

# **ADVANCED DATABASE MANAGEMENT SYSTEM**

## **LAB ASSIGNMENT**

**GROUP-(21-25)**

**SUBMITTED BY**

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**TOPIC:** Design database schemas and implement min 10 queries  
using Cassandra column based databases

<b>Aim</b>
To Design database schemas and implement queries using Cassandra databases

<b>Objective(s)</b>
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<b>1</b>	Study of NOSQL Cassandra.
<b>2</b>	Study the procedure to execute a query using Apache Cassandra.
<b>3</b>	Execute min 10 queries using Cassandra column based database.

# **1.STUDY OF NOSQL CASSANDRA**

## **Cassandra**

Apache Cassandra is an open source distributed database management system designed to handle large amounts of data across many commodity servers, providing high availability with no single point of failure.

# **Features**

## **1) Scalability:**

- Read and write throughput both increase linearly as new machines are added, with no downtime or interruption to applications.

## **2) Fault-tolerant:**

- Data is automatically replicated to multiple nodes for fault-tolerance.
- Replication across multiple data centers is supported.
- Failed nodes can be replaced with no downtime.

## **3) MapReduce support:**

- Cassandra has Hadoop integration, with MapReduce support.

## **4) Query language:**

- Cassandra introduces CQL (Cassandra Query Language), a SQL-like alternative to the traditional RPC interface.
  - **Keyspace:** Keyspace is the outermost container for data. It is similar to the schema in a relational database.

**Basic attributes** of Keyspace are:

- **Replication Factor:** It is the number of machines in the cluster that will receive copies of the same data
- **Replica Placement Strategy:** It is a strategy to place replicas in the ring
- Simple Strategy,
- Old Network Topology Strategy
- Network Topology Strategy

**Column Families:** Column family is a NoSQL object that contains columns of related data. It is a tuple (pair) that consists of a key-value pair, where the key is mapped to a value that is a set of columns. It is similar to a table in a relational database and each key-value pair being a row.

Each column is a tuple (triplet) consisting of

- Column name
- Value
- Timestamp

# **1. STUDY THE PROCEDURE TO EXECUTE A QUERY USING APACHE CASSANDRA**

## **Introduction**

DataStax Community Edition must be installed on system before installing Cassandra. Verify the Cassandra installation using the following command:

- **\$ Cassandra version**
- If Cassandra is already installed on system, then you will get the following response:
- **Connected to Test Cluster at 127.0.0.1:9042.**
- **[ cqlsh 5.0.1 | Cassandra 2.2.4 | CQL spec 3.3.1 | Native protocol v4] Use HELP for help.**
- **WARNING: pyreadline dependency missing. Install to enable tab completion. From**

source with checksum 79e53ce7994d1628b240f09af91e1af4

### Creating KEYSPACE :

Cassandra is technology that can define databases and tables to analyze structured data. The theme for structured data analysis is to store the data in a tabular manner, and pass queries to analyze it.

#### Create KEYSPACE Statement

- Create KEYSPACE is a statement used to create a KEYSPACE in Cassandra. A KEYSPACE in Cassandra is aKEYSPACE or a collection of tables. The syntax for this statement is as follows:  
**cqlsh>CREATE KEYSPACE ABC userdb replication={  
'class':'SimpleStrategy','replication\_factor':'1'};**
- Here, IF NOT EXISTS is an optional clause, which notifies the user that a database with the same name already exists. We can use SCHEMA in place of DATABASE in this command.
- The following query is executed to create a database named userdb:

**cqlsh> userdb;**

**Or**

**cqlsh> CREATE SCHEMA userdb;**

The following query is used to verify a databases list:

**cqlsh>:userdb> show tables; Improper show command. default  
userdb**

For creating Table:

**Create Table**

**CREATE TABLE test\_table (  
id int, address text, name text,  
PRIMARY KEY ((id))  
);**

CURD using cql Updating Table:

**Update Table**

**insert into test\_table (id, name, address) values (4, 'somnath', 'Sus');**

CURD using cql Delete Table

### Deleting rows from Table

**delete from test\_table where id =1;**

The following queries are used to drop a database. Let us assume that the database name is **userdb**.

**cqlsh:userdb> delete from Tablename where condition;**

### For describing tables

**cqlsh:userdb> describe tables; show all table names**

**cqlsh:userdb>**

### For Help of any Topic

**Cqshl> Help;**

### Display topics

**Cqshl> Help topic name;**

Help open in Browser.

## **3.Execute minimum 10 queries using Cassandra column-based database**

### **INITIAL PROCEDURE:**

Step 1: Here we consider the database “users”

Step 2: Creating and updating a keyspace ,here keyspace is “company”

Step 3: Creating a table “staffs”

Step 4: Describe table “staffs”

Dashboard / Users

Load DataConnect

OverviewHealthConnectCQL ConsoleSettings

```
Connected as ananyaanuzz31@gmail.com.
Connected to cndb at cassandra.ingress:9042.
[cqlsh 6.8.0 | DSE DB 4.0.0.6815 | CQL spec 3.4.5 | Native protocol v4]
Use HELP for help.
token@cqlsh> USE company;
token@cqlsh:company>
```

Dashboard / Users

Load DataConnect

OverviewHealthConnectCQL ConsoleSettings

```
token@cqlsh:company> CREATE TABLE company.staffs ( firstname text PRIMARY KEY, lastname text, nationality text );
token@cqlsh:company> DESCRIBE company.staffs;

CREATE TABLE company.staffs (
  firstname text PRIMARY KEY,
  lastname text,
  nationality text
) WITH additional_write_policy = '99PERCENTILE'
AND bloom_filter_fp_chance = 0.01
AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
AND comment = ''
AND compaction = {'class': 'org.apache.cassandra.db.compaction.UnifiedCompactionStrategy'}
AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
AND crc_check_chance = 1.0
AND default_time_to_live = 0
AND gc_grace_seconds = 864000
AND max_index_interval = 2048
AND memtable_flush_period_in_ms = 0
AND min_index_interval = 128
AND read_repair = 'BLOCKING'
AND speculative_retry = '99PERCENTILE';

token@cqlsh:company>
```

# QUERIES

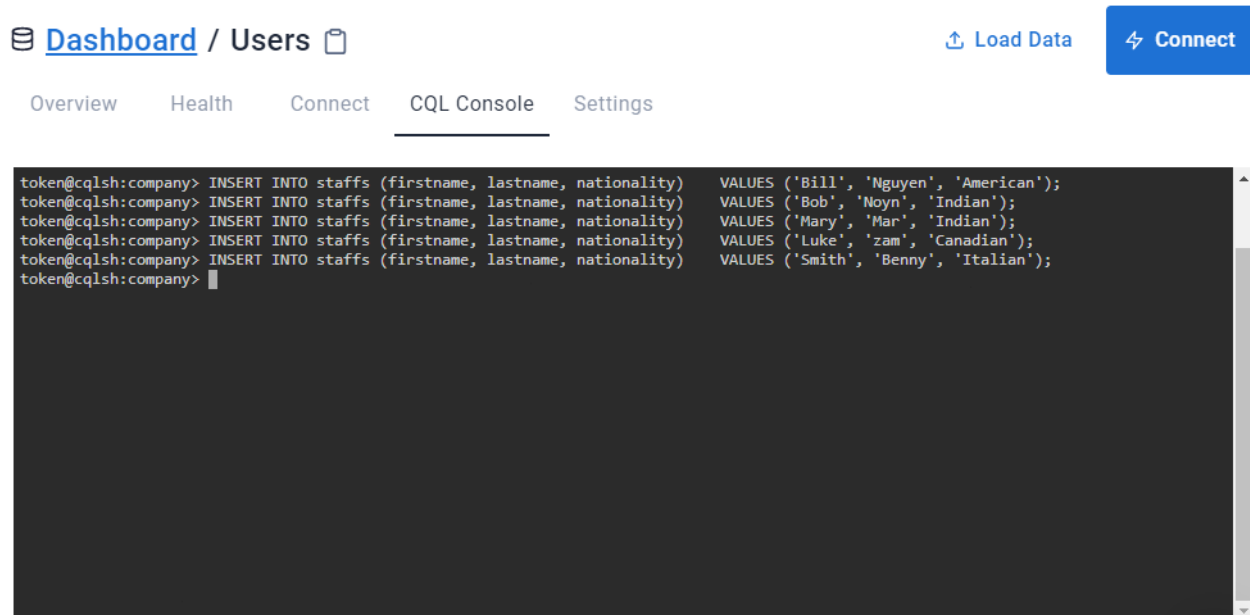
## 1. INSERTING DATA INTO A TABLE

Procedure:



- INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bill', 'Nguyen', 'American');
- INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bob', 'Noyn', 'Indian');
- INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Mary', 'Mar', 'Indian');
- INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Luke', 'zam', 'Canadian');
- INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Smith', 'Benny', 'Italian');

## OUTPUT



The screenshot shows a web application interface with a top navigation bar containing a menu icon, the text "Dashboard / Users", and a "Load Data" button. Below the navigation bar is a tabbed interface with tabs for "Overview", "Health", "Connect", "CQL Console", and "Settings". The "CQL Console" tab is active, displaying a terminal window with the following text:

```
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bill', 'Nguyen', 'American');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bob', 'Noyn', 'Indian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Mary', 'Mar', 'Indian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Luke', 'zam', 'Canadian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Smith', 'Benny', 'Italian');
```

## 2.RETRIEVAL OF ALL DATA

Procedure:

- SELECT \* FROM company.staffs;

## OUTPUT

```
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bill', 'Nguyen', 'American');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Bob', 'Noyrn', 'Indian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Mary', 'Mar', 'Indian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Luke', 'zam', 'Canadian');
token@cqlsh:company> INSERT INTO staffs (firstname, lastname, nationality) VALUES ('Smith', 'Benny', 'Italian');
token@cqlsh:company> SELECT * FROM company.staffs;
```

firstname	lastname	nationality
Mary	Mar	Indian
Bill	Nguyen	American
Bob	Noyrn	Indian
Smith	Benny	Italian
Luke	zam	Canadian

(5 rows)  
token@cqlsh:company> █

## 3.RETRIEVE THE DETAILS OF STAFFS USING CONDITIONS

### Procedure:

- SELECT \* FROM company.staffs WHERE nationality = 'Indian' ALLOW FILTERING;
- SELECT \* FROM company.staffs WHERE firstname = 'Bill' ALLOW FILTERING;

## OUTPUT

```
token@cqlsh:company> SELECT * FROM company.staffs WHERE nationality = 'Indian' ALLOW FILTERING;
```

firstname	lastname	nationality
Mary	Mar	Indian
Bob	Noyn	Indian

(2 rows)

```
token@cqlsh:company>
```

```
token@cqlsh:company> SELECT * FROM company.staffs WHERE nationality = 'Indian' ALLOW FILTERING;
```

firstname	lastname	nationality
Mary	Mar	Indian
Bob	Noyn	Indian

(2 rows)

```
token@cqlsh:company> SELECT * FROM company.staffs WHERE firstname = 'Bill' ALLOW FILTERING;
```

firstname	lastname	nationality
Bill	Nguyen	American

(1 rows)

```
token@cqlsh:company>
```

## 2. ALTER TABLE command

- Adding new column 'title' into the table 'staffs'

### Procedure:

- ALTER TABLE staffs ADD title text;
- DESCRIBE TABLE staffs;
- Add Datas into that column using insert command
- Then displayed the details using select command

## OUTPUT



The screenshot shows a database dashboard interface. At the top, there is a navigation bar with a menu icon, the text "Dashboard / Users", and a folder icon. On the right side of the navigation bar, there are two buttons: "Load Data" and "Connect". Below the navigation bar, there is a horizontal menu with five items: "Overview", "Health", "Connect", "CQL Console", and "Settings". The "CQL Console" item is currently selected and highlighted with a blue underline. Below the menu, there is a large dark gray area representing the CQL Console. Inside this area, the following text is displayed: 

```
token@cqlsh:company> DESCRIBE TABLE staffs;

CREATE TABLE company.staffs (
  firstname text PRIMARY KEY,
  lastname text,
  nationality text,
  title text
) WITH additional_write_policy = '99PERCENTILE'
   AND bloom_filter_fp_chance = 0.01
   AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
   AND comment = ''
   AND compaction = {'class': 'org.apache.cassandra.db.compaction.UnifiedCompactionStrategy'}
   AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
   AND crc_check_chance = 1.0
   AND default_time_to_live = 0
   AND gc_grace_seconds = 864000
   AND max_index_interval = 2048
   AND memtable_flush_period_in_ms = 0
   AND min_index_interval = 128
   AND read_repair = 'BLOCKING'
   AND speculative_retry = '99PERCENTILE';

token@cqlsh:company>
```

```
token@cqlsh:company> SELECT * FROM company.staffs;
```

firstname	lastname	nationality	title
Mary	Mar	Indian	Mrs
Bill	Nguyen	American	Mr
Bob	Noyn	Indian	Mr
Smith	Benny	Italian	Mr
Luke	zam	Canadian	Mr

(5 rows)

```
token@cqlsh:company> 
```

## 4.RETRIEVING TIMESTAMPS

### Timestamps

Each time you write data into Cassandra, a timestamp is generated for each column value that is updated. Internally, Cassandra uses these timestamps for resolving any conflicting changes that are made to the same value.

### Procedure:

- `SELECT firstname ,lastname , writetime(lastname) FROM staffs;`

## OUTPUT

 [Dashboard](#) / [Users](#) 

 Load Data

 Connect

Overview

Health

Connect

CQL Console

Settings

```
token@cqlsh:company> SELECT firstname ,lastname , writetime(lastname) FROM staffs;
```

firstname	lastname	writetime(lastname)
Mary	Mar	1629996463400605
Bill	Nguyen	1629996514844036
Bob	Noyn	1629996485749276
Smith	Benny	1629996393466451
Luke	zam	1629996432325374

(5 rows)

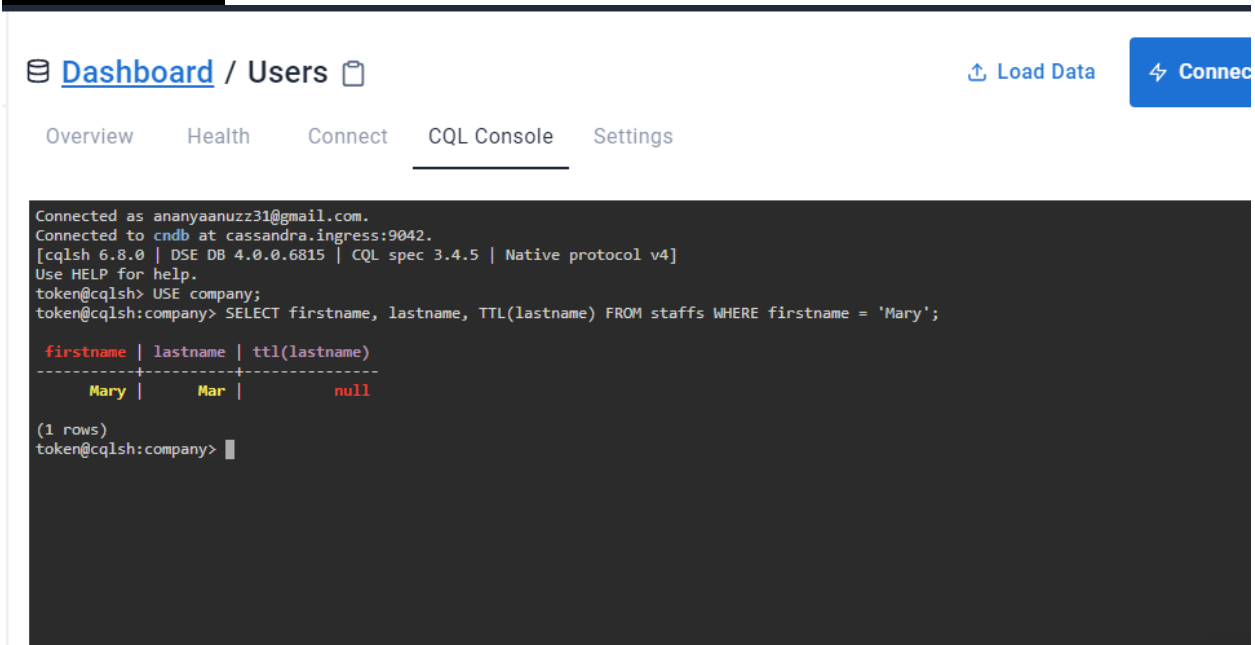
```
token@cqlsh:company> █
```

## 5.RETRIEVE THE TTL VALUE FOR ‘ Mary’s lastname’

### Procedure:

- SELECT firstname, lastname, TTL(lastname) FROM staffs WHERE firstname = 'Mary';

## OUTPUT



The screenshot displays the CQL Console interface. At the top, there's a navigation bar with 'Dashboard / Users' and buttons for 'Load Data' and 'Connect'. Below this is a tabbed interface with 'Overview', 'Health', 'Connect', 'CQL Console' (selected), and 'Settings'. The main area shows a terminal-like output of a CQL query execution. The query is: `SELECT firstname, lastname, TTL(lastname) FROM staffs WHERE firstname = 'Mary';`. The output shows a single row with columns `firstname`, `lastname`, and `tvl(lastname)`. The values are `Mary`, `Mar`, and `null` respectively. The interface also shows connection details at the top: 'Connected as ananyaanuzz31@gmail.com. Connected to cndb at cassandra.ingress:9042. [cqlsh 6.8.0 | DSE DB 4.0.0.6815 | CQL spec 3.4.5 | Native protocol v4] Use HELP for help. token@cqlsh> USE company; token@cqlsh:company> SELECT firstname, lastname, TTL(lastname) FROM staffs WHERE firstname = 'Mary';'

```
Connected as ananyaanuzz31@gmail.com.
Connected to cndb at cassandra.ingress:9042.
[cqlsh 6.8.0 | DSE DB 4.0.0.6815 | CQL spec 3.4.5 | Native protocol v4]
Use HELP for help.
token@cqlsh> USE company;
token@cqlsh:company> SELECT firstname, lastname, TTL(lastname) FROM staffs WHERE firstname = 'Mary';

  firstname | lastname | ttl(lastname)
-----+-----+-----
      Mary |      Mar |           null

(1 rows)
token@cqlsh:company> █
```

## 6. QUERY TO ADD THE IDENTIFIER USING A UUID

### Procedure:

- ALTER TABLE staffs ADD id uuid;
- DESCRIBE staffs;

## OUTPUT

 [Dashboard](#) / Users 

 Load Data

 Connect

Overview

Health

Connect

CQL Console

Settings

```
token@cqlsh:company> ALTER TABLE staffs ADD id uuid;
token@cqlsh:company> DESCRIBE staffs;

CREATE TABLE company.staffs (
  firstname text PRIMARY KEY,
  id uuid,
  lastname text,
  nationality text,
  title text
) WITH additional_write_policy = '99PERCENTILE'
  AND bloom_filter_fp_chance = 0.01
  AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
  AND comment = ''
  AND compaction = {'class': 'org.apache.cassandra.db.compaction.UnifiedCompactionStrategy'}
  AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
  AND crc_check_chance = 1.0
  AND default_time_to_live = 0
  AND gc_grace_seconds = 864000
  AND max_index_interval = 2048
  AND memtable_flush_period_in_ms = 0
  AND min_index_interval = 128
  AND read_repair = 'BLOCKING'
  AND speculative_retry = '99PERCENTILE';
```



## 7.QUERY TO INSERT AN ID FOR MARY USING UUID() FUNCTION AND THEN VIEW THE RESULTS

### **uuid**

A universally unique identifier (UUID) is a 128-bit value in which the bits conform to one of several types, of which the most commonly used are known as Type 1 and Type 4. The CQL uuid type is a Type 4 UUID, which is based entirely on random numbers. UUIDs are typically represented as dash-separated sequences of hex digits. For example:

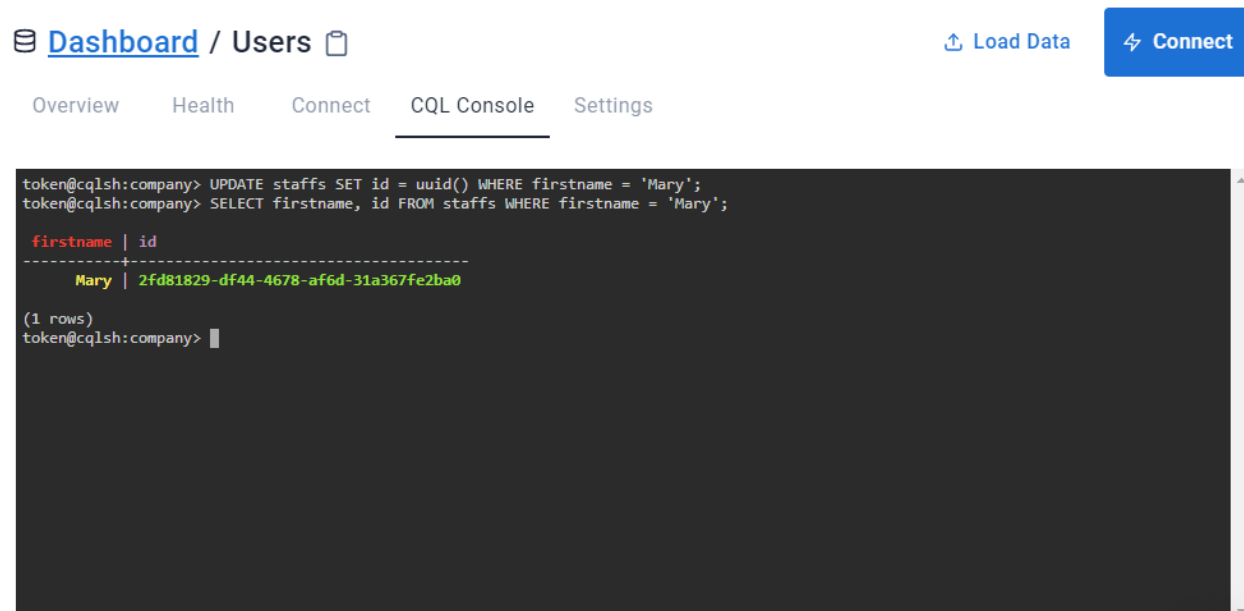
1a6300ca-0572-4736-a393-c0b7229e193e

The uuid type is often used as a surrogate key, either by itself or in combination with other values.

### Procedure:

- UPDATE staffs SET id = uuid() WHERE firstname = 'Mary';
- SELECT firstname, id FROM staffs WHERE firstname = 'Mary';

## OUTPUT



The screenshot shows a database interface with a top navigation bar containing 'Dashboard / Users', 'Load Data', and 'Connect' buttons. Below the navigation bar are tabs for 'Overview', 'Health', 'Connect', 'CQL Console', and 'Settings'. The 'CQL Console' tab is active, displaying a terminal window with the following content:

```
token@cqlsh:company> UPDATE staffs SET id = uuid() WHERE firstname = 'Mary';
token@cqlsh:company> SELECT firstname, id FROM staffs WHERE firstname = 'Mary';
```

firstname	id
Mary	2fd81829-df44-4678-af6d-31a367fe2ba0

(1 rows)  
token@cqlsh:company> █

## 8.QUERY TO MODIFY OUR STAFFS TABLE TO ADD A SET OF EMAIL ADDRESSES

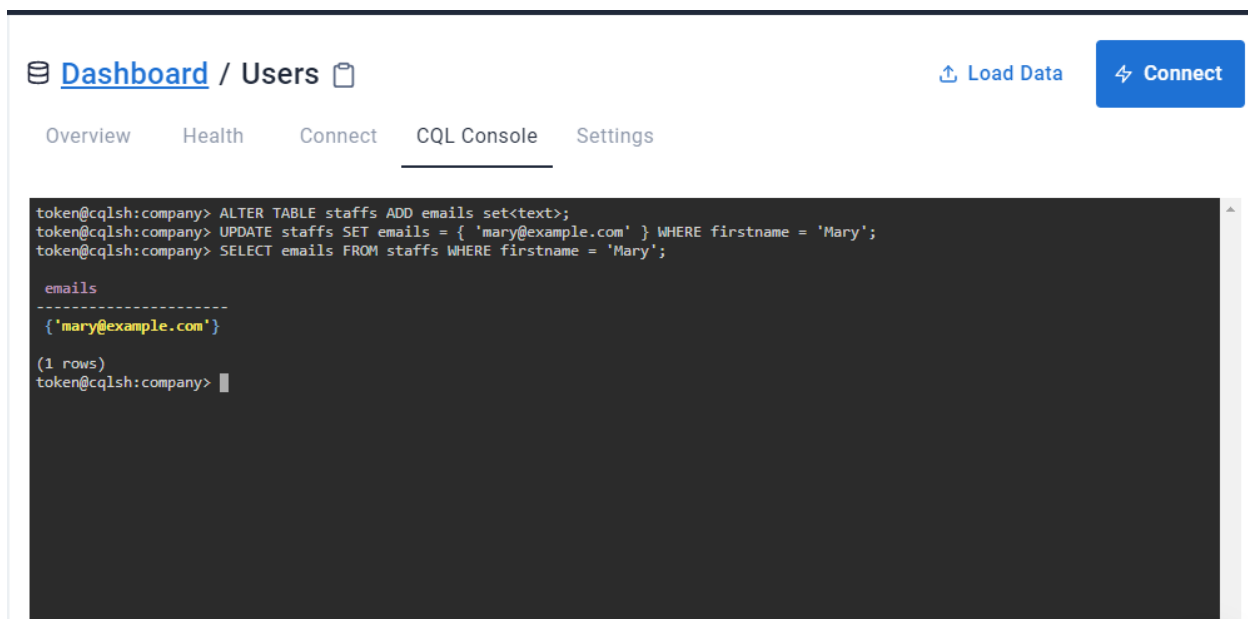
### set

The set data type stores a collection of elements. The elements are unordered, but cqlsh returns the elements in sorted order. For example, text values are returned in alphabetical order. One advantage of using set is the ability to insert additional items without having to read the contents first.

### Procedure:

- ALTER TABLE staffs ADD emails set<text>;
- UPDATE staffs SET emails = { 'mary@example.com' } WHERE firstname = 'Mary';
- SELECT emails FROM staffs WHERE firstname = 'Mary';

## OUTPUT



The screenshot shows a database interface with a top navigation bar containing 'Dashboard / Users', 'Load Data', and 'Connect' buttons. Below the navigation bar are tabs for 'Overview', 'Health', 'Connect', 'CQL Console', and 'Settings'. The 'CQL Console' tab is active, displaying a terminal window with the following content:

```
token@cqlsh:company> ALTER TABLE staffs ADD emails set<text>;
token@cqlsh:company> UPDATE staffs SET emails = { 'mary@example.com' } WHERE firstname = 'Mary';
token@cqlsh:company> SELECT emails FROM staffs WHERE firstname = 'Mary';

emails
-----
{'mary@example.com'}

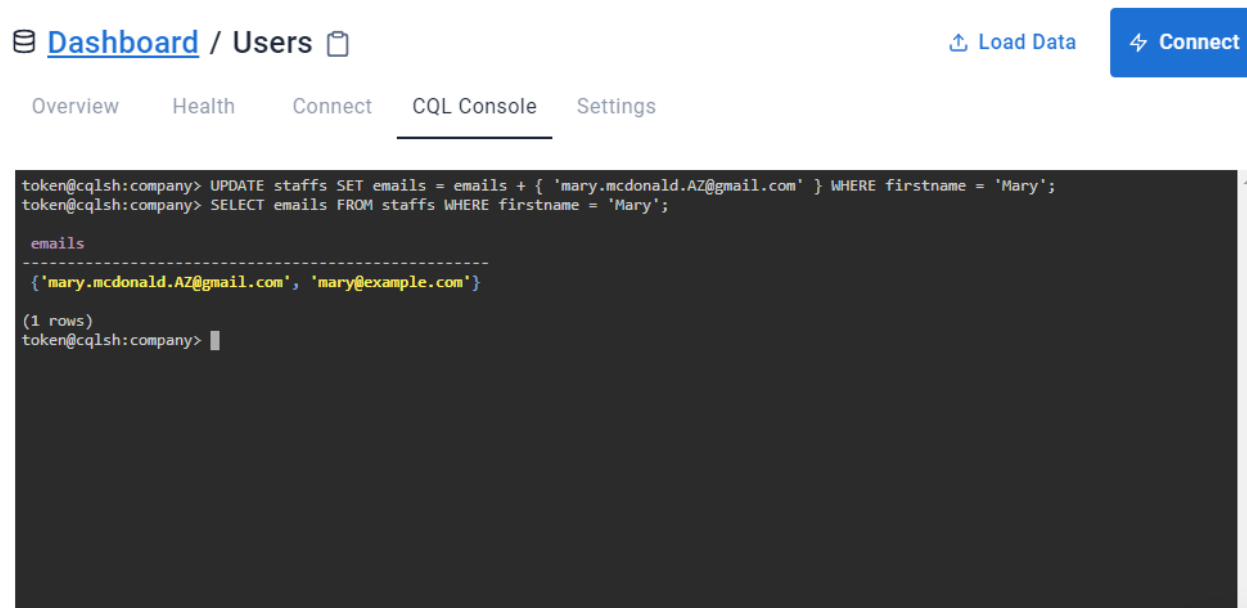
(1 rows)
token@cqlsh:company> |
```

## 9.QUERY TO ADD ANOTHER EMAIL ADDRESS WITHOUT REPLACING THE WHOLE SET BY USING CONCATENATION

### Procedure:

- UPDATE staffs SET emails = emails + { 'mary.mcdonald.AZ@gmail.com' } WHERE firstname = 'Mary';
- SELECT emails FROM staffs WHERE firstname = 'Mary';

## OUTPUT



The screenshot shows a web-based CQL console interface. At the top, there is a navigation bar with a hamburger menu icon, the text "Dashboard / Users", and a clipboard icon. On the right side of the navigation bar are two buttons: "Load Data" and "Connect". Below the navigation bar is a horizontal menu with five items: "Overview", "Health", "Connect", "CQL Console" (which is underlined), and "Settings". The main area of the console is a dark-themed text editor. It contains the following text:

```
token@cqlsh:company> UPDATE staffs SET emails = emails + { 'mary.mcdonald.AZ@gmail.com' } WHERE firstname = 'Mary';
token@cqlsh:company> SELECT emails FROM staffs WHERE firstname = 'Mary';

emails
-----
{'mary.mcdonald.AZ@gmail.com', 'mary@example.com'}

(1 rows)
token@cqlsh:company> █
```

## **10.QUERY TO MODIFY OUR STAFFS TABLE TO ADD A LIST OF PHONE NUMBERS AND ADD A PHONE NUMBER FOR MARY AND CHECK THAT IT WAS ADDED SUCCESSFULLY**

### **List**

The list data type contains an ordered list of elements. By default, the values are stored in order of insertion.

### **Procedure:**

- ALTER TABLE staffs ADD phone\_numbers list<text>;
- UPDATE staffs SET phone\_numbers = ['1-800-999-9999' ]  
WHERE firstname = 'Mary';
- SELECT phone\_numbers FROM staffs WHERE firstname =  
'Mary';

# OUTPUT



The screenshot shows a web-based database dashboard. At the top, there is a navigation bar with a hamburger menu icon, the text "Dashboard / Users", and a clipboard icon. To the right of this bar are two buttons: "Load Data" with an upload icon and a blue button labeled "Connect" with a lightning bolt icon. Below the navigation bar is a horizontal menu with five items: "Overview", "Health", "Connect", "CQL Console" (which is underlined), and "Settings". The main content area is a dark-themed terminal window. It displays a CQL session with the following commands and output:

```
token@cqlsh:company> ALTER TABLE staffs ADD phone_numbers list<text>;
token@cqlsh:company> UPDATE staffs SET phone_numbers = ['1-800-999-9999' ] WHERE firstname = 'Mary';
token@cqlsh:company> SELECT phone_numbers FROM staffs WHERE firstname = 'Mary';
```

The output of the last query is shown in a table format:

phone_numbers
['1-800-999-9999']

Below the table, it indicates "(1 rows)" and shows the prompt "token@cqlsh:company>". At the bottom right of the terminal window, there is a watermark that says "Activate Windows".