LAB FILE

ADVANCED DBMS LAB

(ETCS-457)

Submitted to:

Ms. Savita Sharma

Assistant Professor

CSE Dept., MAIT

Name: **Sarvesh Nath Tiwari**

Roll No.: 42814802718

Semester: 7th

Group: 7C-7

Maharaja Agrasen Institute of Technology, PSP Area,

Sector – 22, Rohini New Delhi – 110085

S No.	List of experiments	Date	Remarks
1.	a. Learn to install PostgreSql. b. Compare different Databases such as PostgreSQL, Oracle, MySql and Maria DB.		
2.	Consider Schema: Student (student_name, enrollment_no, marks, area, branch) Write SQL queries on a. DDL (eg create, alter, drop, rename, truncate), b. DML (eg. Insert, update, delete etc.), c. DCL (eg. Grant, revoke etc.) d. Built-in Functions (eg. Sum, min, max, avg, count, lower, upper, trim, len etc.) e. Indexes and views: Create and Drop		
3.	Write SQL queries on Nested queries and Join.		
4.	**PL/SQL** a. Write a program to calculate total students enrolled areawise. b. Write a program to calculate average marks obtained by students residing in area that starts with "R"		
5.	**Cursor** Write the cursor to increase the marks of student by 10%		
6.	**Exception Handling** Write a program to create exceptions if enrollment no. is not issued to students by the university and raise the exception explicitly by using raise command.		
7.	**Procedure & Function** a. Write the procedure to get the average marks of students for branch "CSE". b. Write a function that accepts the branch and returns the total no. of students of the branch.		
8.	**Trigger** c. Create a trigger on the table after inserting a new student into the table. d. Write a row trigger to insert the existing values of the student table into a new table when the marks of the student is updated.		

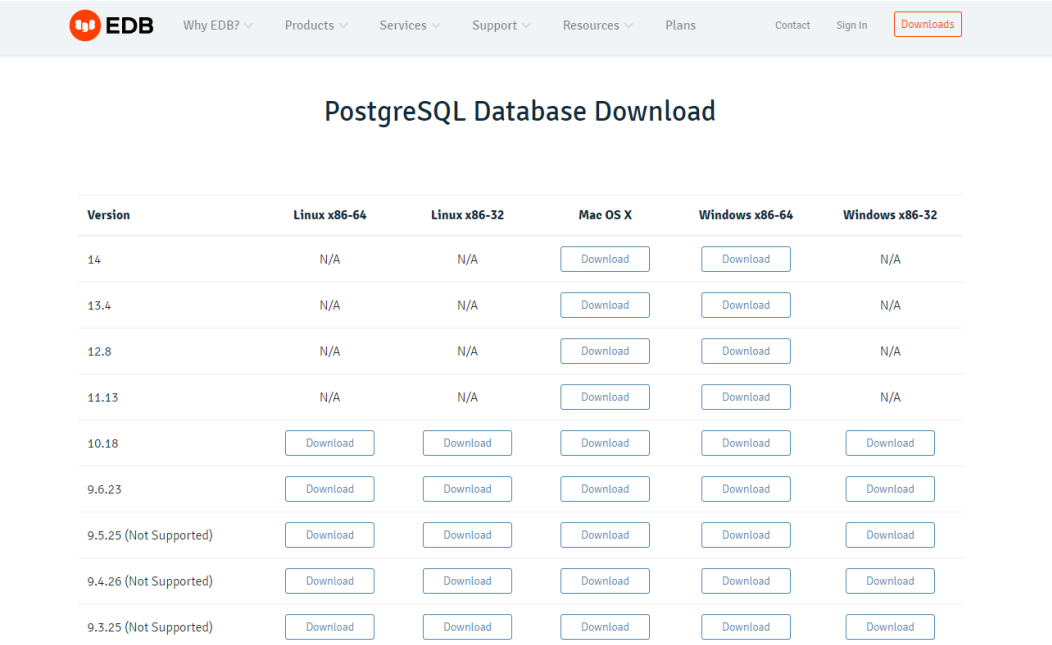
Experiment 1(a)

Aim : Learn to install PostgreSql.

Theory:PostgreSQL was developed for UNIX-like platforms, however, it was designed to be portable. It means that PostgreSQL can also run on other platforms such as Mac OS X, Solaris, and Windows.
PostgreSQL is an advanced, enterprise-class, and open-source relational database system. It supports both SQL (relational) and JSON (non-relational) querying. PostgreSQL is used as a primary database for many web applications as well as mobile and analytics applications.

Installation of PostgreSQL:

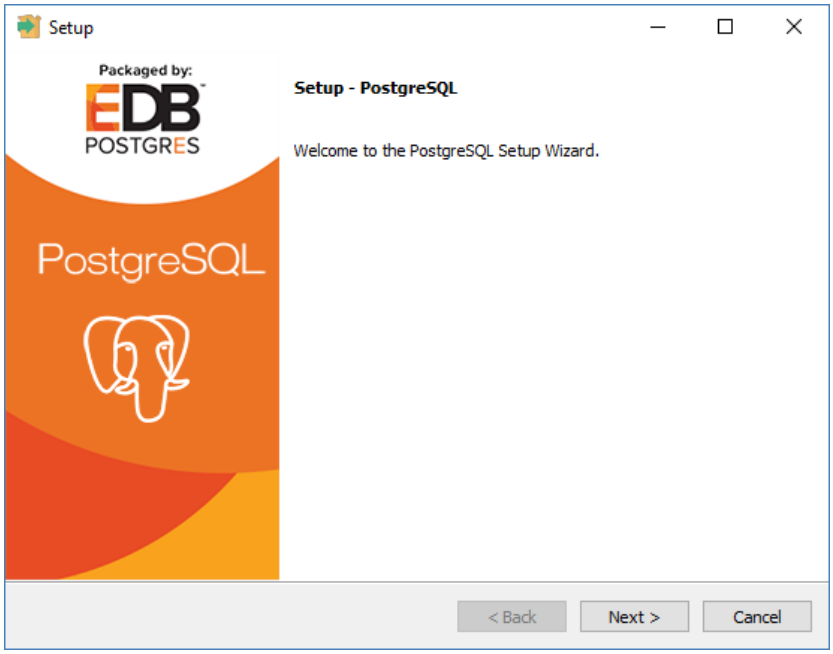
- We will download PostgreSQL installer for Windows
- First, we need to go to the download page of PostgreSQL installers on the EnterpriseDB.
- Then we will click the download link as shown below figure.
- It will take a few minutes to complete the download.

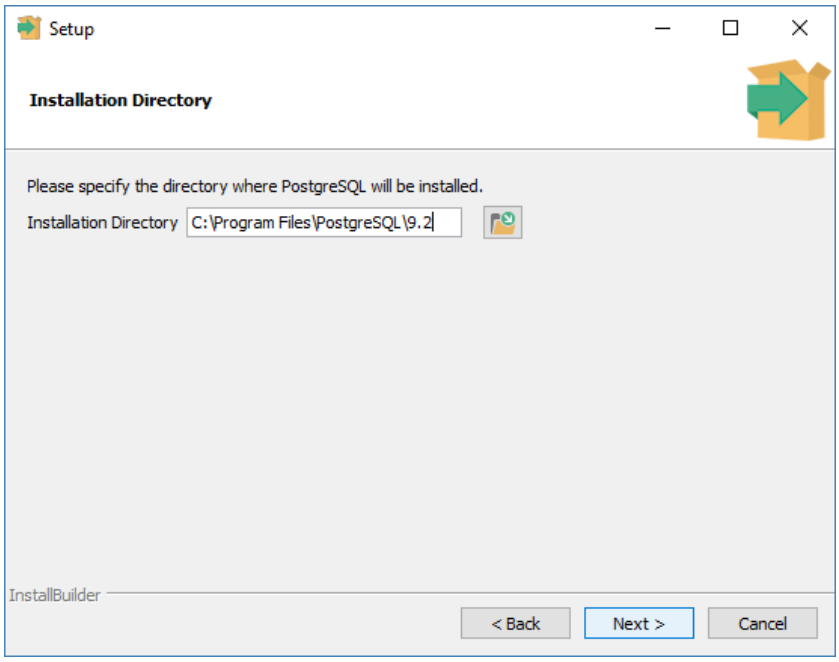


The further installation steps are:

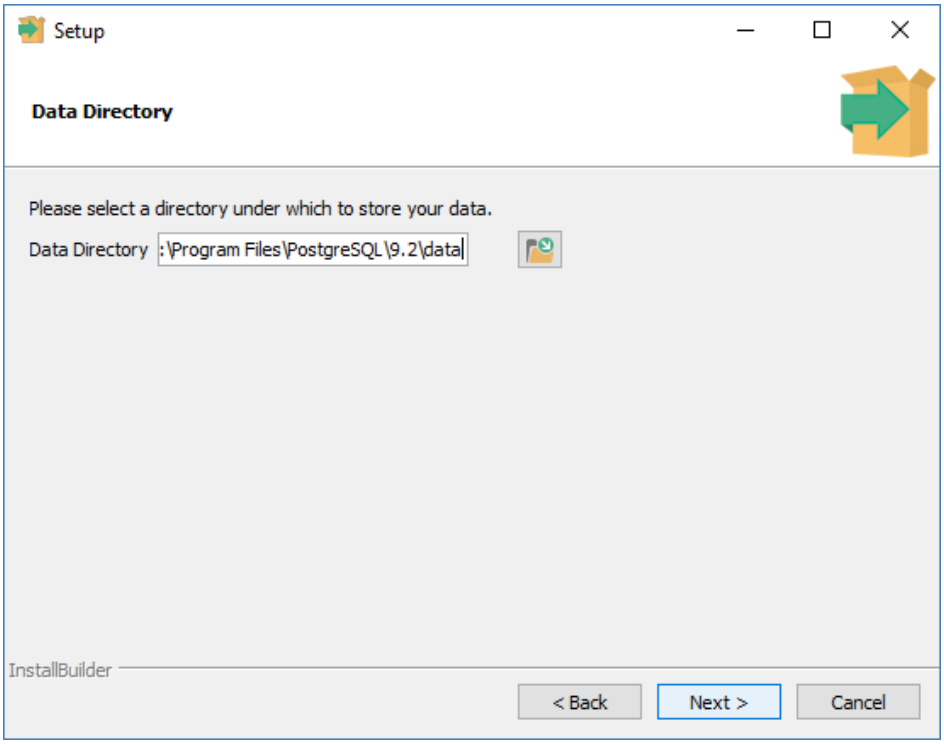
1) Double click on the installer file, an installation wizard will appear and guide you through multiple steps where you can choose different options that you would like to have in PostgreSQL

2) Click the Next button.

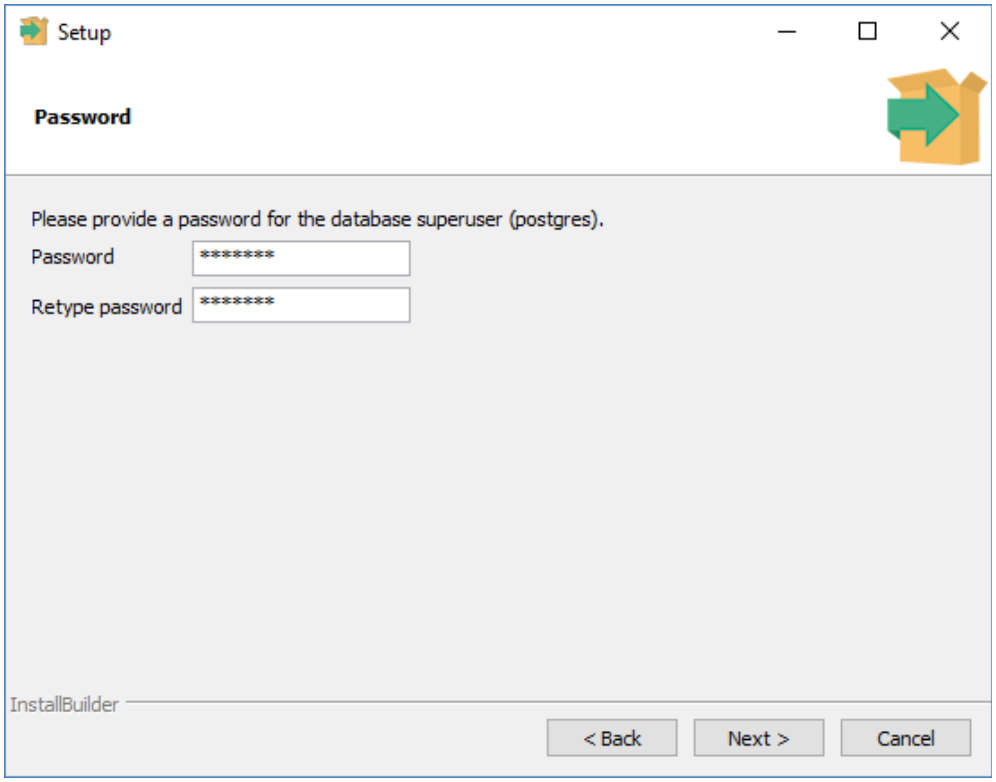




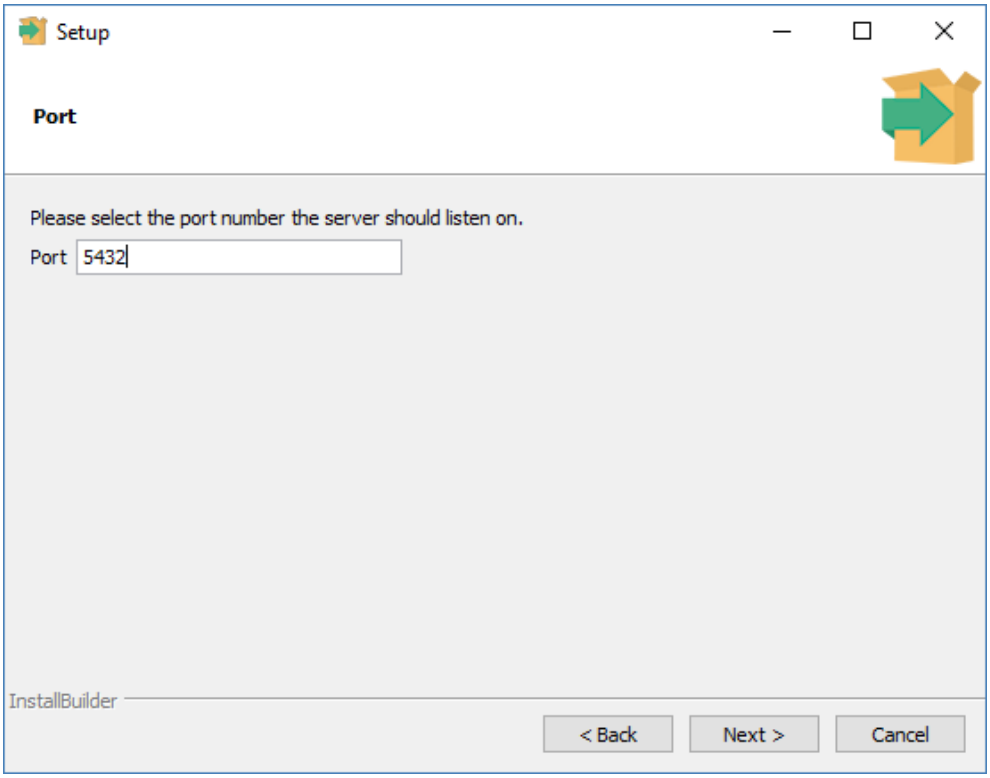
3) The next step of the installation process would be to select the directory where data would be stored, by default it is stored under "data" directory.



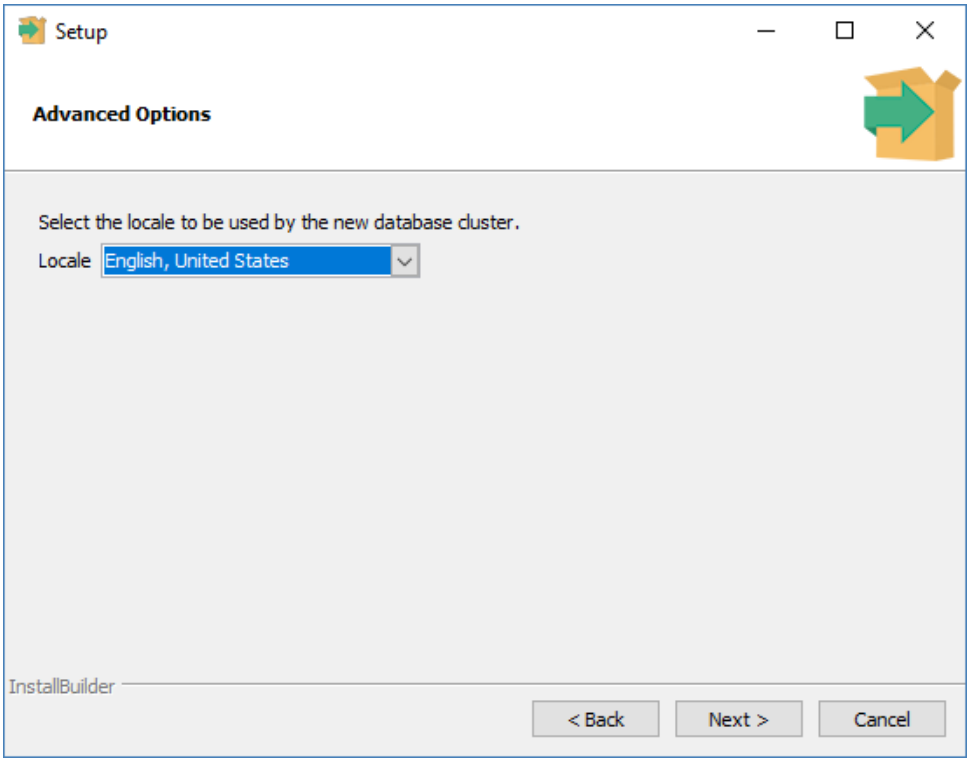
4) In the next step, setup asks for password, so you can use your favorite password

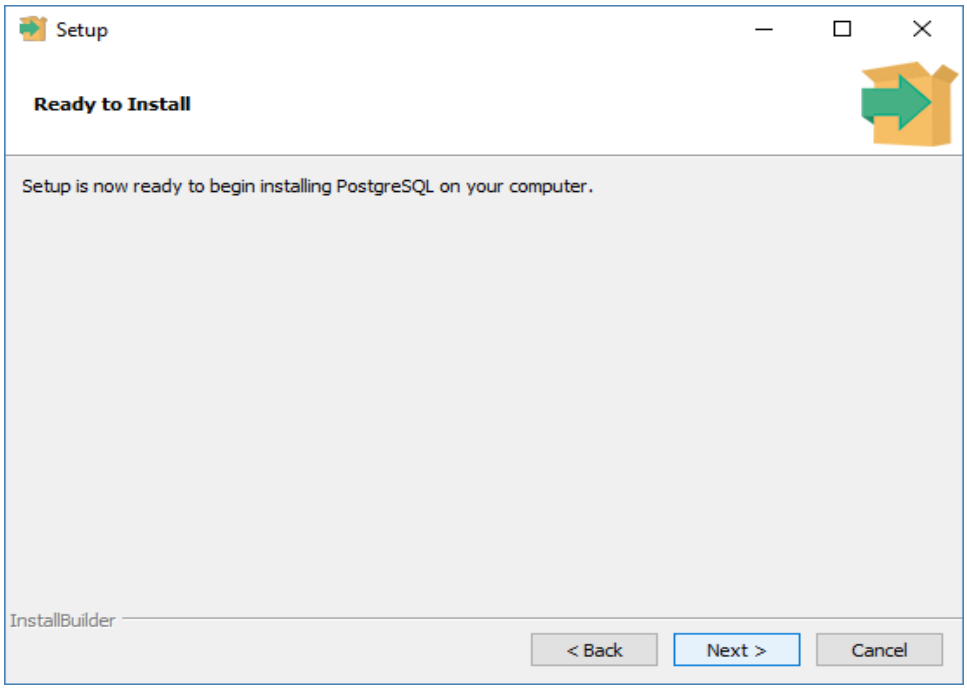


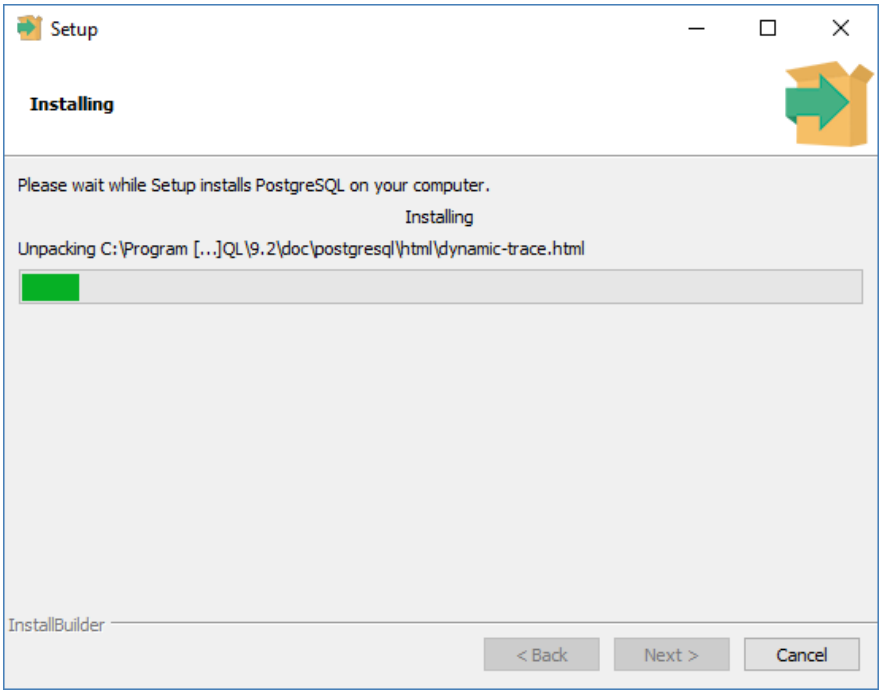
5) In the next step, keep the port as default.



6) In the next step, when asked for "Locale", "English, United States" has been selected.



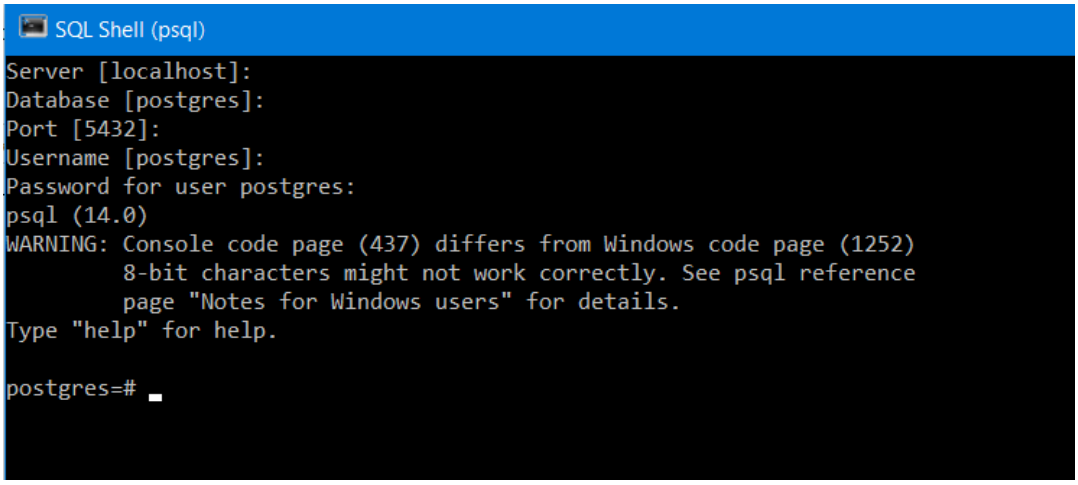




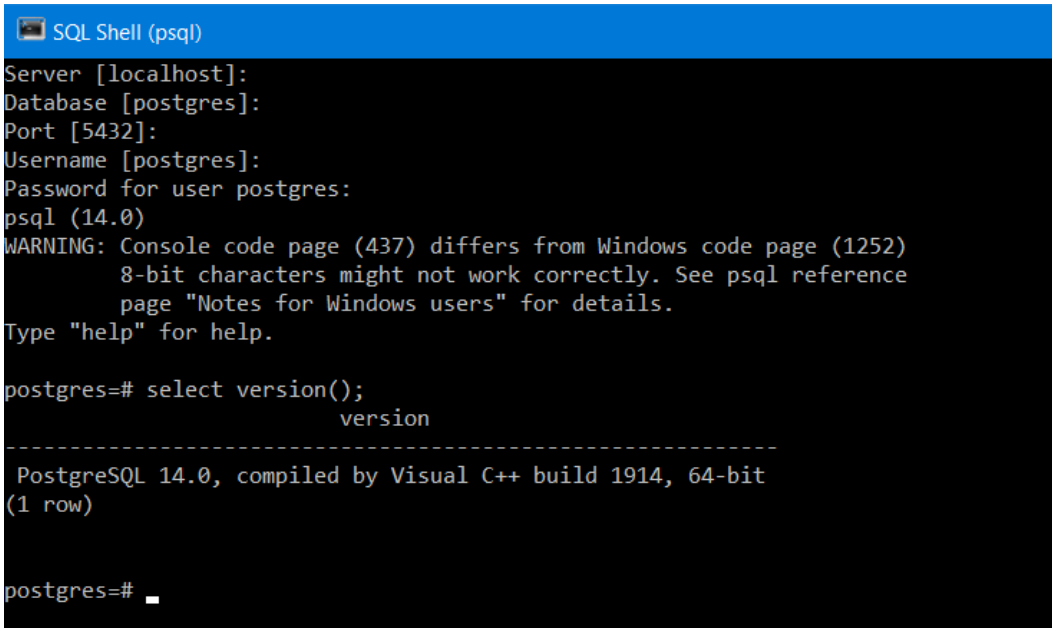
7) It takes a while to install PostgreSQL on your system. On completion of the installation process, you will get the following screen. Uncheck the checkbox and click on the Finish button.

Verify the Installation of PostgreSQL:

1) Click the **psql** (SQL SHELL) application to launch it. The psql command-line program will display. Enter all the necessary information such as the server, database, port, username, and password. To accept the default, you can press Enter. Note that you should provide the password that you entered during installing the PostgreSQL.



2) Enter the command SELECT version () and you will see the following output.



Experiment 1(b)

Aim : Compare different Databases such as PostgreSQL, Oracle, IBM DB2, MySql and Maria DB.

Theory: Let's look at some of the major database management systems currently available in regards to their pros and cons.

1. **Oracle**
    - Closed-source; free version has very limited feature set
    - Temporary tables persist across sessions, and must be removed by the user
    - Support for four different character/string types: CHAR, VARCHAR2, NCHAR, NVARCHAR2
    - Offers both table and row locking
    - Extensive and flexible storage customization with commands like tablespace, synonym, and packages
    - Extensive backup mechanisms
    - Designed to manage tables and databases on a large-scale basis

2. **MySQL**
    - Open-source
    - Compatible with a wide range of engines and interfaces; one Huof the most mature databases on the market
    - Lightweight
    - One of the most popular database tools; easy to find support online
    - Temporary tables are only visible within the current active session, and are removed automatically afterwards.
    - Lacks ACID compliance
    - Can partition tables via LIST, HASH, RANGE, and SET
    - Support for two different character/string types: CHAR and VARCHAR
    - Offers only table locking
    - Lacks options for table views
    - Limited storage customization
    - Admin tools are incredibly powerful
    - Two backup mechanisms: mysqlhotcopy and mysqldump
    - Experiences significant performance degradation at high scale.
    - Provides little in the way of performance optimization Issues with reliability
    - Limited security compared to some other database systems.
    - Designed for transactional workloads, and as such is ill-suited for analytical workloads

3. **IBM DB2**
    - Closed-source. Enterprise version only available for a price
    - Schema-based table management
    - Does not support XML
    - Can only partition tables via sharding
    - No in-memory capabilities
    - Designed for relational integrity
    - More robust table/data management than MySQL
    - Materialized table views
    - Lacks native character/string support
    - Multiple options for disaster recovery, availability, and scalability

4. **PostgreSQL**
    - Open-source
    - Adheres well to current SQL standards, and easier to learn as a result
    - Large footprint makes it ill-suited for read-heavy operations
    - Advanced business/location analytics features
    - Rich variety of data and character types
    - Fully ACID-compliant
    - Designed for reliability and data-integrity; developer-focused
    - Full-text search, support for powerful server-side procedural languages
    - Full support for advanced SQL features such as table expressions and window functions
    - Can efficiently join large numbers of tables
    - Replication is poorly-implemented
    - Not well-suited for low-concurrency projects

5. **Maria DB**
    - MariaDB is forked out of MySQL. So, there are a lot of similarities between these two databases.
    - MariaDB is an open-source database of type RDBMS and is compatible with My-SQL for drop-in replacement of the MySQL database.
    - Implemented in C, C++.
    - Supports complex data transactions.
    - Supports OLAP and OLTP systems.
    - Relatively easy to scale up when compared to MySQL.
    - Can be used for large sized data.
    - MariaDB is faster in processing transactions and can also handle over 200,000+ connections which are over and above the capacity of MySQL.

Feature	PostgreSQL	MySQL
Open Source	Completely Open source	Open source, but owned by Oracle and offers commercial versions
ACID Compliance	Complete ACID Compliance	Some versions are compliant
SQL Compliance	Almost fully compliant	Some versions are compliant
Concurrency Support	MVCC implementation supports multiple requests without read locks	Support in some versions.
Security	Secure from ground up with SSL support	SSL support in some versions
NoSQL/JSON Support	Multiple supported features	JSON data support only
Access Methods	Supports all standards	Supports all standards
Replication	Multiple replication technologies available: Single master to one standby Single master to multiple standbys Hot Standby/Streaming Replication Bi-Directional replication Logical log streaming replication	Standard master-standby replication: Single master to one standby Single master to multiple standbys Single master to one standby to one or more standbys Circular replication (A to B to C and back to A) Master to master
Materialized Views	Supported	Not supported
Temporary Tables	Supported	Supported
GeoSpatial Data	Supported	Supported
Programming Languages	Supported	Not supported
Extensible Type System	Supported	Not supported

Experiment 2

Aim : Consider Schema: Student(student_name, enrollment_no, marks, area, branch)

Write SQL queries on

- DDL (eg create, alter, drop, rename, truncate),
- DML (eg. Insert, update, delete etc.),
- DCL (eg. Grant, revoke etc.)
- Built-in Functions (eg. Sum, min, max, avg, count, lower, upper, trim, len etc.)
- Indexes and views: Create and Drop

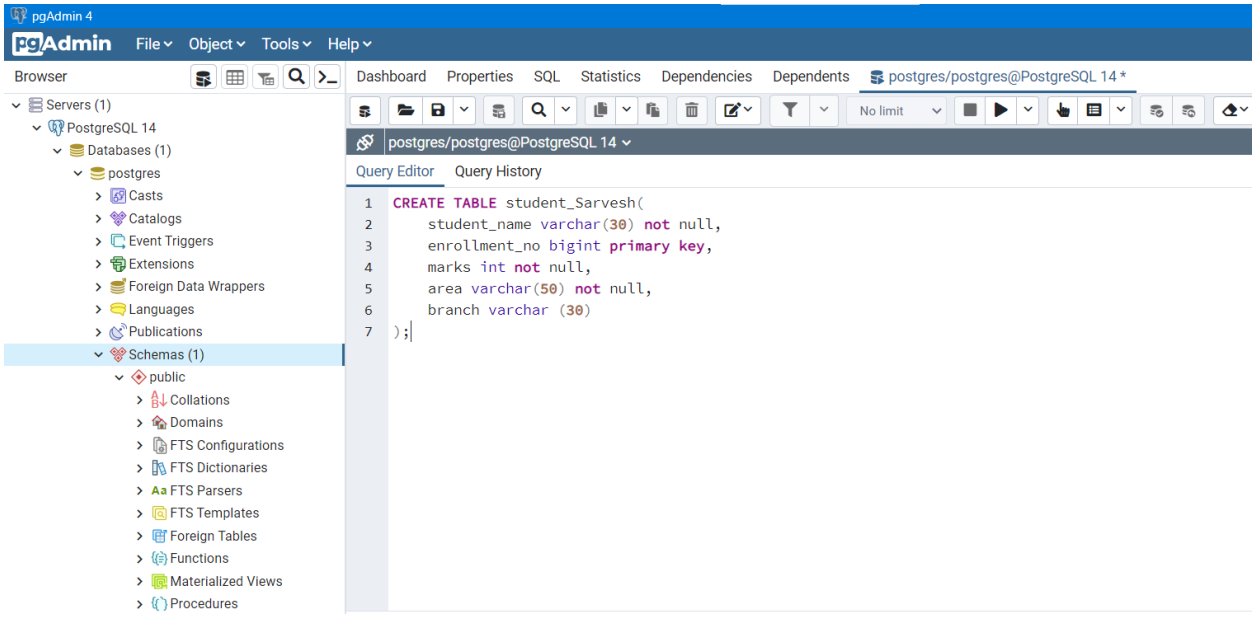
Theory:

- **Data Definition Language(DDL):** It consists of the SQL commands that can be used to define the database schema. It simply deals with descriptions of the database schema and is used to create and modify the structure of database objects in the database.

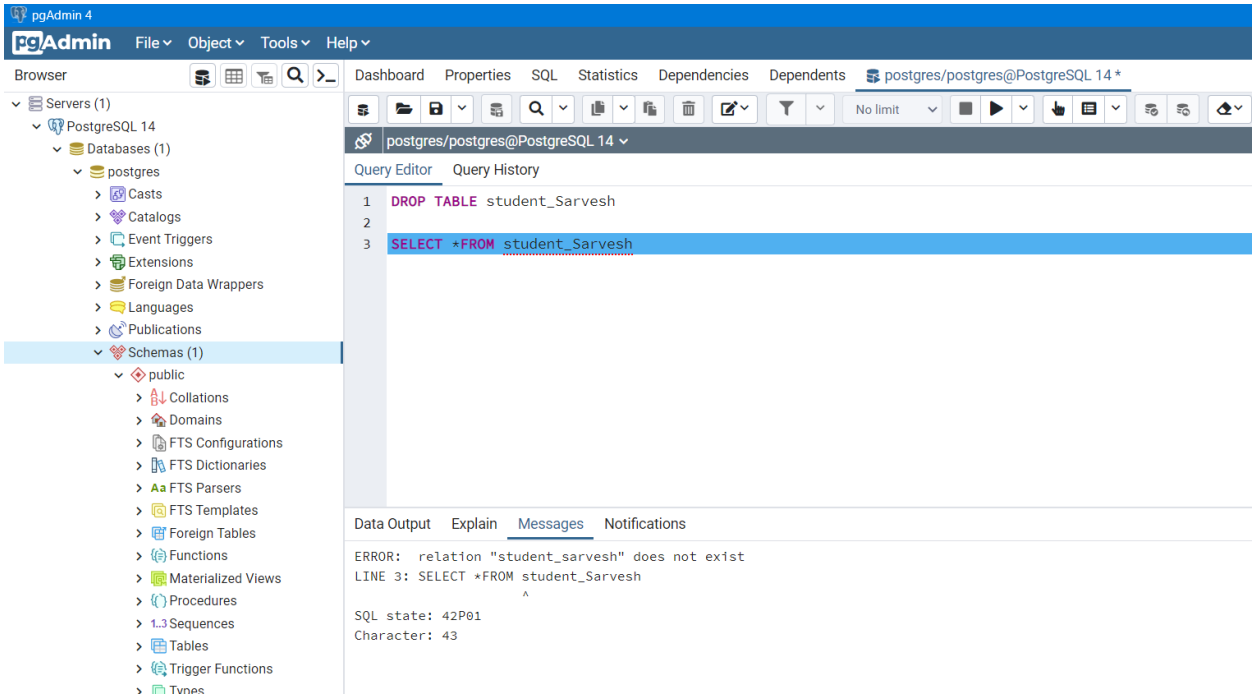
Let us build the table “Student”:

CREATE - It is used to create the database or its objects (like table, index, function, views, store procedure and triggers).

```
create table student_Sarvesh(
        student_name varchar(30) not null,
        enrollment_no bigint primary key,
        marks int not null,
        area varchar(50) not null,
        branch varchar (30)
);
```

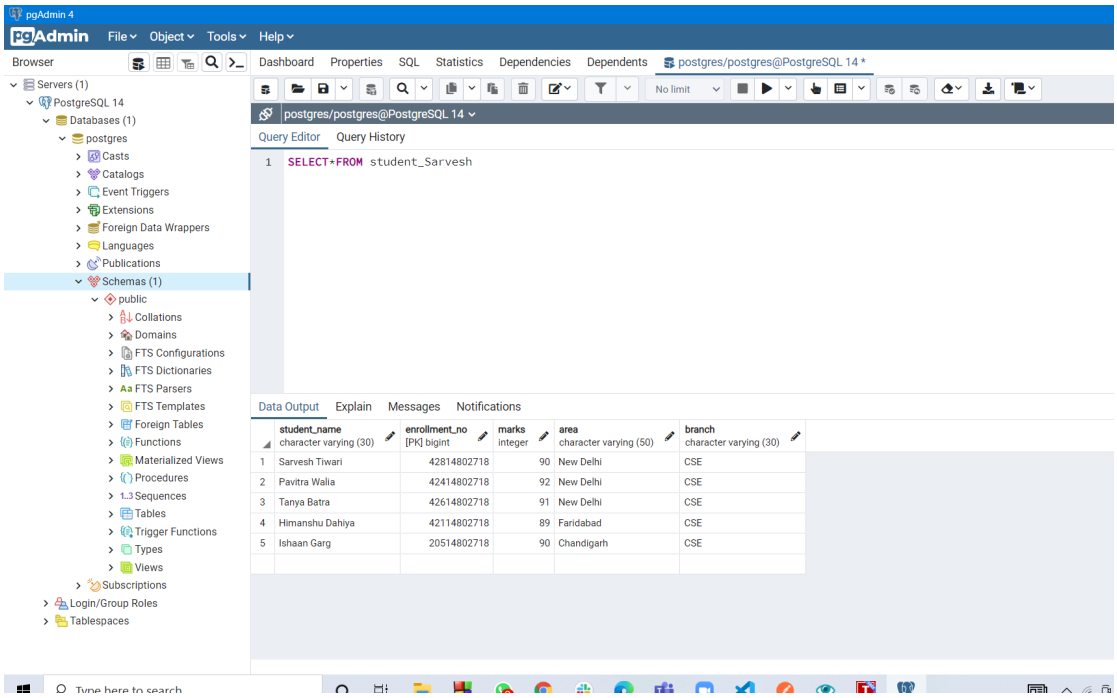


DROP- The DROP command is a type of SQL DDL command that is used to delete an existing database or an object within a database.

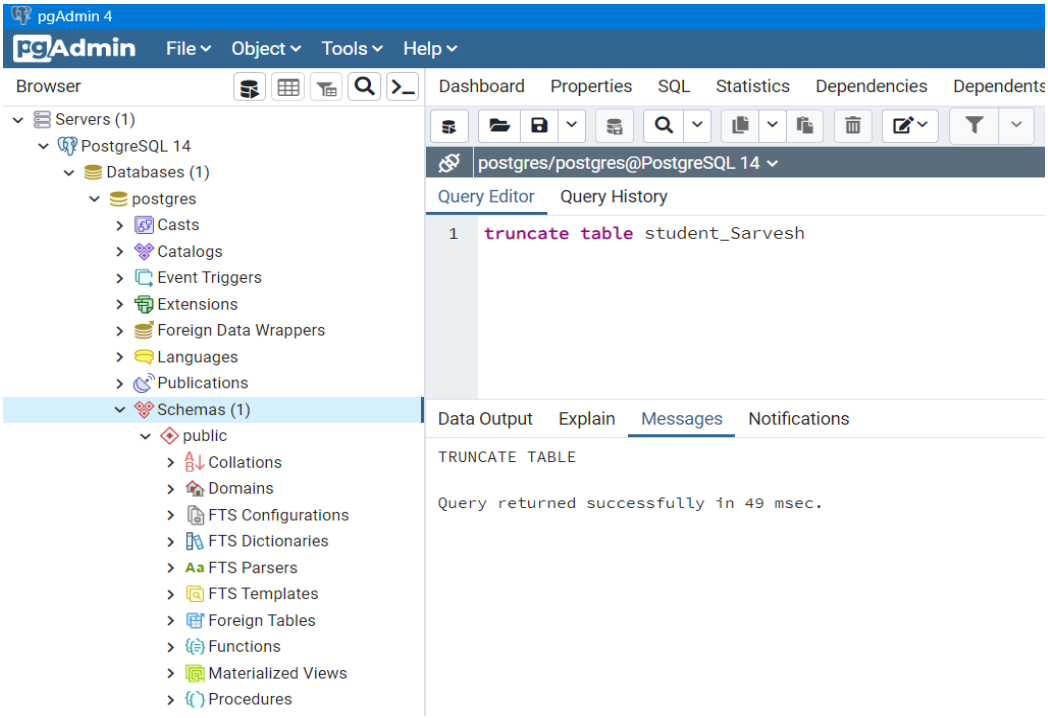


TRUNCATE : The TRUNCATE command in SQL DDL is used to remove all the records from a table. Let's insert a few records in the Books table:

Before TRUNCATE:



After TRUNCATE:


pgAdmin 4
File
Object
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Browser
Dashboard
Properties
SQL
Statistics
Dependencies
Dependents
Servers (1)
PostgreSQL 14
Databases (1)
postgres
Casts
Catalogs
Event Triggers
Extensions
Foreign Data Wrappers
Languages
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FTS Configurations
FTS Dictionaries
FTS Parsers
FTS Templates
Foreign Tables
Functions
Materialized Views
Procedures
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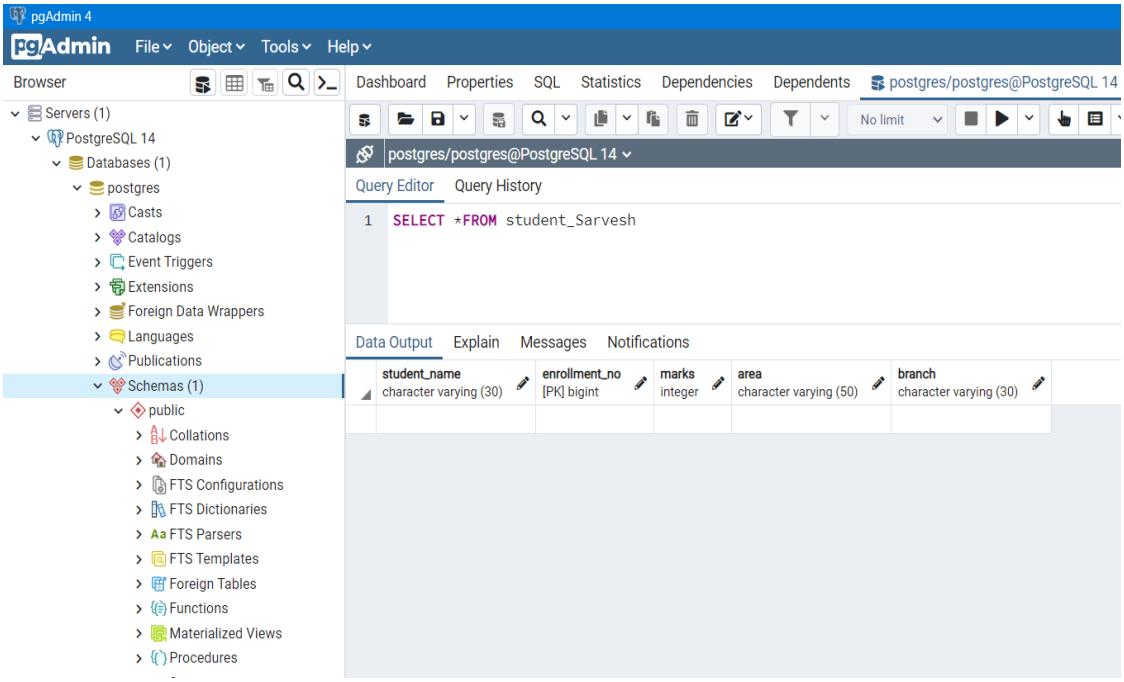
Query History
1 truncate table student_Sarvesh
Data Output
Explain
Messages
Notifications
TRUNCATE TABLE
Query returned successfully in 49 msec.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Servers (1)
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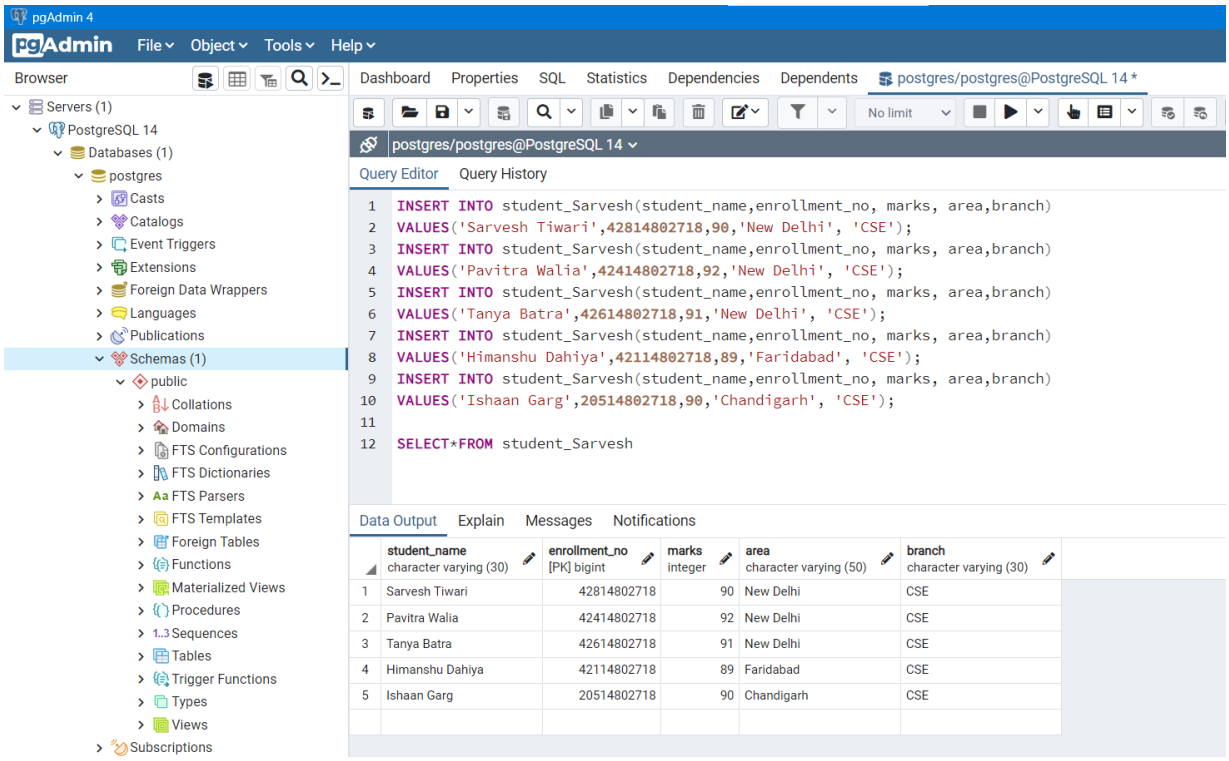
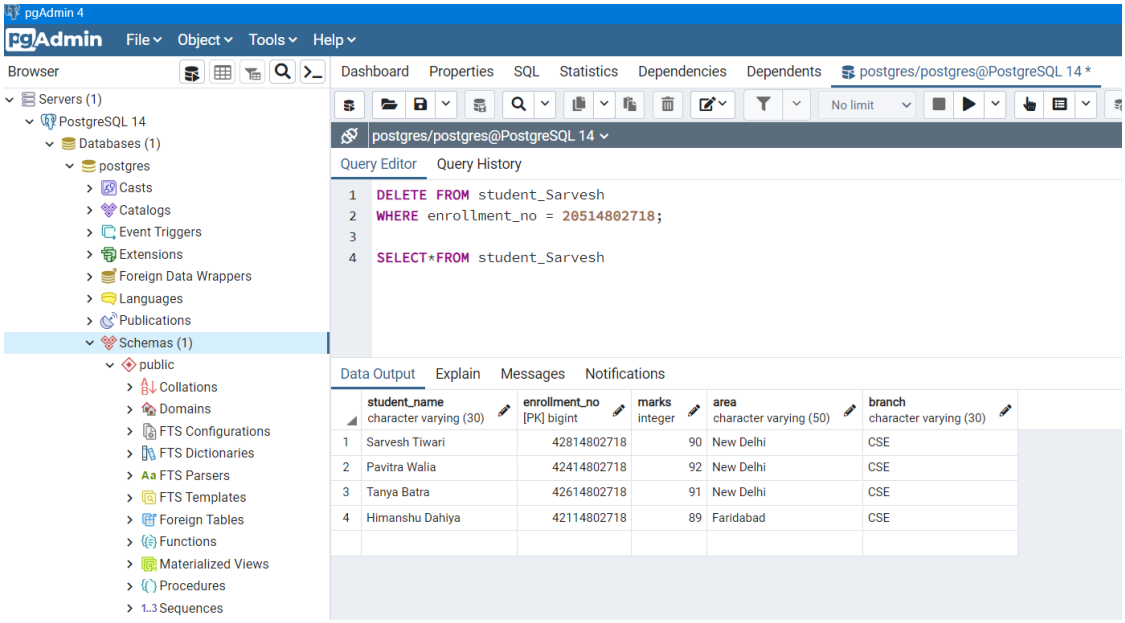
Databases (1)
postgres
Casts
Catalogs
Event Triggers
Extensions
Foreign Data Wrappers
Languages
Publications
Schemas (1)
public
Collations
Domains
FTS Configurations
FTS Dictionaries
FTS Parsers
FTS Templates
Foreign Tables
Functions
Materialized Views
Procedures
Query Editor
Query History
1 SELECT *FROM student_Sarvesh
Data Output
Explain
Messages
Notifications
student_name character varying (30)
enrollment_no [PK] bigint
marks integer
area character varying (50)
branch character varying (30)

- **Data Manipulation Language (DML)**: The SQL commands that deal with the manipulation of data present in the database belong to DML or Data Manipulation Language and this includes most of the SQL statements. It is the component of the SQL statement that controls access to data and to the database.

INSERT : The INSERT statement is a SQL query used to insert data into the row of a table.

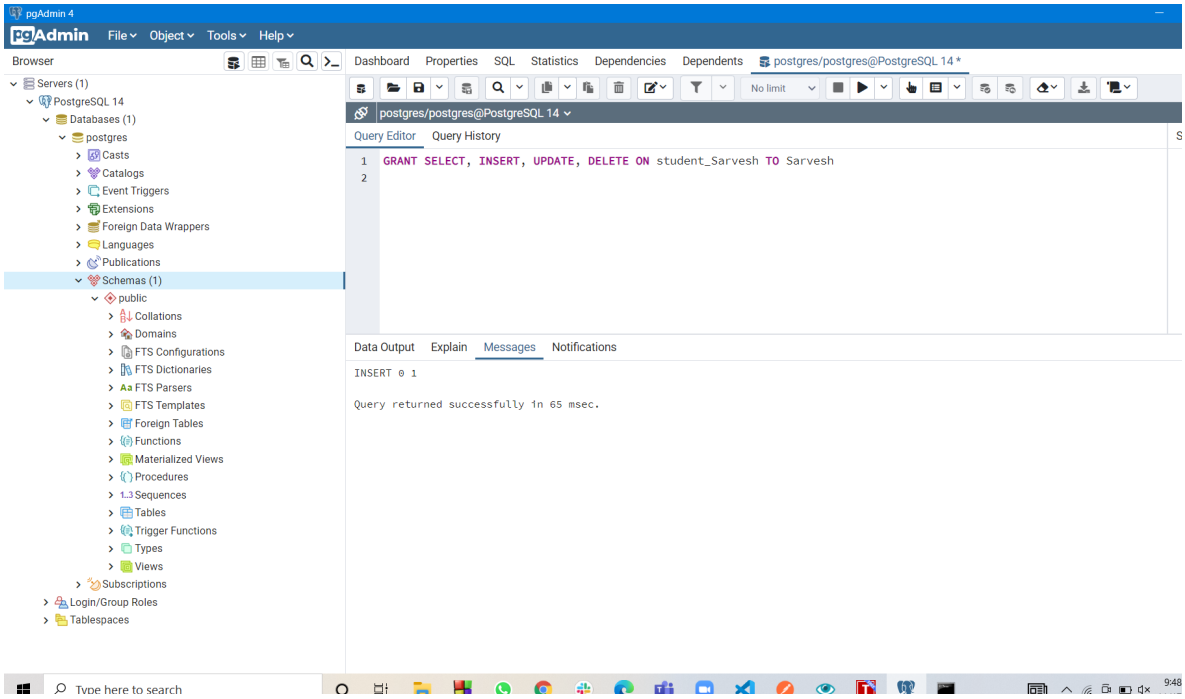


DELETE: It is used to remove one or more rows from a table.

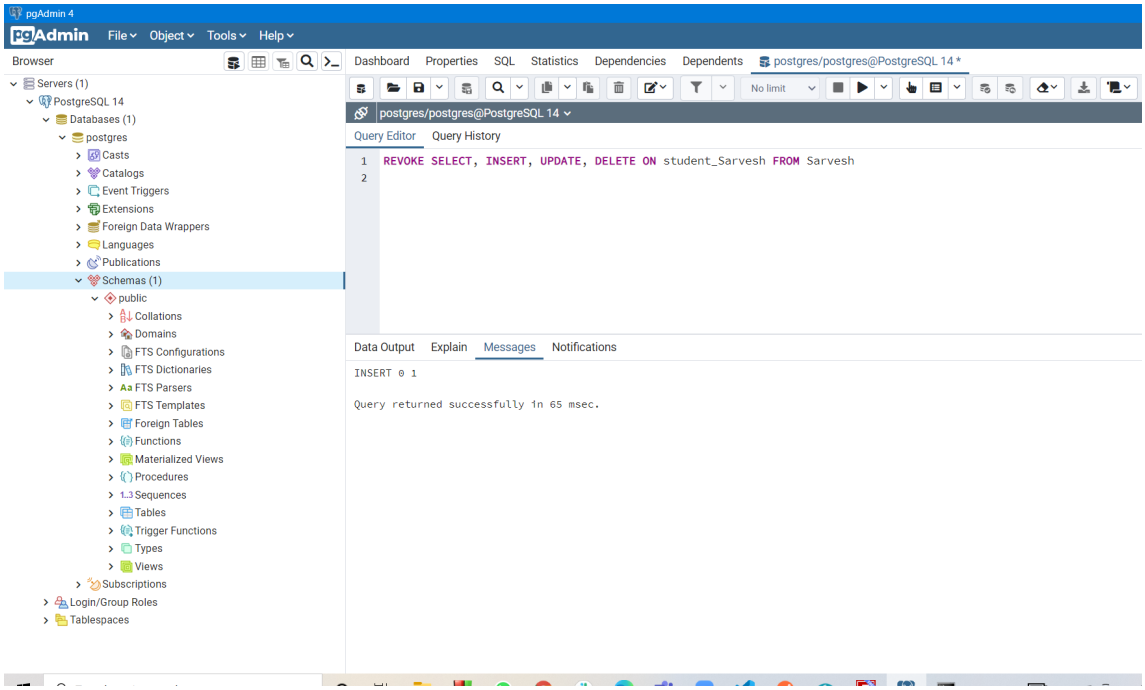


- **Data Control Language(DCL)**: It includes commands such as GRANT and REVOKE which mainly deal with the rights, permissions, and other controls of the database system.

GRANT: It is used to give user access privileges to a database.

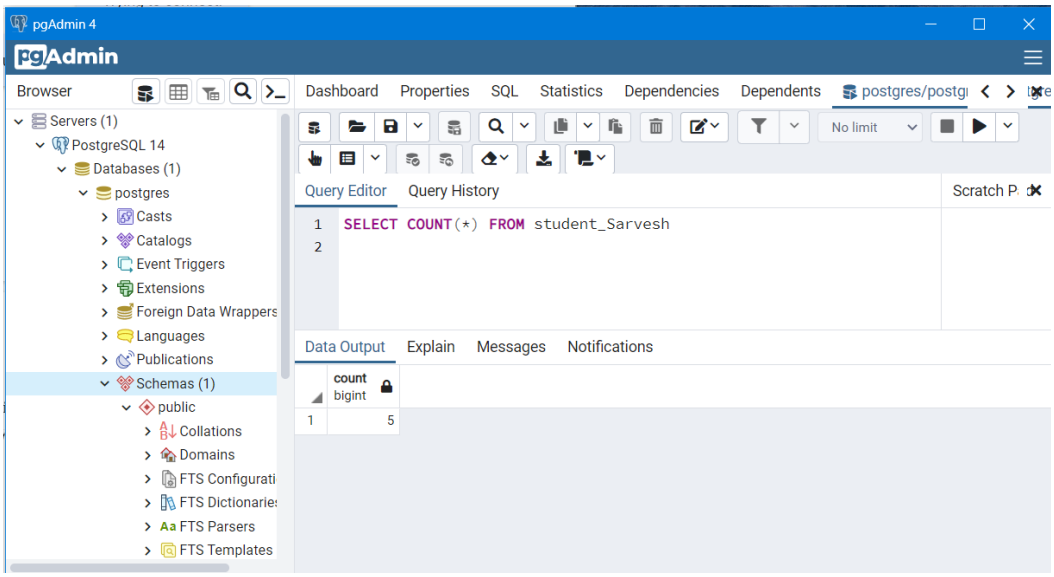


REVOKE: It is used to take back permissions from the user.

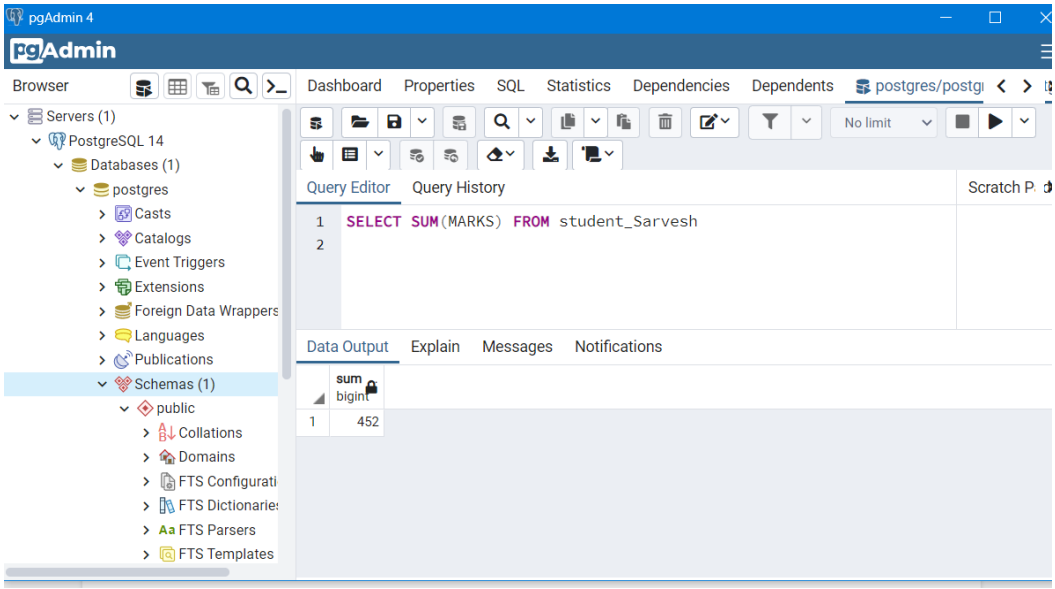


Built-in Functions of SQL : Built-in functions are predefined functions that give you convenient ways to manipulate your data. Examples are count, sum, avg, min, max, etc.

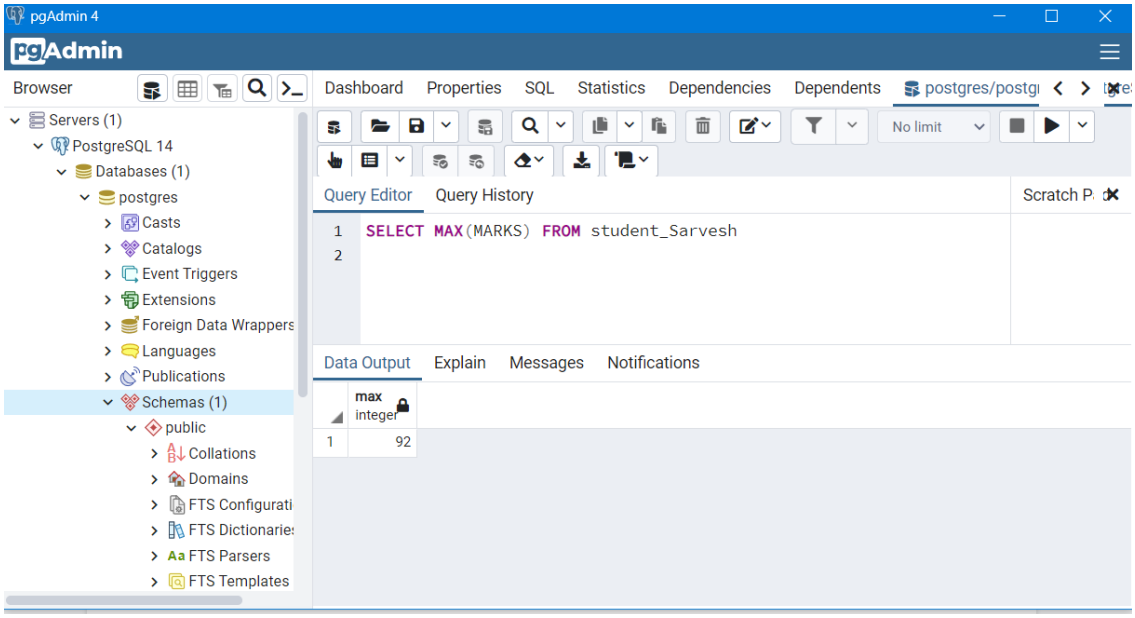
COUNT() :This function returns the number of rows that matches a specified criterion.



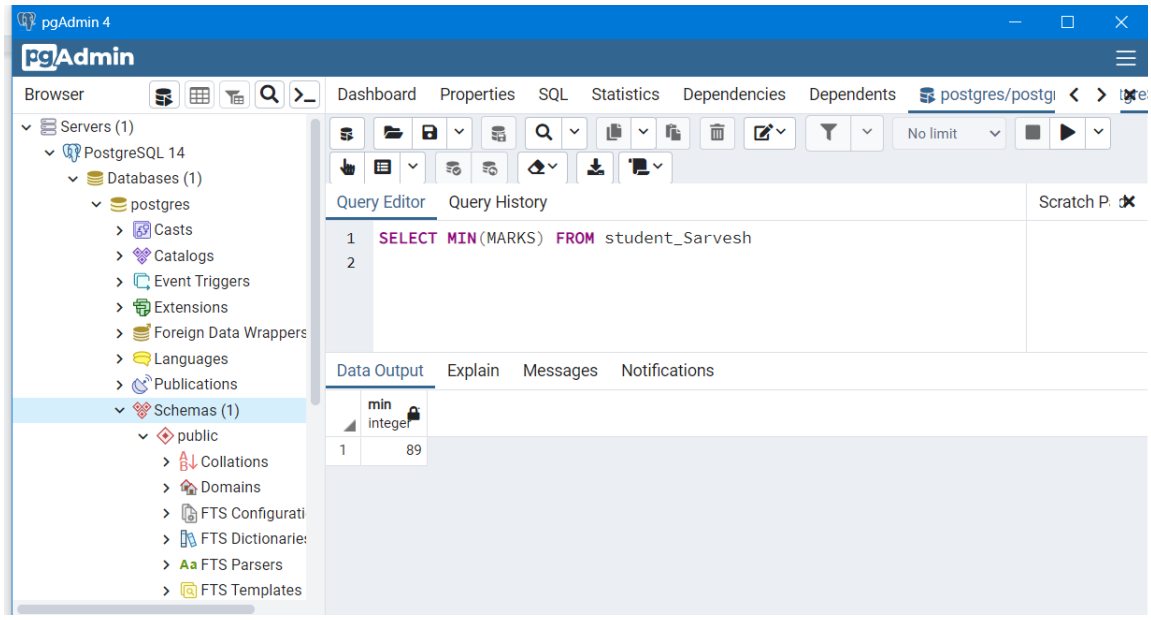
SUM() : This function returns the total sum of a numeric column.



MAX() : This function returns the largest value of the selected column.

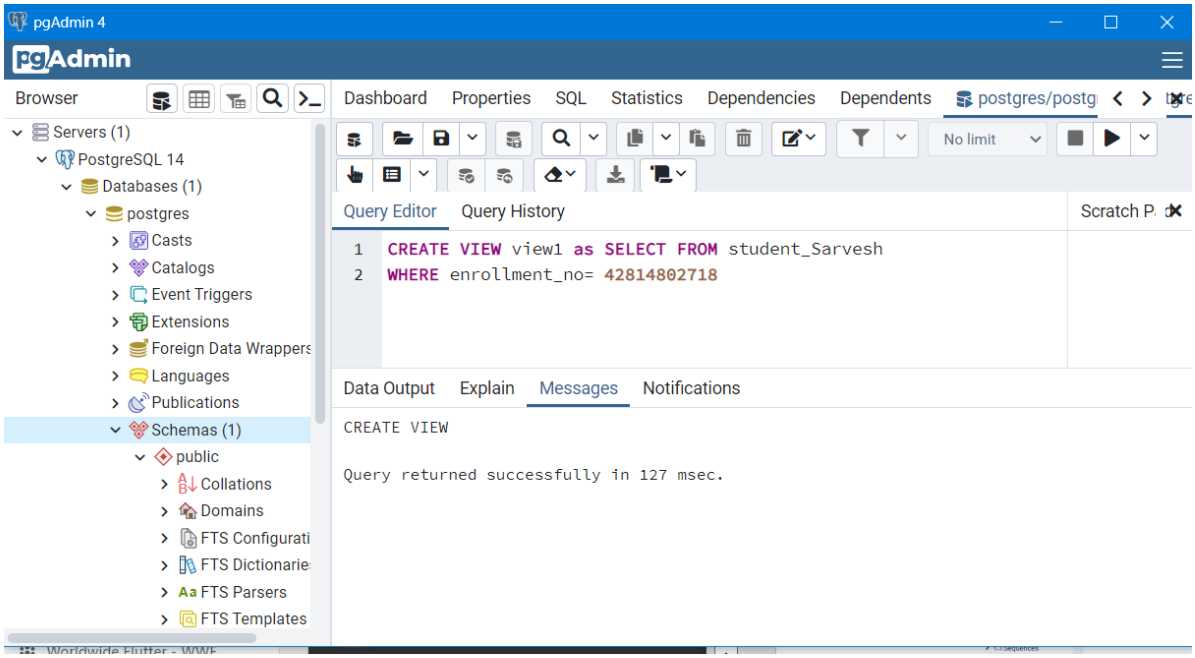


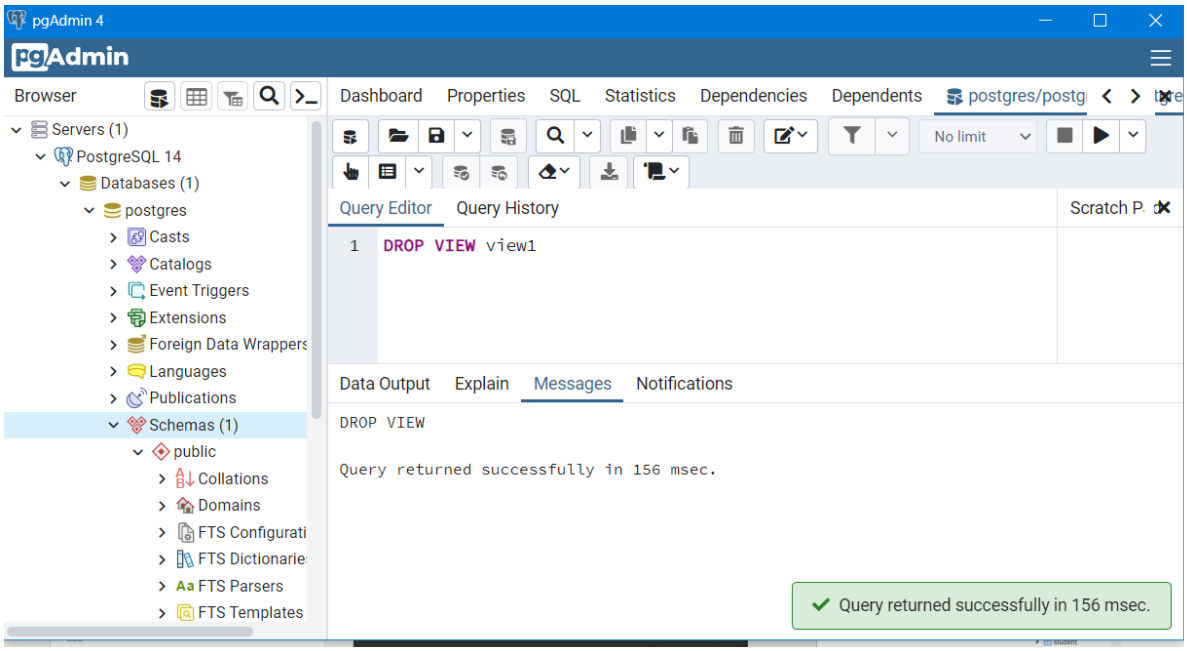
MIN() : This function returns the smallest value of the selected column.



INDEXES and VIEWS :

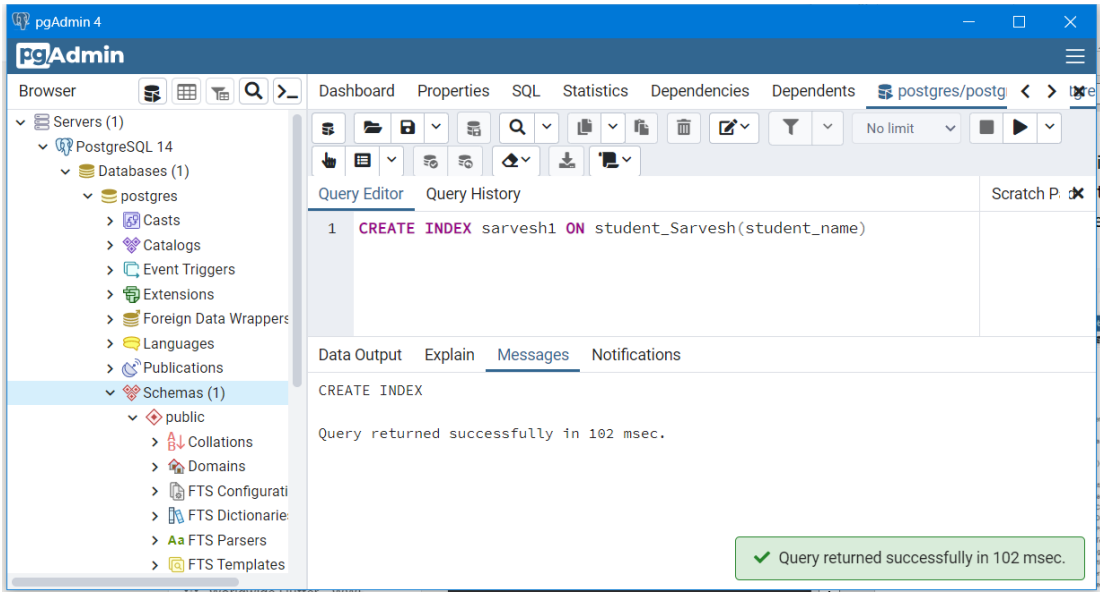
A **VIEW** is simply any SELECT query that has been given a name and saved in the database. For this reason, a view is sometimes called a named query or a stored query.

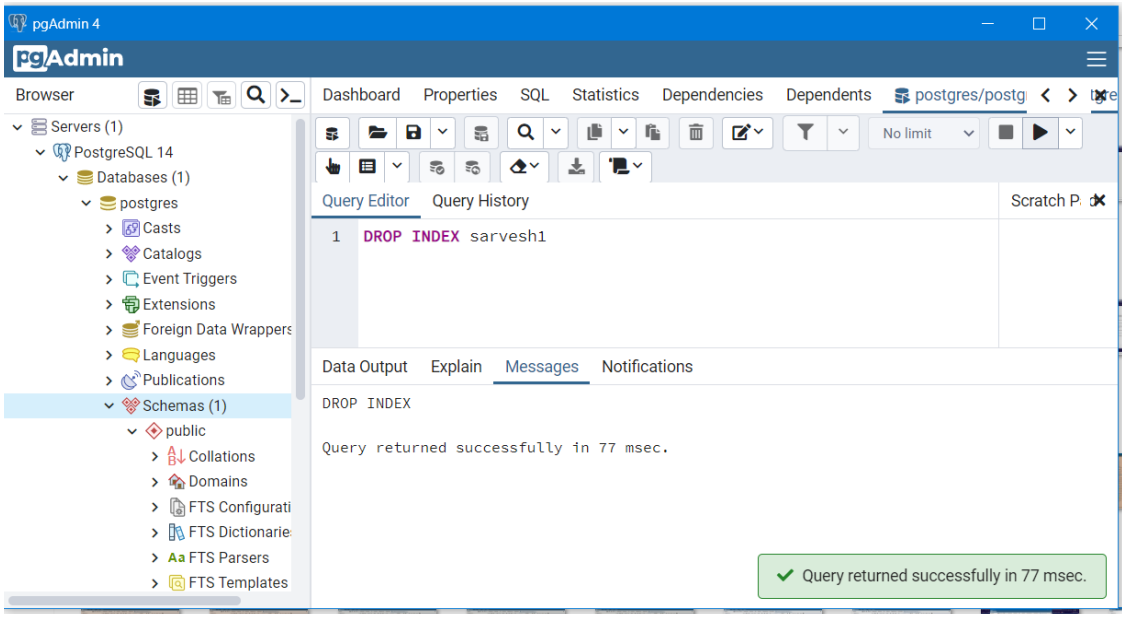




INDEX is a data structure that the database uses to find records within a table more quickly. Indexes are built on one or more columns of a table; each index maintains a list of values within that field that are sorted in ascending or descending order. Rather than sorting records on the

field or fields during query execution, the system can simply access the rows in order of the index.





Experiment 3

Aim : Write SQL queries on Nested queries and Join.

Theory:

1) Nested Queries:

There are mainly two types of nested queries:

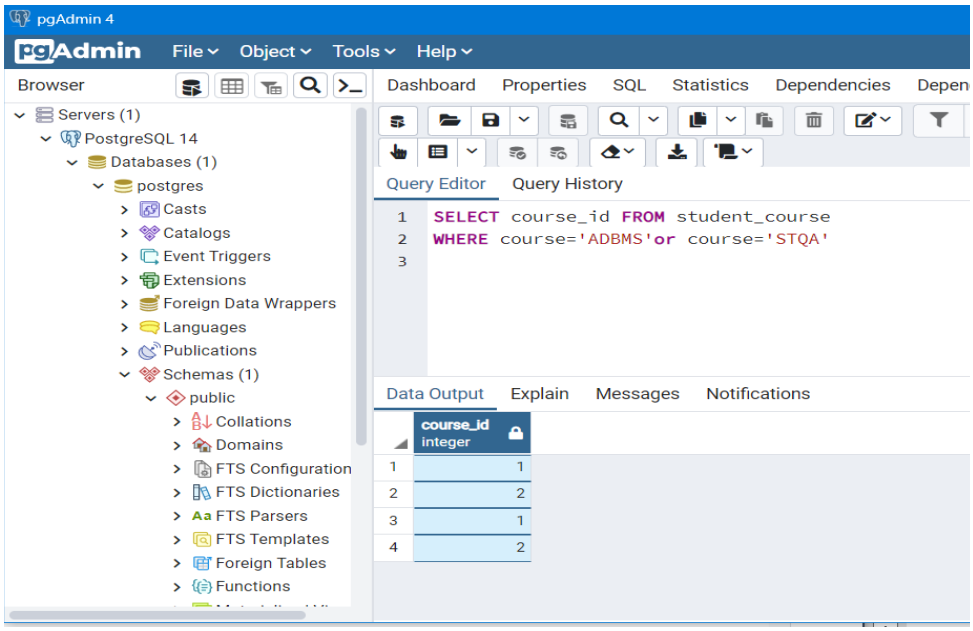
• **Independent Nested Queries:** In independent nested queries, query execution starts from innermost query to outermost queries. The execution of the inner query is independent of the outer query, but the result of the inner query is used in execution of the outer query. Various operators like IN, NOT IN, ANY, ALL etc are used in writing independent nested queries.

• **Co-related Nested Queries:** In correlated nested queries, the output of the inner query depends on the row which is being currently executed in the outer query.

Finding **COURSE_ID** for **COURSE**=’ADBMS’ or ‘STQA’

Select COURSE_ID from STUDENT_COURSE

where COURSE = ‘ADBMS’ or COURSE = ‘STQA’

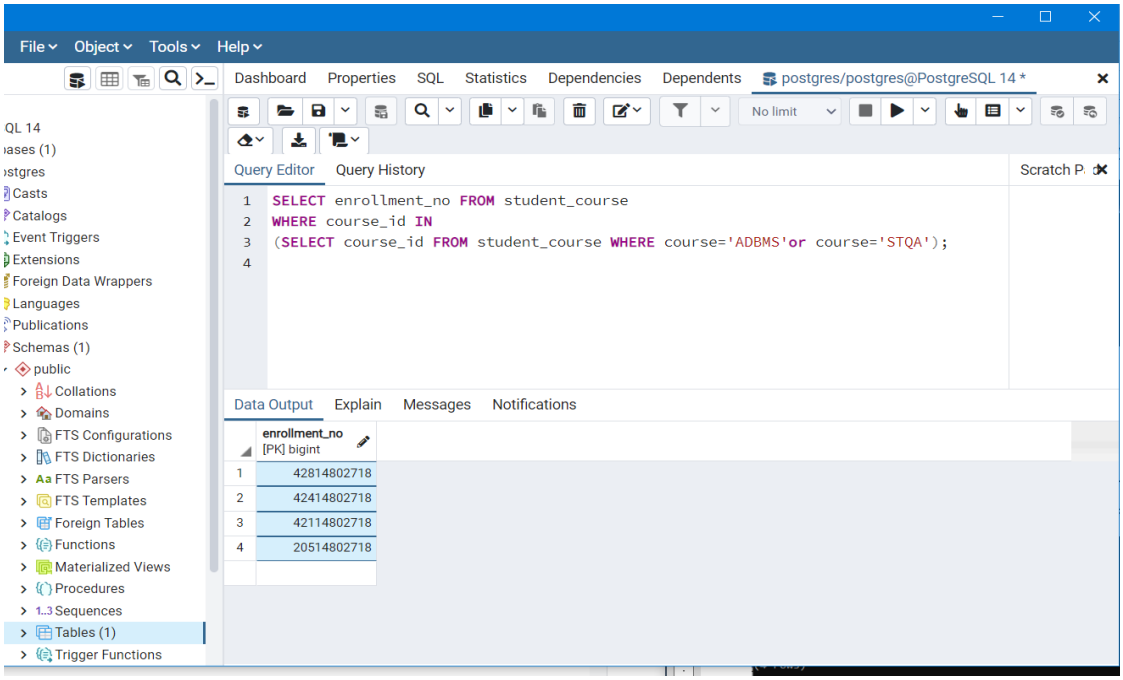


- **IN:**

SELECT enrollment_no FROM student_course

WHERE course_id IN

(SELECT course_id FROM student_course WHERE course='ADBMS'or course='STQA');

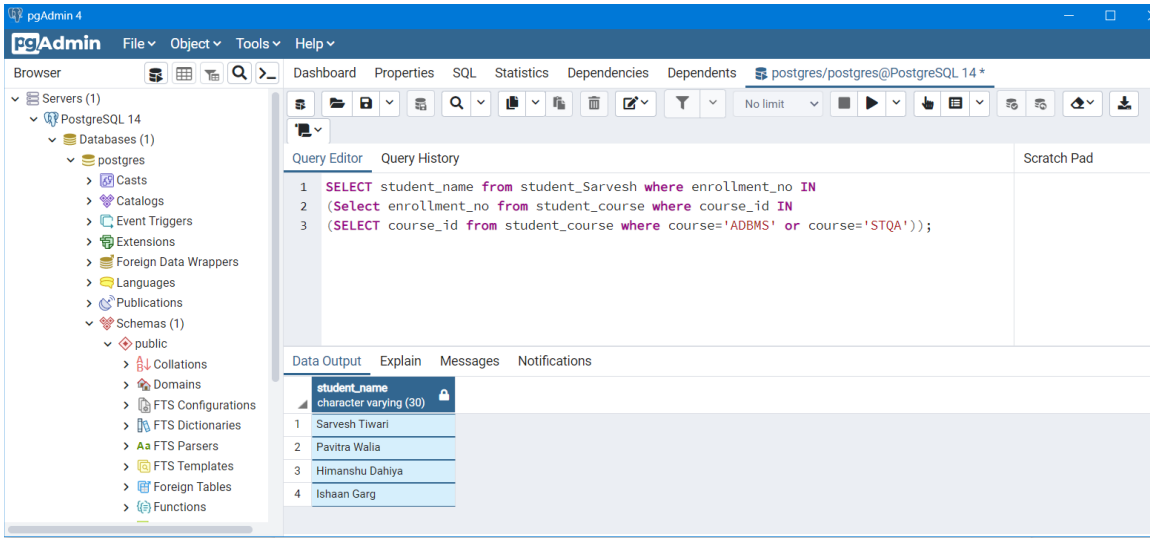


Note: If we want to find out names of **STUDENT**s who have either enrolled in ‘ADBMS’ or ‘STQA’, it can be done as:

SELECT student_name from student_Sarvesh where enrollment_no IN

(Select enrollment_no from student_course where course_id IN

(SELECT course_id from student_course where course='ADBMS' or C_NAME='STQA'));

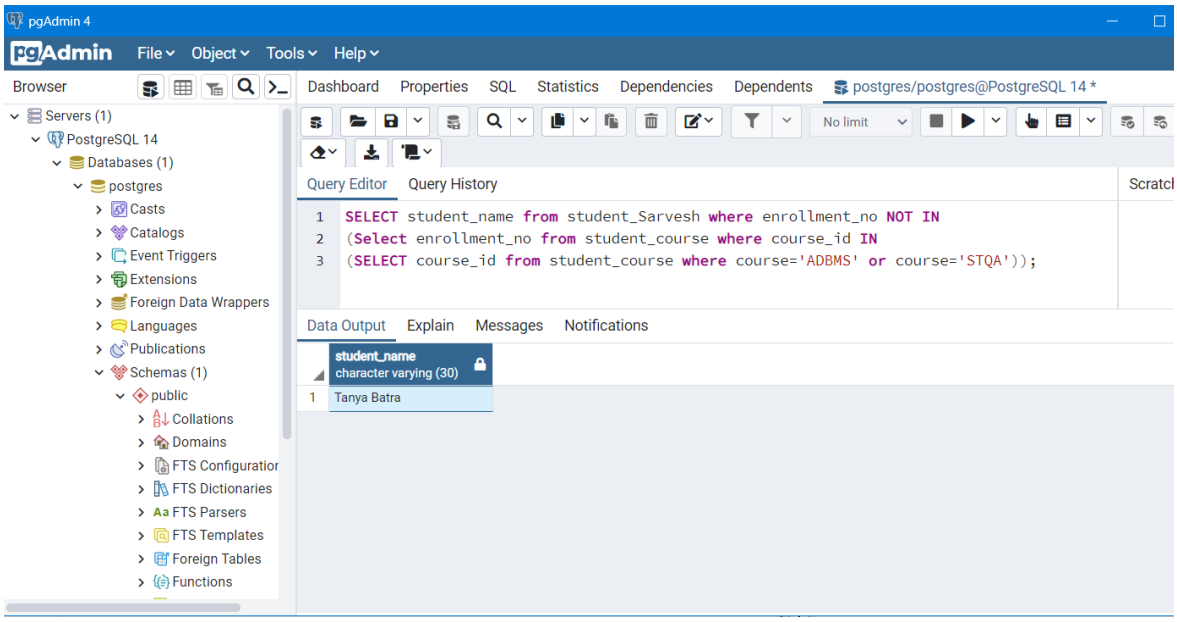


- **NOT IN:** If we want to find out **enrollment_no**s of **STUDENT**s who have neither enrolled in 'ADBMS' nor in 'STQA', it can be done as:

SELECT student_name from student_Sarvesh where enrollment_no NOT IN

(Select enrollment_no from student_course where course_id IN

(SELECT course_id from student_course where course='ADBMS' or course='STQA'));

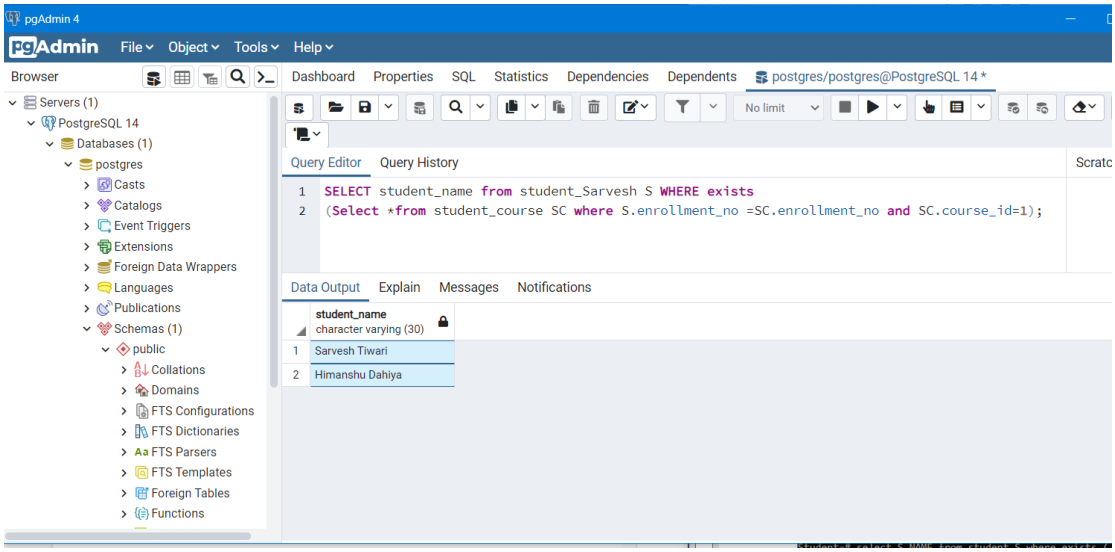


- **EXISTS:**

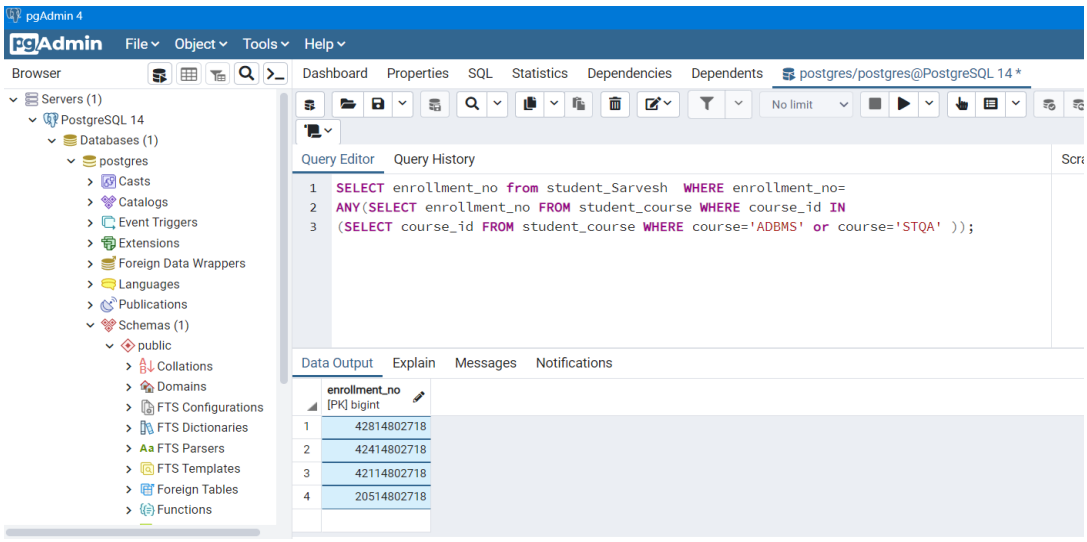
If we want to find out **STUDENT_NAME** of **STUDENT**s who are enrolled in **COURSE_ID** '1', it can be done with the help of co-related nested query as:

SELECT student_name from student_Sarvesh S WHERE exists

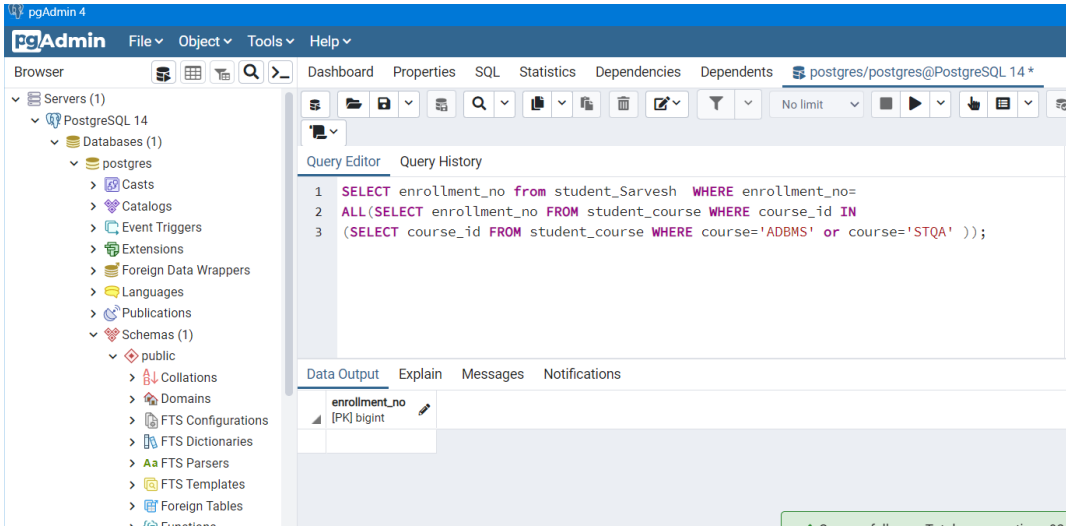
*(Select *from student_course SC where S.enrollment_no =SC.enrollment_no and SC.course_id='C1');*



- **ANY:**



- **ALL:**



2) **JOIN: A SQL Join statement is used to combine data or rows from two or more tables based on a common field between them. Different types of Joins are:**
   - CROSS JOIN
   - INNER JOIN
   - OUTER JOIN
     - LEFT OUTER JOIN
     - RIGHT OUTER JOIN
     - FULL OUTER JOIN

CROSS JOIN: The CROSS JOIN is used to generate a paired combination of each row of the first table with each row of the second table. This join type is also known as cartesian join.

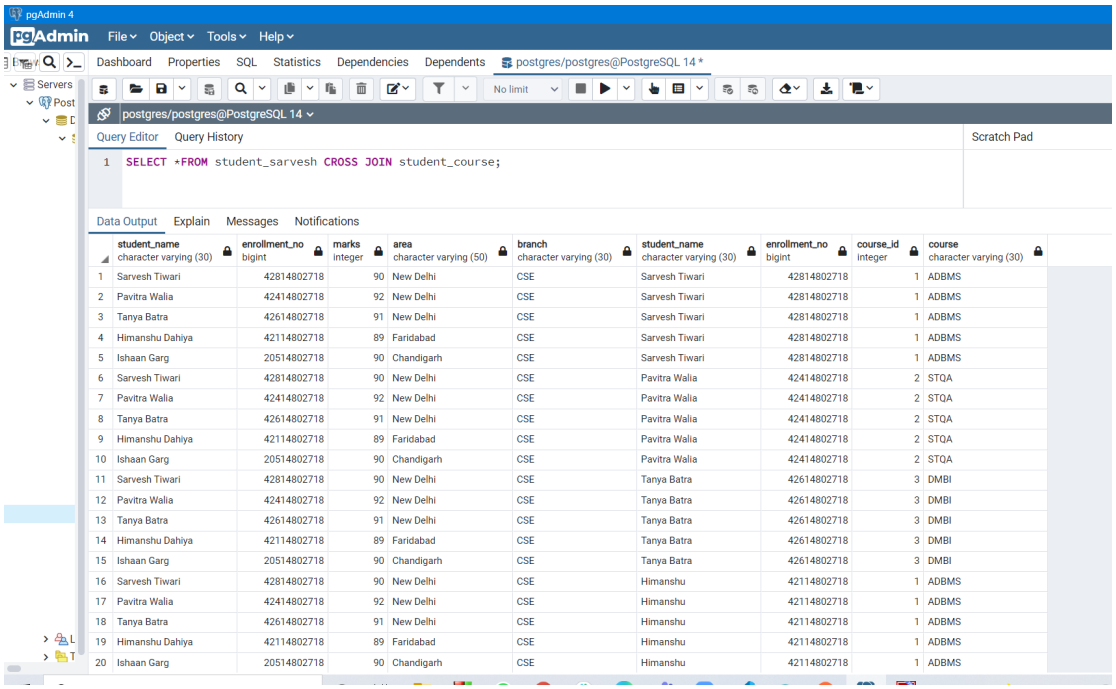
INNER JOIN: The INNER JOIN keyword selects all rows from both the tables as long as the condition satisfies. This keyword will create the result-set by combining all rows from both the tables where the condition satisfies i.e value of the common field will be the same.

LEFT OUTER JOIN: This join returns all the rows of the table on the left side of the join and matching rows for the table on the right side of join. The rows for which there is no matching row on the right side, the result-set will contain *null*. LEFT JOIN is also known as LEFT OUTER JOIN

RIGHT OUTER JOIN: RIGHT JOIN is similar to LEFT JOIN. This join returns all the rows of the table on the right side of the join and matching rows for the table on the left side of the join. The rows for which there is no matching row on the left side, the result-set will contain *null*. RIGHT JOIN is also known as RIGHT OUTER JOIN.

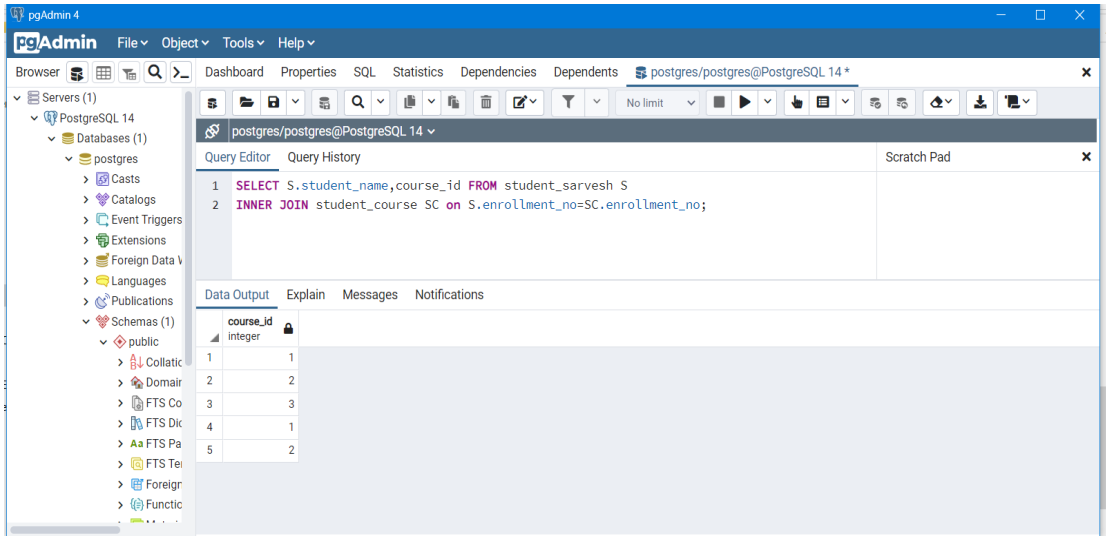
FULL OUTER JOIN: FULL JOIN creates the result-set by combining the result of both LEFT JOIN and RIGHT JOIN. The result-set will contain all the rows from both the tables. The rows for which there is no matching, the result-set will contain *NULL* values.

- **CROSS JOIN**

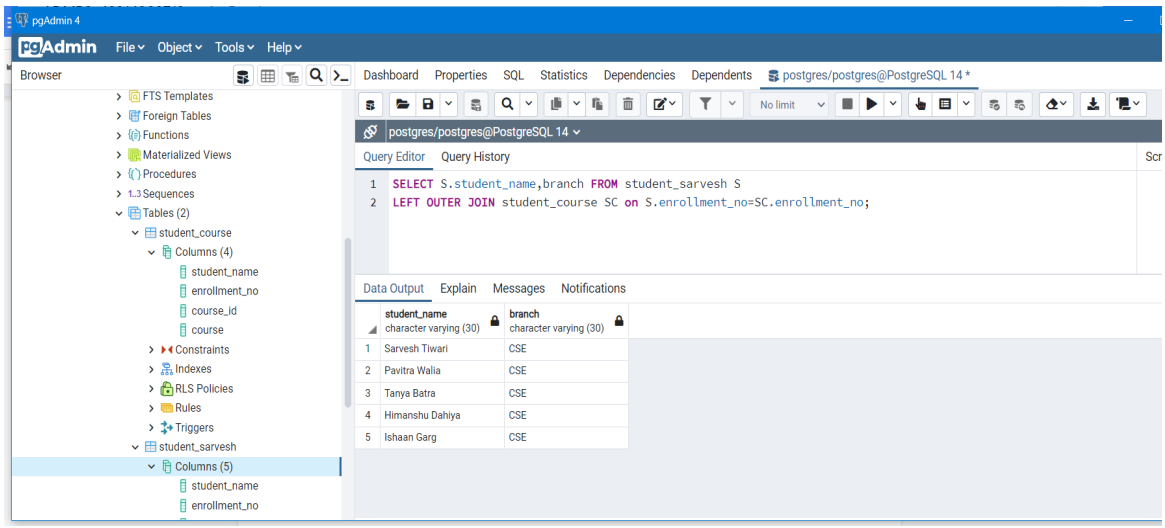


	student_name character varying (30)	enrollment_no bigint	marks integer	area character varying (50)	branch character varying (30)	student_name character varying (30)	enrollment_no bigint	course_id integer	course character varying (30)
1	Sarvesh Tiwari	42814802718	90	New Delhi	CSE	Sarvesh Tiwari	42814802718	1	ADBMS
2	Pavitra Walia	42414802718	92	New Delhi	CSE	Sarvesh Tiwari	42814802718	1	ADBMS
3	Tanya Batra	42614802718	91	New Delhi	CSE	Sarvesh Tiwari	42814802718	1	ADBMS
4	Himanshu Dahiya	42114802718	89	Faridabad	CSE	Sarvesh Tiwari	42814802718	1	ADBMS
5	Ishaan Garg	20514802718	90	Chandigarh	CSE	Sarvesh Tiwari	42814802718	1	ADBMS
6	Sarvesh Tiwari	42814802718	90	New Delhi	CSE	Pavitra Walia	42414802718	2	STQA
7	Pavitra Walia	42414802718	92	New Delhi	CSE	Pavitra Walia	42414802718	2	STQA
8	Tanya Batra	42614802718	91	New Delhi	CSE	Pavitra Walia	42414802718	2	STQA
9	Himanshu Dahiya	42114802718	89	Faridabad	CSE	Pavitra Walia	42414802718	2	STQA
10	Ishaan Garg	20514802718	90	Chandigarh	CSE	Pavitra Walia	42414802718	2	STQA
11	Sarvesh Tiwari	42814802718	90	New Delhi	CSE	Tanya Batra	42614802718	3	DMBI
12	Pavitra Walia	42414802718	92	New Delhi	CSE	Tanya Batra	42614802718	3	DMBI
13	Tanya Batra	42614802718	91	New Delhi	CSE	Tanya Batra	42614802718	3	DMBI
14	Himanshu Dahiya	42114802718	89	Faridabad	CSE	Tanya Batra	42614802718	3	DMBI
15	Ishaan Garg	20514802718	90	Chandigarh	CSE	Tanya Batra	42614802718	3	DMBI
16	Sarvesh Tiwari	42814802718	90	New Delhi	CSE	Himanshu	42114802718	1	ADBMS
17	Pavitra Walia	42414802718	92	New Delhi	CSE	Himanshu	42114802718	1	ADBMS
18	Tanya Batra	42614802718	91	New Delhi	CSE	Himanshu	42114802718	1	ADBMS
19	Himanshu Dahiya	42114802718	89	Faridabad	CSE	Himanshu	42114802718	1	ADBMS
20	Ishaan Garg	20514802718	90	Chandigarh	CSE	Himanshu	42114802718	1	ADBMS

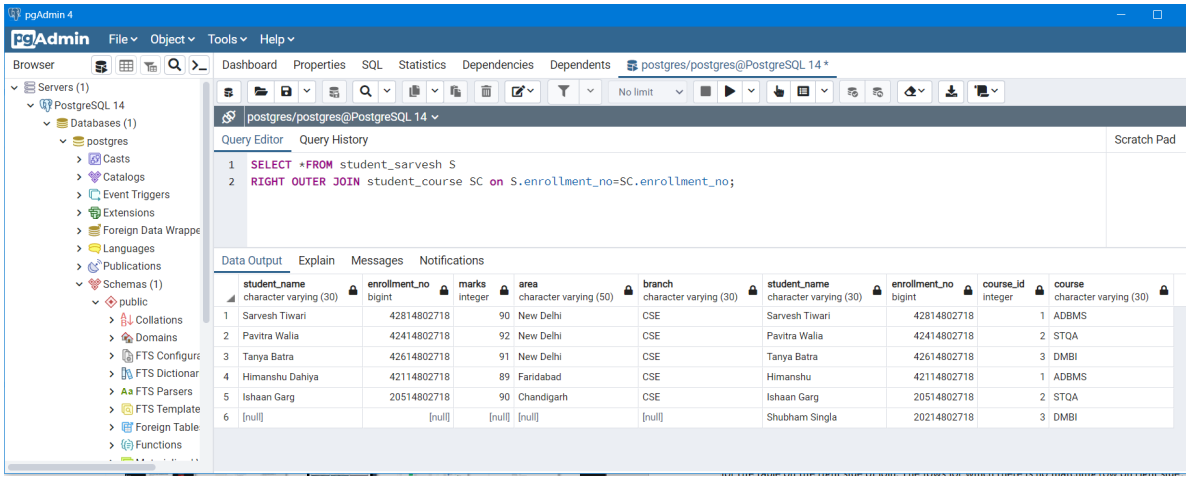
- **INNER JOIN**



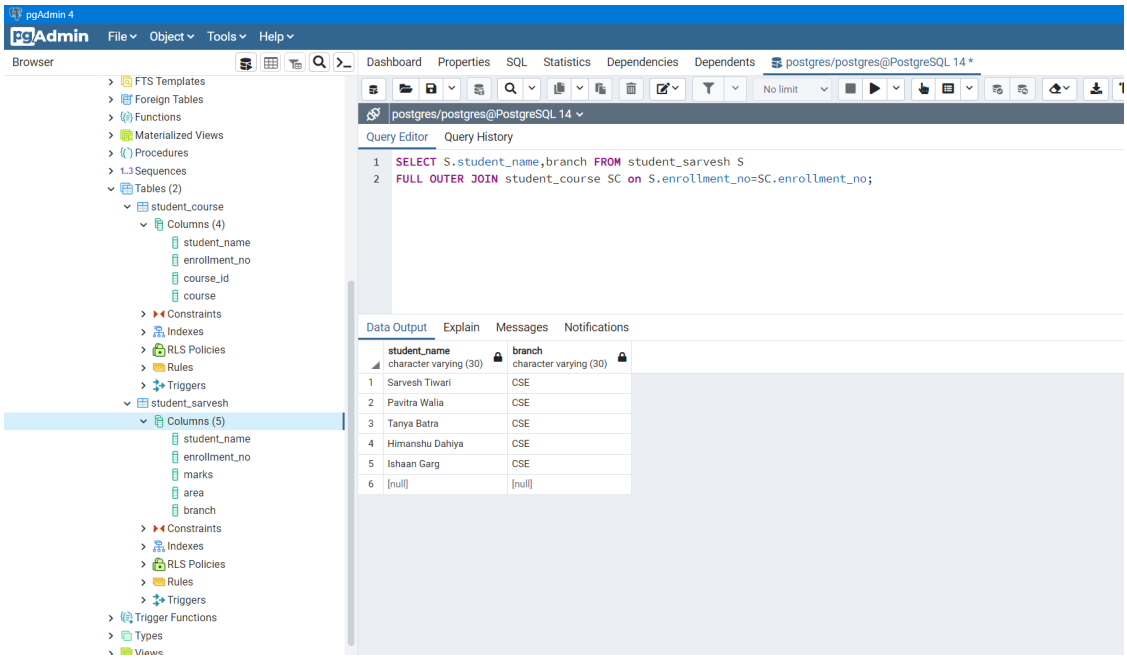
- **LEFT OUTER JOIN**



- **RIGHT OUTER JOIN**



- **FULL OUTER JOIN**

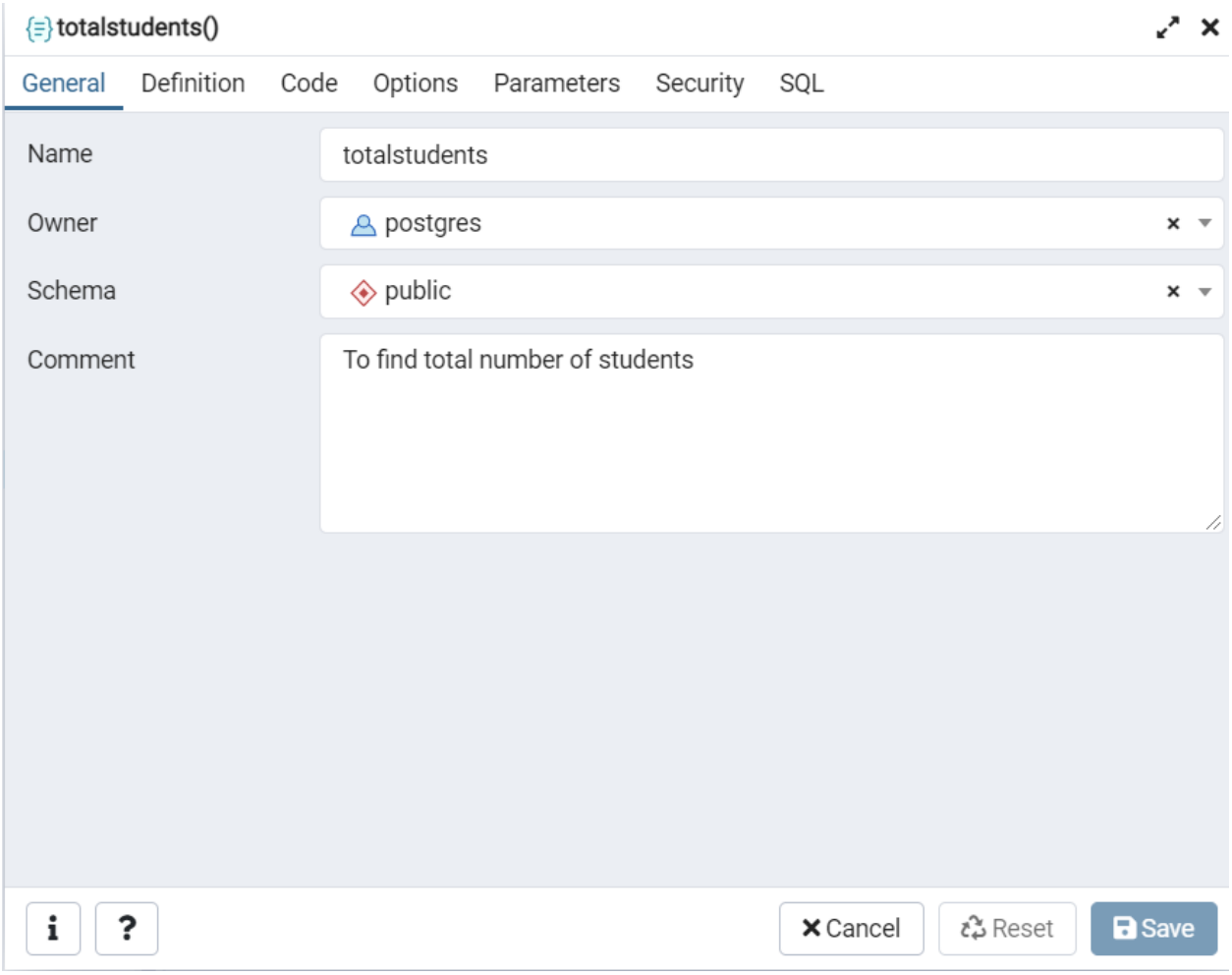


Experiment 4

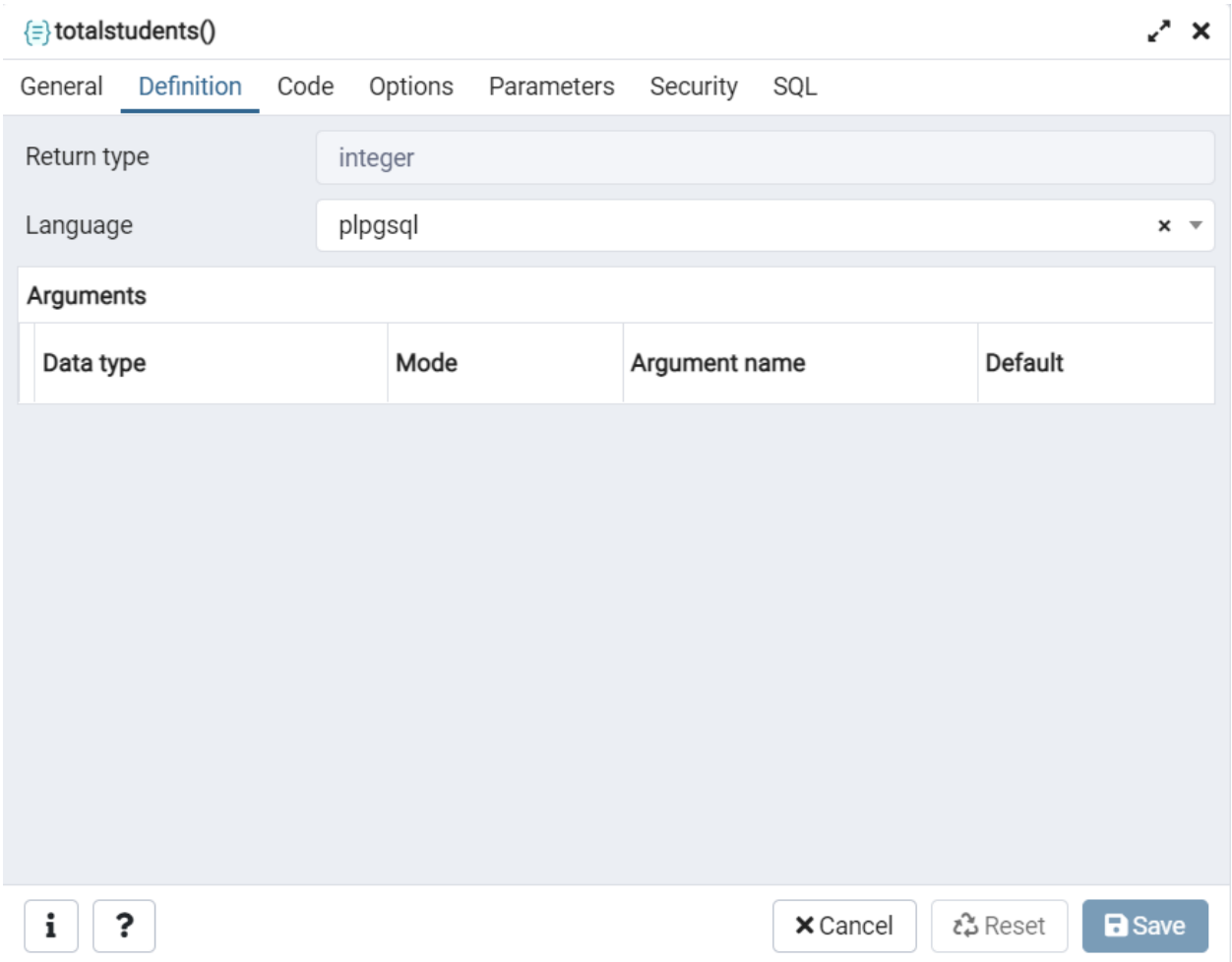
Aim :PL/SQL Programs

1. Write a program to calculate total students enrolled areawise.

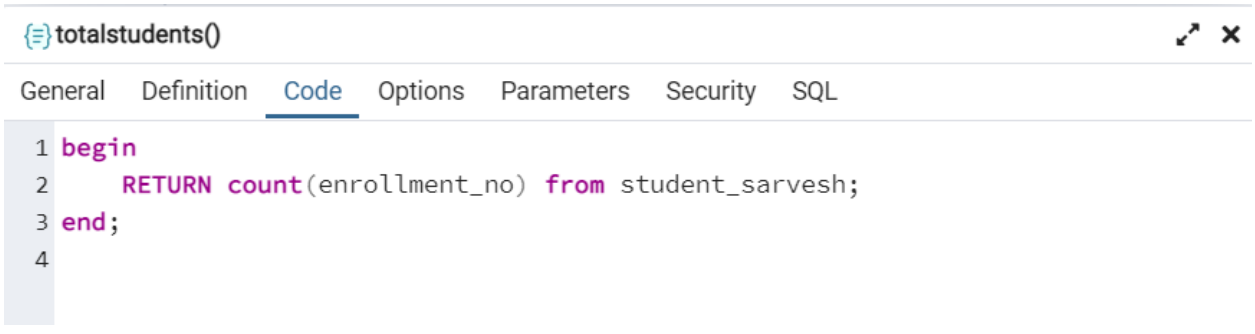
- WE WILL CREATE A FUNCTION **TOTALSTUDENTS** . THIS FUNCTION WILL CALCULATE TOTAL NO OF STUDENTS



- THEN WE WILL SET THE RETURN TYPE OF THE FUNCTION AS INTEGER AND THEN WE WILL SET THE LANGUAGE



- WE WRITE THE CODE SO THAT THIS FUNCTION RETURNS THE TOTAL NO OF STUDENTS



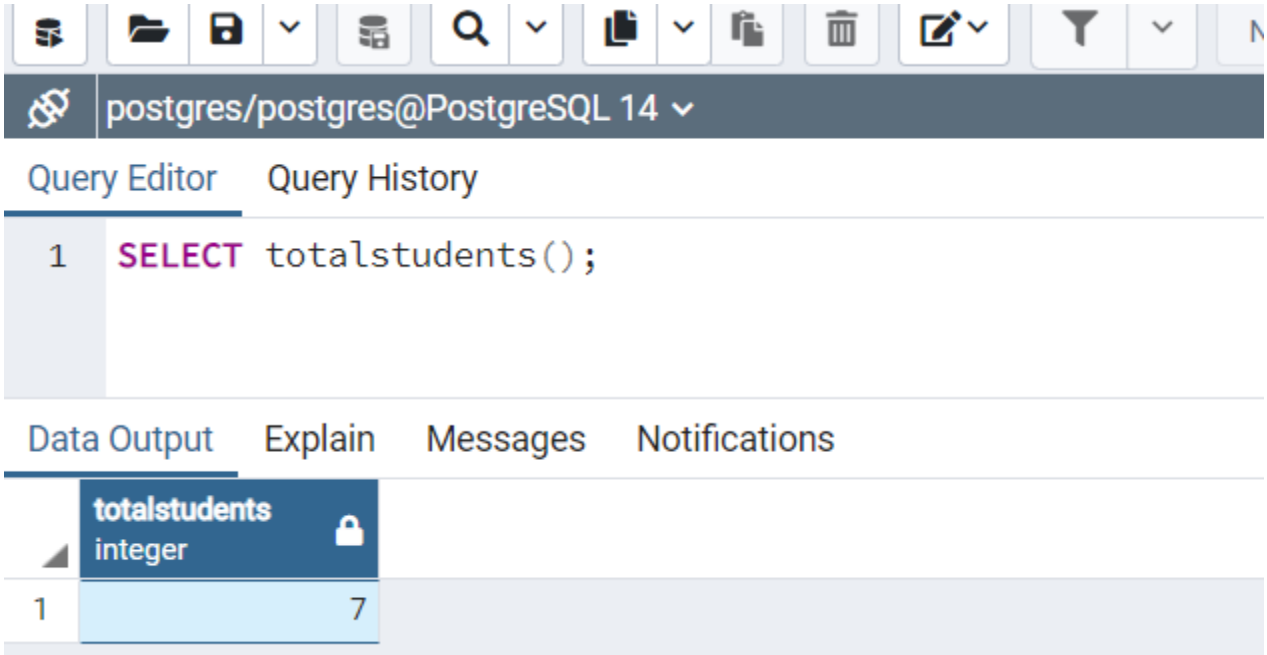
- THIS IS THE FUNCTION IN SQL.

Create - Function

General Definition Code Options Parameters Security SQL

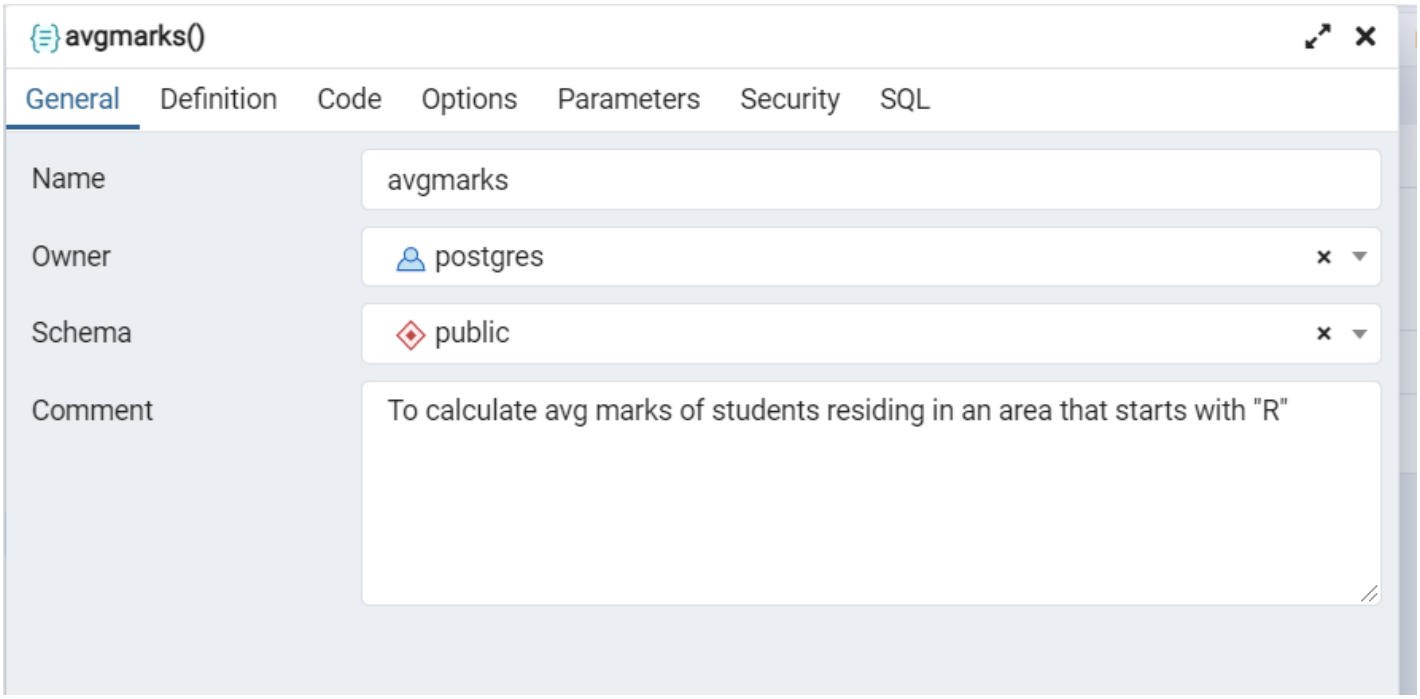
```
1  CREATE FUNCTION public.totalstudents()
2      RETURNS integer
3      LANGUAGE 'plpgsql'
4
5  AS $BODY$
6  begin
7      RETURN count(enrollment_no) from student_sarvesh;
8  end;
9  $BODY$;
10
11 ALTER FUNCTION public.totalstudents()
12     OWNER TO postgres;
13
14 COMMENT ON FUNCTION public.totalstudents()
15     IS 'To find total number of students';
```

- WE RUN THE FUNCTION USING SELECT FUNCTION NAME().

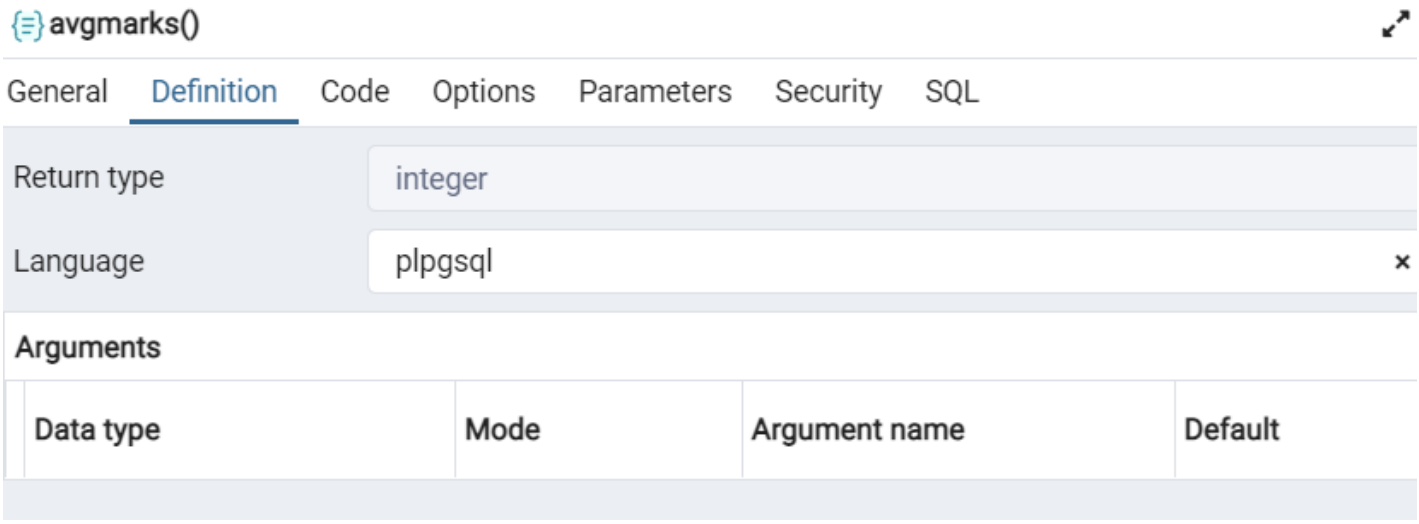


2. Write a program to calculate average marks obtained by the students residing in area that starts with "R"

- We will make a function named **avgmarks**.



- Now we set the return type and language plpgsql



- We write the code for the function avgmarks.

avgmarks()

General Definition Code Options Parameters Security SQL

```
1 begin
2     RETURN AVG(marks) FROM student_sarvesh where area like 'N%';
3 end;
4
```

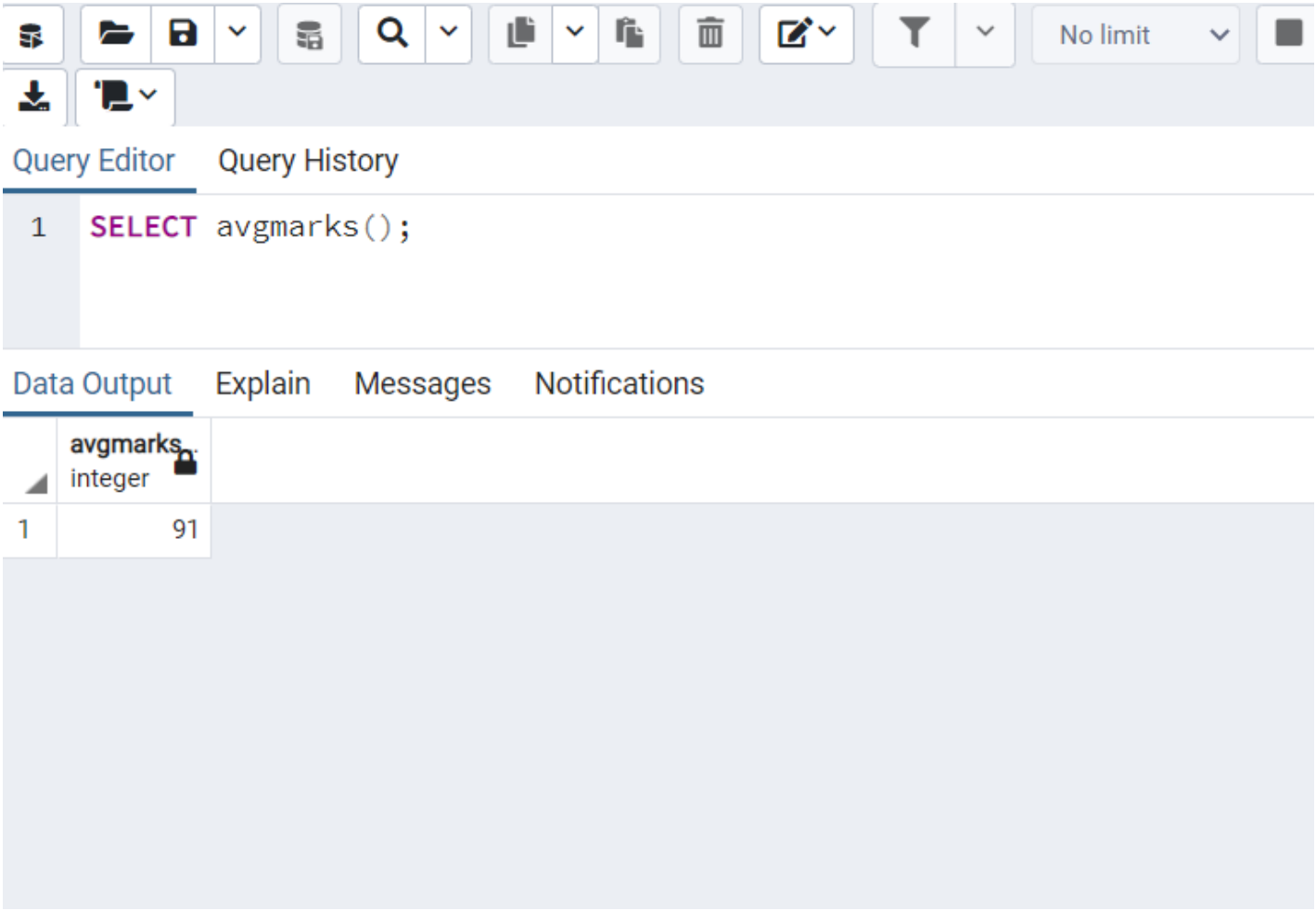
- This is the function in SQL

Create - Function

General Definition Code Options Parameters Security SQL

```
1  CREATE FUNCTION public.avgmarks()
2      RETURNS integer
3      LANGUAGE 'plpgsql'
4
5  AS $BODY$
6  begin
7      RETURN AVG(marks) FROM student_sarvesh where area like 'N%';
8  end;
9  $BODY$;
10
11 ALTER FUNCTION public.avgmarks()
12     OWNER TO postgres;
13
14 COMMENT ON FUNCTION public.avgmarks()
15     IS 'To calculate avg marks of students residing in an area that starts with
```

- Now in query editor , we will run the function we write select function name()



Experiment 5

Aim : Write the cursor to increase the marks of students by 10%.

Theory:
A cursor is a pointer to this context area. PL/SQL controls the context area through a cursor. A cursor holds the rows (one or more) returned by a SQL statement. The set of rows the cursor holds is referred to as the active set.

You can name a cursor so that it could be referred to in a program to fetch and process the rows returned by the SQL statement, one at a time. There are two types of cursors:Implicit cursors and Explicit cursors.

Code:

```
CREATE OR REPLACE FUNCTION increasemarks()
     RETURNS SETOF varchar AS
$func$
     DECLARE
     rec record;
     BEGIN
     FOR rec IN
          SELECT *
          FROM   student_sarvesh
          LOOP
                update student_sarvesh
                set marks=marks*1.10;
          END LOOP;
    END
$func$  LANGUAGE plpgsql VOLATILE;
select increasemarks();
```

```
select * from student_sarvesh;
```

Output:

- Before increasing the marks of students by 10%.

Data Output | Explain | Messages | Notifications

	student_name character varying (30)	enrollment_no bigint	marks integer	area character varying (50)	branch character varying (30)
1	Sarvesh Tiwari	42814802718	90	New Delhi	CSE
2	Pavitra Walia	42414802718	92	New Delhi	CSE
3	Tanya Batra	42614802718	91	New Delhi	CSE
4	Himanshu Dahiya	42114802718	89	Faridabad	CSE
5	Ishaan Garg	20514802718	90	Chandigarh	CSE

- After increasing the marks of students by 10%.

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Query Editor | Query History

```
1  CREATE OR REPLACE FUNCTION increasemarks()
2      RETURNS SETOF varchar AS
3  $func$
4      DECLARE
5      rec record;
6      BEGIN
7      FOR rec IN
8          SELECT *
9          FROM   student_sarvesh
10         LOOP
11              update student_sarvesh
12              set marks=marks*1.10;
13         END LOOP;
14     END
15 $func$  LANGUAGE plpgsql VOLATILE;
16 select increasemarks();
17 select * from student_sarvesh;
```

Data Output | Explain | Messages | Notifications

	student_name character varying (30)	enrollment_no [PK] bigint	marks integer	area character varying (50)	branch character varying (30)
1	Sarvesh Tiwari	42814802718	213	New Delhi	CSE
2	Pavitra Walia	42414802718	216	New Delhi	CSE
3	Tanya Batra	42614802718	215	New Delhi	CSE
4	Himanshu Dahiya	42114802718	210	Faridabad	CSE
5	Ishaan Garg	20514802718	213	Chandigarh	CSE

Experiment 6

Aim : Write a program to create exceptions if enrollment no. is not issued to students by the university and raise the exception explicitly by using raise command.

Theory:
An exception occurs when the PL/SQL engine encounters an instruction which it cannot execute due to an error that occurs at run-time. These errors will not be captured at the time of compilation and hence these need to be handled only at the run-time.

Syntax:

```
CREATE [ PROCEDURE | FUNCTION ]
AS
BEGIN
<Execution block>
RAISE <exception_name>
EXCEPTION
WHEN <exception_name> THEN
<Handler>
END;
```

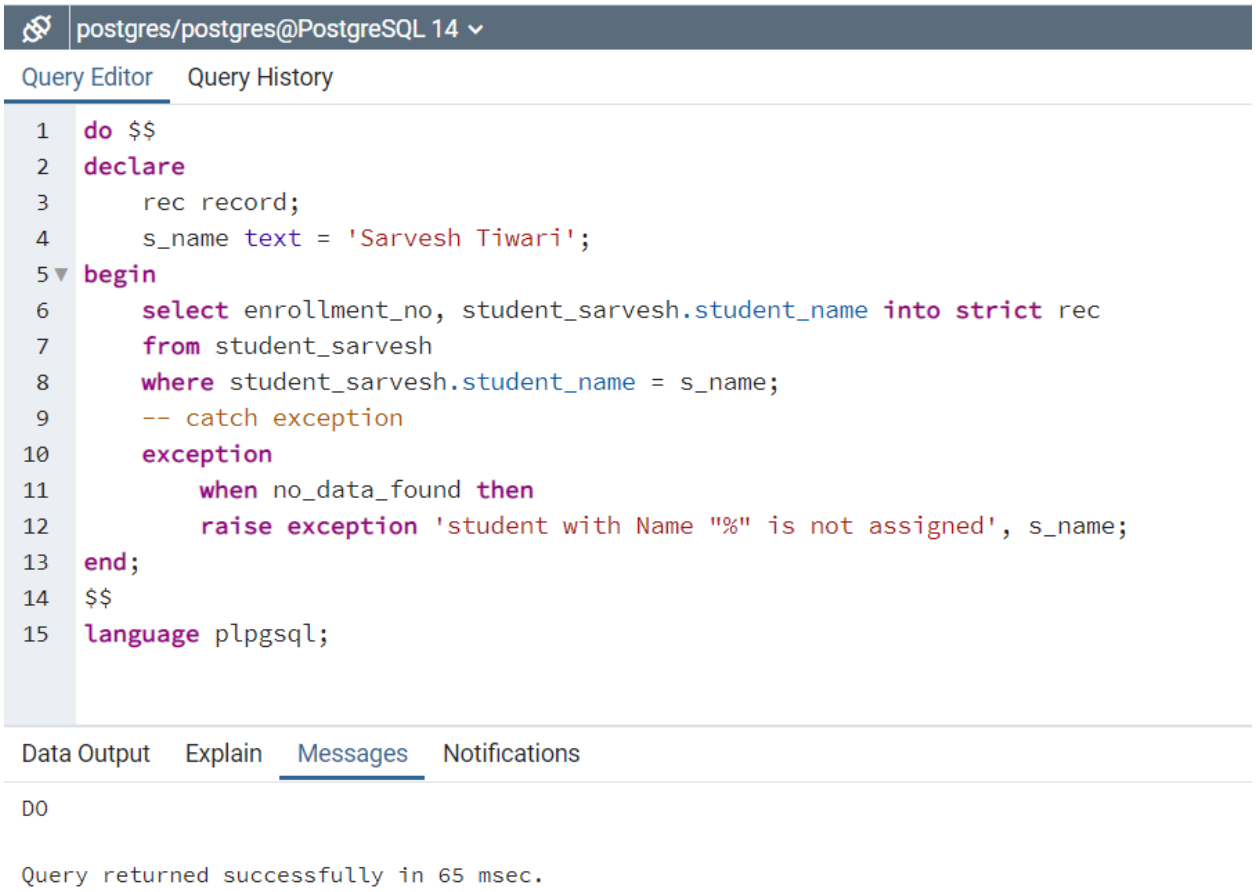
Program:

A. Execution of instruction without any error.

```
do $$
declare
     rec record;
     s_name text = 'Sarvesh Tiwari';
begin
     select enrollment_no, student_sarvesh.student_name
into strict rec
     from student_sarvesh
     where student_sarvesh.student_name = s_name;
     -- catch exception
     exception
          when no_data_found then
```

```
            raise exception 'student with Name "%" is not
assigned', s_name;
end;
$$
language plpgsql;
```

Output:



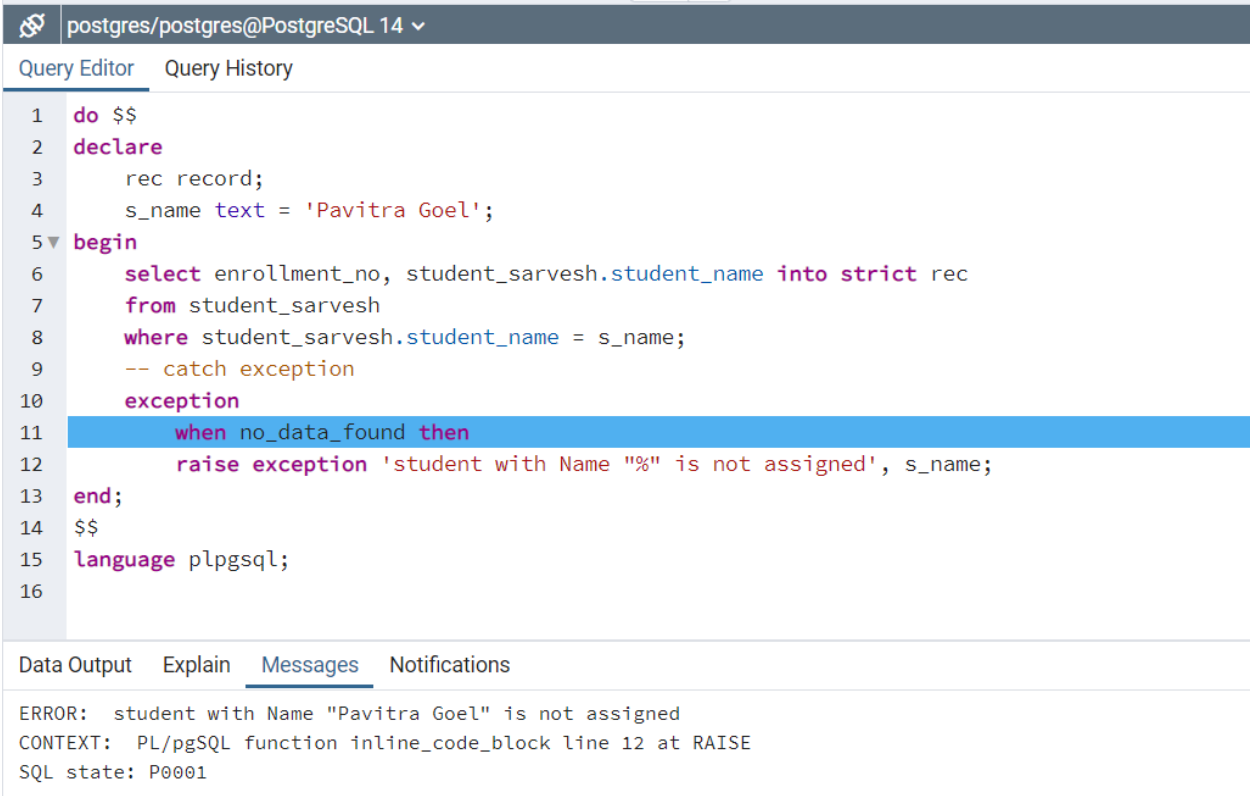
B. Execution of instruction with an exception.

```
do $$
declare
      rec record;
```

```
          s_name text = 'Pavitra Goel';
     begin
          select enrollment_no, student_sarvesh.student_name
into strict rec
          from student_sarvesh
          where student_sarvesh.student_name = s_name;
          -- catch exception
          exception
               when no_data_found then
               raise exception 'student with Name "%" is not
assigned', s_name;
     end;
     $$
     language plpgsql;
```

Output:

.



Experiment 7

Aim : Procedure & Function

a. Write the procedure to get the average marks of students for branch “CSE”.

Theory:

PostgreSQL allows us to extend the database functionality with user-defined functions by using various procedural languages, which are often referred to as stored procedures.

With stored procedures you can create your own custom functions and reuse them in applications or as part of other database’s workflows.

Syntax:

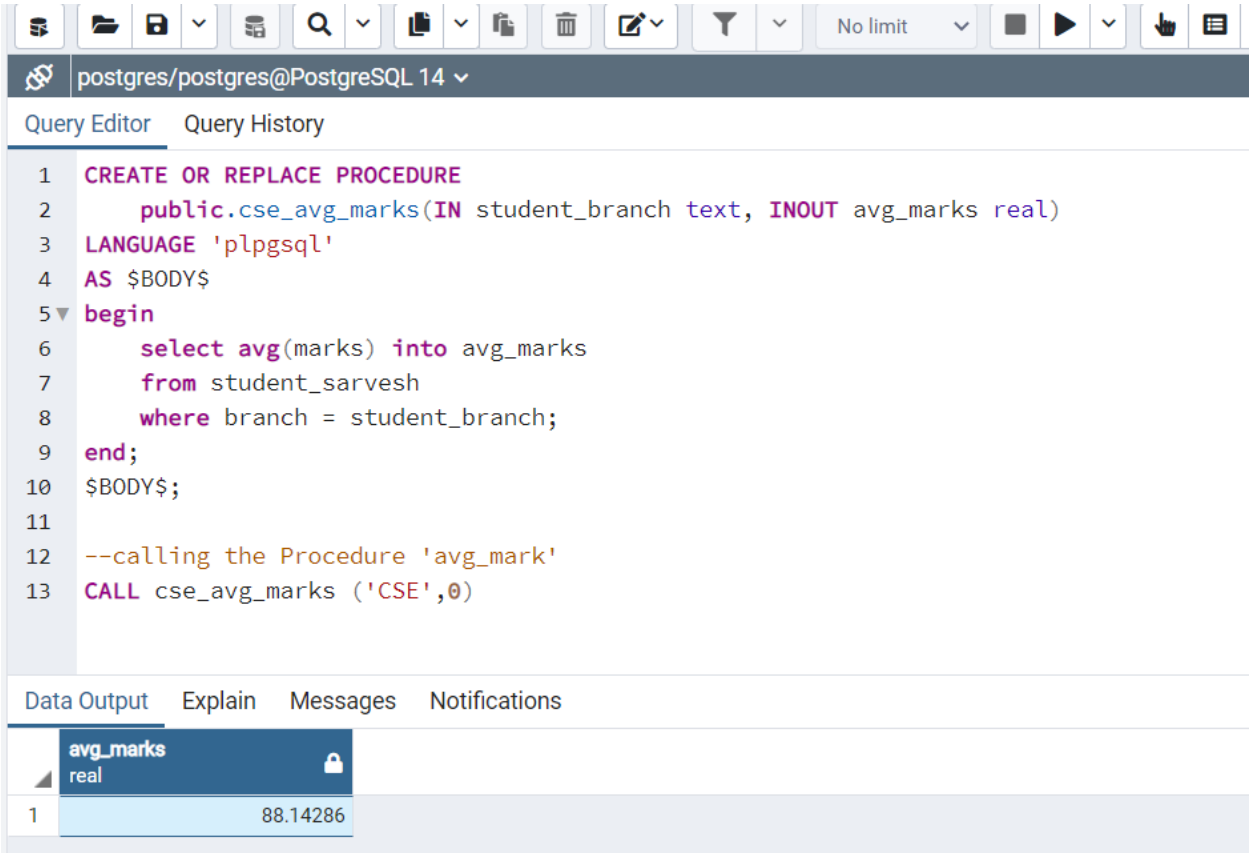
```
create [or replace] procedure
procedure_name(parameter_list)
language plpgsql
as $$
declare
-- variable declaration
begin
-- stored procedure body
end; $$
```

Code:

```
CREATE OR REPLACE PROCEDURE
     public.cse_avg_marks(IN student_branch text, INOUT
avg_marks real)
LANGUAGE 'plpgsql'
AS $BODY$
begin
     select avg(marks) into avg_marks
     from student_sarvesh
     where branch = student_branch;
end;
```

```
$BODY$;
```

Output:



b. Write a function that accepts the branch and returns the total no. of students of the branch.

Code:

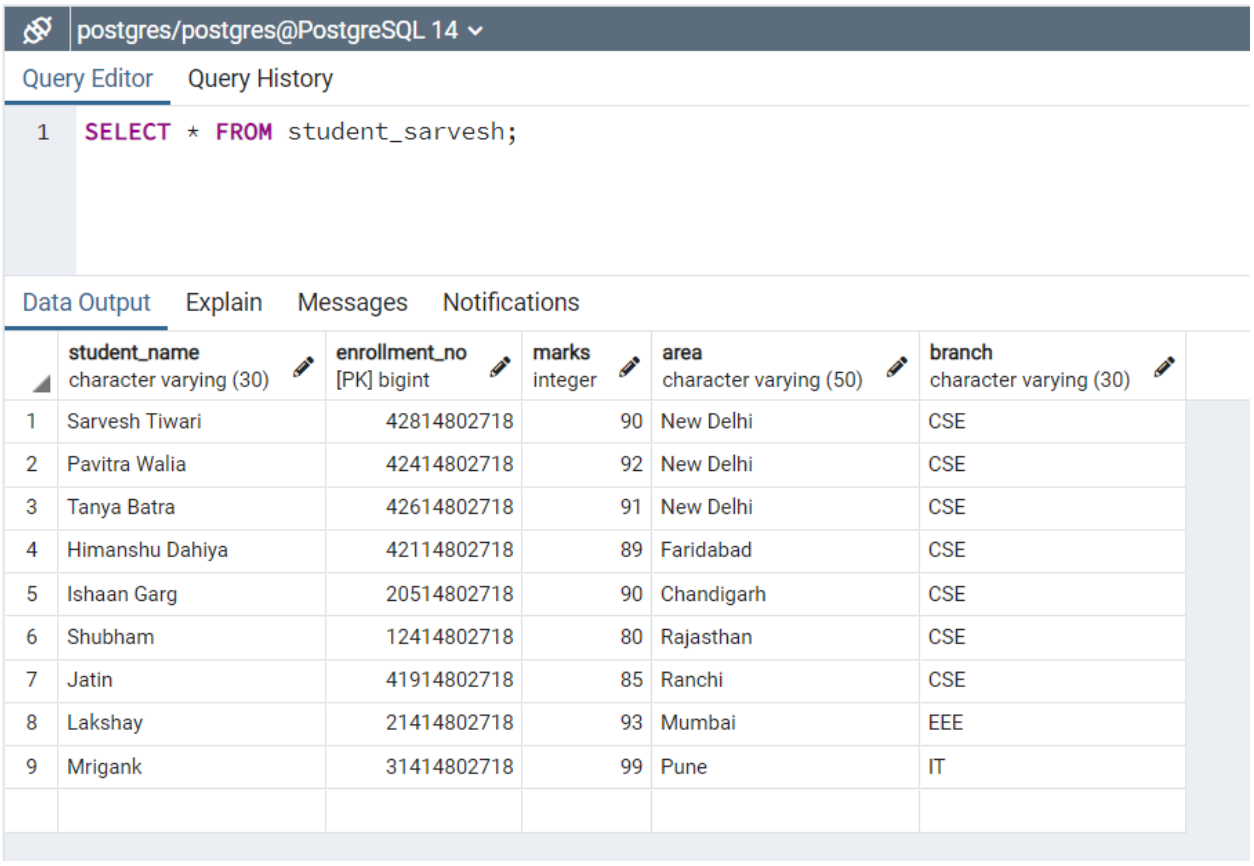
```
CREATE OR REPLACE PROCEDURE
	public.total_students_branchwise(IN student_branch
text, INOUT total_students real)
LANGUAGE 'plpgsql'
AS $BODY$
begin
	select COUNT(enrollment_no) into total_students
	from student_sarvesh
	where branch = student_branch;
```

```
end;
$BODY$;

--calling the Procedure 'avg_mark'
CALL total_students_branchwise ('CSE',0)
```

Output:

- All entries in the table.



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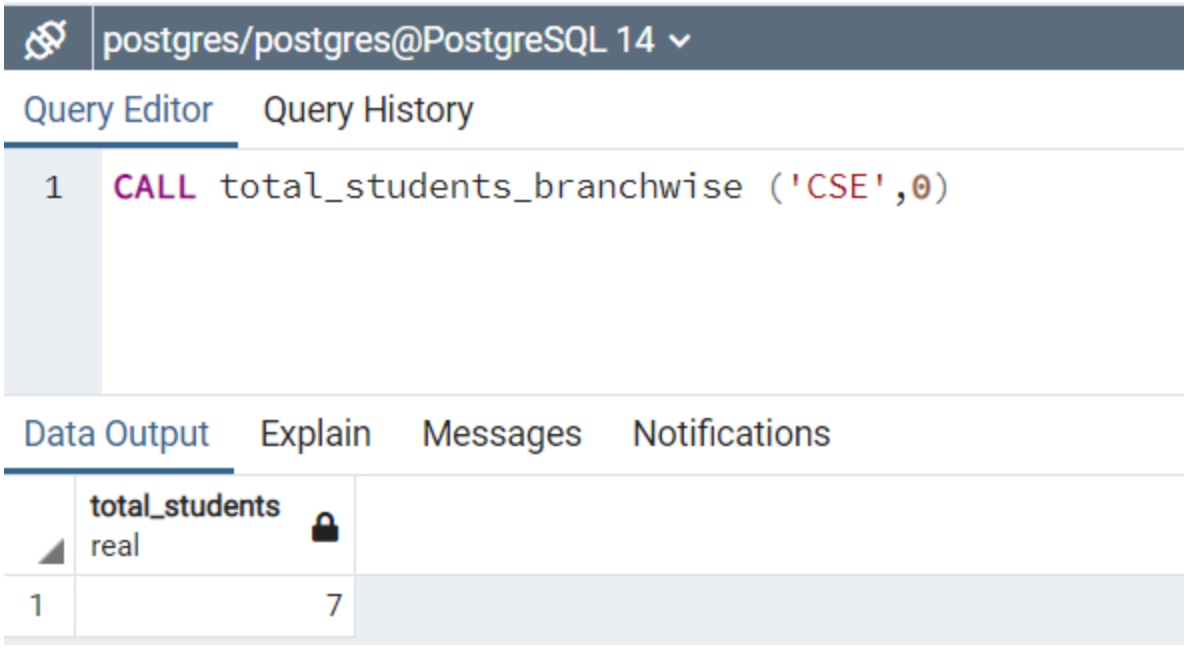
Query Editor | Query History

```
1  SELECT * FROM student_sarvesh;
```

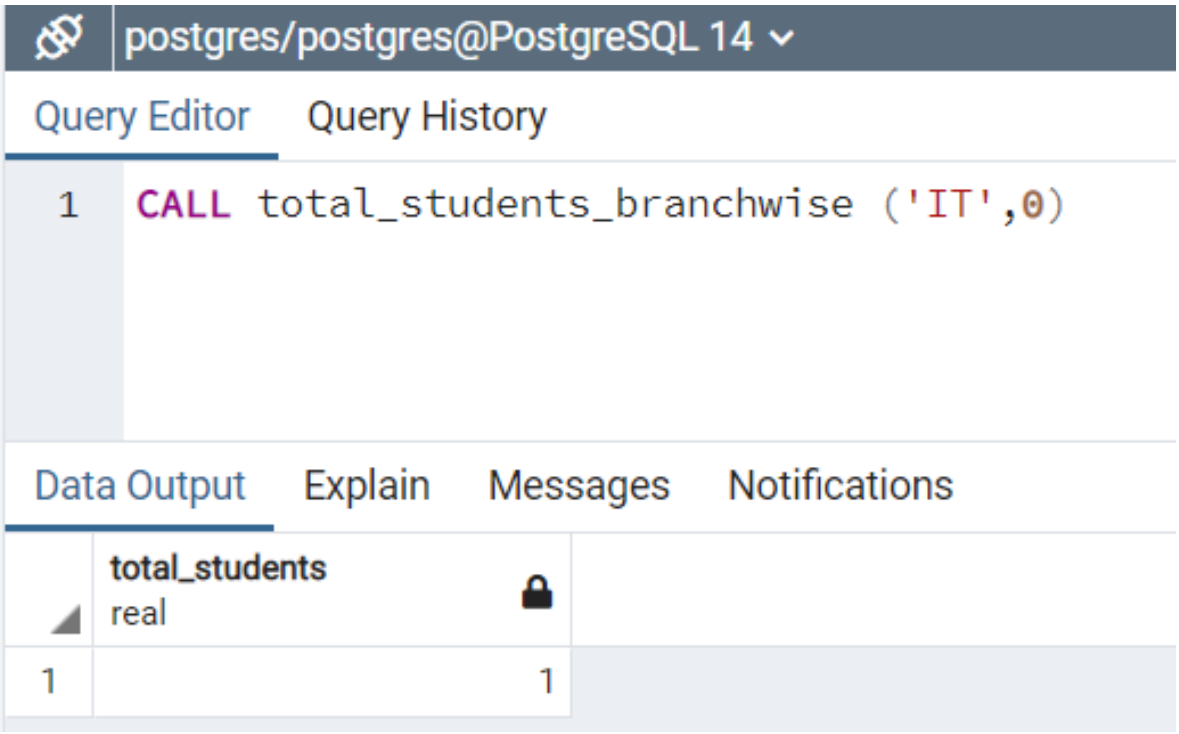
Data Output | Explain | Messages | Notifications

	student_name character varying (30)	enrollment_no [PK] bigint	marks integer	area character varying (50)	branch character varying (30)
1	Sarvesh Tiwari	42814802718	90	New Delhi	CSE
2	Pavitra Walia	42414802718	92	New Delhi	CSE
3	Tanya Batra	42614802718	91	New Delhi	CSE
4	Himanshu Dahiya	42114802718	89	Faridabad	CSE
5	Ishaan Garg	20514802718	90	Chandigarh	CSE
6	Shubham	12414802718	80	Rajasthan	CSE
7	Jatin	41914802718	85	Ranchi	CSE
8	Lakshay	21414802718	93	Mumbai	EEE
9	Mrigank	31414802718	99	Pune	IT

- Total number of students in “CSE” branch



- Total number of students in “IT” branch.



Experiment 8

Aim : Trigger

a. Create a trigger on the table after inserting a new student into the table.

Theory:

A trigger is a set of actions that are run automatically when a specified change operation (SQL INSERT, UPDATE, DELETE or TRUNCATE statement) is performed on a specified table. Triggers are useful for tasks such as enforcing business rules, validating input data, and keeping an audit trail.

Advantages of Triggers

These are the following advantages of Triggers:

- Trigger generates some derived column values automatically
- Enforces referential integrity
- Event logging and storing information on table access
- Auditing
- Synchronous replication of tables
- Imposing security authorizations
- Preventing invalid transactions

The syntax for creating a trigger is −

```
CREATE [OR REPLACE ] TRIGGER trigger_name
{BEFORE | AFTER | INSTEAD OF }
{INSERT [OR] | UPDATE [OR] | DELETE}
[OF col_name]
ON table_name
[REFERENCING OLD AS o NEW AS n]
[FOR EACH ROW]
WHEN (condition)
DECLARE
   Declaration-statements
BEGIN
   Executable-statements
EXCEPTION
   Exception-handling-statements
END;
```

Implementation :

a. Trigger on the table after inserting a new student into the table.

Output:

```
postgres=# create or replace function insertion() returns trigger as $body$
postgres$# begin
postgres$# insert into student(student_name,roll_no,marks,area,branch) values (new.student_name,new.roll_no,new.marks,new.area,new.branch);
postgres$# return new;
postgres$# end;
postgres$# $body$ language plpgsql;
CREATE FUNCTION
```

```
postgres=# create trigger insertoperation
postgres-# after update on student
postgres-# for each row
postgres-# execute procedure insertion();
CREATE TRIGGER
```

```
postgres=# insert into student values('Hina',21,45,'Delhi','CSE');
INSERT 0 1
postgres=#
```

b. Row trigger to insert the existing values of the student table into a new table when the marks of the student are updated.

Output:

```
postgres=# create or replace function update_marks() returns trigger as $body$
postgres$# begin
postgres$# insert into student(student_name,roll_no,marks,area,branch) values(new.student_name,new.roll_
no,new.marks,new.area,new.branch);
postgres$# return new;
postgres$# end;
postgres$# $body$ language plpgsql;
CREATE FUNCTION
```

```
postgres=# create trigger markschange
postgres-# after update on student
postgres-# for each row
postgres-# execute procedure update_marks();
CREATE TRIGGER
```

```
postgres=# update student set marks=marks*2;
UPDATE 4
postgres=# select * from student;
 student_name | roll_no | marks |  area   | branch
--------------+---------+-------+---------+--------
 Hina         |      21 |    90 | Delhi   | CSE
 Rahul        |       1 |    62 | Delhi   | CSE
 Sarvesh      |       4 |   210 | Haryana | EEE
 Tanya        |       3 |   256 | Punjab  | ECE
(4 rows)
```

THANK YOU !