

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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Experiment - 5

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Subject Name: Advanced Database and Management System

Subject Code: 23CSP-333

1. Problem Description/Aim:

Medium-Problem Title: Generate 1 million records per ID in ‘transaction_data’ using generate_series() and random() ,create a normal view and a materialized view ‘sales_summary’ with aggregated metrics (total_quantity_sold , total_sales, total_orders) , and compare their performance and execution time.

Procedure (Step-by-Step):

1. Create a large dataset:

- Create a table names transaction_data (id , value) with 1 million records.
- take id 1 and 2, and for each id, generate 1 million records in value column
- Use Generate_series () and random() to populate the data.

2. Create a normal view and materialized view to for sales_summary, which includes total_quantity_sold, total_sales, and total_orders with aggregation.

3. Compare the performance and execution time of both.

Sample Output Description:

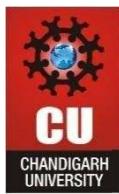
The transaction_data table has 2 million rows (1 million per ID) with random values. The normal view sales_summary computes aggregates on the fly, while the materialized view sales_summary_mv stores precomputed results. Queries on the materialized view are much faster, but it needs refreshing when data changes, whereas the normal view always shows up-to-date results.

Hard-Problem Title: Create restricted views in the sales database to provide summarized, non-sensitive data to the reporting team, and control access using DCL commands(GRANT and REVOKE).

Procedure (Step-by-Step):

1. Create restricted views-

- Define views that show only **aggregated sales data** (e.g., total_sales, total_orders) without exposing sensitive columns like customer details or payment info.



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2. Assign access to reporting team(or client)-
-Use “GRANT SELECT ON view_name TO reporting_user;” to give access.
3. Revoke access if needed.
-Use “REVOKE SELECT ON view_name FROM reporting_user;” to remove access.
4. Verify access
- Reporting users can query the view but cannot access base tables directly, ensuring security.

Sample Output Description:

The result shows the restricted view providing summarized sales data only like
- Columns shown are - product_id, total_quantity_sold, total_sales, total_orders
- Columns hidden are - Customer names, addresses, payment details

A reporting user querying the view sees something like :

- Product 101 - 5000 units sold, total sales Rs. 12,50,000,500 orders.
- Product 102 - 3200 units sold, total sales Rs. 8,60,000,320 orders.

When the user tries to query the base “sales_transactions” table directly, access is denied, enforcing security.

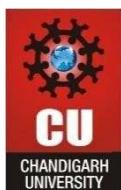
2. **Objective:** To design and implement secure, efficient data access mechanisms by creating large-scale transaction datasets, summarizing them through normal and materialized views for performance comparison, and enforcing restricted access to sensitive data using views and DCL commands.

3. SQL QUERY AND OUTPUTS -

MEDIUM LEVEL PROBLEM

```
Create table TRANSACTION_DATA(id int, val decimal);
INSERT INTO TRANSACTION_DATA(ID,VAL)
SELECT 1,RANDOM()
FROM GENERATE_SERIES(1,1000000);
```

```
INSERT INTO TRANSACTION_DATA(ID,VAL)
SELECT 2,RANDOM()
FROM GENERATE_SERIES(1,1000000);
SELECT * FROM TRANSACTION_DATA;
```



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CREATE or REPLACE VIEW SALES_SUMMARY AS

SELECT

ID,

COUNT(*) AS total_quantity_sold,

sum(val) AS total_sales,

count(distinct id) AS total_orders

FROM TRANSACTION_DATA

GROUP BY ID;

EXPLAIN ANALYZE

SELECT * FROM SALES_SUMMARY;

CREATE MATERIALIZED VIEW SALES_SUMM AS

SELECT

ID,

COUNT(*) AS total_quantity_sold,

sum(val) AS total_sales,

count(distinct id) AS total_orders

FROM TRANSACTION_DATA

GROUP BY ID;

EXPLAIN ANALYZE

SELECT * FROM SALES_SUMM;

```
6   INSERT INTO TRANSACTION_DATA(ID,VAL)
7   SELECT 2,random()
8   FROM generate_series(1,1000000);
9   SELECT * FROM TRANSACTION_DATA;
```

Data Output Messages Notifications

	id integer	val numeric
1	1	0.748060017288284
2	1	0.158813530918857
3	1	0.482094772953915
4	1	0.461220286286965
5	1	0.601375928005661
6	1	0.120882758237791
7	1	0.626445464971291
8	1	0.448741750697511
9	1	0.127332205463045



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```
21   SELECT * FROM SALES_SUMMARY; /*Simple view */
```

Data Output Messages Notifications

A screenshot of a PostgreSQL query result. The table has four columns: id, total_quantity_sold, total_sales, and total_orders. The data shows two rows: one with id 1, total_quantity_sold 2000000, total_sales 1000226.201610874170319933640, and total_orders 1; and another with id 2, total_quantity_sold 1000000, total_sales 499473.47586932728250459408, and total_orders 1.

	id integer	total_quantity_sold bigint	total_sales numeric	total_orders bigint
1	1	2000000	1000226.201610874170319933640	1
2	2	1000000	499473.47586932728250459408	1

```
20   EXPLAIN ANALYZE
```

```
21   SELECT * FROM SALES_SUMMARY; /*Simple view */
```

Data Output Messages Notifications

A screenshot of the EXPLAIN ANALYZE output for the sales summary query. The output is a numbered list of planning and execution steps:

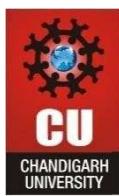
- 1 GroupAggregate (cost=471514.97..509014.99 rows=2 width=52) (actual time=0.135 ms to 0.462 ms)
- 2 Group Key: transaction_data.id
- 3 -> Sort (cost=471514.97..479014.97 rows=3000000 width=15) (actual time=0.135 ms to 0.462 ms)
- 4 Sort Key: transaction_data.id
- 5 Sort Method: external merge Disk: 73504kB
- 6 -> Seq Scan on transaction_data (cost=0.00..46224.00 rows=3000000 width=15) (actual time=0.135 ms to 0.462 ms)
- 7 Planning Time: 0.135 ms
- 8 Execution Time: 4396.880 ms

```
33   SELECT * FROM SALES_SUMM; /*Materialized view*/
```

Data Output Messages Notifications

A screenshot of a PostgreSQL query result from a materialized view. The table has four columns: id, total_quantity_sold, total_sales, and total_orders. The data shows two rows: one with id 1, total_quantity_sold 1000000, total_sales 500106.667545326356598143529, and total_orders 1; and another with id 2, total_quantity_sold 1000000, total_sales 499473.47586932728250459408, and total_orders 1.

	id integer	total_quantity_sold bigint	total_sales numeric	total_orders bigint
1	1	1000000	500106.667545326356598143529	1
2	2	1000000	499473.47586932728250459408	1



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The screenshot shows a SQL interface with the following details:

- Query ID: 32 (EXPLAIN ANALYZE)
- Query: SELECT * FROM SALES_SUMM; /*Materialized view*/
- Data Output, Messages, Notifications tabs are visible.
- Toolbar icons include: New Query, Save, Open, Print, Delete, Download, Refresh, and SQL.
- Text area:
 - QUERY PLAN text
 - 1 Seq Scan on sales_summ (cost=0.00..20.20 rows=1020 width=52) (actual time=0.017..0.018 rows=2 loops=...)
 - 2 Planning Time: 0.063 ms
 - 3 Execution Time: 0.032 ms
- Showing rows: 1

OUTPUT -

As we can see that the execution time using the materialized view is very less as compared to the simple view's execution time.

-----HARD PROBLEM-----

```
CREATE TABLE customer_data (
    transaction_id SERIAL PRIMARY KEY,
    customer_name VARCHAR(100),
    email VARCHAR(100),
    phone VARCHAR(15),
    payment_info VARCHAR(50), -- sensitive
    order_value DECIMAL,
    order_date DATE DEFAULT CURRENT_DATE
);
```

-- Insert sample data

```
INSERT INTO customer_data (customer_name, email, phone, payment_info, order_value)
VALUES
('Mandeep Kaur', 'mandeep@example.com', '9040122324', '1234-5678-9012-3456', 500),
('Mandeep Kaur', 'mandeep@example.com', '9040122324', '1234-5678-9012-3456', 1000),
('Jaskaran Singh', 'jaskaran@example.com', '9876543210', '9876-5432-1098-7654', 700),
('Jaskaran Singh', 'jaskaran@example.com', '9876543210', '9876-5432-1098-7654', 300);
```



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```
CREATE OR REPLACE VIEW RESTRICTED_SALES_DATA AS
```

```
SELECT
```

```
CUSTOMER_NAME,
```

```
COUNT(*) AS total_orders,
```

```
SUM(order_value) as total_sales
```

```
from customer_data
```

```
group by customer_name;
```

```
select * from restricted_sales_data;
```

```
CREATE USER CLIENT1 WITH PASSWORD 'REPORT1234';
```

```
GRANT SELECT ON RESTRICTED_SALES_DATA TO CLIENT1;
```

```
REVOKE SELECT ON RESTRICTED_SALES_DATA FROM CLIENT1;
```

Mandeep/client1@PostgreSQL 17

The session is idle and there is no current transaction.

Query History

```
62 group by customer_name;
63
64 select * from restricted_sales_data;
65
```

Data Output Messages Notifications

ERROR: permission denied for view restricted_sales_data

SQL state: 42501



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Mandeep/postgres@PostgreSQL 17

No limit

Query History

```
65
66 CREATE USER CLIENT1 WITH PASSWORD 'REPORT1234';
67 GRANT SELECT ON RESTRICTED_SALES_DATA TO CLIENT1;
68 REVOKE SELECT ON RESTRICTED_SALES_DATA FROM CLIENT;
```

Data Output Messages Notifications

GRANT

Query returned successfully in 154 msec.

Mandeep/client1@PostgreSQL 17

No limit

Query History

```
62 group by customer_name;
63
64 select * from restricted_sales_data;
65
```

Data Output Messages Notifications

SQL

	customer_name	total_orders	total_sales
1	Jaskaran Singh	2	1000
2	Mandeep Kaur	2	1500



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Mandeep/postgres@PostgreSQL 17

No limit

Query History

```
64 select * from restricted_sales_data;
65
66 CREATE USER CLIENT1 WITH PASSWORD 'REPORT1234';
67 GRANT SELECT ON RESTRICTED_SALES_DATA TO CLIENT1;
68 REVOKE SELECT ON RESTRICTED_SALES_DATA FROM CLIENT1;
```

Data Output Messages Notifications

REVOKE

Query returned successfully in 163 msec.

Mandeep/client1@PostgreSQL 17

No limit

Query History

```
63
64 select * from restricted_sales_data;
65
66 CREATE USER CLIENT1 WITH PASSWORD 'REPORT1234';
67 GRANT SELECT ON RESTRICTED_SALES_DATA TO CLIENT1;
68 REVOKE SELECT ON RESTRICTED_SALES_DATA FROM CLIENT1;
```

Data Output Messages Notifications

ERROR: permission denied for view restricted_sales_data

SQL state: 42501