Step 1: Problem Definition

Problem:

- Telecommunication problems on customers frequency in Rwanda

Business context

- A telecommunication company in Rwanda (MTN or Airtel) wants to understand customer usage behavior to improve loyalty and revenue.

Data challenge

- The company collects large numbers of call and data records but struggles to identify how frequently customers use services. It doesn't always come easy to separate active customers from inactive ones and detect whether their services is covering all the areas.
- Not forgetting to mention that many customers subscribe to their services but use them rarely due to cost, device limitations, or poor network quality hence this may lead to users switching to competitors or abandoning their SIM cards.

Expected Outcome

A PL/SQL approach can help by:

- Calculating customer frequency scores, segments users (frequent, occasional, inactive), and provides insights to guide promotions and retention strategies.

Step 2: Success Criteria

5 Measurable Goals

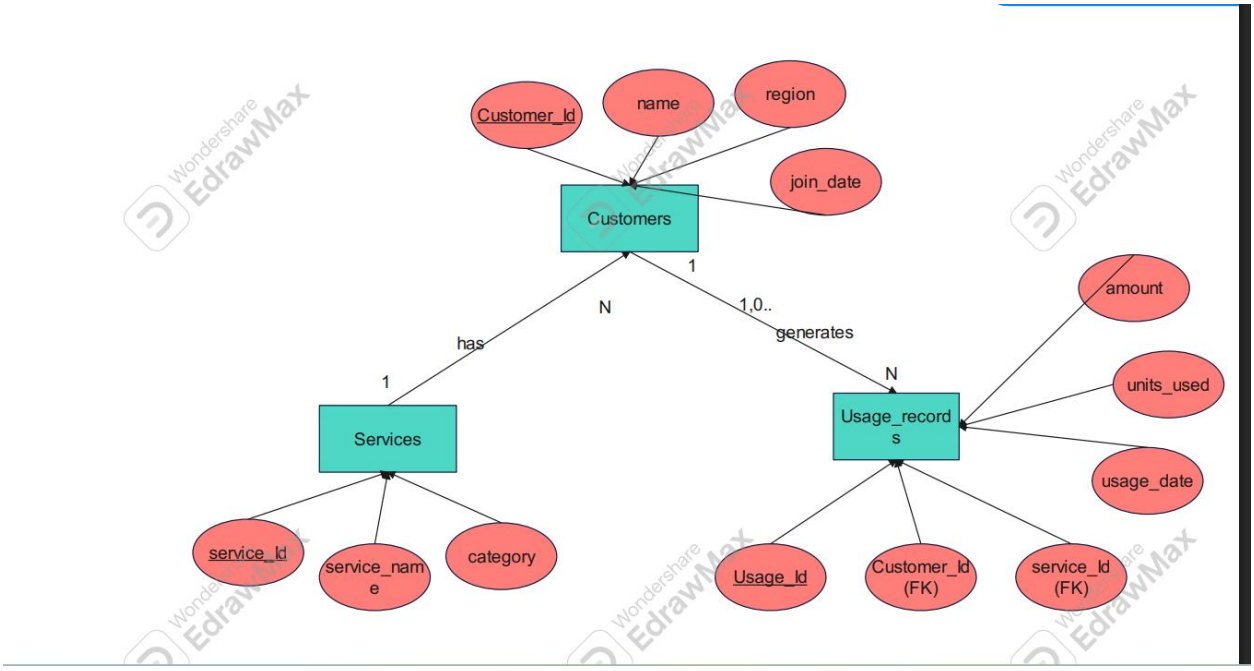
1. **Top 5 Services per Region/Quarter**: Identify the five most frequently used telecom services (Voice, SMS, data bundles, Mobile Money) by using RANK ()
2. **Running Monthly usage totals:** Track the cumulative number of customer interactions (calls, SMS,..etc) by using SUM () OVER (ORDER BY MONTH) to show growth in total.
3. **Month-over-Month Growth in Usage:** Measure the increase or decrease in customer service usage compared to the previous month, by using LAG () for comparison
4. **Customers Quartiles by Frequency:** Divide customers into four groups (frequent, regular, occasional, inactive) based on usage frequency by using NTILE (4) to segment customers.

5. **3-month Moving Average of Usage**: Running customers activity trends by averaging service usage over the current and last two months by using AVG () OVER ().

Step 3: Database Schema

Table	Purpose	Key Columns	Example Row
Customers	Stores customer info	Customer_id (PK), name, region, join_date	1001, Alice Uwase, Kigali, 2022-05-12
Services	Lists of telecommunication services	Service_id (PK), service_name, category (Voice, SMS, data, Mobile Money	2001, Monthly Data Bundle, Data
Usage records	Tracks customer service usage	Usage_id (PK), customer_id (FK), service_id (FK), usage_date, units_used, amount	3001,1001, 2001, 2022-05-20, 2GB, 2000

ER Diagram



✓ **Customers Table**

```
CREATE TABLE customers (
    customer_id NUMBER PRIMARY KEY,
    name VARCHAR2(100),
    region VARCHAR2(50),
    join_date DATE
);
```

- **Inserting data**

```
INSERT INTO customers VALUES (1001, 'Alice Uwase', 'Kigali', TO_DATE('2023-06-12','YYYY-MM-DD'));

INSERT INTO customers VALUES (1002, 'Jean Bosco', 'Musanze', TO_DATE('2023-07-05','YYYY-MM-DD'));

INSERT INTO customers VALUES (1003, 'Aline Mukamana', 'Huye', TO_DATE('2023-05-20','YYYY-MM-DD'));

INSERT INTO customers VALUES (1004, 'Eric Nshimiyimana', 'Kigali', TO_DATE('2023-08-15','YYYY-MM-DD'));

INSERT INTO customers VALUES (1005, 'Sandra Uwitonze', 'Rubavu', TO_DATE('2023-04-10','YYYY-MM-DD'));
```

```
C:\WINDOWS\system32\cmd.

Copyright (c) 1982, 2005, Oracle.  All rights reserved.

Enter user-name: system
Enter password:

Connected to:
Oracle Database 10g Express Edition Release 10.2.0.1.0 - Production

SQL> INSERT INTO customers VALUES (1001, 'Alice Uwase', 'Kigali', TO_DATE('2023-06-12','YYYY-MM-DD'));

1 row created.

SQL> INSERT INTO customers VALUES (1002, 'Jean Bosco', 'Musanze', TO_DATE('2023-07-05','YYYY-MM-DD'));

1 row created.

SQL> INSERT INTO customers VALUES (1003, 'Aline Mukamana', 'Huye', TO_DATE('2023-05-20','YYYY-MM-DD'));

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1 row created.

SQL> INSERT INTO customers VALUES (1005, 'Sandra Uwitonze', 'Rubavu', TO_DATE('2023-04-10','YYYY-MM-DD'));

1 row created.

SQL>
```
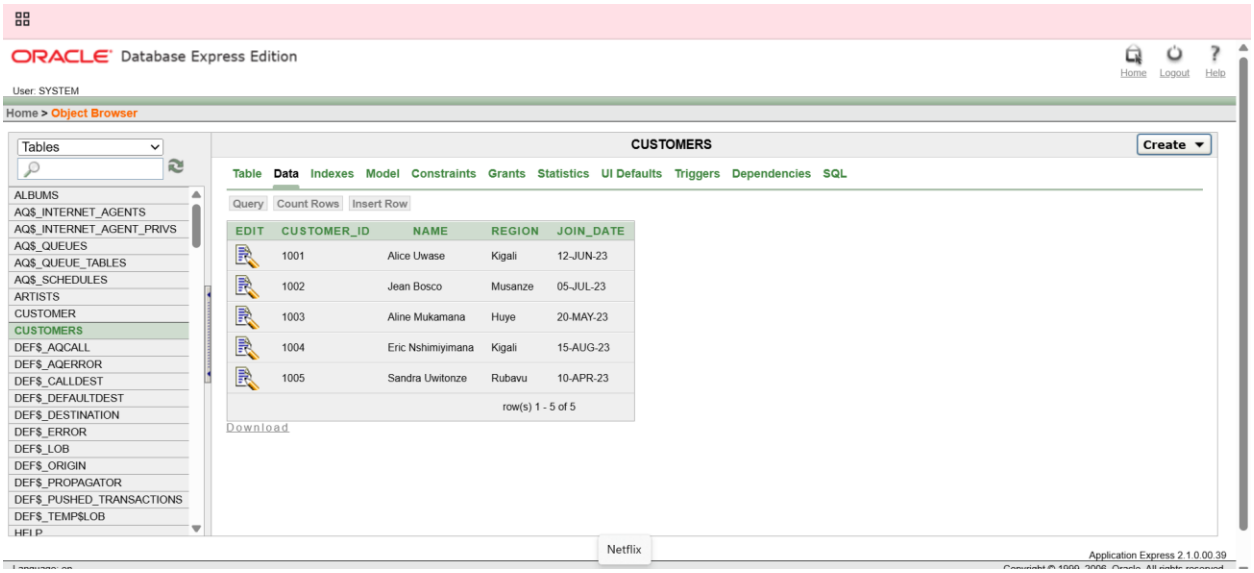



✓ Services Table

CREATE TABLE services (

service_id NUMBER PRIMARY KEY,

service_name VARCHAR2(100),

category VARCHAR2(50)

);

- **Inserting data**

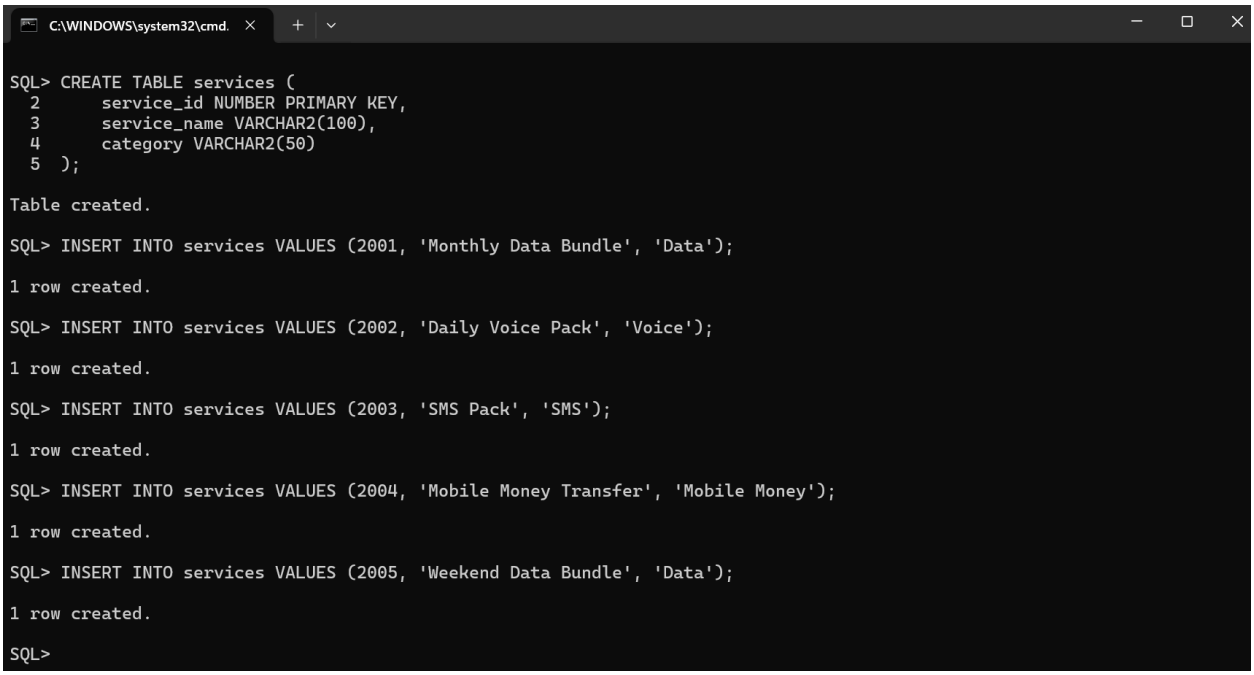
INSERT INTO services VALUES (2001, 'Monthly Data Bundle', 'Data');

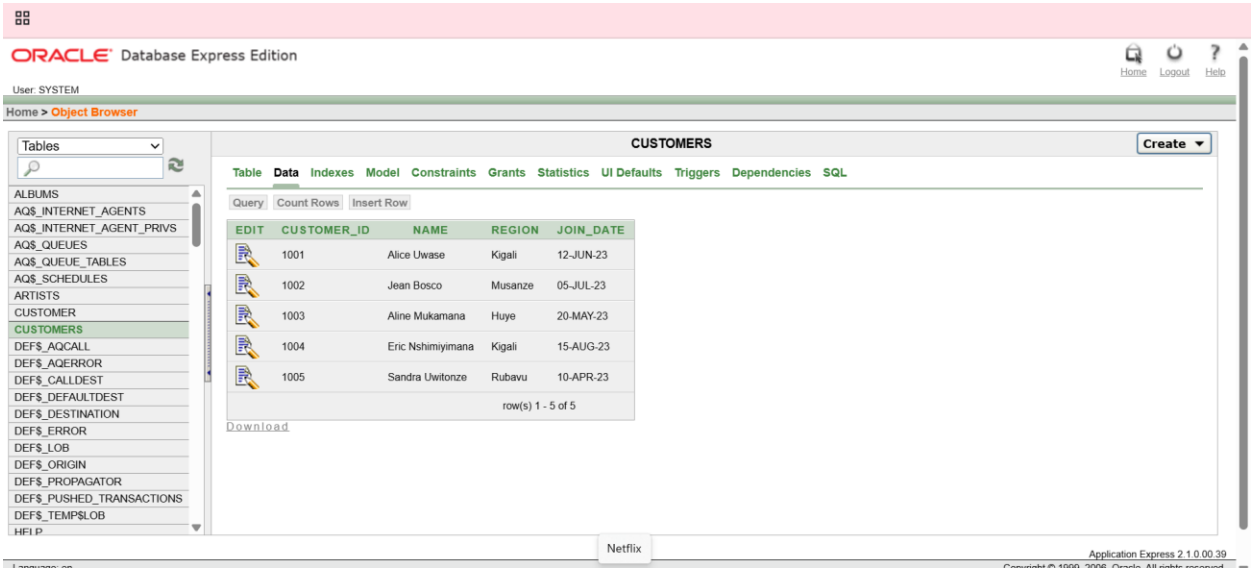
INSERT INTO services VALUES (2002, 'Daily Voice Pack', 'Voice');

INSERT INTO services VALUES (2003, 'SMS Pack', 'SMS');

INSERT INTO services VALUES (2004, 'Mobile Money Transfer', 'Mobile Money');

INSERT INTO services VALUES (2005, 'Weekend Data Bundle', 'Data');



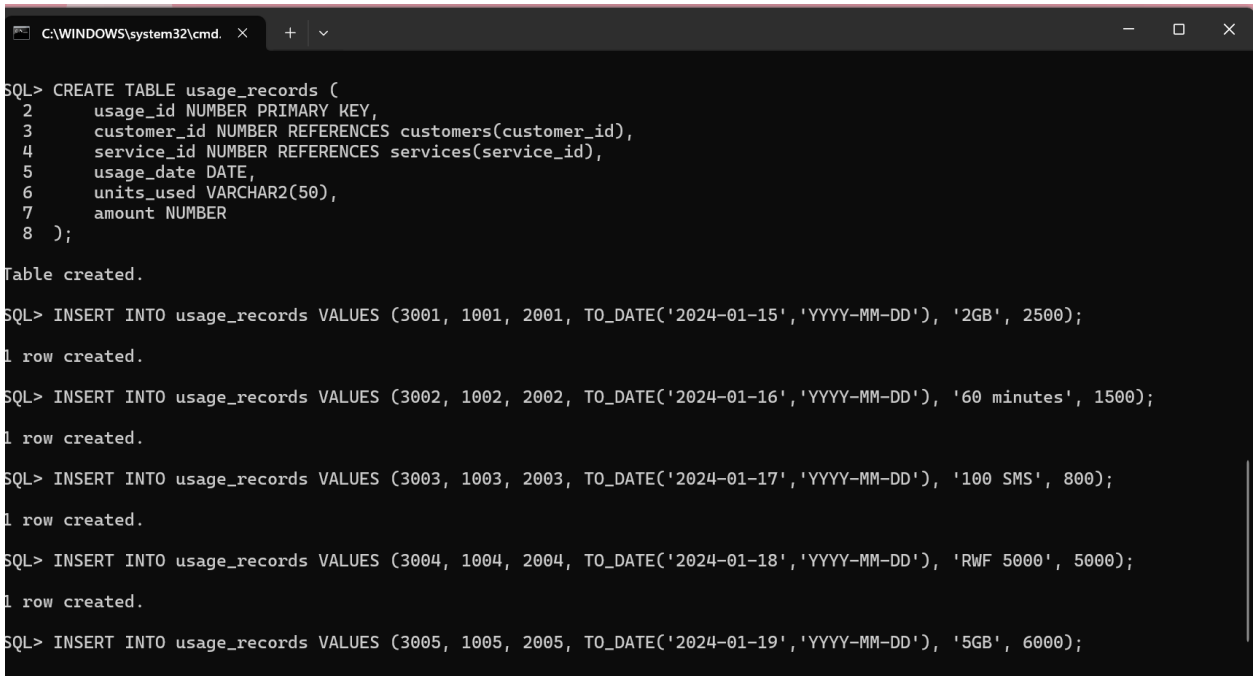


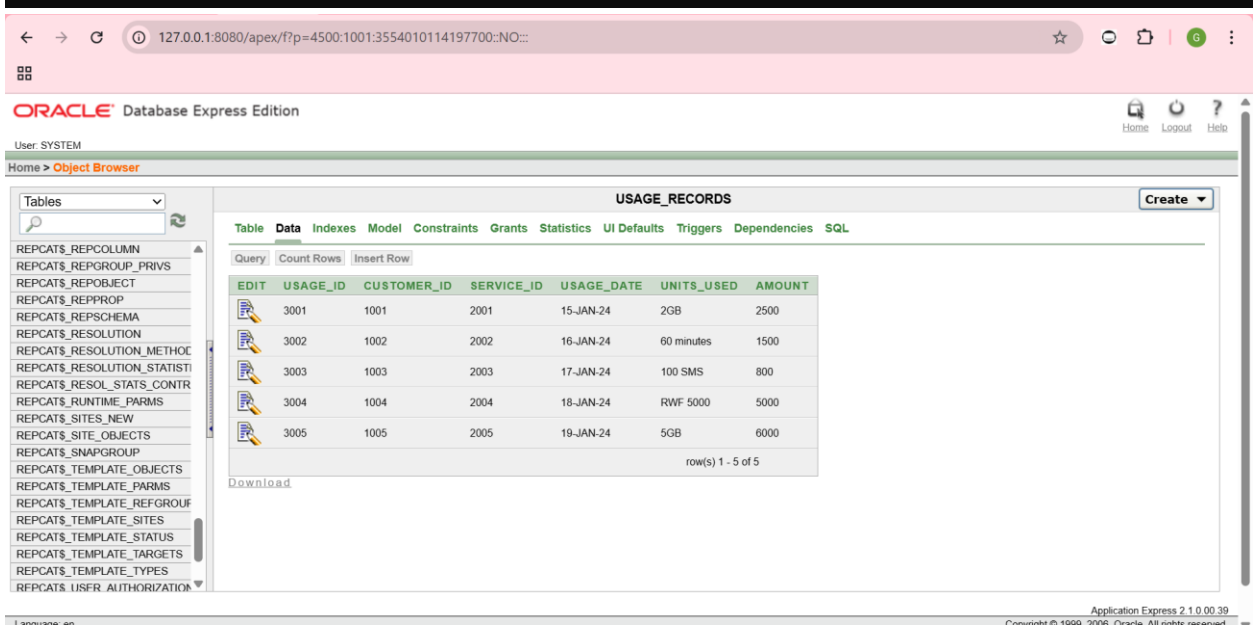
✓ Usage Records Table

```
CREATE TABLE usage_records (
    usage_id NUMBER PRIMARY KEY,
    customer_id NUMBER REFERENCES customers(customer_id),
    service_id NUMBER REFERENCES services(service_id),
    usage_date DATE,
    units_used VARCHAR2(50),
    amount NUMBER
);
```

- **Inserting data**

```
INSERT INTO usage_records VALUES (3001, 1001, 2001, TO_DATE('2024-01-15','YYYY-MM-DD'), '2GB', 2500);
INSERT INTO usage_records VALUES (3002, 1002, 2002, TO_DATE('2024-01-16','YYYY-MM-DD'), '60 minutes', 1500);
INSERT INTO usage_records VALUES (3003, 1003, 2003, TO_DATE('2024-01-17','YYYY-MM-DD'), '100 SMS', 800);
INSERT INTO usage_records VALUES (3004, 1004, 2004, TO_DATE('2024-01-18','YYYY-MM-DD'), 'RWF 5000', 5000);
INSERT INTO usage_records VALUES (3005, 1005, 2005, TO_DATE('2024-01-19','YYYY-MM-DD'), '5GB', 6000);
```





Step 4: Windows Functions Implementation

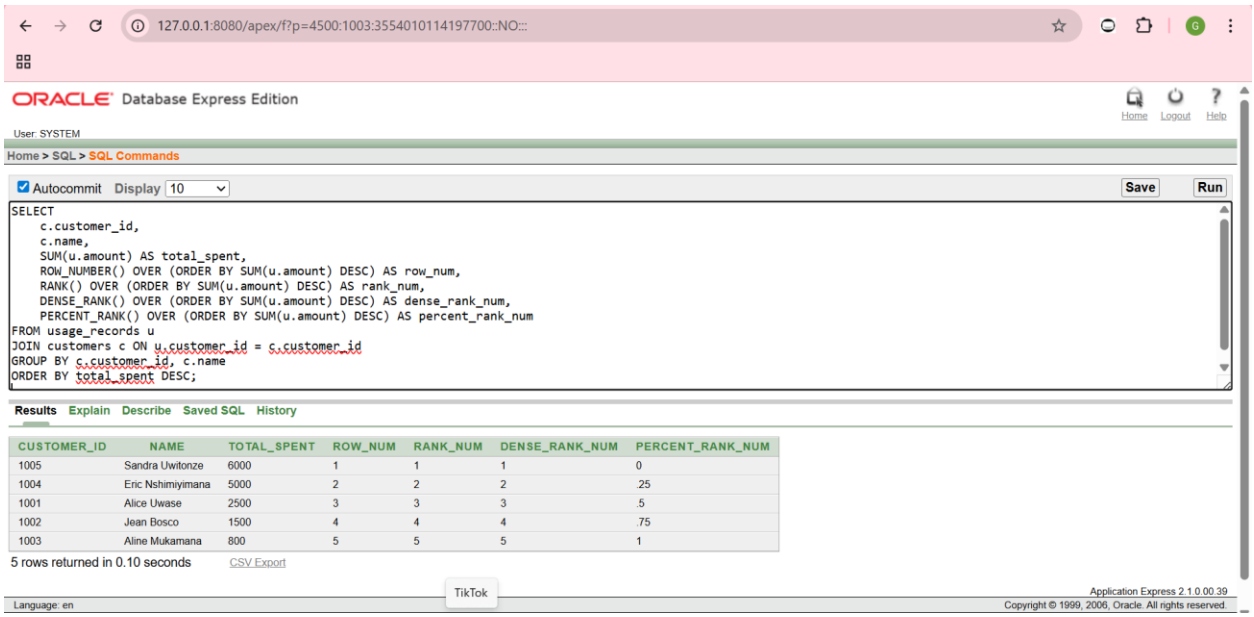
1. Ranking

SELECT

c.customer_id,

c.name,

```
    SUM(u.amount) AS total_spent,
    ROW_NUMBER() OVER (ORDER BY SUM(u.amount) DESC) AS row_num,
    RANK() OVER (ORDER BY SUM(u.amount) DESC) AS rank_num,
    DENSE_RANK() OVER (ORDER BY SUM(u.amount) DESC) AS dense_rank_num,
    PERCENT_RANK() OVER (ORDER BY SUM(u.amount) DESC) AS percent_rank_num
FROM usage_records u
JOIN customers c ON u.customer_id = c.customer_id
GROUP BY c.customer_id, c.name
ORDER BY total_spent DESC;
```

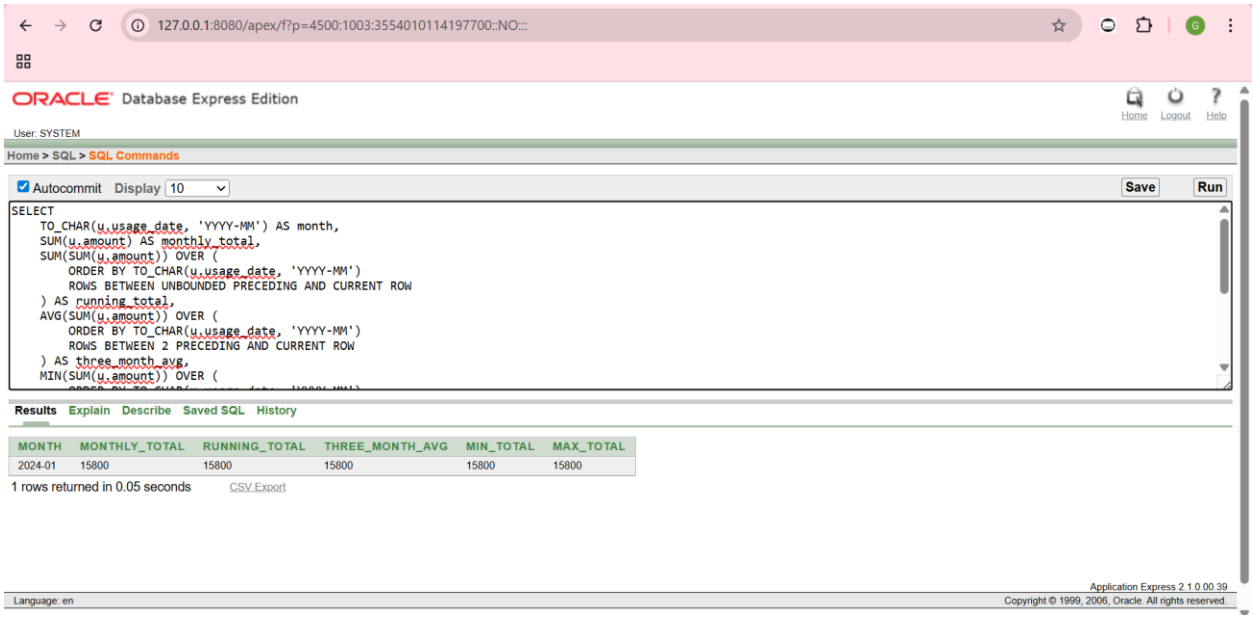


- The ranking query shows which customers contribute the most revenue allowing the company to identify the top spenders and compare them even when the totals are tied.

2. Aggregate

```
SELECT
    TO_CHAR(u.usage_date, 'YYYY-MM') AS month,
    SUM(u.amount) AS monthly_total,
    SUM(SUM(u.amount)) OVER (
```

```
        ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')
        ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW
    ) AS running_total,
    AVG(SUM(u.amount)) OVER (
        ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')
        ROWS BETWEEN 2 PRECEDING AND CURRENT ROW
    ) AS three_month_avg,
    MIN(SUM(u.amount)) OVER (
        ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')
        ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW
    ) AS min_total,
    MAX(SUM(u.amount)) OVER (
        ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')
        ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW
    ) AS max_total
FROM usage_records u
GROUP BY TO_CHAR(u.usage_date, 'YYYY-MM')
ORDER BY month;
```

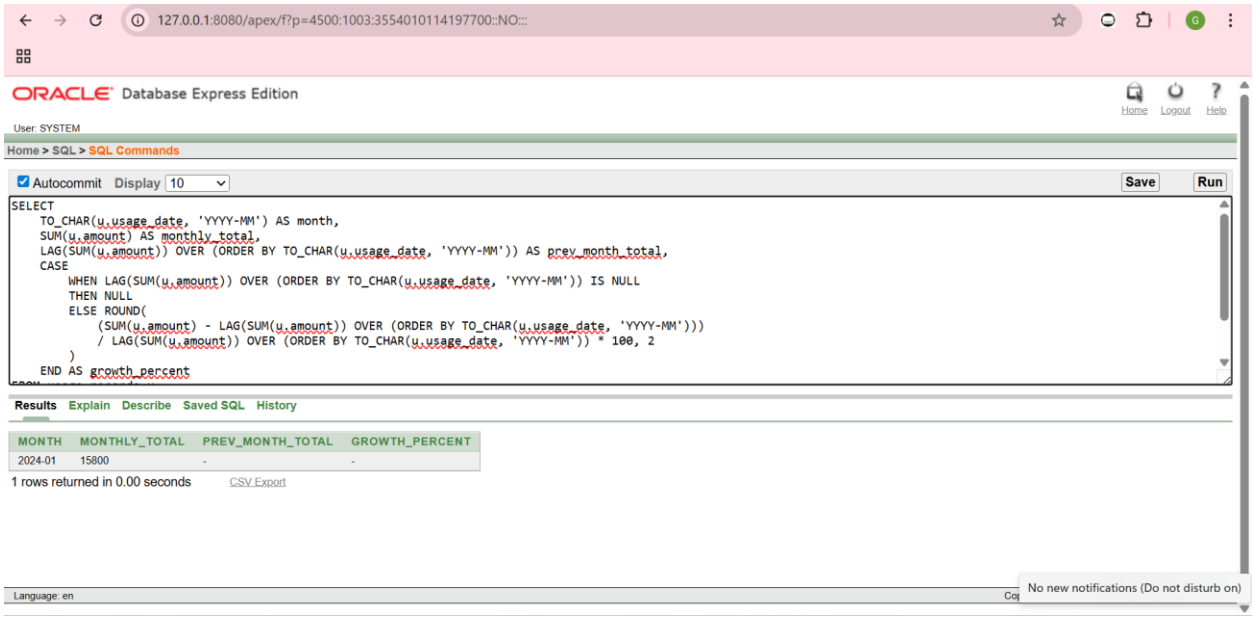


- The aggregate help track spending trends over time, giving insights into whether overall customer usage is increasing, decreasing or stable.

3. Navigation

```
SELECT
   TO_CHAR(u.usage_date, 'YYYY-MM') AS month,
   SUM(u.amount) AS monthly_total,
   LAG(SUM(u.amount)) OVER (ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')) AS prev_month_total,
   CASE
      WHEN LAG(SUM(u.amount)) OVER (ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')) IS NULL
      THEN NULL
      ELSE ROUND(
         (SUM(u.amount) - LAG(SUM(u.amount)) OVER (ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')))
         / LAG(SUM(u.amount)) OVER (ORDER BY TO_CHAR(u.usage_date, 'YYYY-MM')) * 100, 2
      )
```

```
    END AS growth_percent
FROM usage_records u
GROUP BY TO_CHAR(u.usage_date, 'YYYY-MM')
ORDER BY month;
```

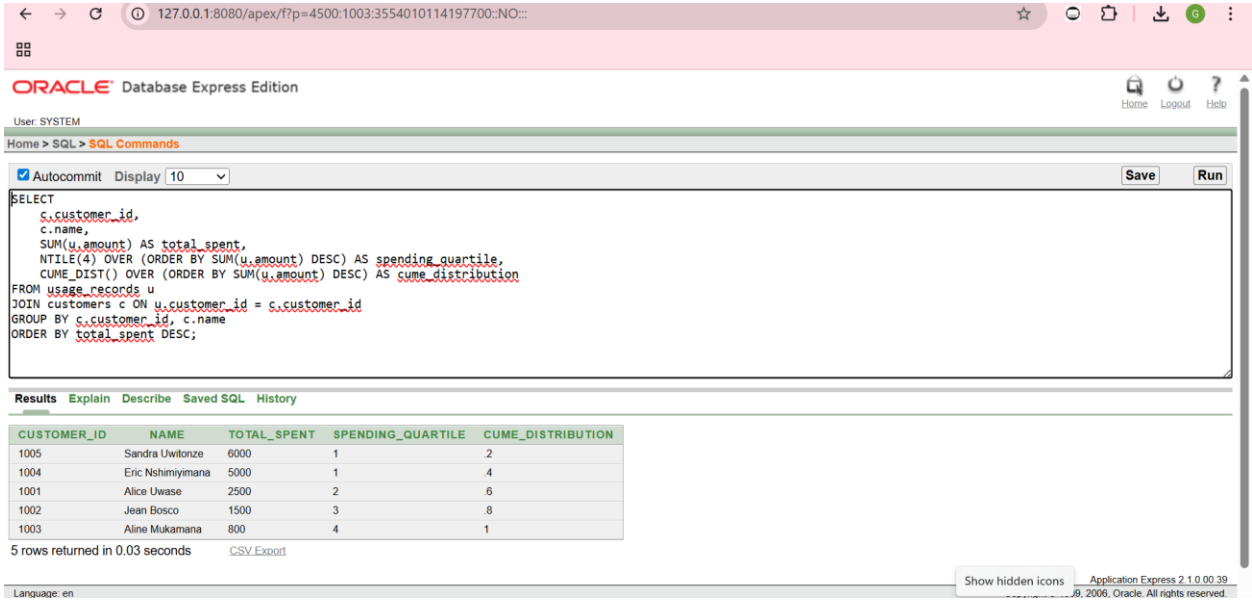


- Measuring growth or decline in usage, helping to identify seasonal changes or sudden changes in customer activity.

4. Distribution

```
SELECT
    c.customer_id,
    c.name,
    SUM(u.amount) AS total_spent,
    NTILE(4) OVER (ORDER BY SUM(u.amount) DESC) AS spending_quartile,
    CUME_DIST() OVER (ORDER BY SUM(u.amount) DESC) AS cume_distribution
FROM usage_records u
JOIN customers c ON u.customer_id = c.customer_id
GROUP BY c.customer_id, c.name
```

ORDER BY total_spent DESC;



- Customer spending is segmented into quartiles, showing which group spends the most versus the least, which supports targeted marketing and retention strategies.