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Lab1: Algebraic query language

We have the database consist of 5 relations:

Product (<u>ProductCode</u>, Name, PurchasePrice, SellPrice, Type, SupplierCode)

Supplier (<u>SupplierCode</u>, SupplierName, Address)

Employee (<u>EmloyeeID</u>, FullName, Gender, BirthDate, Address)

Invoice (<u>InvoiceID</u>, SellDate, EmployeeID)

InvoiceLine(<u>ProductCode, InvoiceID,</u> Quantity)

EXERCISE 1: WRITE EXPRESSIONS OF RELATIONAL ALGEBRA TO ANSWER THE FOLLOWING QUERIES:

a. Find name and sell price of televisions supplied by Samsung.

$$R1 := \pi_{SupplierCode}\left(¿¿ SupplierName ¿ {}' Samsun g {}'\overset{\sigma}{(Supplier)}\right)$$

$$R2 := \pi_{Name, SellPrice}\left(\sigma_{(Type ¿ {}' Television s {}')}\left(R1 \bowtie Product\right)\right)$$

b. Find name and address of all suppliers who supply television product.

$$R1 := \pi_{SupplierCode}\left(¿¿ Type ¿ {}' Television s {}'\overset{\sigma}{(Product)}\right)$$

$$R2 := \pi_{(SupplierName, Address)}\left(R1 \bowtie SupplierCode\right)$$

c. Find name of all employee who were born in 1983.

$$R1 := \pi_{FullName}\left(¿¿ BirthDate \geq {}' 01/01/1983 {}' \wedge BirthDate \leq {}' 31/12/1983 {}'\overset{\sigma}{(Employee)}\right)$$

d. Find name and type of all products sold in '23/05/2018'.

$$R1 := \pi_{ProductCode}\left(¿¿ SellDate ¿ {}' 23/05/2018 {}'\overset{\sigma}{(Invote \bowtie InvoiceLine)}\right)$$

$$R2 := \pi_{Name, Type}\left(R1 \bowtie Product\right)$$

e. Find name of female employees who sold televisions.

$$R1 := \pi_{FullName}\left(\sigma_{Gender = 'Female' \wedge Type = 'Television's}\left(Product \bowtie InvoiceLine \bowtie Invoice \bowtie Employee\right)\right)$$

f. Find name and address of suppliers who supply both television and mobile.

$$R1 := \pi_{SupplierCode, Type}\left(\sigma_{Type = 'Television's}\left(Product\right)\right)$$

$$R2 := \pi_{SupplierCode, Type}\left(\sigma_{Type = 'Mobile'}\left(Product\right)\right)$$

$$R3 := \pi_{R1.SupplierCode}\left(R1_{(R1.SupplierCode = R2.SupplierCode \wedge R1.Type \neq R2.Type)} \bowtie R2\right)$$

$$R4 := \rho_{R4(SupplierCode)}(R3)$$

$$R5 := \pi_{SupplierName, Address}\left(R4 \bowtie Supplier\right)$$

g. List name and price of all product sold by employee "Nguyễn Văn A" in April 2018.

$$R1 := \pi_{EmployeeID}\left(\sigma_{FullName = 'Nguyễn Văn A'}\left(Employee\right)\right)$$

$$R2 := \pi_{InvoiceID}\left(\sigma_{SellDate \geq '01/08/2018' \wedge SellDate \leq '31/08/2018'}\left(Invoice \bowtie R1\right)\right)$$

$$R3 := \pi_{ProductCode}\left(R2 \bowtie InvoiceLine\right)$$

$$R4 := \pi_{Name, SellPrice}\left(R3 \bowtie Product\right)$$

h. Find name and price of all mobile products of Samsung sold in April 2018.

$$R1 := \pi_{ProductCode}\left(\sigma_{SellDate \geq '01/08/2018' \wedge SellDate \leq '31/08/2018'}\left(Invoice \bowtie InvoiceLine\right)\right)$$

$$R2 := \pi_{SupplierCode}\left(\sigma_{SupplierName = 'Samsung'}\left(R1 \bowtie Supplier \bowtie Product\right)\right)$$

$$R3 := \pi_{Name, SellPrice}\left(\overset{\sigma}{\overset{}{¿¿ \, Type \, ¿' \, Mobile'}}\left(R2 \bowtie Product\right)\right)$$

i. Find the product with highest SellPrice.

$$R1 := \pi_{Name, SellPrice}\left(Product\right)$$

$$R2 := \rho_{R2(Name2, SellPrice2)}\left(R1\right)$$

$$R3 := \pi_{Name, SellPrice}\left(R1 \bowtie_{¿¿(sellPrice < sellPrice2)} R2\right)$$

$$R4 := \pi_{Name, SellPrice}\left(R1 - R3\right)$$

j. Find the amount (quantity * sellPrice) of each invoice line of product sold in 30/04/2018.

$$R1 := \sigma_{SellDate \, ¿ \, '30/04/2018'}\left(Invoice \bowtie InvoiceLine\right)$$

$$R2 := \pi_{InvoiceID, \, Amount = Quantity * SellPrice}\left(R1 \bowtie Product\right) ¿$$

EXERCISE 2: USE RELATIONAL ALGEBRA TO EXPRESS FOLLOWING CONSTRAINTS:

a. The sell price must be higher than the purchase price.

$$\sigma_{SellPrice < PurchasePrice}\left(Product\right) = \varnothing$$

b. A product of Samsung must be television, mobile or tablet.

$$\sigma_{(Type \neq 'Televisions' \wedge Type \neq 'Mobile' \wedge Type \neq 'Tablet')}\left(Product \bowtie\left(\overset{\sigma_{SupplierName \, ¿ \, 'Samsung'}(Supplier)}{¿}\right)\right) = \varnothing ¿$$

c. No supplier of mobile's or tablet's may also supply food.

$$\pi_{SupplierName}\left(\sigma_{Type \, ¿ \, 'Mobile' \wedge Type \, ¿ \, 'Table'}\left(Supplier \bowtie Product\right)\right) \cap \pi_{SupplierName}\left(\sigma_{Type \, ¿ \, 'Food'}\left(Supplier \bowtie Product\right)\right) = \varnothing$$

d. No product may appear more than one time in an invoice.

$$R1 := \rho_{IvoiceLine1(ProductCode, InvoiceID, Quantity)}\left(InvoiceLine\right)$$

$$R2 := \rho_{IvoiceLine2(ProductCode, InvoiceID, Quantity)}\left(InvoiceLine\right)$$

$$\sigma_{InvoiceLine1.ProductCode = InvoiceLine2.ProductCode \wedge InvoiceLine1.InvoiceID \neq InvoiceLine2.InvoiceID}\left(R1 \times R2\right) = \varnothing$$

e. The quantity of each product in each invoice should be greater than 0.

$$\sigma_{Quantity \leq 0}(InvoiceLine) = \varnothing$$

f. There is no invoice without product.

$$\pi_{InvoiceID}(Invoice) - \pi_{InvoiceID}(Invoice\ Line) = \varnothing$$

g. If purchase price is less than 500.000 VND, the sell price could not be greater than 9.000.000 VND.

$$\sigma_{PurchasePrice < 500000 \wedge SellPrice > 9000000}(Product) = \varnothing$$

h. The sell price could not be greater than 2 times the purchase price.

$$\sigma_{SellPrice > 2*PurchasePrice}(Product) = \varnothing$$

i. The gender of an employee should be "Nam" or "Nữ".

$$\sigma_{Gender \neq 'Nam' \wedge Gender \neq 'Nữ'}(Employee) = \varnothing$$

j. With the same purchase price, the sell price of two products could not have the difference more than 0.5 times of the purchase price.

$$R1 := \rho_{Product1(ProductCode, Name, PurchasePrice, SellPrice, Type, SupplierCode)}(Product)$$

$$R2 := \rho_{Product2(ProductCode, Name, PurchasePrice, SellPrice, Type, SupplierCode)}(Product)$$

$$\sigma_{Product1.ProductCode \neq Product2.ProductCode \wedge Product1.PurchasePrice = Product2.PurchasePrice \wedge \dot{\iota} (Product1.SellPrice > \frac{1}{2} Product1.PurchasePrice \vee \dot{\iota} Product1.SellPrice < \frac{1}{2} Product}$$