

# Project 3

Ahmed Tlili, Leon Petrinos, Mathilde Peruzzo

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## Relational Schema

- **Store**(s\_id, s\_address, phone\_number, manager\_id UNIQUE NOT NULL)  
FOREIGN KEY(manager\_id) REFERENCES Employee(employee\_id)
- **Employee**(e\_id, e\_name, s\_id)  
FOREIGN KEY(s\_id) REFERENCES Store(s\_id)
- **Manufacturer**(m\_id, m\_name)
- **Product**(p\_id, p\_name NOT NULL, unit\_price NOT NULL, description, discount\_percentage, m\_id NOT NULL)  
FOREIGN KEY(m\_id) REFERENCES Manufacturer(m\_id)
- **Paint**(p\_id, base, color)  
FOREIGN KEY(p\_id) REFERENCES Product(p\_id)
- **Tool**(p\_id, type)
- **Has\_in\_stock**(p\_id, s\_id, quantity NOT NULL )  
FOREIGN KEY(p\_id) REFERENCES Product(p\_id)  
FOREIGN KEY(s\_id) REFERENCES Store(s\_id)
- **Customer**(email, c\_name, c\_address NOT NULL)  
PRIMARY KEY(email)
- **Purchase**(p\_id, amount NOT NULL, p\_date NOT NULL, p\_time NOT NULL)
- **Contains\_purchase**(p\_id, product\_id, quantity NOT NULL)  
FOREIGN KEY(p\_id) REFERENCES Purchase(p\_id)  
FOREIGN KEY(product\_id) REFERENCES Product(p\_id)
- **Instore**(p\_id, e\_id)  
FOREIGN KEY(p\_id) REFERENCES Purchase(p\_id)  
FOREIGN KEY(e\_id) REFERENCES Employee(e\_id)
- **Online**(p\_id, rating, delivery\_fee NOT NULL, email NOT NULL)  
FOREIGN KEY(p\_id) REFERENCES Purchase(p\_id)  
FOREIGN KEY(email) REFERENCES Customer(email)

## Stored Procedure

- (a) This stored procedure increases the discount of products that haven't been sold in the past year. The discount is increased by 10%, but the maximum discount is 50%. So a product that already has a 45% discount will get a 5% discount. The input parameter is the maximum discount.

(b)

```
CREATE OR REPLACE PROCEDURE DiscountInactiveProducts(IN
    max_discount INT)
BEGIN
    DECLARE done INT DEFAULT 0;
    DECLARE current_pid INT;
    DECLARE current_discount INT;

    DECLARE product_cursor CURSOR FOR
        SELECT p_id, COALESCE(discount_pourcentage, 0)
        FROM Product
        WHERE COALESCE(discount_pourcentage, 0) < max_discount;

    DECLARE CONTINUE HANDLER FOR NOT FOUND SET done = 1;

    OPEN product_cursor;

    FETCH product_cursor INTO current_pid, current_discount;

    WHILE done = 0 DO

        IF NOT EXISTS (
            SELECT 1
            FROM Contains_purchase cp
            JOIN Purchase pur
            ON cp.p_id = pur.p_id
            WHERE cp.product_id = current_pid
            AND pur.p_date >= CURRENT DATE - 6 MONTHS
        ) THEN
            IF (current_discount + 10 > max_discount) THEN
                SET current_discount = max_discount;
            ELSE
                SET current_discount = current_discount + 10;
            END IF;

            UPDATE Product
            SET discount_pourcentage = current_discount
            WHERE p_id = current_pid;
        END IF;

        FETCH product_cursor INTO current_pid, current_discount;

    END WHILE;

    CLOSE product_cursor;
END
```

(c) d

## Application Program

The application handles all the errors gracefully.

This is the current menu of the application.

```
Paint Store Management System
  1. List sales generated by every store
  2. Add new Employee
  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: █
```

Let's discuss what each option does:

- Type 1 to select Option 1: list sales generated by every store

```
Paint Store Management System
  1. List sales generated by every store
  2. Add new Employee
  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: 1█
```

Output is the following:

```
Store ID  Address                      Total Amount
-----
1         9301 Leopard St              44.47
2         456 Oakwood Dr            195.90
3         789 Maple Ave             157.41
4         321 Pine St               279.86
5         654 Cedar Ln              162.39
6         987 Birch Rd              0.00
7         159 Elm St                0.00
8         753 Walnut Blvd           0.00
-----
Press Enter to Continue...
█
```

- Type 2 to select Option 2: Add new Employee

```

Paint Store Management System
  1. List sales generated by every store
  2. Add new Employee
  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: 2

```

Just enter the name of the employee and the store he will be working for, output is the following:

```

Enter the full name: Ahmed Tlili
Enter the store ID: 2
Employee added successfully!
  Given Employee ID: 52
Press Enter to Continue...

```

- Type 3 to select Option 3: Search for a product by name substring

```

Paint Store Management System
  1. List sales generated by every store
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  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: 3

```

Example below shows the output when searching for the products with name containing "Peach"

```

Enter the product name: Peach

```

Product ID	Product Name	Unit Price	Description	Discount
22	Peach Blush	16.99	Warm peach paint for living rooms	25
46	Peach Fizz	13.49	Fresh peach paint for warm living spaces	18
88	Pale Peach	16.49	Light peach color for dining rooms	22

```

Press Enter to Continue...

```

- Type 4 to select Option 4: Change the discount percentatge of a product

```

Paint Store Management System
    1. List sales generated by every store
    2. Add new Employee
    3. Search for a product by name substring
    4. Change the discount percentage of a product
    5. Issue refund for online purchase
    6. Biggest purchase in every store
    7. Quit
Please Enter Your Option: 4

```

Just enter the ID of the product and the new discount percentage, output is the following:

```

Enter the product ID: 5
Enter the new discount percentage: 10
Discount percentage updated successfully!
Press Enter to Continue...

```

- Type 5 to select Option 5: Issue refund for online purchase

```

Paint Store Management System
    1. List sales generated by every store
    2. Add new Employee
    3. Search for a product by name substring
    4. Change the discount percentage of a product
    5. Issue refund for online purchase
    6. Biggest purchase in every store
    7. Quit
Please Enter Your Option: 5

```

Just enter the email of the customer, a list of all his online purchases will be displayed, then you can select the purchase you want to refund by typing the correct number in the submenu. Output is the following:

```

Enter the Customer email: michael.wilson@example.com
Purchase IDAmount      Date              Time
-----
7          88.45      2025-03-07      12:25:00
-----
Enter the Purchase ID to refund: 7
Refund issued successfully!
Press Enter to Continue...

```

- Type 6 to select Option 6: Biggest purchase in every store

```
Paint Store Management System
  1. List sales generated by every store
  2. Add new Employee
  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: 6
```

Output is the following:

```
Store ID  Address                Total Amount
-----
1         9301 Leopard St         44.47
2         456 Oakwood Dr        107.45
3         789 Maple Ave         90.95
4         321 Pine St           97.45
5         654 Cedar Ln          105.93
6         987 Birch Rd           0.00
7         159 Elm St            0.00
8         753 Walnut Blvd        0.00
-----
Press Enter to Continue...
```

- Type 7 to select Option 7: Quit

```
Paint Store Management System
  1. List sales generated by every store
  2. Add new Employee
  3. Search for a product by name substring
  4. Change the discount percentage of a product
  5. Issue refund for online purchase
  6. Biggest purchase in every store
  7. Quit
Please Enter Your Option: 7
```

Correctly exits the application.

```
Paint Store Management System
1. List sales generated by every store
2. Add new Employee
3. Search for a product by name substring
4. Change the discount percentage of a product
5. Issue refund for online purchase
6. Biggest purchase in every store
7. Quit
Please Enter Your Option: 7

~/Database Systems /Project 2:3/Project/PaintStore main 13m 36s base 13:54:47
```

## Indexing

### Index 1

(a) `db2 => CREATE INDEX clustered_purchase_idx ON Purchase(p_date) CLUSTER;`  
`DB20000I The SQL command completed successfully.`

- (b) A clustered index on purchase date in the Purchase table is beneficial because purchases are frequently analyzed based on dates and date ranges. Thus, sorting the purchases by date allows for efficient range queries, making it faster to access data for accounting purposes. An example query that would benefit from this index is the following:

```
SELECT SUM(amount) AS total
FROM Purchase
WHERE p_date >= '01/01/2025' AND p_date <= '12/31/2025';
```

This above query computes the total revenue for the year 2025. With this clustered index, the database can quickly locate the first matching row, and perform a sequential scan to retrieve all rows within the specified date range, without needing to follow the pointers of other data entries (value + rid), as in a non-clustered index, which could often lead to more IO.

### Index 2

(a) `db2 => CREATE INDEX stock_idx ON Has_in_stock(s_id, quantity) CLUSTER;`  
`DB20000I The SQL command completed successfully.`

- (b) This index is on the s\_id and quantity attribute of the Has\_in\_stock table. It is useful for this application to efficiently identify products that are running low in stock in a specific store, which is crucial for inventory management. An example query that would benefit from this index is the following:

```
SELECT p_id
FROM Has_in_stock
WHERE s_id = 0 AND quantity < 5;
```

This query identifies all products of a particular store where the quantity of the product is very limited. The fact that it is a clustered index, again, allows for efficient range queries, making it faster to access data for inventory management purposes. It also makes sense to use a clustered index because the other attributes of the table are id's, which are certainly not needed in a sorted order.

## Visualisation

Vis 1

Vis 2

Creativity