

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.

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

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

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

$$Q = p \bowtie b$$

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

$$\pi_{\text{user}} * (\text{User} \bowtie t)$$

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

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

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

$$r \bowtie s$$

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

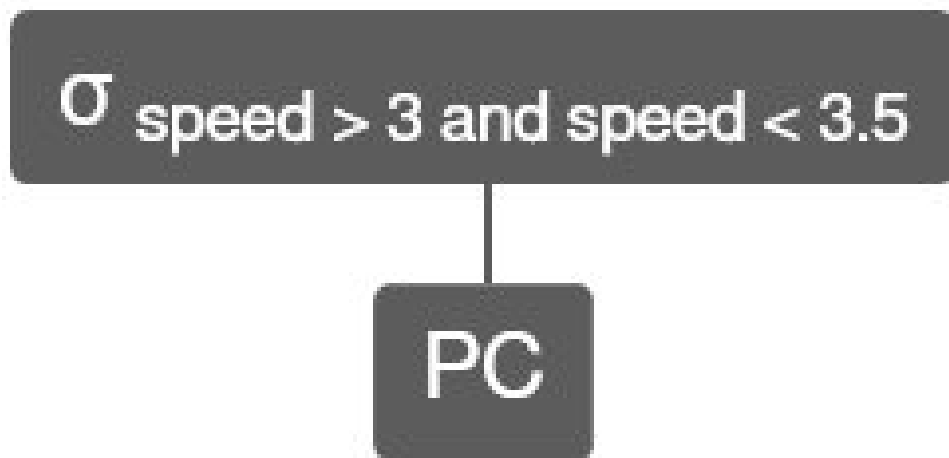
$$s = \pi_{\text{user, id\_fotografía, megustas}} (\text{Subir} \bowtie r)$$

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

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

## Ejercicio 2

- a)  $\sigma_{\text{velocidad} > 3 \wedge \text{velocidad} < 3,5} (\text{PC})$



- b) ¿Qué fabricantes producen computadoras portátiles con un disco duro de menos 100 GB?

Database System: **RelaX - relational algebra calculator 0.19.1**

Algebra Relacional SQL

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

SQL Query:  $\pi$  maker (  $\sigma$  (  $hd \leq 100$  ) (  $Product \Join Laptop$  ) )

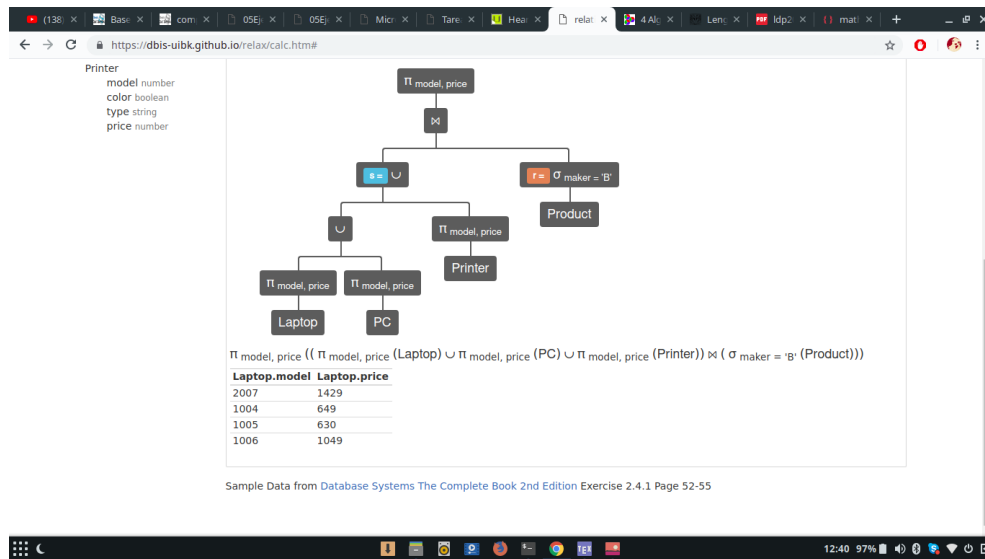
Diagram:  $\pi$  maker (  $\sigma$  (  $hd \leq 100$  ) (  $Product \Join Laptop$  ) )

Result Table:

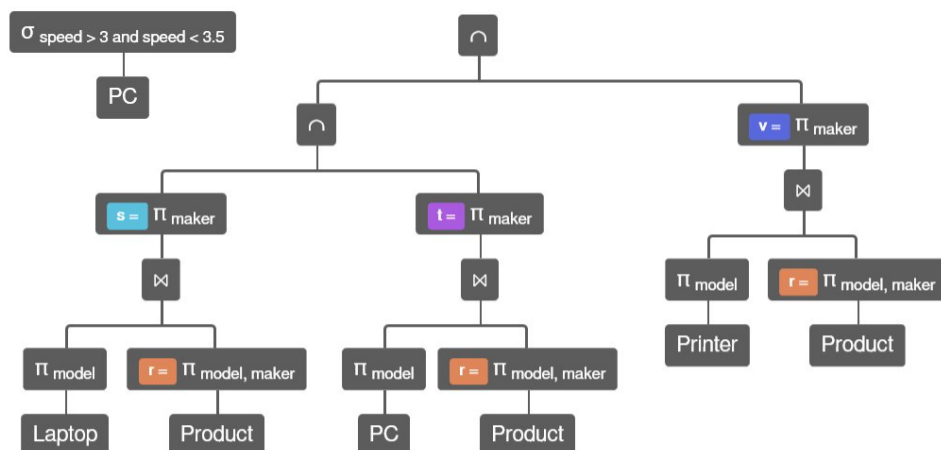
Product.maker
A
E
F

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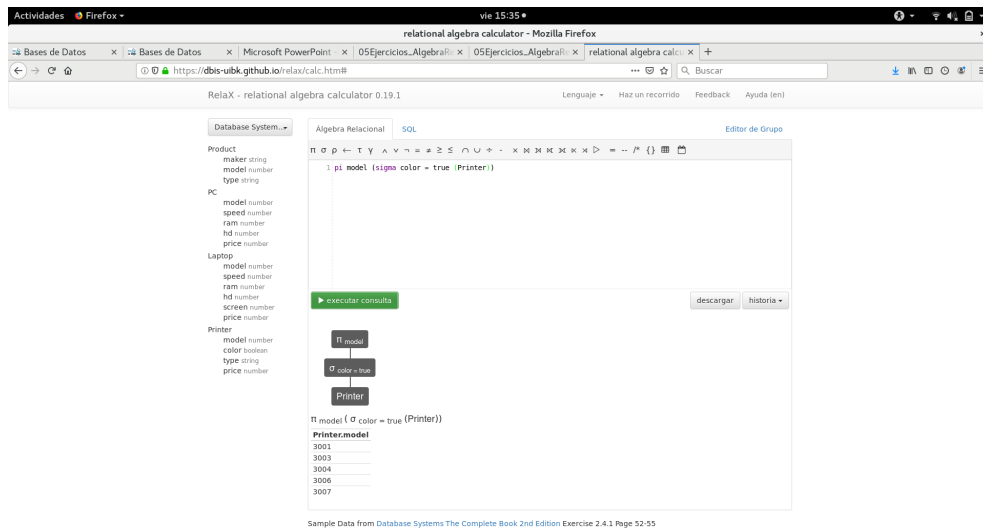
- c) Encontrar el número de modelo y el precio de todos los productos (de cualquier tipo) fabricados por el fabricante B.
- $r = \sigma$  fabricante = 'B' (Producto)
- $s = \pi$  modelo, precio (Laptop)  $\cup \pi$  modelo, precio (PC)  $\cup \pi$  modelo, precio (Impresora)
- $\pi$  modelo, precio ( $s \bowtie r$ )



d)  $r = \pi$  model, maker (Product)  
 $s = \pi$  maker ( $\pi$  model (Laptop)  $\bowtie$   $r$ )  
 $t = \pi$  maker ( $\pi$  model (PC)  $\bowtie$   $r$ )  
 $v = \pi$  maker ( $\pi$  model (Printer)  $\bowtie$   $r$ )  
 $s \cap t \cap v$



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



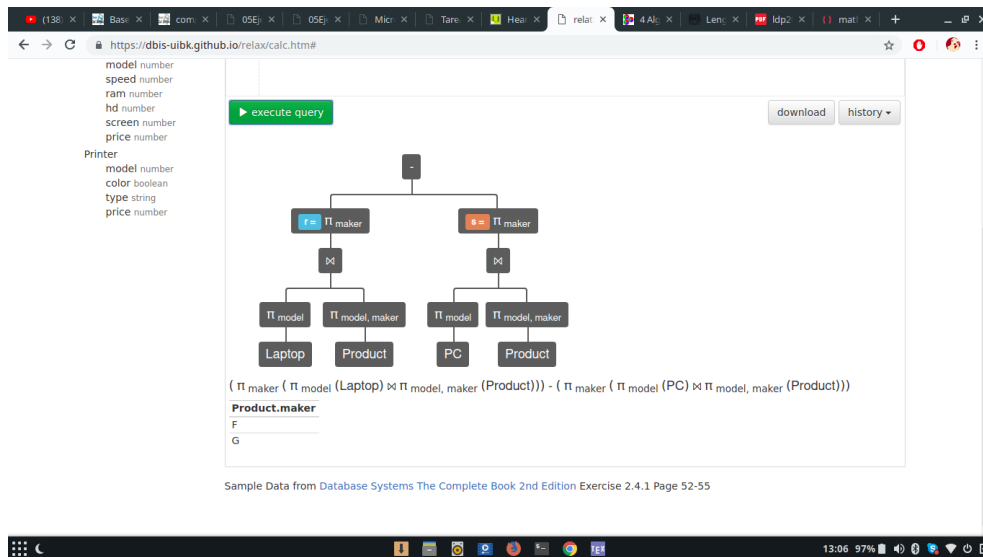
f) Encontrar toda la información de los fabricantes que venden laptops pero no PCs.

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

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

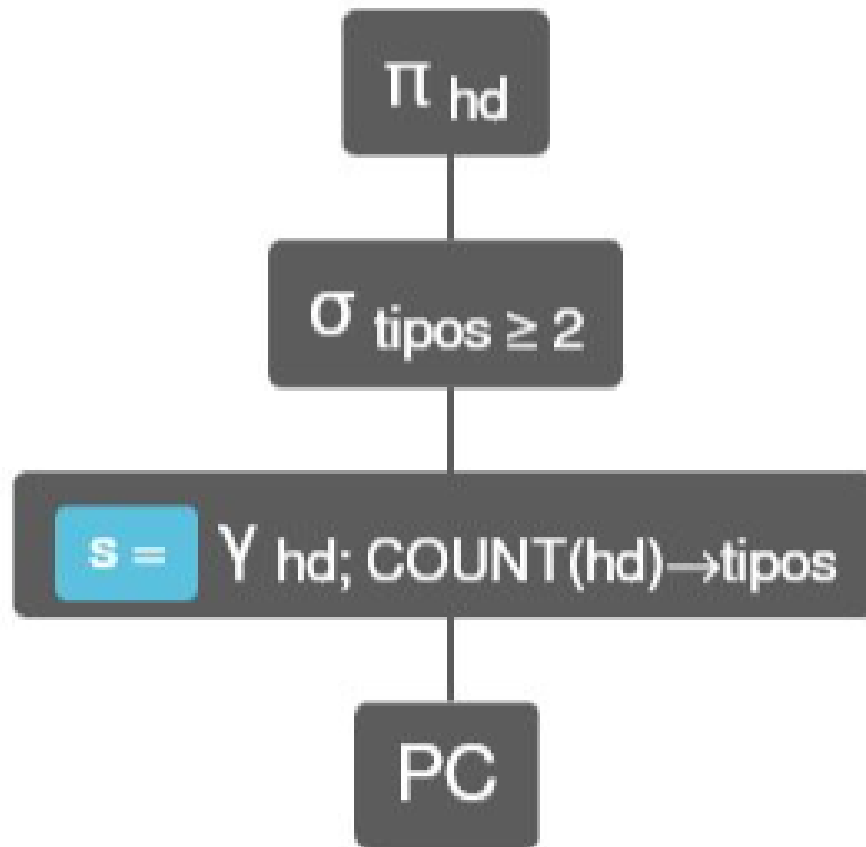
$t = \pi_{\text{fabricante}}(\pi_{\text{modelo}}(\text{PC}) \bowtie r)$

$s - t$



g)  $s = \gamma_{hd} ; \text{count}(hd) \rightarrow \text{tipos (PC)}$

$\pi_{hd}(\sigma_{\text{tipos} \geq 2}(s))$



- 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:  $\pi_{\text{speed, ram}} \sigma_{\text{speed} \geq 2.8} \text{PC}$ . 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: Product, PC, Laptop, and Printer. 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 a web-based relational algebra calculator. On the left, there is a schema definition for three tables: Product, PC, and Printer. The main area displays a query in relational algebra and its execution plan. The query is:

$$\pi_{\text{maker}} (\sigma_{\text{velocidades} \geq 3} (Y \text{ maker, COUNT(speed)} \rightarrow \text{velocidades} ( \pi_{\text{maker, speed}} (\text{Product} \bowtie \text{PC}))))$$

The execution plan shows the following steps:

- $\pi_{\text{maker}}$
- $\sigma_{\text{velocidades} \geq 3}$
- $Y \text{ maker, COUNT(speed)} \rightarrow \text{velocidades}$
- $\pi_{\text{maker, speed}}$
- $\bowtie$
- $\text{Product}$  and  $\text{PC}$

The final result is a table with the following data:

Product.maker
A
D
E

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

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

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

$\pi_{\text{fabricante}} (\sigma_{\text{numproductos} = 3} (s))$

The screenshot shows the same relational algebra calculator interface. The query is:

$$\pi_{\text{maker}} (\sigma_{\text{num\_products} = 3} (Y \text{ maker, COUNT(modelo)} \rightarrow \text{num\_products} ( \pi_{\text{model, maker}} (\text{Product} \bowtie \text{PC}))))$$

The execution plan shows the following steps:

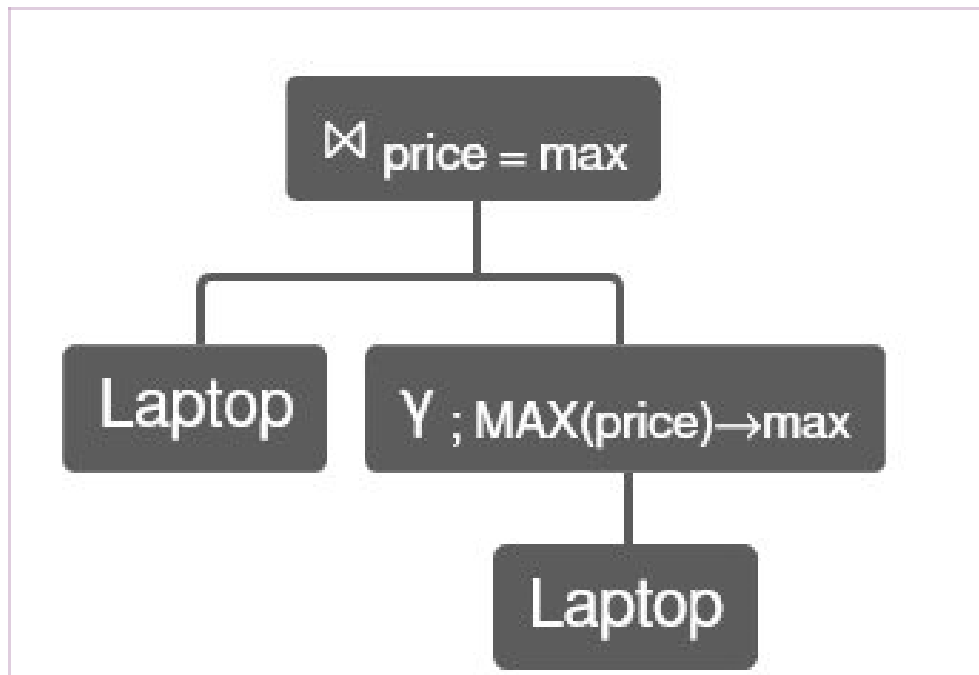
- $\pi_{\text{maker}}$
- $\sigma_{\text{num\_products} = 3}$
- $Y \text{ maker, COUNT(modelo)} \rightarrow \text{num\_products}$
- $\pi_{\text{model, maker}}$
- $\bowtie$
- $\text{Product}$  and  $\text{PC}$

The final result is a table with the following data:

Product.maker
A
B
D
E

- m)  $\text{Laptop} \bowtie \text{price} = \max (\Gamma ; \max(\text{price}) \rightarrow \max (\text{Laptop}))$





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

relational algebra calculator - Mozilla Firefox

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

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

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

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

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

t

The screenshot shows the Relational Algebra Calculator interface. The query being executed is:

$$\pi_{\text{model, speed, ram, hd} * 1.15 \leftarrow \text{new\_hd, screen, price}}(\sigma_{hd < 200}(\pi_{\text{model}}(\sigma_{\text{maker} = 'E'}(\text{Product}) \bowtie \text{Laptop})))$$

The result table shows the following data:

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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p) Borrar las impresoras de inyección de tinta.

The screenshot shows the Relational Algebra Calculator interface. The query being executed is:

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

The result table shows the following data:

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)