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CS157A
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Hw1

Q1 [1.5 pts]: How many different ways (considering orders os tuples and attributes) are there to represent a relation instance if that instance has [1.5 pts]:

- **Three attributes and three tuples?**

The three tuples can be ordered in any 3! Ways = 6 ways
The three attributes can be ordered in any 3! Ways = 6 ways
6 x 6 = 36 ways

- **Four attributes and five tuples?**

The five tuples can be ordered in any 5! Ways = 120 ways
The four attributes can be ordered in any 4! Ways = 24 ways
120 x 24 = 2880 ways

- **N attributes and m tuples?**

The m tuples can be ordered in any m! ways
The N attributes can be ordered in any N! Ways
m! x N!

Q2: Write expressions of relational algebra to answer the following queries [1.5 pts]:

a) What PC models have a speed of at least 3.00?

$\pi_{model}(\sigma_{speed \geq 3.00}(PC))$

Models
1005

1006
1013

b) Which manufacturers make laptops with a hard disk of at least 100 GB?

$\pi_{maker}(Product \bowtie \sigma_{hd \geq 100}(Laptop))$

Makers
E
A
B
F
G

c) Find the model number and price of all products (of any type) made by manufacturer B?

$\pi_{model,price}(\sigma_{maker=B}(Product \bowtie PC)) \cup \pi_{model,price}(\sigma_{maker=B}(Product \bowtie Laptop)) \cup \pi_{model,price}(\sigma_{maker=B}(Product \bowtie Laptop))$

Model	Price
1004	649
1005	630
1006	1049
2007	1429

d) Find the model numbers of all color laser printers?

$\pi_{model}(\sigma_{type=laser \wedge color=true}(Printer))$

Model
3003
3007

e) Find those manufacturers that sells laptops but not PC's?

$\pi_{maker}(\sigma_{type=Laptop}(Product)) - \pi_{maker}(\sigma_{type=PC}(Product))$

Maker
F
G

f) Find those hard disk sizes that occur in two or more PC's?

$\pi_{hd}(\rho_{PC1}(PC) \bowtie_{PC1.hd=PC2.hd \text{ AND } PC1.model<>PC2.model} \rho_{PC2}(PC))$

Hd
250
80
160

Q3 [2 pts]: For the above schema <product, PC, Laptop, Printer> tables, express the following constraints. Also, for the data samples given above, indicate any violations to your constraints [2 pts]:

a) A PC with a processor speed < 2.00 must not sell for more than $500?

$\sigma_{speed<2.00 \wedge price>500}(PC) = \varnothing$

Model
1011

Model 1011 of the query above violates this constraint

b)A laptop with a screen size < 15.4" must have at least a 100 GB Hard Disk or sell for less than $1,000?

$\sigma_{screen<1.5 \wedge hd<100 \wedge price\geq1000}(PC) = \varnothing$

Model
2004

Model 2004 of the query above violates this constraint

c) No manufacturer of PC's may also make laptops?

$\pi_{maker}(Product \bowtie PC) \cap \pi_{maker}(Product \bowtie Laptop) = \varnothing$

Makers
A
B

E

Makers A, B, and E of the query above violate this constraint

d) A manufacturer of a PC must also make a laptop with at least as great a processor speed?

R1(maker, model, speed) := $\pi_{maker,model,speed}$(Product PC)

R2(maker, speed) := $\pi_{maker,speed}$(Product Laptop)

R3(model) := π_{model}(R1 $_{R1.maker = R2.maker \text{ AND } R1.speed \leq R2.speed}$ R2)

R4(model) := π_{model}(PC)

R4 $\subseteq$ R3

Models
B
C
D

Models B, C, and D of the query above violate this constraint