Advanced Data Engineering: Assignment 1

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Fall 2015, W831 Tue. Period 5-6

Due date: 2015/10/20

Problem

Consider 4 relations:

- **Products** (ProductID, ProductName, ProductType, Price)
- **Categories** (ProductType, Category)
- **ShopA** (ProductID, Stocks)
- **ShopB** (ProductID, Stocks)

Question 1

Write a SQL query to derive "ProductName" and "Price" of product categorized as "Printer", of which ShopA or ShopB keeps more than five stocks.

Answer:

Listing 1: SQL query to get 'Printer' product with more than 5 stocks in ShopA or ShopB

```
1  SELECT P.ProductName, P.Price
2  FROM Products P
3  WHERE
4      P.ProductType IN (
5          SELECT C.ProductType
6          FROM Categories C
7          WHERE C.Category = 'Printer')
8      AND
9      (P.ProductID IN (
10         SELECT A.ProductID
11         FROM ShopA A
12         WHERE Stocks > 5)
13     OR P.ProductID IN (
14         SELECT B.ProductID
15         FROM ShopB B
16         WHERE Stocks > 5)
17     );
```

Question 2

Express the same query in Relational Algebra and draw a query tree for the expression.

Answer: The Relational Algebra expression equivalent with the query in *Listing 1* is given as follow:

$$\Pi_{\substack{\text{P.ProductName,}\\\text{P.Price}}}\Big(\big(\Pi_{\substack{\text{P.ProductID,}\\\text{P.ProductName,}\\\text{P.Price}}}\sigma_{\substack{\text{P.ProductType = C.ProductType}\\\wedge\ \text{C.Category = 'Printer'}}}\big(\rho_P(\text{Products}) \times \rho_C(\text{Categories})\big)\big) \bowtie \big(\Pi_{\text{A.ProductID}}\sigma_{\text{Stocks} > 5}\ \rho_A(\text{ShopA}) \cup \Pi_{\text{B.ProductID}}\ \sigma_{\text{Stocks} > 5}\ \rho_B(\text{ShopB})\big)\Big)$$

The equivalent query tree:

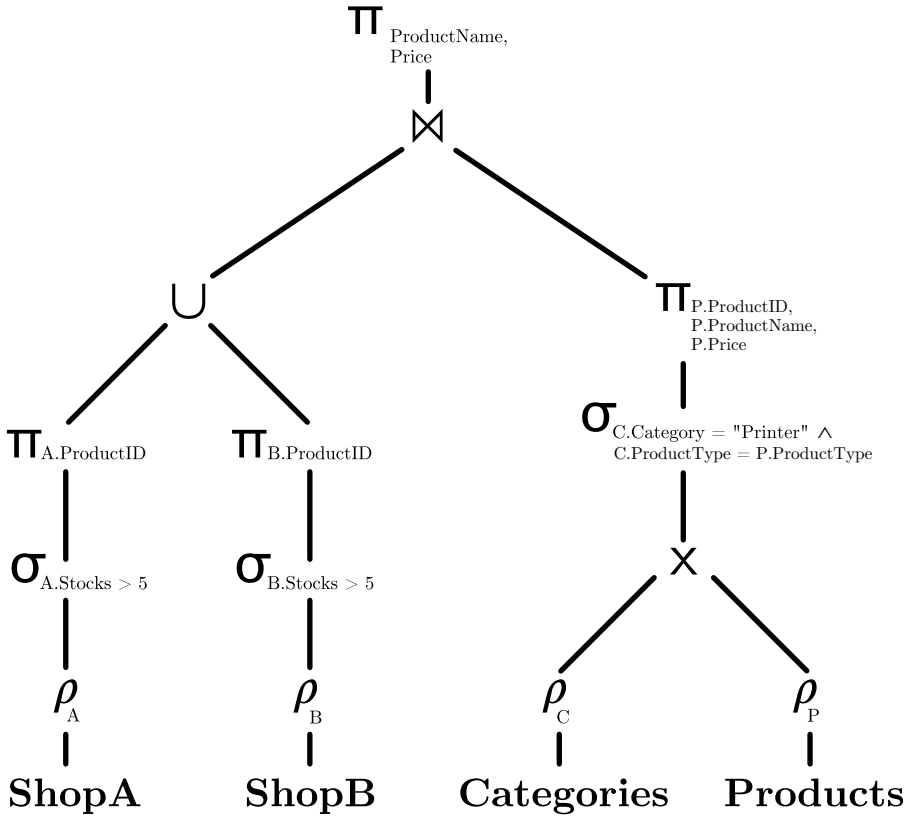

Figure 1: Query Tree for ProductName and Price of all 'Printer'

Question 3

Write an SQL query to derive maximum price of each product type of products sold in both ShopA and ShopB with "ProductType" and "Category".

Answer:

Listing 2: SQL query to return maximum price for each categories.

```
SELECT P.ProductType, C.Category, Max(P.Price) AS MaxPrice
FROM Products P, Categories C
WHERE
    P.ProductID IN (
        SELECT ProductID
        FROM ShopA)
    AND P.ProductID IN (
        SELECT ProductID
        FROM ShopB)
    AND P.ProductType = C.ProductType
    GROUP BY P.ProductType;
```

Question 4

Write an SQL query to derive "ProductType" and its "Category" of products sold in both ShopA and ShopB, where the maximum price of the product type is less than 1000.

Answer:

Listing 3: Query for ProductType and Category pair that has maximum price less than 1000.

```
SELECT P.ProductType, C.Category
FROM Products P, Categories C
WHERE
    P.ProductID IN (
        SELECT ProductID
        FROM ShopA)
    AND P.ProductID IN (
        SELECT ProductID
        FROM ShopB)
    AND P.ProductType = C.ProductType
    GROUP BY P.ProductType;
    HAVING MAX(P.Price) < 1000;
```