

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.

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

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

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

$$Q = p \bowtie b$$

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

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

b)

c)

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

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

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

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

e)

## Ejercicio 2

a)

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

The screenshot shows a web-based relational algebra calculator interface. The browser tabs include 'Bases de Datos', 'Microsoft PowerPoint', and 'relational algebra calculator - Mozilla Firefox'. The address bar shows 'https://dbis-ubk.github.io/relax/calc.html#'. The page title is 'RelaX - relational algebra calculator 0.19.1'. The interface has a sidebar on the left with a 'Database System' dropdown and a list of tables: Product, PC, Laptop, and Printer, each with its attributes. The main area has tabs for 'Algebra Relacional' and 'SQL'. The 'Algebra Relacional' tab is active, showing a query:  $\pi_{\text{maker}} (\sigma_{\text{hd} \leq 100} (\text{Product} \bowtie \text{Laptop}))$ . Below the query is a green 'ejecutar consulta' button. To the right are 'descargar' and 'historia' buttons. Below the query is a visual execution plan diagram showing the join of Product and Laptop tables, followed by a selection operation  $\sigma_{\text{hd} \leq 100}$ , and finally a projection operation  $\pi_{\text{maker}}$ . The final result is shown as a table 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.

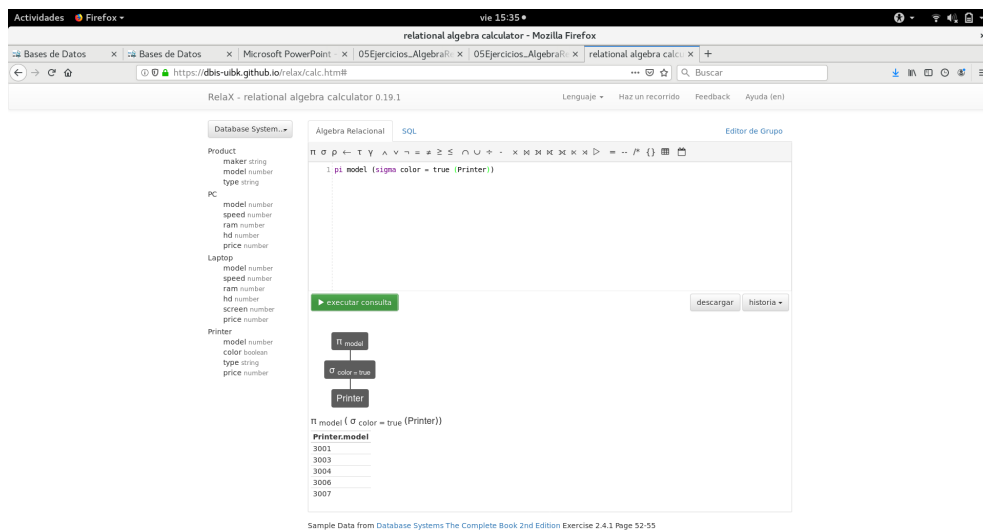
$r = \sigma \text{ fabricante} = 'B'$  (Producto)

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

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

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 the 'relational algebra calculator' interface. On the left, there is a schema definition for a database with tables: Product, PC, Laptop, and Printer. Each table has attributes like model, speed, ram, hd, price, etc. The main area contains 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 execution plan. The result table is displayed below the query plan, showing columns: PCmodel, PCspeed, PCram, PChd, PCprice. The table contains 10 rows of data.

PCmodel	PCspeed	PCram	PChd	PCprice
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

$r = \pi_{\text{modelo}} (\sigma_{\text{velocidad} \geq 2.8} (\text{PC}))$

$s = \pi_{\text{modelo}} (\sigma_{\text{velocidad} \geq 2.8} (\text{Laptop}))$

$\pi_{\text{fabricante}} ((r \cup s) \bowtie \text{Producto})$

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 a database with tables: Product, PC, Laptop, and Printer. Each table has attributes like model, speed, ram, hd, price, etc. The main area contains a query:  $\pi_{\text{maker}} (\sigma_{\text{velocidades} \geq 3} (\gamma_{\text{maker}, \text{COUNT(speed)} \rightarrow \text{velocidades}} (\text{Product} \bowtie \text{PC})))$ . Below the query, there is a visual representation of the query execution plan. The result table is displayed below the query plan, showing columns: Product.maker. The table contains 3 rows of data.

Product.maker
A
D
E

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

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

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

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

m)

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

The screenshot shows a web-based relational algebra calculator. On the left, there is a schema definition for a database with tables: PC, Laptop, and Printer. Each table has attributes like model number, speed, ram, hd, price, etc. The main area contains a query written in relational algebra:

```

1: r = pi maker, model, type (Product)
2: g = gamma maker, type; count(model) -> tipo (r)
3: pi maker, type, tipo g

```

Below the query, there is a visual query plan diagram showing the execution flow from the Product table through aggregation and projection operations. At the bottom, the result of the query is displayed as a table:

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

- 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

o)

- p) Borrar las impresoras de inyección de tinta.

Firefox browser window showing the Relational Algebra Calculator (RelaX) interface. The URL is <https://dbis-ubik.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)