

Exercise 2.4.1 (p. 52)

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

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

Result:

model
1005
1006
1013

**SELECT model
FROM pc
WHERE speed >= 3.00;**

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

$$\pi_{\text{maker}} (\sigma_{\text{type} = \text{'laptop'}} (\text{Product}) \bowtie \sigma_{\text{hd} \geq 100} (\text{Laptop}))$$

Result:

maker
E
A
B
F
G

**SELECT maker
FROM product
WHERE model IN (SELECT model
FROM laptop
WHERE hd >= 100);**

Product(maker, model, type)

PC(model, speed, ram, hd, price)

Laptop(model, speed, ram, hd, screen, price)

Printer(model, color, type, price)

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

$$R_1 := \pi_{\text{model, price}} \left(\sigma_{\text{maker} = B} (\text{Product}) \bowtie \text{PC} \right)$$

$$R_2 := \pi_{\text{model, price}} \left(\sigma_{\text{maker} = B} (\text{Product}) \bowtie \text{laptop} \right)$$

$$R_3 := \pi_{\text{model, price}} \left(\sigma_{\text{maker} = B} (\text{Product}) \bowtie \text{printer} \right)$$

$$\text{Result} := R_1 \cup R_2 \cup R_3$$

model	price
1004	649
1005	630
1006	1049
2007	1429

Product(maker, model, type)

PC(model, speed, ram, hd, price)

Laptop(model, speed, ram, hd, screen, price)

Printer(model, color, type, price)

d) Find the model numbers of all color laser printers

$$\pi_{\text{model}} \left(\sigma_{\text{color}='true' \text{ AND } \text{type}='laser'} (\text{Printer}) \right)$$

Result:

model
3003
3007

```
SELECT model
FROM printer
WHERE (color=1 AND type='laser');
```

e) Find those manufacturers that sell Laptop, but not PCs

$$\pi_{\text{maker}} \left(\sigma_{\text{type}='laptop'} (\text{Product}) \right) - \pi_{\text{maker}} \left(\sigma_{\text{type}='pc'} (\text{Product}) \right)$$

Result:

maker
F
G

```
SELECT DISTINCT maker
FROM product
WHERE type='laptop' AND maker NOT IN
(SELECT maker
FROM product
WHERE type='pc');
```

f) Find those hard disk sizes that occur in two or more PCs

$$R_1 := \rho_{PC_1} (PC)$$

$$R_2 := \rho_{PC_2} (PC)$$

$$R_3 := R_1 \bowtie_{(PC_1.hd = PC_2.hd \text{ AND } PC_1.model \neq PC_2.model)} R_2$$

$$R_4 := \pi_{hd} (R_3)$$

Result:

hd
250
80
160

```
SELECT DISTINCT pc1.hd
FROM pc pc1, pc pc2
WHERE pc1.model <> pc2.model AND pc1.hd=pc2.hd;
```

g) Find those pairs of PC models that have both the same speed and RAM. A pair should be listed only once.

$$R_1 = \int_{PC_1} (PC)$$

$$R_2 := \int_{PC_2} (PC)$$

$$R_3 := R_1 \bowtie R_2$$

(PC1.speed = PC2.speed AND PC1.ram = PC2.ram ...

... AND PC1.model < PC2.model)

$$R_4 := \pi_{PC1.model, PC2.model} (R_3)$$

Result:

PC1.model	PC2.model
1004	1012

```
SELECT pc1.model, pc2.model
FROM pc pc1, pc pc2
WHERE (pc1.speed=pc2.speed) AND
      (pc1.ram=pc2.ram) AND
      (pc1.model < pc2.model);
```

h) Find manufacturers of at least two different computers (PCs or laptops) with speeds of at least 2.80

$$R_1 := \sigma_{\text{Speed} \geq 2.80} (PC)$$

$$R_2 := \sigma_{\text{Speed} \geq 2.80} (\text{Laptop})$$

$$R_3 := \pi_{\text{model}} (R_1) \cup \pi_{\text{model}} (R_2)$$

$$R_4 := \pi_{\text{maker, model}} (R_3 \bowtie \text{Product})$$

$$R_5 := \int_{\text{maker4, model4}} R_4$$

$$R_6 := R_4 \bowtie_{(\text{maker} = \text{maker4, model} <> \text{model4})} R_5$$

$$R_7 := \pi_{\text{maker}} (R_6)$$

Result:

maker
B
E

i) Find the manufacturers of the computer (PC or laptop) with the highest available speed.

$$R1 := \pi_{\text{model, speed}}(\text{PC}) \cup \pi_{\text{model, speed}}(\text{Laptop})$$

$$R2 := \rho_{\text{model2, speed2}}(R1)$$

$$R3 := R1 \bowtie_{(\text{speed} < \text{speed2})} R2$$

$$R4 := \pi_{\text{model, speed}}(R3) \quad // \text{ R4 contains the slower speed models}$$

$$R5 := R1 - R4 \quad // \text{ R5 contains the fastest speed models}$$

$$R6 := \pi_{\text{maker}}(R5 \bowtie \text{Product})$$

Result:

maker
B

SELECT DISTINCT maker

FROM product

WHERE model IN (SELECT model

FROM pc

WHERE speed >= ALL(SELECT speed FROM pc));

Product(maker, model, type)

PC(model, speed, ram, hd, price)

Laptop(model, speed, ram, hd, screen, price)

Printer(model, color, type, price)