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FACULTY OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF COMPUTER ENGINEERING
DÉPARTEMENT DE GÉNIE INFORMATIQUE
COURSE CODE: CEF 438

COURSE TITLE: ADVANCED DATABASES AND ADMINISTRATION
LECTURER: Dr. HUGUES MARIE KAMDJOU

DESIGN AND IMPLEMENTATTION OF AN ONLINE ELECTION SOFTEWARE

GROUP NAMES

NAMES	MATRICULE
NDIKINTUM CARL NFON	FE20A073
NYENTY EYONG ARREHQUETTE	FE20A094
OBASIARREY M'ONEKE MARY ARREY-NJOK	FE20A095
TANDONGFOR SHALOM CHANGEH	FE20A111

TABLE OF CONTENT

I. PROJECT DESCRIPTION

An online election software is a platform that allows voters to cast their votes electronically, rather than using traditional paper ballots. The software typically includes features such as voter registration, ballot creation, vote casting, and vote counting. The goal of an online election software is to make the voting process more efficient, secure, and accessible to a wider range of voters.

II. DATABASE IMPLEMENTATION

1. Types of data that need to be stored

I. Voter Data:

This is the information about individual voters, including their names, addresses, contact details, and voter IDs.

- The relationship involves each voter having a unique identifier associated with their data.
- Rules: Ensure that each voter has a valid and unique identification number, and enforce privacy and security measures to protect voter information.

ii. Candidate Data:

It concerns the details about the candidates participating in the election, such as their names, party and candidate identification numbers.

- Relationships: Each candidate has a unique identifier associated with their data.
- Rules: Ensure that each candidate has a valid and unique identification number

iii. Ballot Data:

This is the information related to the ballots cast in the election, including the voter's identification, the selected candidate(s), and the timestamp of the vote.

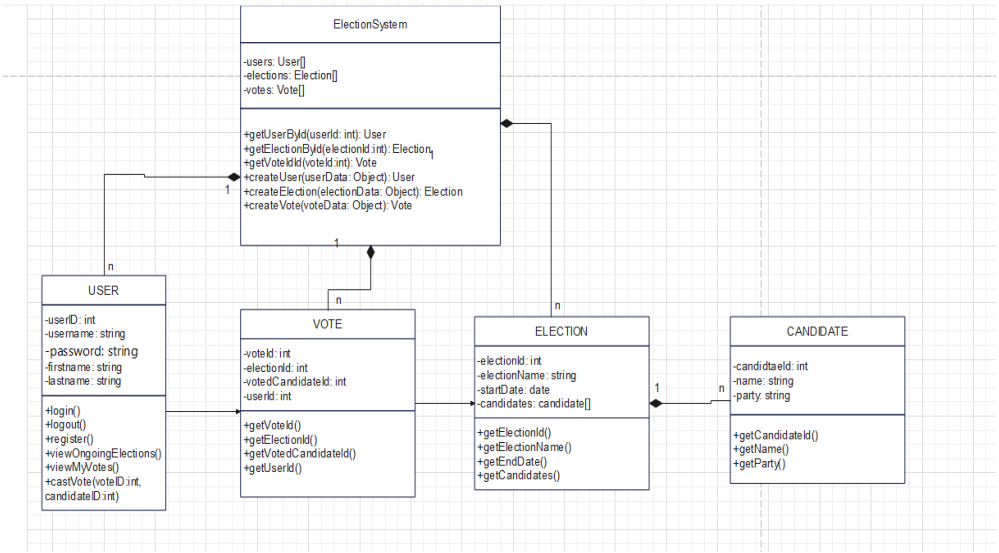
- The Relationships: Each ballot is associated with a specific voter and candidate(s).
- The Constraints/Rules: This is Implementing measures to prevent duplicate voting by the same individual, maintain ballot secrecy, and ensure that only eligible voters can cast their ballots.

V. Election Results Data:

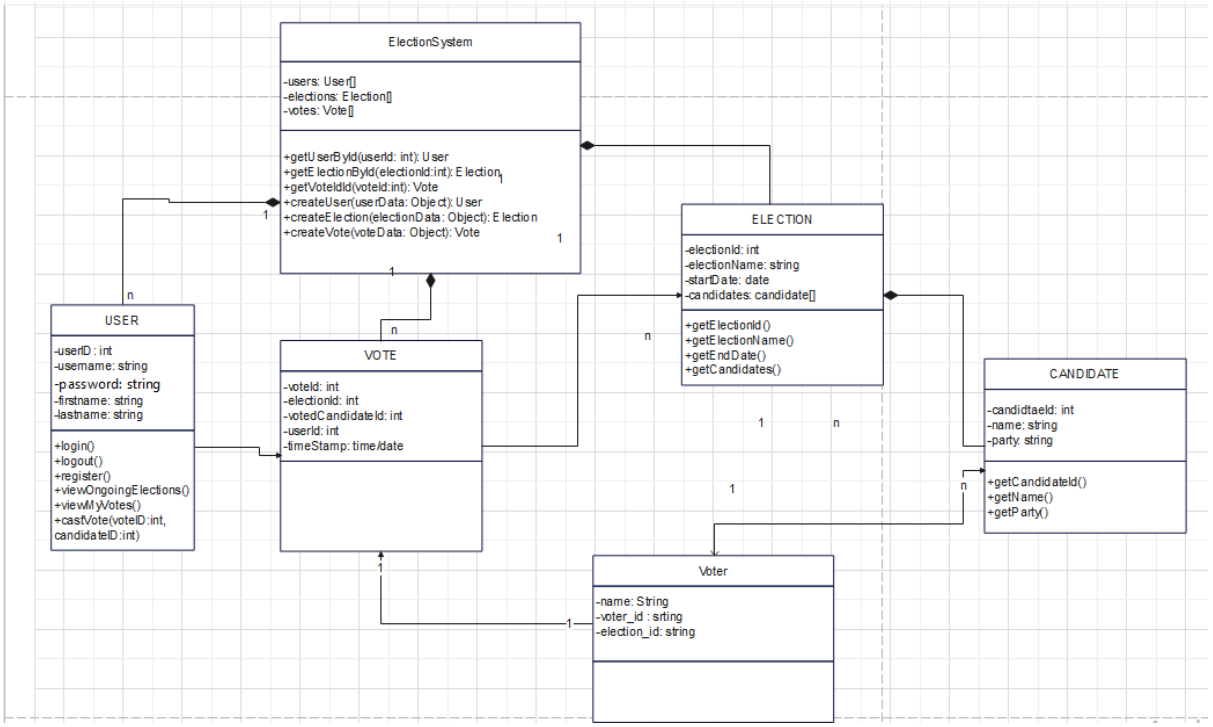
This is the outcome of the election,it includes the number of votes received by each candidate, the overall voter turnout, and any other relevant statistics.

- Relationships: Results data can be associated with specific candidates
- Rules: The rules include performing data validation to ensure accurate calculation of results, maintain result integrity, and provide mechanisms for result verification and auditing.

2. Class Diagram



3. Refined Class Diagram



4. Physical Database Schema :

- **Table for storing election information**

```
CREATE TABLE Elections (
   election_id INT PRIMARY KEY,
   name VARCHAR(255) NOT NULL,
   start_date DATETIME NOT NULL,
   );
```

- **Table for storing candidate information**

```
CREATE TABLE Candidates (
   candidate_id INT PRIMARY KEY,
   election_id INT,
   name VARCHAR(255) NOT NULL,
   party VARCHAR(100),

);
```

- **Table for storing voter information**

```
CREATE TABLE Voters (
   voter_id INT PRIMARY KEY,
   election_id INT,
   name VARCHAR(255) NOT NULL
   );
```

- **Table for storing votes**

```
CREATE TABLE Votes (
   vote_id INT PRIMARY KEY,
   election_id INT,
   candidate_id INT,
   voter_id INT,
   vote_timestamp DATETIME,
   );
```

Above, we have created four tables: **ELECTIONS, CANDIDATES VOTERS** and **VOTES** The ELECTIONS table stores information about each election, including its unique ID, name of election and start dates

The CANDIDATES table stores details of individual candidates participating in an election. It includes a candidate ID, election ID, the candidate name, and party affiliation.

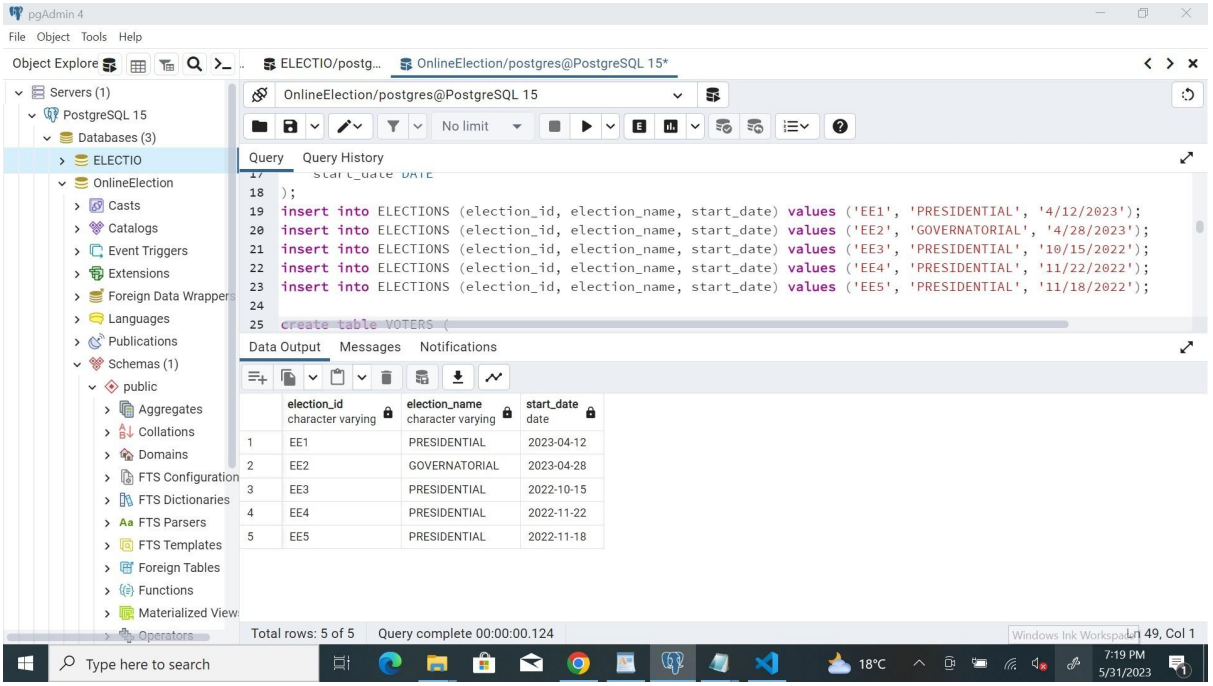
The VOTERS table stores information about registered voters. It includes a voter ID, election ID and voter name.

The Votes table stores voting information. It includes a vote ID, election ID , candidate ID , voter ID, and a timestamp for when the vote was cast.

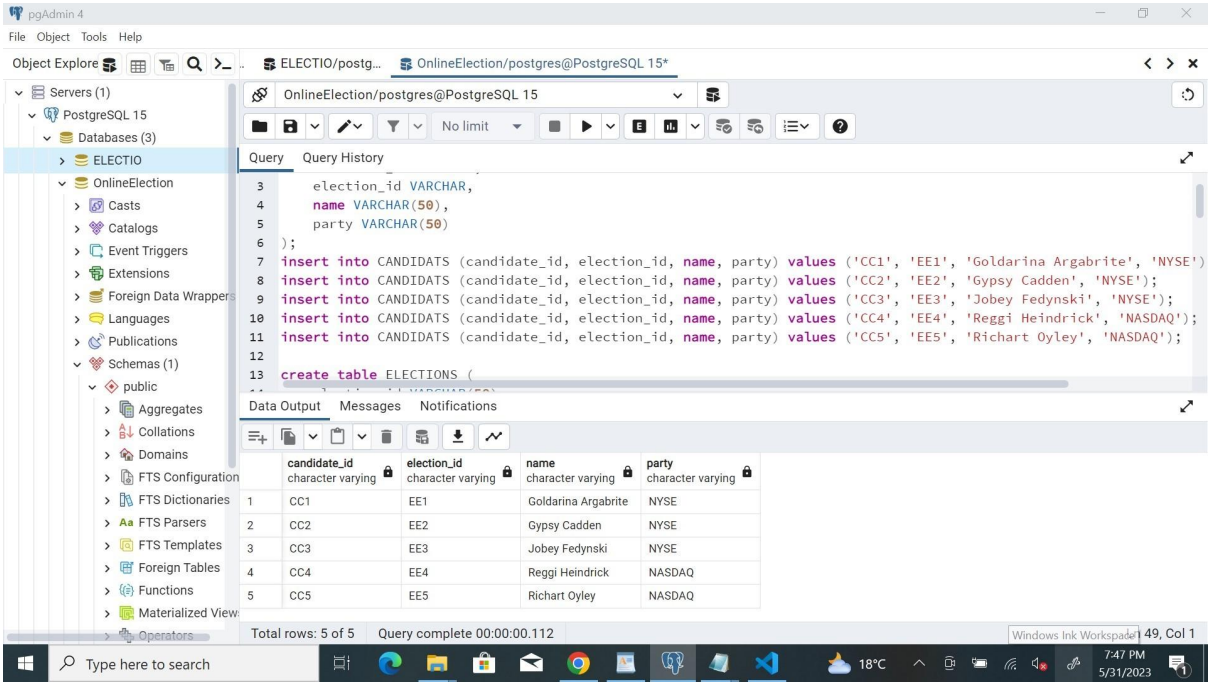
5. TABLES AND IMPORTED DATA

The data was generated and imported from Mockaroo

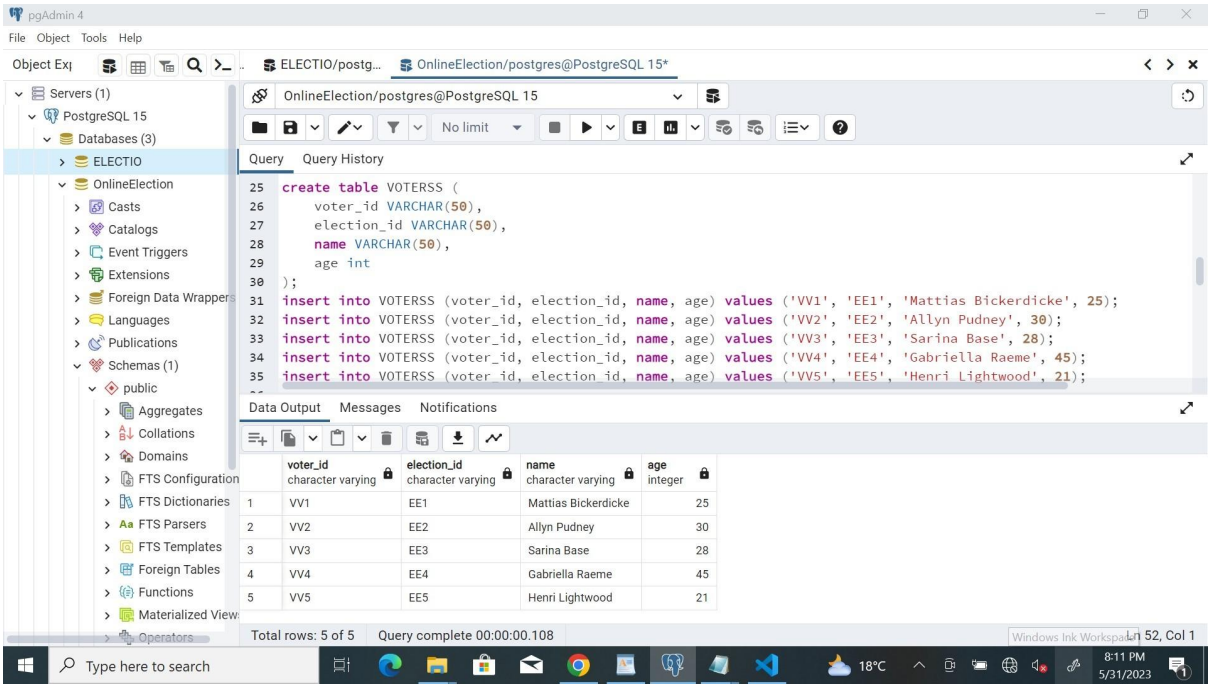
ELECTION TABLE



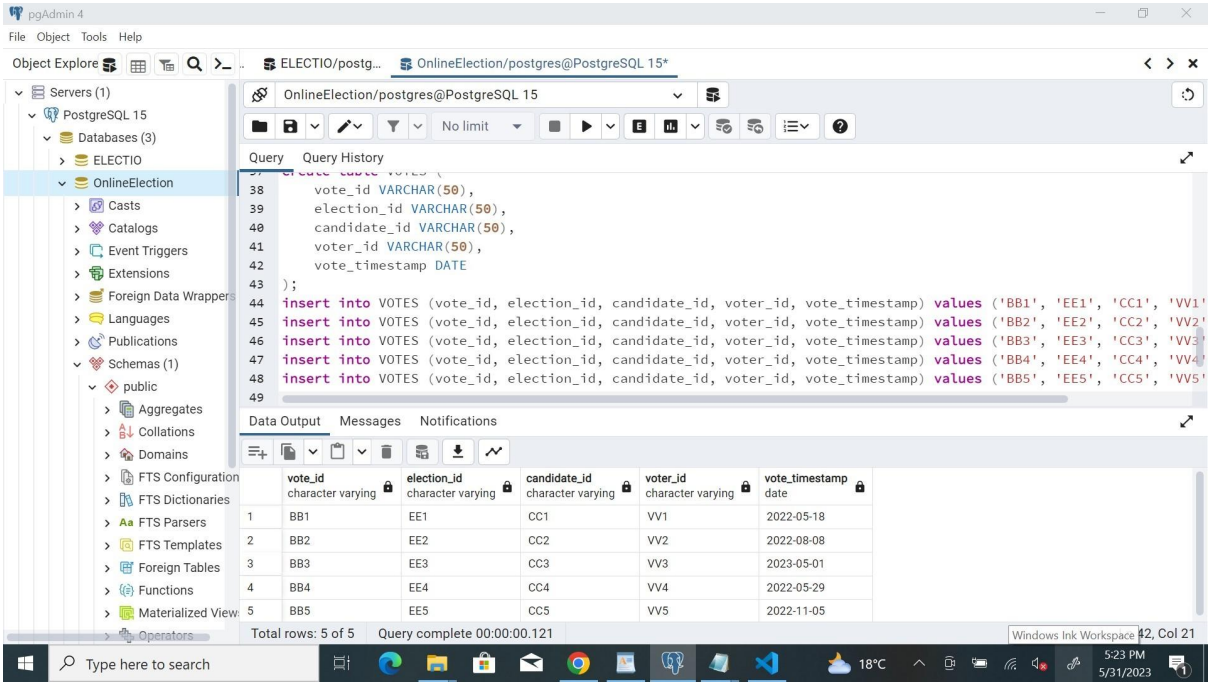
CANDIDATE TABLE



VOTERS TABLE



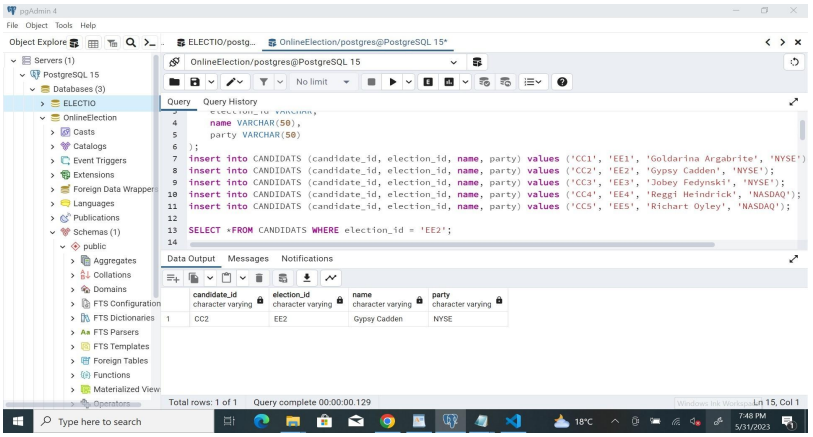
VOTES TABLE



7. Search queries

Retrieve all the candidates participating in a specific election:

SELECT * FROM CANDIDATS WHERE election_id = (‘EE2’);

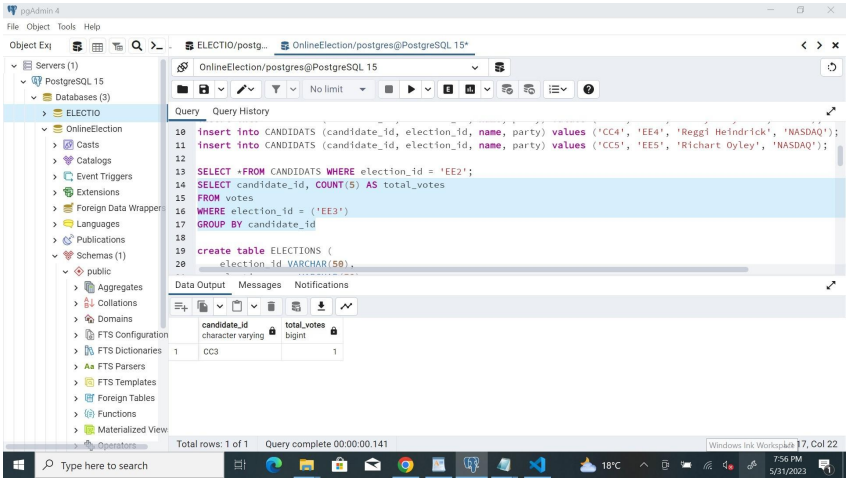


Algebraic tree

SELECT
|
candidates
|
WHERE
|
election_id = ‘EE2’

Retrieve the total number of votes received by each candidate in a specific election:

```
SELECT candidate_id, COUNT(5) AS total_votes
FROM VOTES
WHERE election_id = ‘EE2’
GROUP BY candidate_id;
```

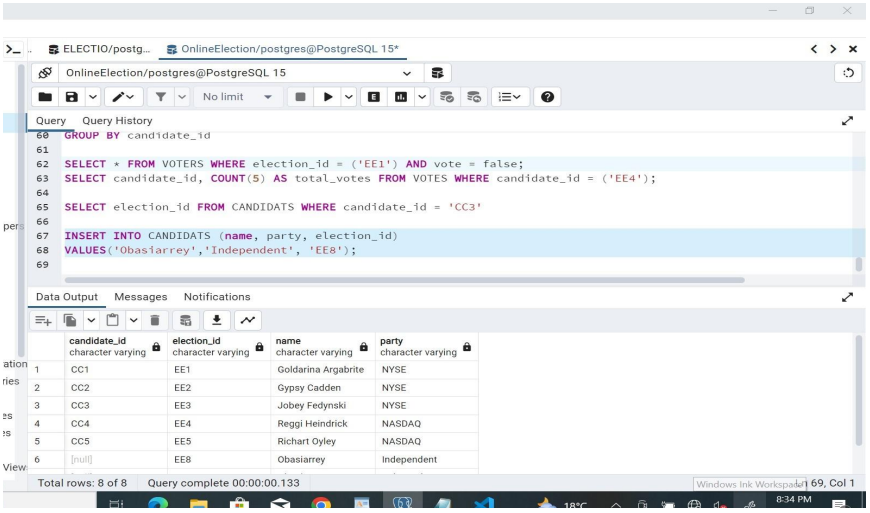


Algebraic tree

SELECT
|
candidate_id, COUNT(5) AS total_votes
|
FROM
|
votes
|

WHERE
|
election_id = ‘EE3’
|
GROUP BY
|
candidate_id

8. Data Addition Queries :



Insert a new candidate into the candidates table:

INSERT INTO CANDIDATS (name, party, election_id)
VALUES ('Obasiarrey', 'Independent', EE8);

Insert a new voter into the voters table:

```
INSERT INTO VOTERSS (name, age)
VALUES ('Nyenty', 24);
```

```
INSERT INTO VOTERSS (name, age)
VALUES ('Nyenty', 24);
```

Data Output | Messages | Notifications

	voter_id character varying	election_id character varying	name character varying	age integer
1	VV1	EE1	Mattias Bickerdicke	25
2	VV2	EE2	Allyn Pudney	30
3	VV3	EE3	Sarina Base	28
4	VV4	EE4	Gabriella Raeme	45
5	VV5	EE5	Henri Lightwood	21
6	[null]	[null]	Nyenty	24

Total rows: 6 of 6 | Query complete 00:00:00.108

Add a new election to the elections table:

INSERT INTO ELECTIONS (election_id, election_name, start_date)

VALUES (‘EE9’,'Municipal', '11/1/2022');

```
INSERT INTO ELECTIONS (election_id, election_name, start_date)
VALUES ('EE9','Municipal', '11/1/2022');
```

Data Output | Messages | Notifications

	election_id character varying	election_name character varying	start_date date
2	EE2	GOVERNATORIAL	2023-04-28
3	EE3	PRESIDENTIAL	2022-10-15
4	EE4	PRESIDENTIAL	2022-11-22
5	EE5	PRESIDENTIAL	2022-11-18
6	[null]	Municipal	2022-11-01
7	EE9	Municipal	2022-11-01

Record a vote by a specific voter for a specific candidate:

INSERT INTO votes (vote_id, voter_id, candidate_id, election_id, vote_timestamp)
VALUES (‘BB7’, ‘VV10’, ‘EE6’, 3/29/2022);

```
INSERT INTO VOTES (vote_id, voter_id, candidate_id, election_id, vote_timestamp)
VALUES ('BB7', 'VV10', 'CC8', 'EE6','3/29/2022');
```

a Output Messages Notifications

vote_id character varying	election_id character varying	candidate_id character varying	voter_id character varying	vote_timestamp date
BB2	EE2	CC2	VV2	2022-08-08
BB3	EE3	CC3	VV3	2023-05-01
BB4	EE4	CC4	VV4	2022-05-29
BB5	EE5	CC5	VV5	2022-11-05
[null]	EE6	CC8	VV10	[null]
BB7	EE6	CC8	VV10	2022-03-29

Add a new voter to the voters table:

INSERT INTO VOTERSS (voter_id, election_id, name, age)
VALUES (‘VV9’,‘EE10’,'Shalom', 33);

```
ALUES ('VV9', 'EE10', 'Shalom', 33);
```

utput Messages Notifications

voter_id character varying	election_id character varying	name character varying	age integer
VV4	EE4	Gabriella Raeme	45
VV5	EE5	Henri Lightwood	21
[null]	[null]	Nyenty	24
VV9	EE10	Shalom	33

9 . Data Modification Queries :

A . Database Update Queries:

Update the party of a specific candidate:

```
UPDATE CANDIDATS
SET party = 'CPDM'
WHERE candidate_id = ‘CC4’;
```

```
UPDATE CANDIDATS
SET party = 'CPDM'
WHERE candidate_id = 'CC4';
```

a Output Messages Notifications

candidate_id character varying	election_id character varying	name character varying	party character varying
CC5	EE5	Richart Oyley	NASDAQ
[null]	EE8	Obasiarrey	Independent
[null]	EE8	Obasiarrey	Independent
[null]	EE8	Obasiarrey	Independent
CC4	EE4	Reggi Heindrick	CPDM

Update the age of a specific voter:

```
UPDATE VOTERS
SET age = 53
WHERE voter_id = VV4;
```

```
79  UPDATE VOTERSS
80  SET age = '53'
81  WHERE voter_id = 'VV4';
```

Data Output Messages Notifications

	voter_id character varying	election_id character varying	name character varying	age integer
1	VV1	EE1	Mattias Bickerdicke	25
2	VV2	EE2	Allyn Pudney	30
3	VV3	EE3	Sarina Base	28
4	VV5	EE5	Henri Lightwood	21
5	[null]	[null]	Nyenty	24

Total rows: 8 of 8 Query complete 00:00:00.143

Update the election date of a specific election:

This happens incase the election date has been changed

```
UPDATE ELECTIONS
SET election_date = '11/22/2022'
WHERE election_id ='EE4';
```

```
UPDATE ELECTIONS
SET start_date = '11/22/2022'
WHERE election_id = 'EE4';
```

ta Output Messages Notifications

election_id character varying	election_name character varying	start_date date
EE3	PRESIDENTIAL	2022-10-15
EE5	PRESIDENTIAL	2022-11-18
[null]	Municipal	2022-11-01
EE9	Municipal	2022-11-01
EE4	PRESIDENTIAL	2022-11-22

Update a specific voters age:

```
UPDATE VOTERSS
SET age = 30
WHERE voter_id = VV5;
```

This is incase where the voters becomes of age to vote

```
UPDATE VOTERSS
SET age = 30
WHERE voter_id = 'VV5';
```

Data Output Messages Notifications

	voter_id character varying	election_id character varying	name character varying	age integer
4	[null]	[null]	Nyenty	24
5	VV9	EE10	Shalom	33
6	VV9	EE10	Shalom	33
7	VV4	EE4	Gabriella Raeme	53
8	VV5	EE5	Henri Lightwood	30

Update the timestamp of a specific vote:

```
UPDATE VOTES
SET vote_timesamp = '11/3/2022'
WHERE vote_id = ‘BB3;
```

```
UPDATE VOTES
SET vote_timestamp = '3/22/2022'
WHERE vote_id = 'BB3';
```

a Output Messages Notifications

vote_id character varying	election_id character varying	candidate_id character varying	voter_id character varying	vote_timestamp date
BB4	EE4	CC4	VV4	2022-05-29
BB5	EE5	CC5	VV5	2022-11-05
[null]	EE6	CC8	VV10	[null]
BB7	EE6	CC8	VV10	2022-03-29
BB3	EE3	CC3	VV3	2022-03-22

al rows: 7 of 7 Query complete 00:00:00.238

B . Database Modification Queries:

Modify the column name of a specific table:

```
ALTER TABLE CANDIDATS
RENAME COLUMN name TO candidate_name;
```

```
83 ALTER TABLE CANDIDATS
84 RENAME COLUMN name TO candidate_name;
```

Data Output Messages Notifications

	candidate_id character varying	election_id character varying	candidate_name character varying	party character varying
4	CC5	EE5	Richart Oyley	NASDAQ
5	[null]	EE8	Obasiarrey	Independent
6	[null]	EE8	Obasiarrey	Independent
7	[null]	EE8	Obasiarrey	Independent
8	CC4	EE4	Reggi Heindrick	CPDM

Add a new column to a specific table:

ALTER TABLE CANDIDATS
ADD COLUMN age INT;

```
ALTER TABLE CANDIDATS
ADD COLUMN age int;
```

Output Messages Notifications

candidate_id character varying	election_id character varying	candidate_name character varying	party character varying	age integer
CC1	EE1	Goldarina Argabrite	NYSE	[null]
CC2	EE2	Gypsy Cadden	NYSE	[null]
CC3	EE3	Jobey Fedynski	NYSE	[null]
CC5	EE5	Richart Oyley	NASDAQ	[null]
[null]	EE8	Obasiarrey	Independent	[null]

Delete a specific column from a table:

ALTER TABLE CANDIDATS
DROP COLUMN age;

```
83 ALTER TABLE CANDIDATS
84 DROP COLUMN age;
```

Data Output Messages Notifications

	candidate_id character varying	election_id character varying	candidate_name character varying	party character varying
1	CC1	EE1	Goldarina Argabrite	NYSE
2	CC2	EE2	Gypsy Cadden	NYSE
3	CC3	EE3	Jobey Fedynski	NYSE
4	CC5	EE5	Richart Oyley	NASDAQ
5	[null]	EE8	Obasiarrey	Independent

Total rows: 8 of 8 Query complete 00:00:00.116

Rename a specific table:

```
ALTER TABLE ELECTIONS
RENAME TO ELECTORAL;
```

```
ALTER TABLE ELECTIONS
RENAME TO ELECTORIAL
SELECT * FROM ELECTORIAL
```

a Output Messages Notifications

election_id character varying	election_name character varying	start_date date
EE1	PRESIDENTIAL	2023-04-12
EE2	GOVERNATORIAL	2023-04-28
EE3	PRESIDENTIAL	2022-10-15
EE5	PRESIDENTIAL	2022-11-18
[null]	Municipal	2022-11-01

Modify the data type of a specific column:

```
ALTER TABLE ELECTIONS
RENAME COLUMN name
TYPE text;
```

10 . Data Deletion Queries:

Delete a specific vote from the votes table:

```
DELETE FROM VOTES
WHERE vote_id = 'BB5';
```

```
DELETE FROM VOTES WHERE vote_id = 'BB5';
```

a Output Messages Notifications

vote_id character varying	election_id character varying	candidate_id character varying	voter_id character varying	vote_timestamp date
BB2	EE2	CC2	VV2	2022-08-08
BB4	EE4	CC4	VV4	2022-05-29
[null]	EE6	CC8	VV10	[null]
BB7	EE6	CC8	VV10	2022-03-29
BB3	EE3	CC3	VV3	2022-03-22

Delete all elections held after a specific date from the elections table:

DELETE FROM ELECTIONS
WHERE start_date > ’5/1/2023’;

```
DELETE FROM ELECTIONS WHERE start_date >'5/1/2023';
```

ata Output Messages Notifications

election_id character varying	election_name character varying	start_date date
EE1	PRESIDENTIAL	2023-04-12
EE2	GOVERNATORIAL	2023-04-28
EE3	PRESIDENTIAL	2022-10-15
EE5	PRESIDENTIAL	2022-11-18
[null]	Municipal	2022-11-01
EE9	Municipal	2022-11-01
EE4	PRESIDENTIAL	2022-11-22

Delete all votes cast in a specific election from the votes table:

DELETE FROM VOTES
WHERE election_id = ‘EE5’;

```
DELETE FROM VOTES WHERE election_id = 'EE5';
```

Data Output Messages Notifications

	vote_id character varying	election_id character varying	candidate_id character varying	voter_id character varying	vote_timestamp date
1	BB1	EE1	CC1	VV1	2022-05-18
2	BB2	EE2	CC2	VV2	2022-08-08
3	BB4	EE4	CC4	VV4	2022-05-29
4	[null]	EE6	CC8	VV10	[null]
5	BB7	EE6	CC8	VV10	2022-03-29

Total rows: 6 of 6 Query complete 00:00:00.108

Delete all votes from the Votes table:

DELETE FROM VOTES;

```
DELETE FROM VOTES;
```

a Output Messages Notifications

vote_id character varying	election_id character varying	candidate_id character varying	voter_id character varying	vote_timestamp date

Delete a specific election from the elections table along with all associated data:

DELETE FROM ELECTIONS
WHERE election_id = ‘EE4’;

11 .Queries With Parameters :

Retrieve the details of a specific candidate by candidate ID:

SELECT *
FROM CANDIDATS
WHERE candidate_id = CC1;

```
87
88  SELECT * FROM CANDIDATS WHERE candidate_id = 'CC3';
```

Data Output Messages Notifications

	candidate_id character varying	election_id character varying	candidate_name text	party character varying
1	CC3	EE3	Jobey Fedynski	NYSE

Retrieve the list of candidate running in a specific election:

SELECT *FROM CANDIDATS
WHERE election_id ='EE1'

Retrieve the number of votes received for a specific candidate

SELECT COUNT(*) AS vote_count
FROM VOTES
WHERE candidate_id = 'CC1':

```
88  SELECT COUNT(*) AS vote_count FROM VOTES WHERE candidate_id = 'CC1';
89
```

Data Output Messages Notifications

	vote_count bigint
1	0

Retrieve the list of elections within a specific date range:

SELECT *
FROM elections
WHERE start_date >= '11/1/2022 AND start_date <= '2/14/2023';

```
88  SELECT * FROM ELECTIONS WHERE start_date >= '11/1/2022' AND start_date <='2/14/2023';
89
```

Data Output Messages Notifications

	election_id character varying	election_name character varying	start_date date
1	EE5	PRESIDENTIAL	2022-11-18
2	[null]	Municipal	2022-11-01
3	EE9	Municipal	2022-11-01
4	EE4	PRESIDENTIAL	2022-11-22

12 . Database Backup & Restore :

Backup

By using the pg_dump utility. PostgreSQL provides the pg_dump utility to perform logical backups of databases. We open the command prompt and execute the following command:

pg_dump -U <postgres> -d <OnlineElection> -f <backup_file.sql>

We store the backup file in a secure location, such as a dedicated backup server, network storage, or cloud storage. And we make sure the file is protected and accessible when needed.

Restore:

We start by creating an empty database, then using the psql utility,we open a command prompt and executed the following command to restore the backup file to the newly created database:

psql -U <postgres> -d <OnlineElection> -f <backup_file.sql>.

After the restoration is complete, we can connect to the database and perform tests or checks to ensure the data has been successfully restored.

List of participants

NAME	WORK
NDIKINTUM CARL NFON	Project description, class diagram, algebraic trees, queries with parameters, backup and restore
NYENTY EYONG ARREHQUETTE	Generating data from mockaroo, data update queries, data modification queries, data deletion queries,

OBASIARREY M’ONEKE MARY ARREY-NJOK	Create all tables and columns, search queries,
TANGDONFOR SHALOM CHANGEH	Types of data that need to be stored, Physical database schema