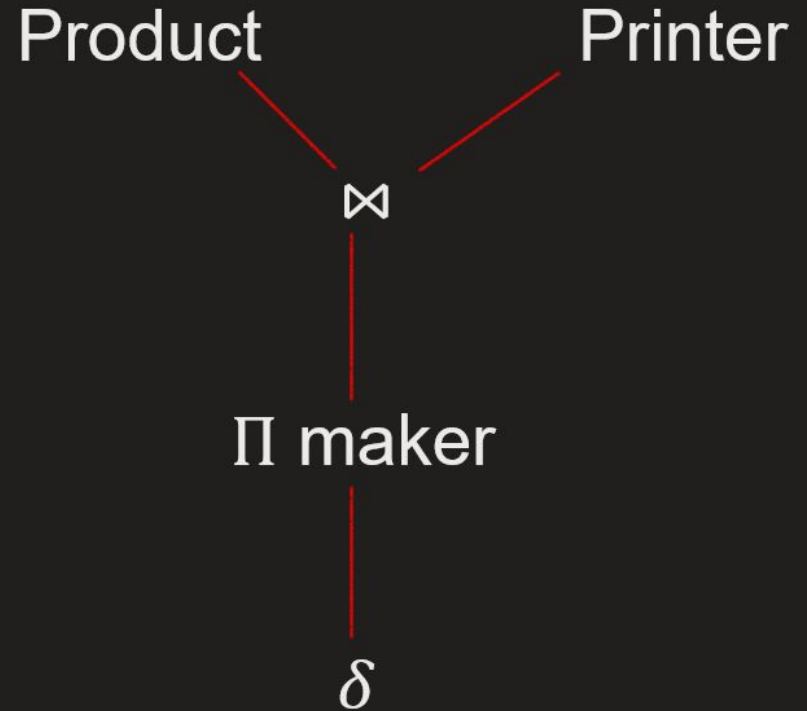# CSE111: Midterm

Uriel Montes

1. What makers produce printers?

```sql
SELECT DISTINCT maker
FROM Product, Printer
WHERE Product.model = Printer.model;
```

Product   Printer

$\bowtie$

Π maker

δ

2. What makers produce color printers cheaper than $200?

```sql
SELECT maker
FROM Product, Printer
WHERE Product.model = Printer.model
    AND Printer.color = 1
    AND Printer.price < 200;
```

Product   Printer

σ Printer.color = 1
    AND Printer.price < 200

⋈

Π maker

3. What makers produce PCs, Laptops, and Printers?

```sql
SELECT maker
FROM Product
WHERE type = 'pc'
    AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'printer'
                )
    AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'laptop'
                )
GROUP BY maker;
```

Product

Product

Product

$\sigma$ type = 'printer'

$\sigma$ type = 'laptop'

$\Pi$ maker

$\Pi$ maker

$\sigma$ type = 'pc'
    AND maker IN
    AND maker IN

$\gamma$ maker

# 4. What makers produce PCs and Printers but do not produce Laptops?

```sql
SELECT maker
FROM Product
WHERE type = 'pc'
    AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'printer'
                )
    AND maker NOT IN (
                SELECT maker
                FROM Product
                WHERE type = 'laptop'
                )
GROUP BY maker;
```

Product

Product

σ type = 'printer'

Product

Π maker

σ type = 'laptop'

σ type = 'pc'
  AND maker IN
  AND maker NOT IN
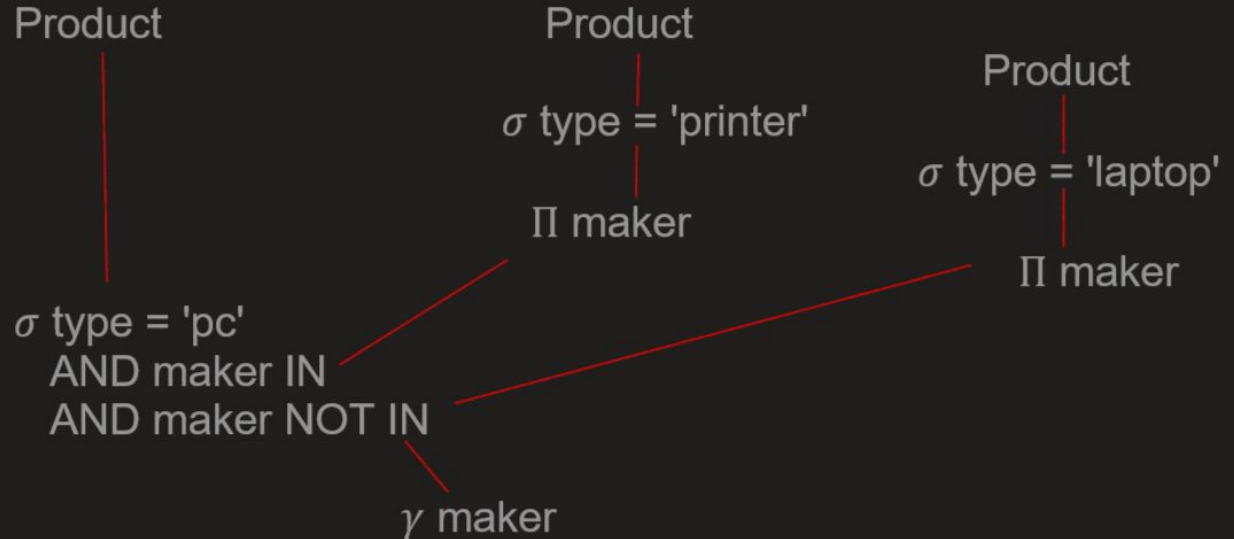
Π maker

γ maker

5. For every maker that sells both PCs and Laptops, find the combination of PC and Laptop that has minimum price. Print the maker, the PC model, Laptop model, and the combination price (PC price + Laptop price)

```sql
SELECT maker, PC.model, Laptop.model, MIN(PC.price + Laptop.price)
FROM Product, PC, Laptop
WHERE type = 'pc'
    AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'laptop'
                    AND Product.model = Laptop.model
                )
    AND Product.model = PC.model
GROUP BY maker;
```
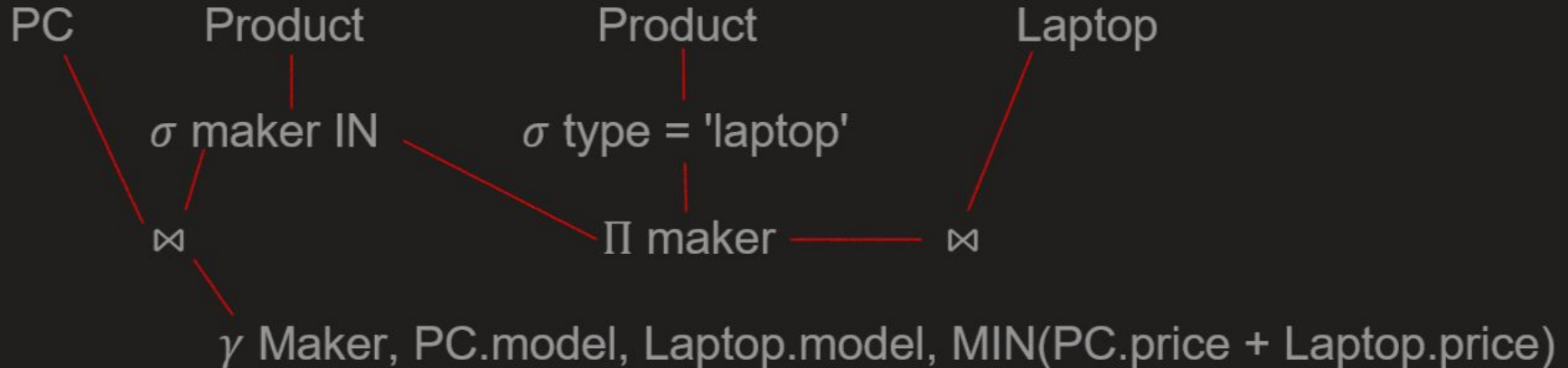
6. What is the average price of a printer?

```sql
SELECT AVG(Printer.price)
FROM Printer;
```

Printer

Π AVG(Printer.price)

7. How many models of each different type of printers are offered?

```sql
SELECT DISTINCT COUNT(Printer.model)
FROM Printer
GROUP BY Printer.type;
```

Printer
|
γ Printer.type, DISTINCT COUNT(Printer.model)

8. How many models of laser color printers are available?

```sql
SELECT COUNT(Printer.model)
FROM Printer
WHERE type = 'laser'
    AND color = 1;
```

Printer
|
σ type = 'laser'
AND color = 1
|
Π COUNT(Printer.model)

9. How many makers produce at least 2 different types (not models) of printers?

```sql
SELECT COUNT(counted)
FROM (
    SELECT COUNT(DISTINCT maker) AS counted
    FROM Product, Printer
    WHERE Product.model = Printer.model
    GROUP BY maker
    HAVING COUNT(DISTINCT Printer.type) >= 2
    ) AS counted_makers;
```

Product   Printer

⋈

γ maker, COUNT(DISTINCT maker) AS counted

σ COUNT(DISTINCT Printer.type) >= 2

counted_makers

Π COUNT(counted)
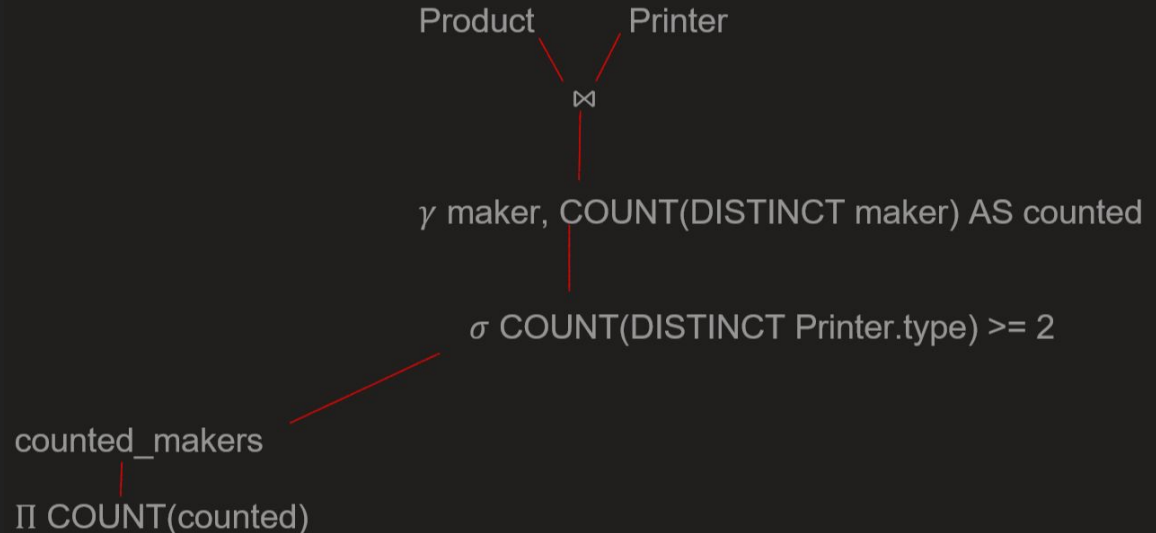
10. For every laptop screen size, find the minimum price of laptops having that screen size.

```sql
SELECT DISTINCT screen, MIN(price)
FROM Laptop
GROUP BY screen;
```

Laptop

γ screen, DISTINCT screen, MIN(price)

11. What laptop screen sizes are offered in at least 3 different models?

```sql
SELECT screen
FROM Laptop
GROUP BY screen
HAVING COUNT(DISTINCT model) >= 3;
```

Laptop

γ screen

σ COUNT(DISTINCT model) >= 3

12. What laptop screen sizes are offered with at least 2 different speeds?

```sql
SELECT screen
FROM Laptop
GROUP BY screen
HAVING COUNT(DISTINCT speed) >= 2;
```

Laptop

γ screen

σ COUNT(DISTINCT speed) >= 2

13. What laptops are more expensive than any PC? Print the model and the price.

```sql
SELECT Laptop.model, Laptop.price
FROM Laptop
WHERE Laptop.price > (
                      SELECT MAX(PC.price)
                      FROM PC
                      )
GROUP BY Laptop.model;
```

PC

Laptop

Π MAX(PC.price)

σ Laptop.price >

γ Laptop.model, Laptop.price
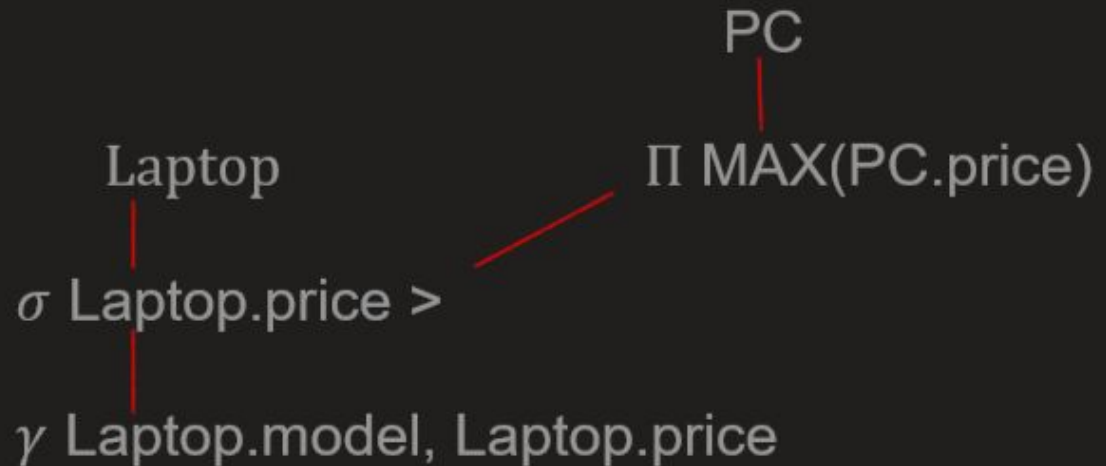
14. What printers produced by the maker of the most expensive PC that also produces printers are the cheapest? Print the model and the price.

```sql
SELECT Printer.model, MIN(Printer.price)
FROM (
    SELECT maker AS Max_Maker, MAX(PC.price)
    FROM Product, PC
    WHERE Product.model = PC.model
        AND type = 'pc'
        AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'printer'
                )
) AS Max_Maker_pc,
    Printer
```
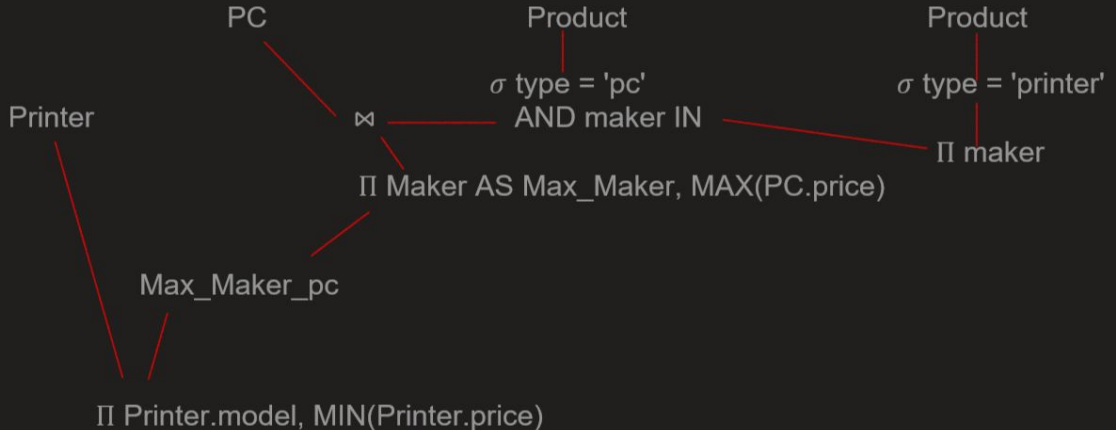
## 15. Find the average price for each product category (PC, Laptop, Printer) for every maker having products in all categories.

```sql
SELECT AVG(PC.price), AVG(Laptop.price), AVG(Printer.price)
FROM PC, Laptop, Printer, Product
WHERE Product.model = PC.model
    AND Product.type = 'pc'
    AND Product.maker IN (
                SELECT Product.maker
                FROM Product
                WHERE Product.model = Printer.model
                    AND Product.type = 'printer'
                )
    AND Product.maker IN (
                SELECT Product.maker
                FROM Product
                WHERE Product.model = Laptop.model
                    AND Product.type = 'laptop'
                );
```
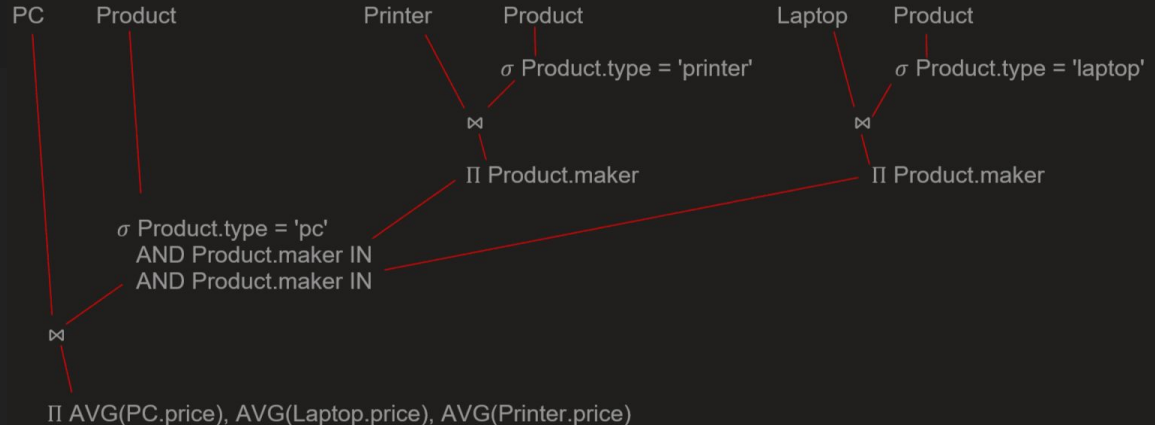
16. What makers produce exactly a single Laptop model?

```sql
SELECT maker
FROM Product
WHERE type = 'laptop'
GROUP BY maker
HAVING COUNT(DISTINCT model) = 1;
```

Product

|

σ type = 'laptop'

|

γ maker

|

σ COUNT(DISTINCT model) = 1
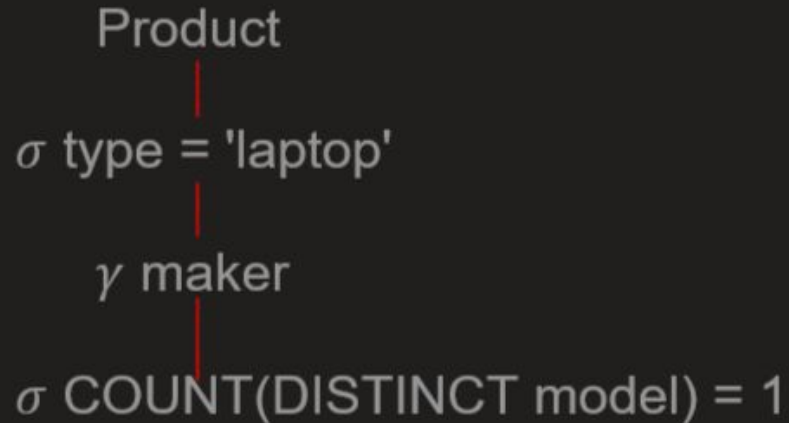
17. What makers do not produce any laptop model?

```sql
SELECT maker
FROM Product
WHERE maker NOT IN (
            SELECT maker
            FROM Product
            WHERE type = 'laptop'
            GROUP BY maker
            )
GROUP BY maker;
```

18. What makers produce a single laptop model and exactly 3 PC models?

```sql
SELECT Product.maker
FROM Product
WHERE Product.maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'laptop'
                GROUP BY maker
                HAVING COUNT(DISTINCT model) = 1
                )
    AND Product.type = 'pc'
GROUP BY Product.maker
HAVING COUNT(DISTINCT Product.model) = 3;
```
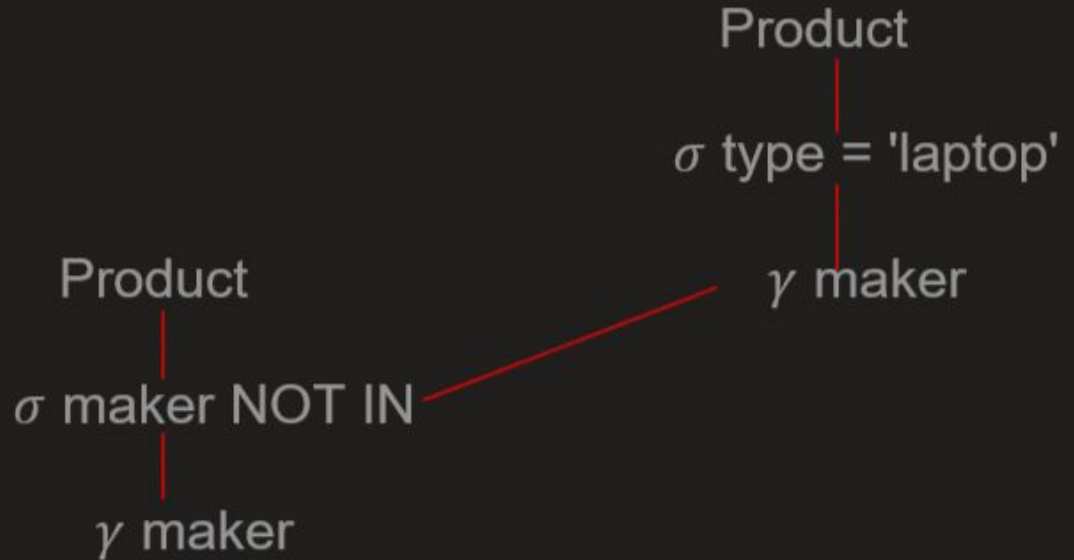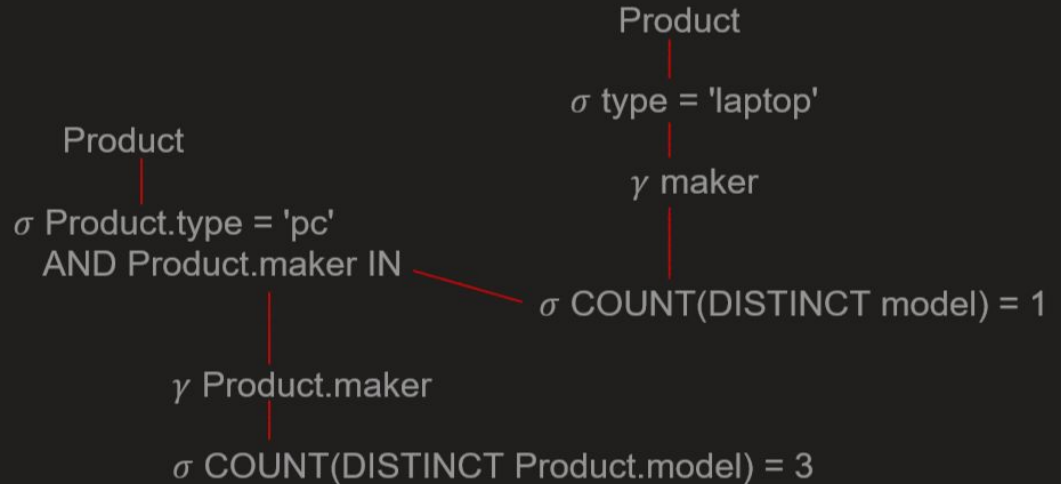
Product

σ type = 'laptop'

γ maker

Product

σ Product.type = 'pc'
AND Product.maker IN

σ COUNT(DISTINCT model) = 1

γ Product.maker

σ COUNT(DISTINCT Product.model) = 3

19. What makers produce at least a PC or Laptop model and at most 3 Printer models?

```sql
SELECT Product.maker
FROM Product
WHERE Product.maker IN (
                    SELECT Product.maker
                    FROM Product, PC
                    WHERE Product.model  = PC.model
                    GROUP BY Product.maker
                    HAVING COUNT(DISTINCT Product.maker) >= 1
                    )
    AND Product.maker IN(
                    SELECT Product.maker
                    FROM Product, Laptop
                    WHERE Product.model = Laptop.model
                    GROUP BY Product.maker
                    HAVING COUNT(DISTINCT Product.maker) >= 1
                    )
    AND Product.maker IN (
                    SELECT Product.maker
                    FROM Product, Printer
                    WHERE Product.model = Printer.model
                    GROUP BY Product.maker
                    HAVING COUNT(DISTINCT Product.maker) <= 3
                    )
GROUP BY Product.maker;
```

Printer   Product   PC   Product   Laptop   Product

⋈   ⋈   ⋈

γ Product.maker   γ Product.maker   γ Product.maker

σ COUNT(DISTINCT Product.maker) >= 1   σ COUNT(DISTINCT Product.maker) >= 1   σ COUNT(DISTINCT Product.maker) >= 1

Product

σ Product.maker IN
  AND Product.maker IN
  AND Product.maker IN
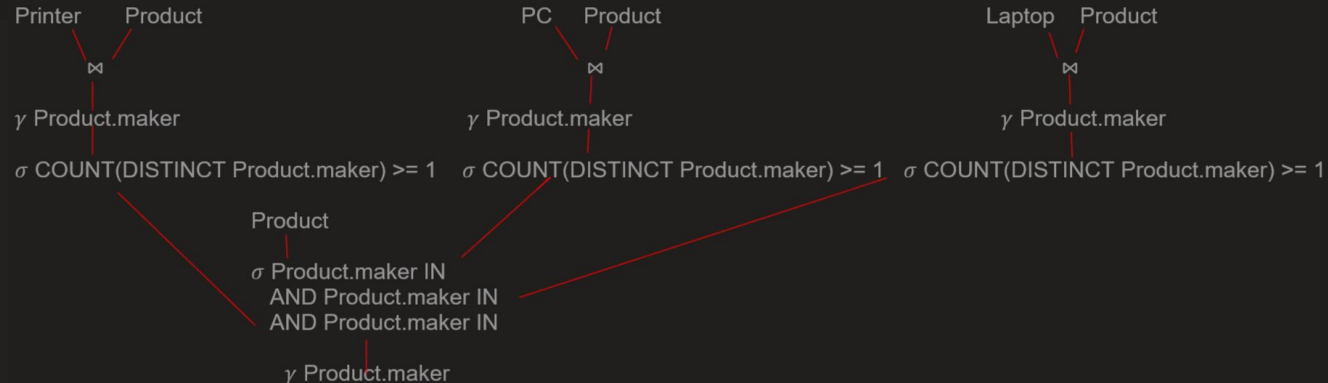
γ Product.maker

20. List the laptops with screen size 15 or larger and speed less than 2 made by a maker that also makes printers. Print the laptop model, the screen, the speed, and the maker.

```sql
SELECT DISTINCT Laptop.model, Laptop.screen, Laptop.speed, Product.maker
FROM Laptop, Product
WHERE Product.model = Laptop.model
    AND Laptop.screen >= 15
    AND Laptop.speed < 2
    AND maker IN (
                SELECT maker
                FROM Product
                WHERE type = 'printer'
                );
```

Laptop

σ Laptop.screen >= 15
AND Laptop.speed < 2

Product

σ maker IN

Product

σ type = 'printer'

Π maker

⋈

Π Laptop.model, Laptop.screen, Laptop.speed, Product.maker