

Bases de datos 2023-1

Tarea 4: Álgebra Relacional

November 7, 2022

1. Cardinalidad de la consulta Considera las siguientes relaciones:

R

A	B
1	x
2	y
2	z
3	x
9	a

S

B	C	D
x	0	3
y	2	1
y	3	3
w	3	0
y	4	2

Para las siguientes expresiones de álgebra relacional completa la tabla con el número de tuplas.

Deberás indicar las tablas resultantes en cada caso.

Expresión	Cardinalidad del resultado
$R \times S$	25
$R \bowtie_{\theta D > A} S$	7
$R =\bowtie S$	7
$R \bowtie = S$	6
$R \bowtie_{\theta A=D} S$	5
$\rho_{C \leftarrow A}(R) \bowtie S$	4
$\Pi_B(R) - \Pi_B(\sigma_{C \geq 3}(S))$	3
$\Pi_A(R) \cap \rho_{A \leftarrow D}(\Pi_D(S))$	3
$\Pi_D(S) \bowtie R$	20
$\gamma_{A; count(B) \rightarrow t}(R =\bowtie = S)$	5

tablas:

- $R \times S$

A	BR	BS	C	D
1	x	x	0	3
1	x	y	2	1
1	x	y	3	3
1	x	w	3	0
1	x	y	4	2
2	y	x	0	3
2	y	y	2	1
2	y	y	3	3
2	y	w	3	0
2	y	y	4	2
2	z	x	0	3
2	z	y	2	1
2	z	y	3	3
2	z	w	3	0
2	z	y	4	2
3	x	x	0	3
3	x	y	2	1
3	x	y	3	3
3	x	w	3	0
3	x	y	4	2
9	a	x	0	3
9	a	y	2	1
9	a	y	3	3
9	a	w	3	0
9	a	y	4	2

- $R \bowtie_{\theta D > A} S$

A	BR	BS	C	D
1	x	x	0	3
1	x	y	3	3
1	x	y	4	2
2	y	x	0	3
2	y	y	3	3
2	z	x	0	3
2	z	y	3	3

- $R =_{\bowtie} S$

A	BR	BS	C	D
1	x	x	0	3
2	y	y	2	1
2	y	y	3	3
2	y	y	4	2
2	z	NULL	NULL	NULL
3	x	x	0	3
9	a	NULL	NULL	NULL

- $R \bowtie S$

A	BR	BS	C	D
1	x	x	0	3
3	x	x	0	3
2	y	y	2	1
2	y	y	3	3
NULL	NULL	w	3	0
2	y	y	4	2

- $R \bowtie_{\theta A=D} S$

A	BR	BS	C	D
1	x	y	2	1
2	y	y	4	2
2	z	y	4	2
3	x	x	0	3
3	x	y	3	3

- $\rho_{C \leftarrow A}(R) \bowtie S$

C	RB	SB	D
2	y	y	1
2	z	y	1
3	x	y	3
3	x	w	0

- $\pi_B(R) - \pi_B(\sigma_{C \geq 3}(S))$

B
x
z
a

- $\Pi_A(R) \cap \rho_{A \leftarrow D}(\Pi_D(S))$

A
1
2
3

- $\Pi_D(S) \bowtie R$

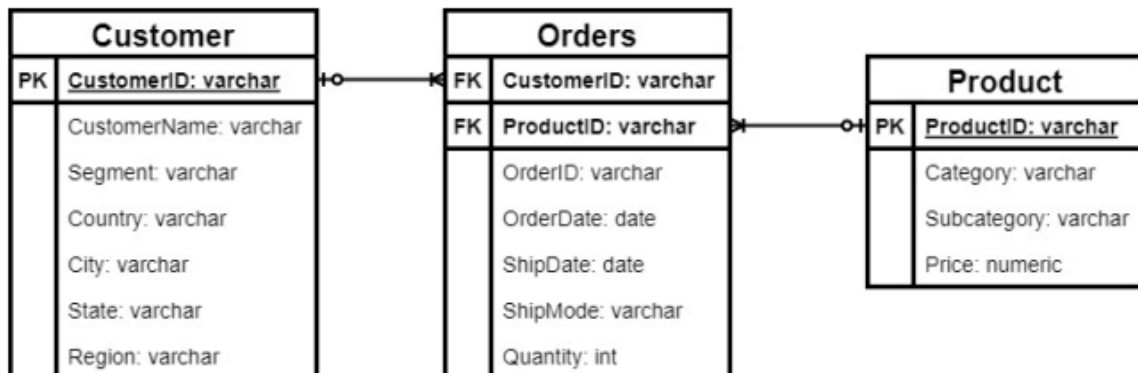
D	A	B
3	1	x
1	1	x
0	1	x
2	1	x
3	2	y
1	2	y
0	2	y
2	2	y
3	2	z
1	2	z
0	2	z
2	2	z
3	3	x
1	3	x
0	3	x
2	3	x
3	9	a
1	9	a
0	9	a
2	9	a

- $\gamma_{A;count(B) \rightarrow t}(R \bowtie S)$

A	T
1	1
2	4
3	1
9	1
NULL	1

2. Tienda de productos en línea.

Tienes el siguiente esquema de una base de datos para una tienda en línea (ID gist: 31074567738afef8c497f6ca89335782)



Escribe una expresión de álgebra relacional para responder las siguientes consultas. Deberás comprobar cada una ellas en la calculadora Relax y agregar para cada inciso la expresión en álgebra relacional y una captura de pantalla con el resultado obtenido (no es necesario mostrar todas las tuplas):

a. Obtener toda la información de los clientes que viven en Seattle o en San Francisco, que pertenezcan al segmento corporate que hayan solicitado una orden en el segundo trimestre de 2014. Mostrar la información ordenada por la cantidad solicitada.

$r = \sigma (\text{city} = \text{'Seattle'} \vee \text{city} = \text{'San Francisco'}) \wedge \text{segment} = \text{'corporate'} (\text{customer})$
 $s = \sigma \text{orderdate} \geq \text{date}(\text{'2014-04-01'}) \wedge \text{orderdate} < \text{date}(\text{'2014-07-01'}) (r \bowtie \text{orders})$
 $\tau \text{ quantity asc } (s)$

customer.customerid	customer.customername	customer.segment	customer.quantity
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La relación es vacía porque no hay un segmento con el nombre 'Corporate'. Suponiendo que se trata del segmento Corporate y de la ciudad de Seattle estos son la consulta y los resultados

$r = \sigma (\text{city} = \text{'Seattle'} \vee \text{city} = \text{'San Francisco'}) \wedge \text{segment} = \text{'Corporate'} (\text{customer})$
 $s = \sigma \text{orderdate} \geq \text{date}(\text{'2014-04-01'}) \wedge \text{orderdate} < \text{date}(\text{'2014-07-01'}) (r \bowtie \text{orders})$
 $\tau \text{ quantity asc } (s)$

customer.customerid	customer.customername	customer.segment	customer.quantity
'KL-16555'	'Kelly Lampkin'	'Corporate'	'Unit: 1000'
'JM-15655'	'Jim Mitchum'	'Corporate'	'Unit: 1000'
'ML-17395'	'Marina Lichtenstein'	'Corporate'	'Unit: 1000'

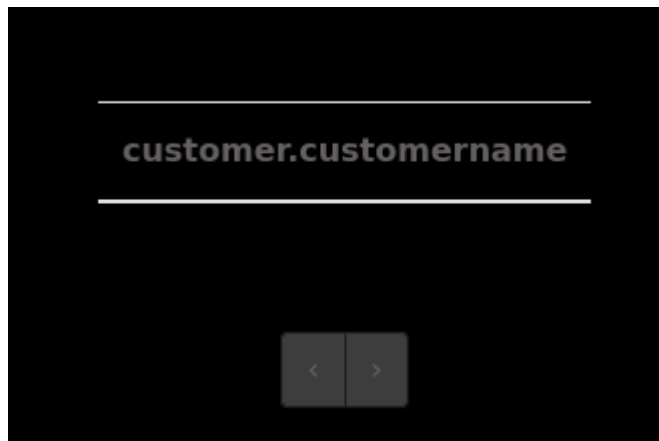
b. Obtener una relación de los productos que pertenecen a la categoría Office Supplies con precio mayor de \$300 y menor de \$600, pero que no hayan sido solicitados en ninguna orden.

$r = \sigma \text{ category} = \text{'Office Supplies'} \wedge \text{price} > 300 \wedge \text{price} < 600 (\text{products})$
 $\sigma \text{orderid} = \text{NULL} (r \bowtie \text{orders})$

products.productid	products.category	products.subcategory	products.price
'OFF-PA-10001593'	'Office Supplies'	'Paper'	563.4
'OFF-PA-10002109'	'Office Supplies'	'Paper'	505.18
'OFF-PA-10003205'	'Office Supplies'	'Paper'	478.48

c. Obtener el nombre de todos los clientes que vivan en la región West y hayan solicitado productos de las categorías Technology o Furniture. El pedido debió de solicitarse en 2106 y el modo de envío debe ser Standard Class.

$r = \sigma \text{region} = \text{'West'} \wedge (\text{category} = \text{'Technology'} \vee \text{category} = \text{'Furniture'}) \wedge$
 $\text{orderdate} \geq \text{date('2106-01-01')} \wedge \text{orderdate} < \text{date('2107-01-01')} \wedge \text{shipmode} = \text{'Standard Class'} (\text{customer} \bowtie \text{orders} \bowtie \text{products})$
 $\pi \text{customername} (r)$



No hay resultados en esta consulta ya que no hay ninguna orden que cumpla ser del año 2106. Si suponemos que la intención era para fechas del 2016 estos son la consulta y los resultados

$r = \sigma \text{region} = \text{'West'} \wedge (\text{category} = \text{'Technology'} \vee \text{category} = \text{'Furniture'}) \wedge$
 $\text{orderdate} \geq \text{date('2016-01-01')} \wedge \text{orderdate} < \text{date('2017-01-01')} \wedge \text{shipmode} = \text{'Standard Class'} (\text{customer} \bowtie \text{orders} \bowtie \text{products})$
 $\pi \text{customername} (r)$

customer.customername
'Brosina Hoffman'
'Zuschuss Donatelli'
'Emily Burns'
'Eric Hoffmann'
'Lena Creighton'
'Jonathan Doherty'
'Nora Paige'
'Chad Sievert'
'Jennifer Braxton'
'Jonathan Howell'

d. Toda la información de los clientes del segmento Corporate que realizaron una orden con modo de envío First Class y que no viven en California.

σ segment='Corporate' \wedge state \neq 'California' \wedge shipmode='First Class' (customer \bowtie orders)

customer.customerid	customer.customername	customer.segment	customer.shipmode
'KB-16585'	'Ken Black'	'Corporate'	'Unit Price'
'KB-16585'	'Ken Black'	'Corporate'	'Unit Price'

e. Obtener el estado y el total de clientes que no han solicitado ninguna orden.

$r = \sigma \text{orderid=NULL (customer} \bowtie \text{orders)}$
 $\gamma \text{ state; count(customerid)} \rightarrow \text{totalClientes (r)}$

customer.state	totalClientes
'California'	5
'Illinois'	1
'Ohio'	3

f. Una lista que muestre la región, el estado y el total de clientes que se tienen, considerando que los clientes deben haber realizado órdenes con al menos 6 productos durante 2014 o 2015. Ordenar la información por región y estado.

$r = \sigma \text{quantity} \geq 6 \wedge \text{orderdate} \geq \text{date('2014-01-01')} \wedge \text{orderdate} < \text{date('2016-01-01')}$
 $(\text{customer} \bowtie \text{orders})$
 $\gamma \text{ region, state; count(customerid)} \rightarrow \text{totalClientes (r)}$

customer.region	customer.state	totalClientes
'West'	'California'	101
'West'	'Washington'	23
'Central'	'Texas'	38

g. Obtener el modo de envío y categoría que más productos ha vendido.

$\tau \text{ totsales desc } (\gamma \text{ shipmode, category; sum(quantity)} \rightarrow \text{totsales (orders} \bowtie \text{products)})$

orders.shipmode	products.category	totsales
'Standard Class'	'Office Supplies'	8278

h. Una lista con la venta promedio, venta total, mayor venta, menor venta, y total de órdenes, por región, estado y ciudad. La venta promedio debe estar entre \$900 y \$1,500.

-- Relación auxiliar

ventaTotalPorOrden = γ region, state, city, orderid; sum(price) → ventatotalorden
(customer⋈orders⋈products)

ventaTotal = γ region, state, city; sum(ventatotalorden) → ventaTotal (ventaTotalPorOrden)

prom = γ region, state, city; avg(ventatotalorden) → prom (ventaTotalPorOrden)

max = γ region, state, city; max(ventatotalorden) → max (ventaTotalPorOrden)

min = γ region, state, city; min(ventatotalorden) → min (ventaTotalPorOrden)

totalOrdenes = γ region, state, city; count(orderid) → totalOrdenes (customer⋈orders)

σ prom>900 ∧ prom<1500 (prom⋈ventaTotal⋈max⋈min⋈totalOrdenes)

customer.region	customer.state	customer.city	prom
'South'	'Florida'	'Fort Lauderdale'	1485.4366666666667
'Central'	'Texas'	'Richardson'	1127.01
'East'	'New York'	'Troy'	1041.8585714285714

prom	ventaTotal	max	min	totalOrdenes
1485.4366666666667	4456.31	3005.47	470.89	10
1127.01	1127.01	1127.01	1127.01	2
1041.8585714285714	7293.01	4060.19	93.98	29

i. El estado que ha realizado la menor cantidad de órdenes. Se debe mostrar también el total de ordenes que haya entregado.

r = γ state; count(orderid) → totalOrdenes (customer⋈orders)

τ totalOrdenes asc (r)

customer.state	totalOrdenes
'District of Columbia'	4

j. La información del cliente que más órdenes haya efectuado. Mostrar el número de órdenes que ha realizado.

r = γ customerid; count(orderid) \rightarrow totalOrdenes (customer \bowtie orders)
 τ totalOrdenes desc (r \bowtie customer)

customer.customerid	totalOrdenes	customer.customername	customer.se
'BM-11650'	28	'Brian Moss'	'Corpora

Operaciones de mantenimiento de datos

- a. Borrar toda la información del cliente **Paul Stevenson**

Consulta: $Customer1 = Customer - \sigma_{CustomerName='PaulStevenson'}(Customer)$

customer - $\sigma_{customername = 'Paul Stevenson'}(customer)$						
customer.customerid	customer.customername	customer.segment	customer.country	customer.city	customer.state	customer.postalcode
CG-12520	Claire Gute	Consumer	United States	Henderson	Kentucky	42420
DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	California	90036
SO-20335	Sean ODonnell	Consumer	United States	Fort Lauderdale	Florida	33311
BH-11710	Brosina Hoffman	Consumer	United States	Los Angeles	California	90032
AA-10480	Andrew Allen	Consumer	United States	Concord	North Carolina	28027
IM-15070	Irene Maddox	Consumer	United States	Seattle	Washington	98103
HP-14815	Harold Pawlan	Home Office	United States	Fort Worth	Texas	76106
PK-19075	Pete Kriz	Consumer	United States	Madison	Wisconsin	53711
AG-10270	Alejandro Grove	Consumer	United States	West Jordan	Utah	84084
ZD-21925	Zuschuss Donatelli	Consumer	United States	San Francisco	California	94109
KB-16585	Ken Black	Corporate	United States	Fremont	Nebraska	68025
SF-20065	Sandra Flanagan	Consumer	United States	Philadelphia	Pennsylvania	19140
EB-13870	Emily Burns	Consumer	United States	Orem	Utah	84057
EH-13945	Eric Hoffmann	Consumer	United States	Los Angeles	California	90049
TB-21520	Tracy Blumstein	Consumer	United States	Philadelphia	Pennsylvania	19140
MA-17560	Matt Abelman	Home Office	United States	Houston	Texas	77095
GH-14485	Gene Hale	Corporate	United States	Richardson	Texas	75080
SN-20710	Steve Nguyen	Home Office	United States	Houston	Texas	77041
LC-16930	Linda Cazamias	Corporate	United States	Naperville	Illinois	60540
RA-19885	Ruben Ausman	Corporate	United States	Los Angeles	California	90049
ES-14080	Erin Smith	Corporate	United States	Melbourne	Florida	32935
ON-18715	Odella Nelson	Corporate	United States	Eagan	Minnesota	55122
PO-18865	Patrick ODonnell	Consumer	United States	Westland	Michigan	48185
LH-16900	Lena Hernandez	Consumer	United States	Dover	Delaware	19901
DP-13000	Darren Powers	Consumer	United States	New Albany	Indiana	47150

- b. Borrar todas las ordenes de la ciudad de **Utah** que tengan artículos de la subcategoría **Tables**.

Consulta:

$A = \pi_{CustomerID}(\sigma_{State='Utah'}(Customer))$

$B = \pi_{ProductID}(\sigma_{Subcategory='Tables'}(Products))$

$Orders1 = Orders - (Orders \bowtie A \bowtie B)$

orders - orders $\bowtie (\pi_{customerid}(\sigma_{state='Utah'}(customer))) \bowtie (\pi_{productid}(\sigma_{subcategory='Tables'}(products)))$						
orders.orderid	orders.orderdate	orders.shipdate	orders.shipmode	orders.customerid	orders.productid	orders.quantity
CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	FUR-BO-10001798	2
CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	FUR-CH-10000454	3
CA-2016-138688	2016-06-12	2016-06-16	Second Class	DV-13045	OFF-LA-10000240	2
US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	FUR-TA-10000577	5
US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	OFF-ST-10000760	2
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	FUR-FU-10001487	7
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	OFF-AR-10002833	4
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	TEC-PH-10002275	6
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	OFF-BI-10003910	3
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	OFF-AP-10002892	5
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	FUR-TA-10001539	9
CA-2014-115812	2014-06-09	2014-06-14	Standard Class	BH-11710	TEC-PH-10002033	4
CA-2017-114412	2017-04-15	2017-04-20	Standard Class	AA-10480	OFF-PA-10002365	3
CA-2016-161389	2016-12-05	2016-12-10	Standard Class	IM-15070	OFF-BI-10003656	3
US-2015-118983	2015-11-22	2015-11-26	Standard Class	HP-14815	OFF-AP-10002311	5
US-2015-118983	2015-11-22	2015-11-26	Standard Class	HP-14815	OFF-BI-10000756	3
CA-2014-105893	2014-11-11	2014-11-18	Standard Class	PK-19075	OFF-ST-10004186	6
CA-2014-167164	2014-05-13	2014-05-15	Second Class	AG-10270	OFF-ST-10000107	2
CA-2014-143336	2014-08-27	2014-09-01	Second Class	ZD-21925	OFF-AR-10003056	2
CA-2014-143336	2014-08-27	2014-09-01	Second Class	ZD-21925	TEC-PH-10001949	3
CA-2014-143336	2014-08-27	2014-09-01	Second Class	ZD-21925	OFF-BI-10002215	4
CA-2016-137330	2016-12-09	2016-12-13	Standard Class	KB-16585	OFF-AR-10000246	7
CA-2016-137330	2016-12-09	2016-12-13	Standard Class	KB-16585	OFF-AP-10001492	7
US-2017-156909	2017-07-16	2017-07-18	Second Class	SF-20065	FUR-CH-10002774	2
CA-2016-121755	2016-01-16	2016-01-20	Second Class	EH-13945	OFF-BI-10001634	2
CA-2016-121755	2016-01-16	2016-01-20	Second Class	EH-13945	TEC-AR-10003077	3

- c. La clienta **Lena Cacioppo** compró un producto de cada subcategoría de **Furniture**. Deberás elegir los productos que desees e indicar como parte de esta consulta, la información que se agregará en cada caso.

Elegimos un producto de cada categoría al azar y obtuvimos su id. Luego construimos una relación en línea (juntándola con la id de la clienta) y la unimos a Orders.

Información agregada: (Orders)

OrderID	OrderDate	ShipDate	ShipMode	CustomerID	ProductID	Quantity
'US-2022-000001'	2022-11-06	2022-11-08	First Class	LC-16870	FUR-BO-10001798	3
'US-2022-000002'	2022-11-06	2022-11-08	First Class	LC-16870	OFF-LA-10000240	3
'US-2022-000003'	2022-11-06	2022-11-08	First Class	LC-16870	TEC-PH-10001949	3

La consulta quedo:

```

products
productid string
category string
subcategory string
price number
customer
customerid string
customername string
segment string
country string
city string
state string
postalcode string
region string

8 L = π customerid (σ customername='Lena Cacioppo' customer)
9 chase = {orderdate:date, shipdate:date, shipmode:string
10 2022-11-06, 2022-11-08, 'First Class'} × L
11 cfurniture = {orderid:string
12 'US-2022-000001'} × chase × {productid:string, quantity:number
13 'FUR-BO-10001798', 3}
14 coffice = {orderid:string
15 'US-2022-000002'} × chase × {productid:string, quantity:number
16 'OFF-LA-10000240', 3}
17 ctech = {orderid:string
18 'US-2022-000003'} × chase × {productid:string, quantity:number
19 'TEC-PH-10001949', 3}
20 orders2 = orders1 ∪ cfurniture ∪ coffice ∪ ctech
21 orders2

(orders - orders2) ⋈ (π customerid (σ state='Utah' customer)) ⋈ (π productid (σ subcategory='Tables' products)) ∪
(inlineRelation2 × (inlineRelation1 × (π customerid (σ customername='Lena Cacioppo' customer))) × inlineRelation3) ∪
(inlineRelation4 × (inlineRelation1 × (π customerid (σ customername='Lena Cacioppo' customer))) × inlineRelation5) ∪
(inlineRelation6 × (inlineRelation1 × (π customerid (σ customername='Lena Cacioppo' customer))) × inlineRelation7)

orders.orderid orders.orderdate orders.shipdate orders.shipmode orders.customerid orders.productid orders.quantity
CA-2016-152156 2016-11-08 2016-11-11 Second Class CG-12520 FUR-BO-10001798 2
CA-2016-152156 2016-11-08 2016-11-11 Second Class CG-12520 FUR-CH-10000454 3
CA-2016-138688 2016-06-12 2016-06-16 Second Class DV-13045 OFF-LA-10000240 2
US-2015-108966 2015-10-11 2015-10-18 Standard Class SO-20335 FUR-TA-10000577 5
US-2015-108966 2015-10-11 2015-10-18 Standard Class SO-20335 OFF-ST-10000760 2
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 FUR-FU-10001487 7
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 OFF-AR-10002833 4
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 TEC-PH-10002275 6
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 OFF-BI-10003910 3
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 OFF-AP-10002892 5
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 FUR-TA-10001539 9
CA-2014-115812 2014-06-09 2014-06-14 Standard Class BH-11710 TEC-PH-10002033 4
CA-2017-114412 2017-04-15 2017-04-20 Standard Class AA-10480 OFF-PA-10002365 3
CA-2016-161389 2016-12-05 2016-12-10 Standard Class IM-15070 OFF-BI-10003656 3
US-2015-118983 2015-11-22 2015-11-26 Standard Class HP-14815 OFF-AP-10002311 5
US-2015-118983 2015-11-22 2015-11-26 Standard Class HP-14815 OFF-BI-10000756 3
CA-2014-105893 2014-11-11 2014-11-18 Standard Class PK-19075 OFF-ST-10004186 6
CA-2014-167164 2014-05-13 2014-05-15 Second Class AG-10270 OFF-ST-10000107 2
CA-2014-143336 2014-08-27 2014-09-01 Second Class ZD-21925 OFF-AR-10003056 2
CA-2014-143336 2014-08-27 2014-09-01 Second Class ZD-21925 TEC-PH-10001949 3
CA-2014-143336 2014-08-27 2014-09-01 Second Class ZD-21925 OFF-BI-10003910 3

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- d. Aumentar los precios de productos de la subcategoría Phones en un 8%.

Consulta:

$$A = \sigma_{Subcategory='Phones'}(Products)$$

$$U = \pi_{ProductID, Category, Subcategory, price \leftarrow price * 1.08} A$$

$$Products = (Products - A) \cup U$$

```

(products - (σ subcategory='Phones' (products))) ∪ (π productid, category, subcategory, price * 1.08 → price (σ subcategory='Phones'
(products)))

products.productid products.category products.subcategory products.price
FUR-BO-10001798 Furniture Bookcases 261.96
FUR-CH-10000454 Furniture Chairs 731.94
OFF-LA-10000240 Office Supplies Labels 14.62
FUR-TA-10000577 Furniture Tables 957.58
OFF-ST-10000760 Office Supplies Storage 22.37
FUR-FU-10001487 Furniture Furnishings 48.86
OFF-AR-10002833 Office Supplies Art 7.28
OFF-BI-10003910 Office Supplies Binders 18.5
OFF-AP-10002892 Office Supplies Appliances 114.9
FUR-TA-10001539 Furniture Tables 1706.18
OFF-PA-10002365 Office Supplies Paper 15.55
OFF-BI-10003656 Office Supplies Binders 407.98
OFF-AP-10002311 Office Supplies Appliances 68.81
OFF-BI-10000756 Office Supplies Binders 2.54
OFF-ST-10004186 Office Supplies Storage 665.88
OFF-ST-10000107 Office Supplies Storage 55.5
OFF-AR-10003056 Office Supplies Art 8.56
OFF-BI-10002215 Office Supplies Binders 22.72
OFF-AR-10000246 Office Supplies Art 19.46
OFF-AP-10001492 Office Supplies Appliances 60.34
FUR-CH-10002774 Furniture Chairs 71.37
OFF-BI-10001634 Office Supplies Binders 1044.63
TEC-AC-10003027 Technology Accessories 11.65

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- e. Disminuir 8% los precios de los productos de la categoría **Furniture** cuyo precio sea de \$600 a \$900. Aumentar en un 5% los precios de los productos de la categoría **Technology** y subcategoría **Machines**.

orders

orderdate string

shipmode string

productid string

quantity number

products

productid string

category string

subcategory string

price number

customer

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1 A = σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)
2 AA = π productid, category, subcategory, price<- price* 0.92 (A)
3 products1 = (products - A) ∪ AA
4 B = σ category = 'Technology' and subcategory = 'Machines' (products1)
5 BB = π productid, category, subcategory, price<- price* 1.05 (B)
6 products2 = (products1 - B) ∪ BB
7 products2

```

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(((products - (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)))) ∪ (π productid, category, subcategory, price * 0.92→price (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)))) - (σ category = 'Technology' and subcategory = 'Machines' (((products - (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)))) ∪ (π productid, category, subcategory, price * 0.92→price (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products))))) ∪ (π productid, category, subcategory, price * 1.05→price (σ category = 'Technology' and subcategory = 'Machines' (products - (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)))) ∪ (π productid, category, subcategory, price * 0.92→price (σ subcategory = 'Furniture' and price ≥ 600 and price ≤ 900 (products)))))

```

products.productid	products.category	products.subcategory	products.price
FUR-BO-10001798	Furniture	Bookcases	261.96
FUR-CH-10000454	Furniture	Chairs	731.94
OFF-LA-10000240	Office Supplies	Labels	14.62
FUR-TA-10000577	Furniture	Tables	957.58
OFF-ST-10000760	Office Supplies	Storage	22.37
FUR-FU-10001487	Furniture	Furnishings	48.86
OFF-AR-10002833	Office Supplies	Art	7.28
TEC-PH-10002275	Technology	Phones	907.15
OFF-BI-10003910	Office Supplies	Binders	18.5
OFF-AP-10002892	Office Supplies	Appliances	114.9
FUR-TA-10001539	Furniture	Tables	1706.18
TEC-PH-10002033	Technology	Phones	911.42
OFF-PA-10002365	Office Supplies	Paper	15.55
OFF-BI-10003656	Office Supplies	Binders	407.98
OFF-AP-10002311	Office Supplies	Appliances	68.81
OFF-BI-10000756	Office Supplies	Binders	2.54
OFF-ST-10004186	Office Supplies	Storage	665.88
OFF-ST-10000107	Office Supplies	Storage	55.5
OFF-AR-10003056	Office Supplies	Art	8.56
TEC-PH-10001949	Technology	Phones	213.48