COP 4710: Database Systems
Fall 2013

Chapter 4 – In Class Exercises (Part 1)

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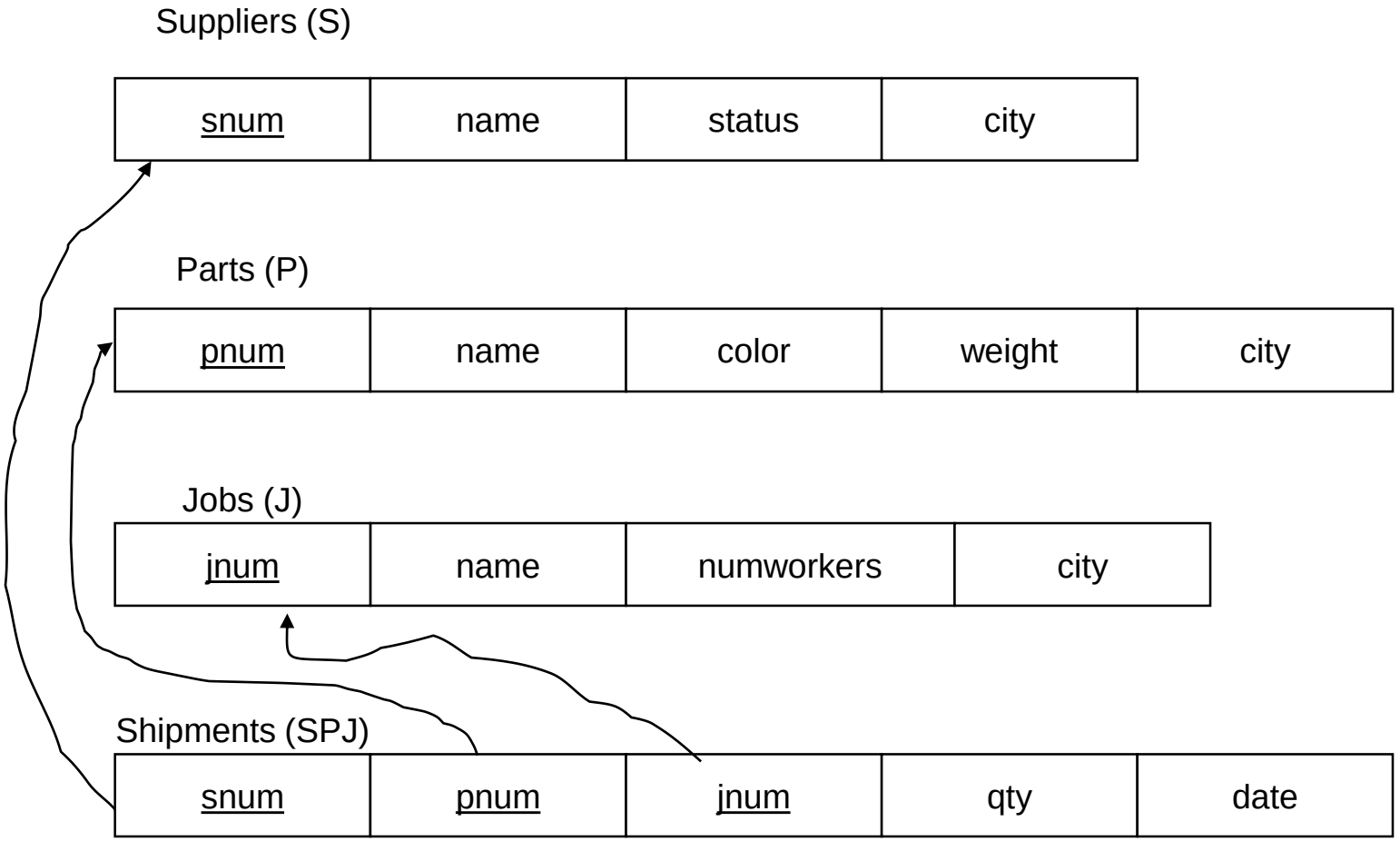
Chapter 4 In Class Exercises



- Use the database scheme on the previous page for the problems in this exercise.
- Develop relational algebra query expressions, using **only** the five fundamental operators, for each of the following queries:

1. List the parts that are either blue or weigh more than 20.

Solution#1: $\sigma_{(color="blue")\ OR\ (weight>20)}(Parts)$

Solution#2: $\sigma_{(color="blue")}(Parts) \cup \sigma_{(weight>20)}(Parts)$

2. List the parts that are blue and weigh more than 20.

Solution#1: $\sigma_{(color="blue") \text{ AND } (weight>20)}(Parts)$

Solution#2: $\sigma_{(color="blue")}(Parts) \cap \sigma_{(weight>20)}(Parts)$

Why isn't the following solution correct?

$$\sigma_{(color="blue")}(Parts) \cup \sigma_{(weight>20)}(Parts)$$

3. List only the names of those parts that are not blue.

Solution#1: $\pi_{(name)}(\sigma_{(color \neq "blue")}(Parts))$

4. List the names of those suppliers who ship part number P3.

Solution#1: $\pi_{(name)}(\sigma_{(pnum="P3")}(Shipments \times Suppliers))$

Is solution #1 correct?

No, because the Cartesian product pairs all combinations from the two operand tables, even those combinations which are not related are generated by this operation.

A Correct Solution

$$\pi_{(name)}(\sigma_{(pnum="P3")\ AND\ (Shipments.snum=Suppliers.snum)}(Shipments \times Suppliers))$$

This condition (called an implicit join condition) eliminates from the Cartesian product unrelated tuples.

5. List only the names of those suppliers who ship a blue part.

Solutions

To shorten the expressions let:

S = Suppliers

P = Parts

SPJ = Shipments

$$\pi_{(name)}\left(\sigma_{(S.snum=SPJ.snum)}\left(S\times\left(\sigma_{(P.pnum=SPJ.pnum)}\left(\left(\sigma_{(color="blue")}(P)\times SPJ\right)\right)\right)\right)\right)$$

$$\pi_{(name)}\left(\sigma_{(S.snum=SPJ.snum)}\left(S\times\left(\sigma_{(color="blue")\ AND\ (P.pnum=SPJ.pnum)}\left(P\times SPJ\right)\right)\right)\right)$$

$$\pi_{(name)}\left(\sigma_{(S.snum=SPJ.snum)\ AND\ (P.pnum=SPJ.pnum)\ AND\ (color="blue")}\left(S\times P\times SPJ\right)\right)$$

6. List the names of those jobs that do not receive a shipment of a blue part.

Solutions

To shorten the expressions let:

J = Jobs

P = Parts

SPJ = Shipments

$$\pi_{name}\left[J \times \left(\pi_{j\#}\left(\sigma_{SPJ.pnum=P.pnum}\left(SPJ \times \left(\pi_{p\#}\left(\sigma_{color \neq blue}\left(P\right)\right)\right)\right)\right)\right)\right]$$

Is this solution correct? NO!

A correct solution:

$$\pi_{name}\left(J \times \left[\begin{array}{l}\left(\pi_{j\#}\left(\sigma_{SPJ.pnum=P.pnum}\left(SPJ \times \left(\pi_{p\#}\left(\sigma_{color \neq blue}\left(P\right)\right)\right)\right)\right)\right) \\ -\left(\pi_{j\#}\left(\sigma_{SPJ.pnum=P.pnum}\left(SPJ \times \left(\pi_{p\#}\left(\sigma_{color = blue}\left(P\right)\right)\right)\right)\right)\right)\end{array}\right]\right)$$

6. List the names of those jobs that do not receive a shipment of a blue part.

Step by step solution

$r1 = \sigma_{(color \neq blue)}(P)$

$r2 = \pi_{(p\#)}(r1)$

$r3 = SPJ \times r2$

$r4 = \sigma_{(SPJ.pnum = P.pnum)}(r3)$

$r5 = \pi_{(j\#)}(r4)$

$r6 = \sigma_{(color = blue)}(P)$

$r7 = \pi_{(p\#)}(r6)$

$r8 = SPJ \times r7$

$r9 = \sigma_{(SPJ.pnum = P.pnum)}(r8)$

$r10 = \pi_{(j\#)}(r9)$

$r11 = r5 - r10$

$r12 = J \times r11$

$r13 = \pi_{(name)}(r12)$