}} \sigma_{\text{speed} \geq 2.8} \text{PC}$ . Below the query, there is a visual representation of the query using relational algebra symbols. The result is a table with 11 rows and 6 columns: PC.model, PC.speed, PC.ram, PC.hd, PC.price, and PC.type. The data is as follows:

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

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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 the same relational algebra calculator interface. The query is now:  $\pi_{\text{maker}} (((\pi_{\text{modelo}} (\sigma_{\text{speed} \geq 2.8} (\text{PC}))) \cup (\pi_{\text{modelo}} (\sigma_{\text{speed} \geq 2.8} (\text{Laptop})))) \bowtie \text{Producto})$ . Below the query, there is a visual representation of the query using relational algebra symbols. The result is a table with 3 rows and 2 columns: Product.maker and Product.type. The data is as follows:

Product.maker	Product.type
B	PC
D	PC
E	PC

Sample Data from Database Systems The Complete Book 2nd Edition Exercise 2.4.1 Page 52-55

- 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:  $\pi \text{ maker } (\sigma \text{ velocidades} \geq 3 \text{ (} \gamma \text{ maker, COUNT(speed) } \rightarrow \text{velocidades (r) } \text{)})$ . Below the query, a flow diagram shows the execution steps:  $\pi \text{ maker}$ ,  $\sigma \text{ velocidades} \geq 3$ ,  $\gamma \text{ maker, COUNT(speed) } \rightarrow \text{velocidades}$ ,  $\pi \text{ maker, speed}$ , and finally  $\pi \text{ maker}$ . The result is shown as a table with columns 'Product' and 'PC'. The SQL equivalent is provided:  $\pi \text{ maker } (\sigma \text{ velocidades} \geq 3 \text{ (} \gamma \text{ maker, COUNT(speed) } \rightarrow \text{velocidades (} \pi \text{ maker, speed (Product } \bowtie \text{ PC))}))$ . The output table 'Product.maker' has columns A, D, and E.

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

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

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

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

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

relational algebra calculator 0.19.1

Database System...

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

Printer

- model number
- color boolean
- type string
- price number

Algebra Relacional

SQL

Editor de Grupo

1.  $\pi$  model, color, type, price (Printer) - ( $\sigma$  type = 'ink-jet' (Printer))

ejecutar consulta

descargar

historia

Diagrama de flujo de la consulta:

```
graph TD
    A[Printer] --> B[" $\sigma$  type = 'ink-jet' (Printer)"]
    B --> C[" $\pi$  model, color, type, price (Printer)"]
```

Printer: model, color, type, price (Printer) - ( $\sigma$  type = 'ink-jet' (Printer))

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)