

Project 3

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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 (EXISTS (
            SELECT 1
            FROM Contains_purchase
            WHERE product_id = current_pid
        ) AND NOT EXISTS (
            SELECT 1
            FROM Contains_purchase cp
            JOIN Purchase pur
            ON cp.product_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

Calling the procedure

```
db2 => CALL DiscountInactiveProducts(25);
```

```
Return Status = 0
```

First 25 before calling procedure:

```
db2 => SELECT p_id, discount_pourcentage FROM Product WHERE p_id <= 25;
```

P_ID	DISCOUNT_POURCENTAGE
1	10
2	15
3	0
4	20
5	10
6	0
7	25
8	30
9	12
10	5
11	15
12	20
13	8
14	10
15	18
16	7
17	22
18	10
19	15
20	12
21	9
22	20
23	5
24	30
25	5

```
25 record(s) selected.
```

Products with ids less than 25 after calling procedure:

```
db2 => SELECT p_id, discount_pourcentage FROM Product WHERE p_id <= 25;
```

P_ID	DISCOUNT_POURCENTAGE
1	10
2	15
3	0
4	20
5	10
6	0
7	25
8	30
9	12
10	5
11	25
12	25
13	8
14	10
15	18
16	7
17	22
18	10
19	15
20	12
21	19
22	25
23	15
24	30
25	15

```
25 record(s) selected.
```

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
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: 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

```

Terminal output showing the application path: ~/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

```
db2 => CREATE INDEX stock_idx ON Has_in_stock(s_id, quantity) CLUSTER;  
(a) 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

Work Division

We had two meetings to discuss the project and the work division. We decided to divide the work as follows:

- Ahmed Tlili: Question 4 coding the application program
- Leon Petrinis: Question 3, 5 about indexing and stored procedures
- Mathilde Peruzzo: Question 6, 7 about visualisation and creativity