Exercise 2.4.1a

$R1 := \sigma_{speed \geq 3.00}(PC)$
$R2 := \pi_{model}(R1)$

SELECT model FROM pc WHERE speed >= 3.00;

model
1005
1006
1013

Exercise 2.4.1b

$R1 := \sigma_{hd \geq 100}(Laptop)$
$R2 := Product \bowtie (R1)$
$R3 := \pi_{maker}(R2)$

SELECT maker from laptop, product WHERE laptop.model = product.model AND hd >= 100; ***OR***
SELECT maker from product JOIN laptop ON product.model = laptop.model WHERE hd >= 100; ***OR***
SELECT maker FROM product WHERE model IN (SELECT model FROM laptop WHERE hd >= 100); ***OR***
. . . (There are many equivalent forms)

maker
E
A
B
F
G

Exercise 2.4.1c

$R1 := \sigma_{maker=B}(Product \bowtie PC)$
$R2 := \sigma_{maker=B}(Product \bowtie Laptop)$
$R3 := \sigma_{maker=B}(Product \bowtie Printer)$
$R4 := \pi_{model,price}(R1)$
$R5 := \pi_{model,price}(R2)$
$R6: = \pi_{model,price}(R3)$
$R7 := R4 \cup R5 \cup R6$

SELECT product.model, price FROM product, printer where product.model = printer.model AND maker='B'
UNION
SELECT product.model, price FROM product, laptop where product.model = laptop.model AND maker='B'
UNION
SELECT product.model, price FROM product, PC where product.model = PC.model AND maker='B'

model	Price
1004	649
1005	630
1006	1049
2007	1429

Exercise 2.4.1d

$R1 := \sigma_{color = true\ AND\ type = laser}(Printer)$
$R2 := \pi_{model}(R1)$

```
SELECT model FROM printer WHERE color = true AND type = 'laser';
```

model
3003
3007

Exercise 2.4.1e

$R1 := \sigma_{type=laptop}(Product)$
$R2 := \sigma_{type=PC}(Product)$
$R3 := \pi_{maker}(R1)$
$R4 := \pi_{maker}(R2)$
$R5 := R3 - R4$

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

(Looks like MySQL doesn't have a difference operator, so we can use NOT IN instead)

maker
F
G

Exercise 2.4.1f

$R1 := \rho(PC)$
$R2 := \rho(PC)$
$R3 := R1 \bowtie_{HD=HD,\ model\ !=\ model} R2$
$R4 := \pi_{HD}(R3)$
$R5 := \delta(R4)$

```
SELECT DISTINCT PC1.HD FROM PC AS PC1, PC AS PC2
        WHERE PC1.HD = PC2.HD AND PC1.model != PC2.model;
```

HD
250
80
160

Exercise 2.4.5

The result of the natural join has only one attribute from each pair of equated attributes. On the other hand, the result of the theta-join has both columns of the attributes and their values are identical.

Exercise 5.1.1

(2.66, 2.1, 1.42, 2.8, 3.2, 3.2, 2.2, 2.2, 2, 2.8, 1.86, 2.8, 3.06)
(2.66, 2.1, 1.42, 2.8, 3.2, 2.2, 2, 1.86, 3.06)
2.4846153809474063
2.366666661368476