Національний технічний університет України

«Київський політехнічний інститут імені Ігоря Сікорського»

Факультет інформатики та обчислювальної техніки

Кафедра інформаційних систем та технологій

Лабораторна робота № 6

з дисципліни «Професійне використання SQL та PL/SQL для СУБД Oracle»

Тема: «Відпрацювання конструкцій мови PL\SQL Oracle – TRIGGERs.»

Виконали:

студент групи

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Перевірила:

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Київ 2024

Тема: «Відпрацювання конструкцій мови PL\SQL Oracle – TRIGGERs.»

Мета: Навчитись створювати TRIGGERS різних типів та конструкцій для дотримання певних обмежень цілісності.

Завдання

1. Написати тригери для кожної таблиці тестової бази даних, з 1-ї лабораторної, яку студенти створювали по варіантах.

a. Тригер на автогенерацію

b. Тригер на оновлення рядка

c. Тригер на видалення рядків

2. Для одної таблиці написати комбінований тригер/тригери, що вміщує всі конструкції BEFORE або AFTER

Хід роботи

1)

```
CREATE TABLE Recipes (
ID NUMBER PRIMARY KEY,
Name VARCHAR2(20),
Ingredients VARCHAR2(20)
);

CREATE TABLE Application_Methods (
ID  NUMBER PRIMARY KEY,
Name VARCHAR2(20)
);
CREATE TABLE Preparation_Methods (
ID NUMBER PRIMARY KEY,
Name VARCHAR2(20)
);

CREATE TABLE Finished_Medicines (
ID NUMBER PRIMARY KEY,
Name VARCHAR2(20),
A_Method_ID NUMBER,
FOREIGN KEY (A_Method_ID) REFERENCES Application_Methods(ID)
);

CREATE TABLE Unfinished_Medicines (
ID NUMBER PRIMARY KEY,
Name VARCHAR2(20),
A_Method_ID NUMBER,
P_Method_ID NUMBER,
Recipe_ID NUMBER,
P_Time NUMBER,
FOREIGN KEY (A_Method_ID) REFERENCES Application_Methods(ID),
FOREIGN KEY (P_Method_ID) REFERENCES Preparation_Methods(ID),
FOREIGN KEY (Recipe_ID) REFERENCES Recipes(ID)
);

CREATE TABLE Deletion_Logs (
Log_ID NUMBER PRIMARY KEY,
Table_Name VARCHAR2(30),
Record_ID NUMBER,
Deleted_By VARCHAR2(30),
Deletion_Date TIMESTAMP,
Details VARCHAR2(4000)
);

ALTER TABLE Recipes MODIFY (Name VARCHAR2(100));
ALTER TABLE Recipes MODIFY (Ingredients VARCHAR2(100));
ALTER TABLE Application_Methods MODIFY (Name VARCHAR2(100));
ALTER TABLE Preparation_Methods MODIFY (Name VARCHAR2(100));
ALTER TABLE Finished_Medicines MODIFY (Name VARCHAR2(100));
ALTER TABLE Unfinished_Medicines MODIFY (Name VARCHAR2(100));


ALTER TABLE Recipes ADD updated_at TIMESTAMP DEFAULT
SYSTIMESTAMP;

ALTER TABLE Application_Methods ADD updated_at TIMESTAMP
DEFAULT SYSTIMESTAMP;

ALTER TABLE Preparation_Methods ADD updated_at TIMESTAMP
DEFAULT SYSTIMESTAMP;

ALTER TABLE Finished_Medicines ADD updated_at TIMESTAMP DEFAULT
SYSTIMESTAMP;

ALTER TABLE Unfinished_Medicines ADD updated_at TIMESTAMP
```

```
DEFAULT SYSTIMESTAMP;



--Sequences
CREATE SEQUENCE Deletion_Logs_Seq
START WITH 1
INCREMENT BY 1
NOCACHE;

CREATE SEQUENCE Recipes_seq
START WITH 1
INCREMENT BY 1
NOCACHE;

CREATE SEQUENCE Application_Methods_seq
START WITH 1
INCREMENT BY 1
NOCACHE;

CREATE SEQUENCE Preparation_Methods_seq
START WITH 1
INCREMENT BY 1
NOCACHE;

CREATE SEQUENCE Finished_Medicines_seq
START WITH 1
```

```
INCREMENT BY 1
NOCACHE;

CREATE SEQUENCE Unfinished_Medicines_seq
START WITH 1
INCREMENT BY 1
NOCACHE;

CREATE OR REPLACE TRIGGER recipes_auto_generate
BEFORE INSERT ON Recipes
FOR EACH ROW
BEGIN
  SELECT Recipes_seq.nextval
  INTO :NEW.ID
  FROM dual;
END;
-- auto generate triggers
CREATE OR REPLACE TRIGGER deletion_logs_auto_generate
BEFORE INSERT ON Deletion_Logs
FOR EACH ROW
BEGIN
  SELECT Deletion_Logs_Seq.nextval
  INTO :NEW.Log_ID
  FROM dual;
END;
```

```
CREATE OR REPLACE TRIGGER application_methods_auto_generate
BEFORE INSERT ON Application_Methods
FOR EACH ROW
BEGIN
SELECT Application_Methods_seq.nextval
INTO :NEW.ID
FROM dual;
END;

CREATE OR REPLACE TRIGGER preparation_methodsauto_generate
BEFORE INSERT ON Preparation_Methods
FOR EACH ROW
BEGIN
SELECT Preparation_Methods_seq.nextval
INTO :NEW.ID
FROM dual;
END;

CREATE OR REPLACE TRIGGER finished_medicines_generate
BEFORE INSERT ON Finished_Medicines
FOR EACH ROW
BEGIN
SELECT Finished_Medicines_seq.nextval
INTO :NEW.ID
```

```
FROM dual;
END;

CREATE OR REPLACE TRIGGER unfinished_medicinesauto_generate
BEFORE INSERT ON Unfinished_Medicines
FOR EACH ROW
BEGIN
SELECT Unfinished_Medicines_seq.nextval
INTO :NEW.ID
FROM dual;
END;
--row deletion triggers
CREATE OR REPLACE TRIGGER recipes_deletion_log
AFTER DELETE ON Recipes
FOR EACH ROW
BEGIN
INSERT INTO Deletion_Logs ( Table_Name, Record_ID, Deleted_By,
Deletion_Date, Details)
VALUES ('Recipes', :OLD.ID, USER, SYSTIMESTAMP, 'Name: ' ||
:OLD.Name || ', Ingredients: ' || :OLD.Ingredients);
END;


CREATE OR REPLACE TRIGGER application_methods_deletion_log
AFTER DELETE ON Application_Methods
FOR EACH ROW
```

```
BEGIN
INSERT INTO Deletion_Logs ( Table_Name, Record_ID, Deleted_By,
Deletion_Date, Details)
VALUES ( 'Application_Methods', :OLD.ID, USER, SYSTIMESTAMP,
'Name: ' || :OLD.Name);
END;

CREATE OR REPLACE TRIGGER preparation_methods_deletion_log
AFTER DELETE ON Preparation_Methods
FOR EACH ROW
BEGIN
INSERT INTO Deletion_Logs (Table_Name, Record_ID, Deleted_By,
Deletion_Date, Details)
VALUES ('Preparation_Methods', :OLD.ID, USER, SYSTIMESTAMP, 'Name:
' || :OLD.Name);
END;

CREATE OR REPLACE TRIGGER finished_medicines_deletion_log
AFTER DELETE ON Finished_Medicines
FOR EACH ROW
BEGIN
INSERT INTO Deletion_Logs (Table_Name, Record_ID, Deleted_By,
Deletion_Date, Details)
VALUES ('Finished_Medicines', :OLD.ID, USER, SYSTIMESTAMP, 'Name: '
|| :OLD.Name || ', A_Method_ID: ' || :OLD.A_Method_ID);
END;
```

```
CREATE OR REPLACE TRIGGER unfinished_medicines_deletion_log
AFTER DELETE ON Unfinished_Medicines
FOR EACH ROW
BEGIN
  INSERT INTO Deletion_Logs (Table_Name, Record_ID, Deleted_By,
Deletion_Date, Details)
  VALUES ('Unfinished_Medicines', :OLD.ID, USER, SYSTIMESTAMP,
'Name: ' || :OLD.Name || ', A_Method_ID: ' || :OLD.A_Method_ID || ',
P_Method_ID: ' || :OLD.P_Method_ID || ', Recipe_ID: ' || :OLD.Recipe_ID || ',
P_Time: ' || :OLD.P_Time);
END;
--update triggers
CREATE OR REPLACE TRIGGER recipes_update_trigger
BEFORE UPDATE ON Recipes
FOR EACH ROW
BEGIN
  :NEW.updated_at := SYSTIMESTAMP;
END;

CREATE OR REPLACE TRIGGER application_methods_update_trigger
BEFORE UPDATE ON Application_Methods
FOR EACH ROW
BEGIN
  :NEW.updated_at := SYSTIMESTAMP;
END;

CREATE OR REPLACE TRIGGER preparation_methods_update_trigger
```

```
BEFORE UPDATE ON Preparation_Methods
FOR EACH ROW
BEGIN
:NEW.updated_at := SYSTIMESTAMP;
END;

CREATE OR REPLACE TRIGGER finished_medicines_update_trigger
BEFORE UPDATE ON Finished_Medicines
FOR EACH ROW
BEGIN
:NEW.updated_at := SYSTIMESTAMP;
END;

CREATE OR REPLACE TRIGGER unfinished_medicines_update_trigger
BEFORE UPDATE ON Unfinished_Medicines
FOR EACH ROW
BEGIN
:NEW.updated_at := SYSTIMESTAMP;
END;

INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Herbal Tea', 'Herbs,
Water');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Cough Syrup', 'Honey,
Lemon, Ginger');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Pain Balm', 'Menthol,
Camphor, Eucalyptus Oil');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Herbal Capsule', 'Herbal
Extract, Gelatin');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Energy Drink', 'Ginseng,
Vitamin B12, Water');
select * from Recipes;

INSERT INTO Application_Methods ( Name) VALUES ( 'Oral');
INSERT INTO Application_Methods ( Name) VALUES ( 'Topical');
INSERT INTO Application_Methods ( Name) VALUES ( 'Inhalation');
INSERT INTO Application_Methods ( Name) VALUES ( 'Injection');
INSERT INTO Application_Methods ( Name) VALUES ( 'Sublingual');
select * from Application_Methods;

INSERT INTO Preparation_Methods ( Name) VALUES ( 'Boiling');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Mixing');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Grinding');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Extraction');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Fermentation');
select * from Preparation_Methods;

INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Herbal
Tea Bag', 1);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Cough
Syrup Bottle', 1);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Pain
Balm Tube', 2);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Herbal
Capsule Box', 1);
```

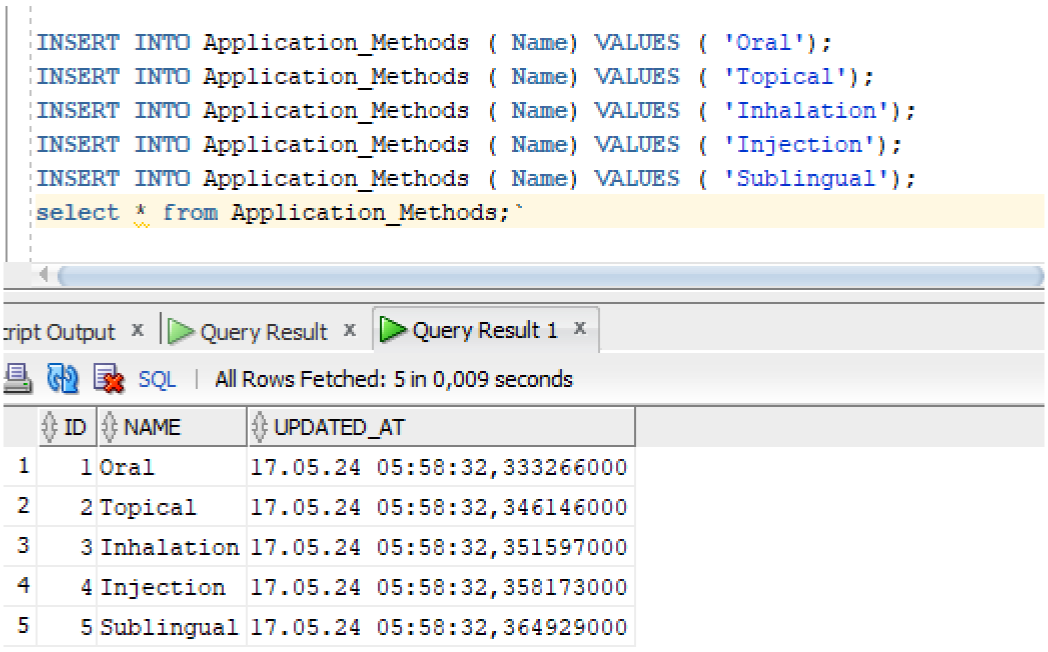
```
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Energy
Drink Can', 1);
select * from Finished_Medicines;

INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID,
Recipe_ID, P_Time) VALUES ( 'Herbal Tea Mixture', 1, 1, 1, 30);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID,
Recipe_ID, P_Time) VALUES ( 'Cough Syrup Mixture', 1, 2, 2, 15);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID,
Recipe_ID, P_Time) VALUES ( 'Pain Balm Base', 2, 3, 3, 45);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID,
Recipe_ID, P_Time) VALUES ( 'Herbal Extract', 1, 4, 4, 60);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID,
Recipe_ID, P_Time) VALUES ( 'Energy Drink Concentrate', 1, 5, 5, 20);
select * from Unfinished_Medicines;

DELETE FROM Recipes
WHERE ID = 2;
DELETE FROM Application_Methods
WHERE ID = 3;

DELETE FROM Finished_Medicines
WHERE ID = 4;

DELETE FROM Preparation_Methods
WHERE ID = 5;
```

DELETE FROM Unfinished_Medicines

WHERE ID = 2;

select * from Deletion_Logs;

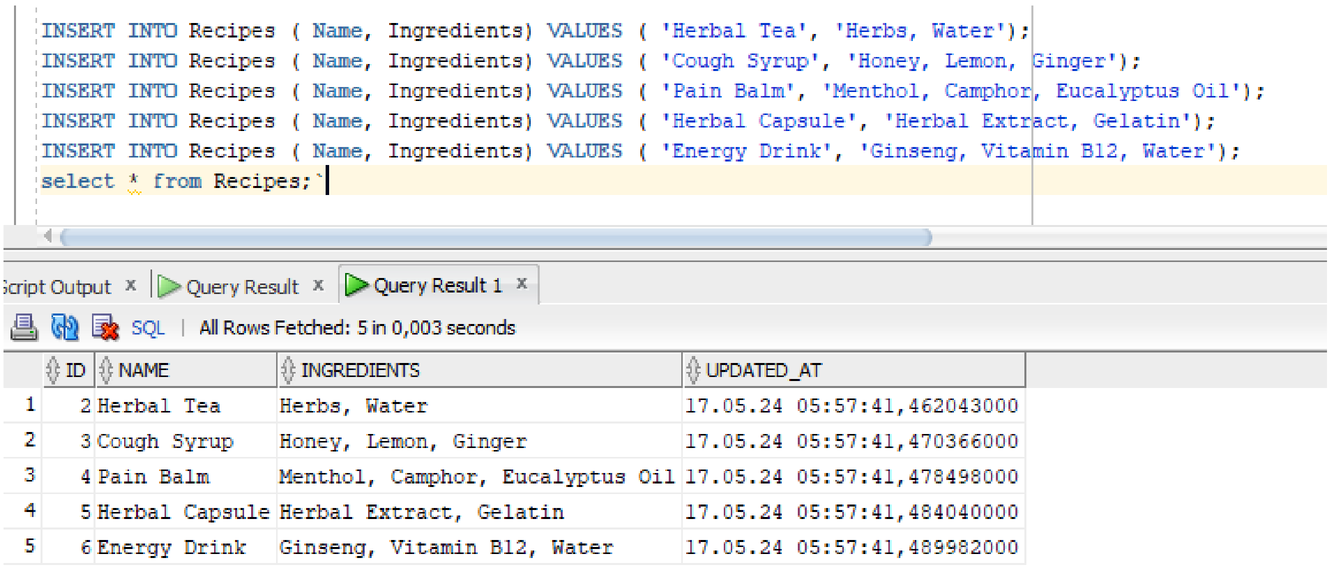
Демонстрація роботи



```
INSERT INTO Application_Methods ( Name) VALUES ( 'Oral');
INSERT INTO Application_Methods ( Name) VALUES ( 'Topical');
INSERT INTO Application_Methods ( Name) VALUES ( 'Inhalation');
INSERT INTO Application_Methods ( Name) VALUES ( 'Injection');
INSERT INTO Application_Methods ( Name) VALUES ( 'Sublingual');
select * from Application_Methods;
```

All Rows Fetched: 5 in 0,009 seconds

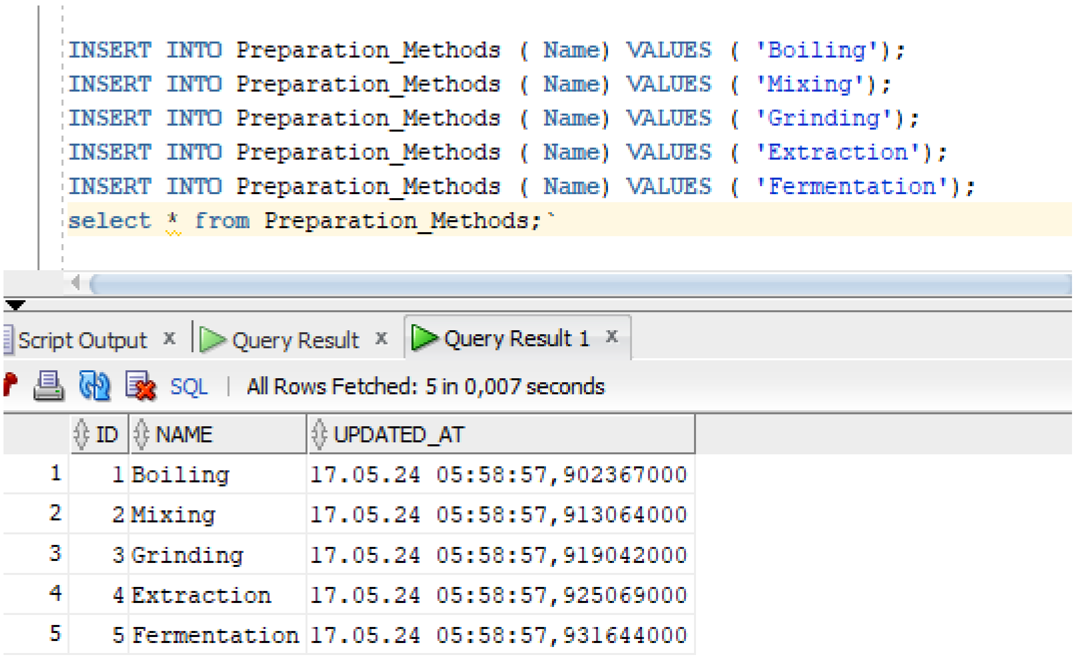
```
   ID NAME       UPDATED_AT
1   1 Oral       17.05.24 05:58:32,333266000
2   2 Topical    17.05.24 05:58:32,346146000
3   3 Inhalation 17.05.24 05:58:32,351597000
4   4 Injection  17.05.24 05:58:32,358173000
5   5 Sublingual 17.05.24 05:58:32,364929000
```



```
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Herbal Tea', 'Herbs, Water');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Cough Syrup', 'Honey, Lemon, Ginger');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Pain Balm', 'Menthol, Camphor, Eucalyptus Oil');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Herbal Capsule', 'Herbal Extract, Gelatin');
INSERT INTO Recipes ( Name, Ingredients) VALUES ( 'Energy Drink', 'Ginseng, Vitamin B12, Water');
select * from Recipes;
```

All Rows Fetched: 5 in 0,003 seconds

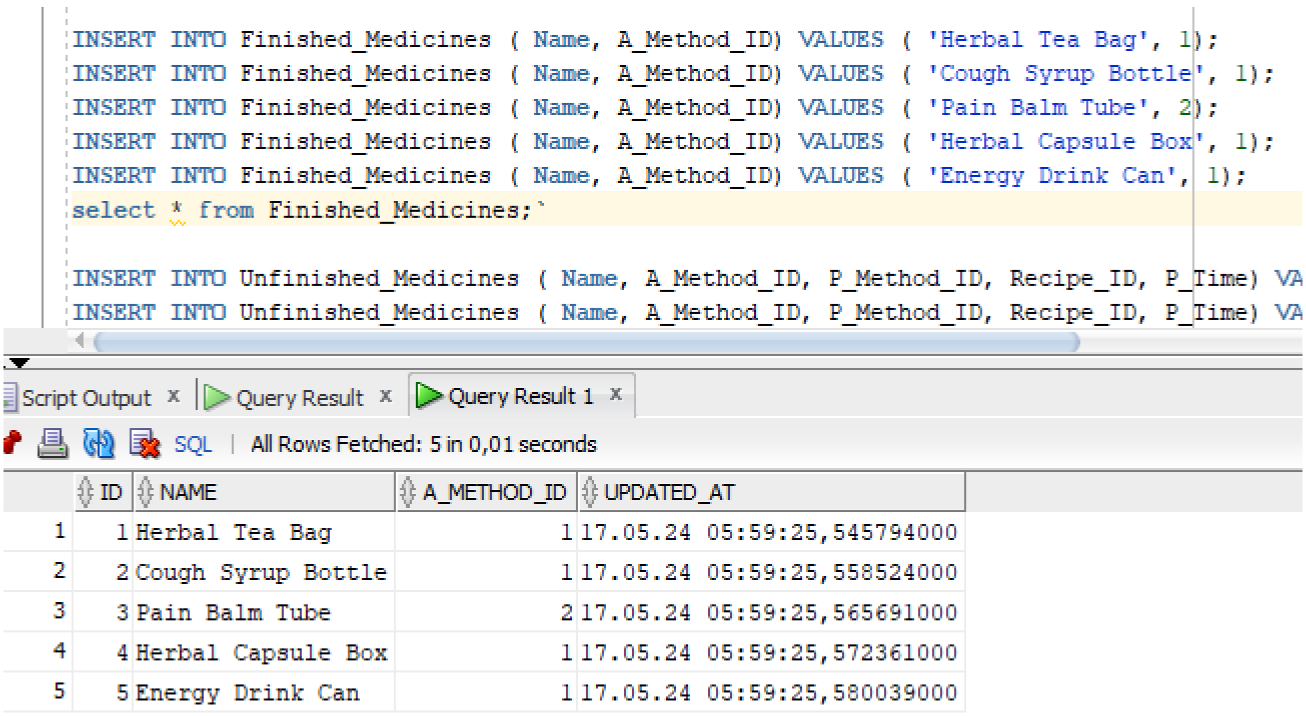
```
   ID NAME           INGREDIENTS                      UPDATED_AT
1   2 Herbal Tea     Herbs, Water                     17.05.24 05:57:41,462043000
2   3 Cough Syrup    Honey, Lemon, Ginger             17.05.24 05:57:41,470366000
3   4 Pain Balm      Menthol, Camphor, Eucalyptus Oil 17.05.24 05:57:41,478498000
4   5 Herbal Capsule Herbal Extract, Gelatin          17.05.24 05:57:41,484040000
5   6 Energy Drink   Ginseng, Vitamin B12, Water      17.05.24 05:57:41,489982000
```



```
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Boiling');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Mixing');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Grinding');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Extraction');
INSERT INTO Preparation_Methods ( Name) VALUES ( 'Fermentation');
select * from Preparation_Methods;`
```

All Rows Fetched: 5 in 0,007 seconds

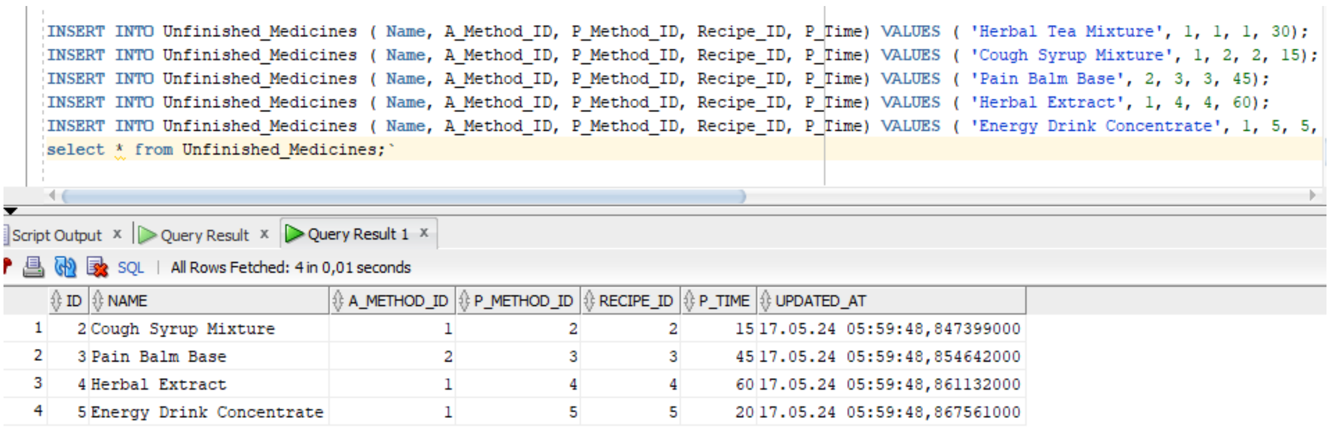
	ID	NAME	UPDATED_AT
1	1	Boiling	17.05.24 05:58:57,902367000
2	2	Mixing	17.05.24 05:58:57,913064000
3	3	Grinding	17.05.24 05:58:57,919042000
4	4	Extraction	17.05.24 05:58:57,925069000
5	5	Fermentation	17.05.24 05:58:57,931644000



```
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Herbal Tea Bag', 1);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Cough Syrup Bottle', 1);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Pain Balm Tube', 2);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Herbal Capsule Box', 1);
INSERT INTO Finished_Medicines ( Name, A_Method_ID) VALUES ( 'Energy Drink Can', 1);
select * from Finished_Medicines;`

INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VA
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VA
```

All Rows Fetched: 5 in 0,01 seconds

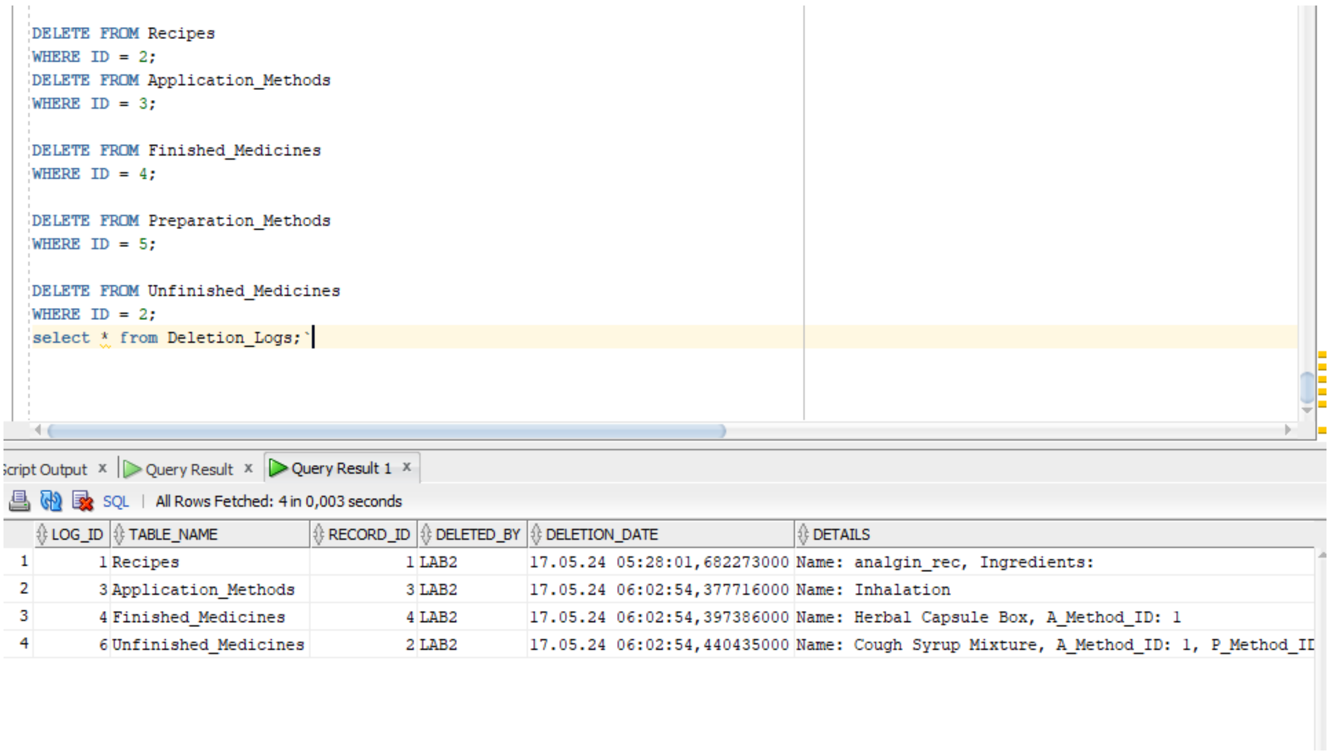
	ID	NAME	A_METHOD_ID	UPDATED_AT
1	1	Herbal Tea Bag	1	17.05.24 05:59:25,545794000
2	2	Cough Syrup Bottle	1	17.05.24 05:59:25,558524000
3	3	Pain Balm Tube	2	17.05.24 05:59:25,565691000
4	4	Herbal Capsule Box	1	17.05.24 05:59:25,572361000
5	5	Energy Drink Can	1	17.05.24 05:59:25,580039000



```
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VALUES ( 'Herbal Tea Mixture', 1, 1, 1, 30);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VALUES ( 'Cough Syrup Mixture', 1, 2, 2, 15);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VALUES ( 'Pain Balm Base', 2, 3, 3, 45);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VALUES ( 'Herbal Extract', 1, 4, 4, 60);
INSERT INTO Unfinished_Medicines ( Name, A_Method_ID, P_Method_ID, Recipe_ID, P_Time) VALUES ( 'Energy Drink Concentrate', 1, 5, 5,
select * from Unfinished_Medicines;
```

All Rows Fetched: 4 in 0,01 seconds

	ID	NAME	A_METHOD_ID	P_METHOD_ID	RECIPE_ID	P_TIME	UPDATED_AT
1	2	Cough Syrup Mixture	1	2	2	15	17.05.24 05:59:48,847399000
2	3	Pain Balm Base	2	3	3	45	17.05.24 05:59:48,854642000
3	4	Herbal Extract	1	4	4	60	17.05.24 05:59:48,861132000
4	5	Energy Drink Concentrate	1	5	5	20	17.05.24 05:59:48,867561000



```
DELETE FROM Recipes
WHERE ID = 2;
DELETE FROM Application_Methods
WHERE ID = 3;

DELETE FROM Finished_Medicines
WHERE ID = 4;

DELETE FROM Preparation_Methods
WHERE ID = 5;

DELETE FROM Unfinished_Medicines
WHERE ID = 2;
select * from Deletion_Logs;
```

All Rows Fetched: 4 in 0,003 seconds

	LOG_ID	TABLE_NAME	RECORD_ID	DELETED_BY	DELETION_DATE	DETAILS
1	1	Recipes	1	LAB2	17.05.24 05:28:01,682273000	Name: analgin_rec, Ingredients:
2	3	Application_Methods	3	LAB2	17.05.24 06:02:54,377716000	Name: Inhalation
3	4	Finished_Medicines	4	LAB2	17.05.24 06:02:54,397386000	Name: Herbal Capsule Box, A_Method_ID: 1
4	6	Unfinished_Medicines	2	LAB2	17.05.24 06:02:54,440435000	Name: Cough Syrup Mixture, A_Method_ID: 1, P_Method_II

2)

--combined trigger

CREATE OR REPLACE TRIGGER combined_trigger

BEFORE INSERT OR UPDATE OR DELETE ON Recipes

FOR EACH ROW

DECLARE

    operation VARCHAR2(10);

BEGIN

```
    IF INSERTING THEN
        operation := 'INSERT';
    ELSIF UPDATING THEN
        operation := 'UPDATE';
    ELSIF DELETING THEN
        operation := 'DELETE';
    END IF;

    DBMS_OUTPUT.PUT_LINE('Triggered ' || operation || ' operation on Recipes
table');
END;
```

ВИСНОВОК

У цій лабораторній роботі ми вивчали створення складних запитів за допомогою конструкції SELECT в мові SQL(WHERE, ORDER BY,JOIN). Використовуючи ці механізми, ми були в змозі створювати складні запити, які відображали результати з декількох таблиць, фільтрували їх за певними умовами, сортували та об'єднували дані в зручному для аналізу вигляді. Вміння працювати з цими механізмами є важливим для розробки ефективних та потужних запитів у базах даних.