# CSE 111 – DATABASE SYSTEMS

**Name:**

Midterm Exam

October 25, 2018

Work time: 60 minutes

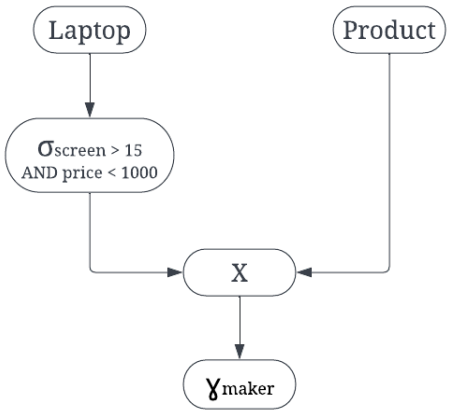
Consider the following relational schema:

- Product(maker, model, type)
- PC(model, speed, ram, hd, price)
- Laptop(model, speed, ram, hd, screen, price)
- Printer(model, color, type, price)

Write the SQL statement and draw the optimized relational algebra query execution tree for each of the following queries (10 points/SQL + 10 points/query tree):

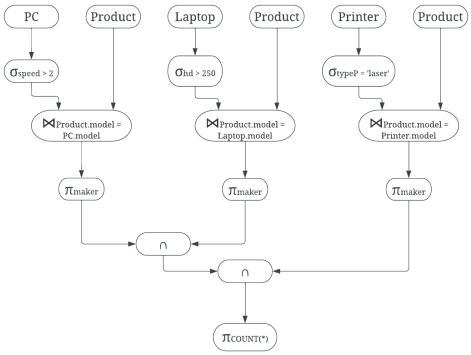
1. What makers produce Laptops with screen larger than `15''` that are cheaper than `$1,000`?
2. How many makers produce PCs with speed larger than `2.0`, Laptops with hd larger than `250 GB`, and `laser` printers?
3. For every maker that produces PCs with more than `4 GB` of ram, find the average price of these PCs (with more than `4 GB` of RAM).
4. What makers produce PCs or Laptops, but do not produce Printers?
5. How many makers produce every type of product?
6. For all the makers that produce PCs, Laptops, and Printers, find the minimum price of a complete package that includes a PC, a Laptop, and a Printer.
7. Find the cheapest Laptop sold by a PC maker.
8. Find the maker that sells the most expensive PC and also sells Printers.
9. We want to rate the value of every PC based on a score computed as the sum of three terms: the score of the speed; the score of the ram; and the score of the hd. Each of these terms is computed as the ratio between the attribute (i.e., speed, ram, or hd) and the price of the PC. List the PCs and their score in decreasing order of the score.
10. Find the makers that produce at least `5` different products out of which there is at least one product of every type (i.e., at least one PC, at least one Laptop, and at least one Printer).

Question 1:



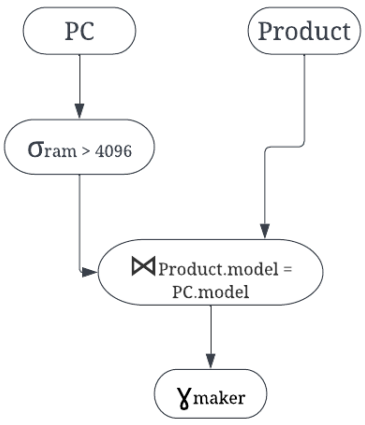

```
SELECT maker
FROM Product, Laptop
WHERE Product.model = Laptop.model
    AND screen > 15
    AND price < 1000
GROUP BY maker
```

Question 2:



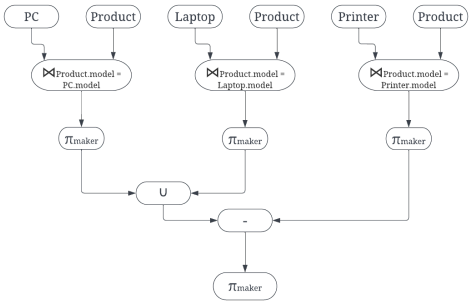

```
SELECT COUNT(*)
FROM (
    SELECT maker AS m1
    FROM Product, PC
    WHERE Product.model = PC.model
        AND speed > 2
    INTERSECT
    SELECT maker AS m2
    FROM Product, Laptop
    WHERE Product.model = Laptop.model
        AND hd > 250
    INTERSECT
    SELECT maker AS m3
    FROM Product, Printer
    WHERE Product.model = Printer.model
        AND typeP = 'laser')
```

Question 3:



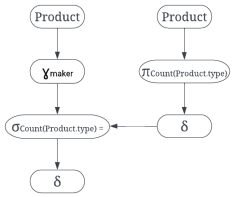

```
SELECT AVG(price)
FROM Product, PC
WHERE Product.model = PC.model
    AND ram > 1024
GROUP BY maker
```

Question 4:



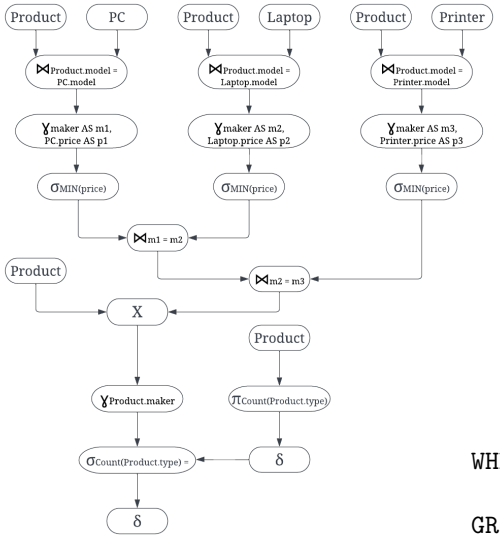

```
SELECT maker
FROM (
    SELECT maker
    FROM Product, PC
    WHERE Product.model = PC.model
    UNION
    SELECT maker
    FROM Product, Laptop
    WHERE Product.model = Laptop.model
    EXCEPT
    SELECT maker
    FROM Product, Printer
    WHERE Product.model = Printer.model)
```

Question 5:



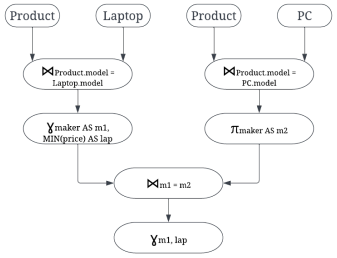

```
SELECT maker
FROM Product
GROUP BY maker
HAVING COUNT(DISTINCT Product.type) =
    (SELECT COUNT(DISTINCT Product.type)
    FROM Product)
```

Question 6:



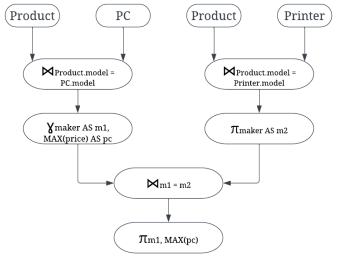

```
SELECT Product.maker, (p1 + p2 + p3)
FROM Product, (
    SELECT maker AS m1, PC.price AS p1
    FROM Product, PC
    WHERE Product.model = PC.model
    GROUP BY maker
    HAVING MIN(price)),
    (SELECT maker AS m2, Laptop.price AS p2
    FROM Product, Laptop
    WHERE Product.model = Laptop.model
    GROUP BY maker
    HAVING MIN(price)),
    (SELECT maker AS m3, Printer.price AS p3
    FROM Product, Printer
    WHERE Product.model = Printer.model
    GROUP BY maker
    HAVING MIN(price))
WHERE m1 = m2
    AND m2 = m3
GROUP BY Product.maker
HAVING COUNT(DISTINCT Product.type) =
    (SELECT COUNT(DISTINCT Product.type)
    FROM Product)
```

Question 7:



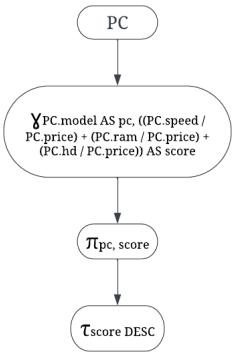

```
SELECT m1, lap
FROM (
    SELECT maker AS m1, MIN(price) AS lap
    FROM Product, Laptop
    WHERE Product.model = Laptop.model
    GROUP BY maker),
    (SELECT maker AS m2
    FROM Product, PC
    WHERE Product.model = PC.model)
WHERE m1 = m2
GROUP BY m1
```

Question 8:



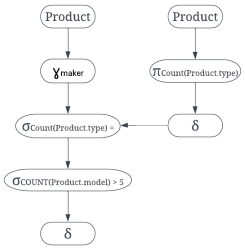

```
SELECT m1, MAX(pc)
FROM (
    SELECT maker AS m1, MAX(price) AS pc
    FROM Product, PC
    WHERE Product.model = PC.model
    GROUP BY maker),
    (SELECT maker AS m2
    FROM Product, Printer
    WHERE Product.model = Printer.model)
WHERE m1 = m2
```

Question 9:




```
SELECT pc, score
FROM (
    SELECT PC.model AS pc,
    ((PC.speed / PC.price) +
    (PC.ram / PC.price) +
    (PC.hd / PC.price)) AS score
    FROM PC
    GROUP BY PC.model)
ORDER BY score DESC
```

Question 10:




```
SELECT maker
FROM Product
GROUP BY maker
HAVING COUNT(DISTINCT Product.type) =
    (SELECT COUNT(DISTINCT Product.type)
    FROM Product)
    AND COUNT(DISTINCT Product.model) > 5
```