Name: Abhishek Obla Hema
Email: oh_abhishek@yahoo.com

Spark Assignment-3(Healthcare Data Analysis) Documentation

This file details and describes all the attached files for the Spark Assignment-3

Tools Used:

1. Python3 – Microsoft VScode
2. Databricks
3. DataStax Astra (Cassandra DB)

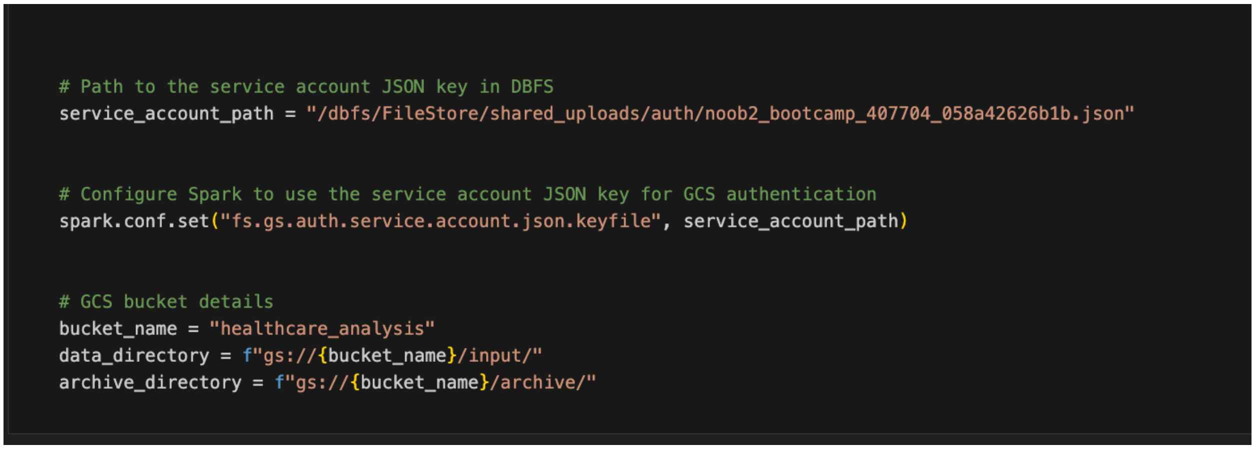
Files Attached:

1. Spark_Ass3.pdf – This file
2. Stage_healthcare_analysis– Pyspark File that creates stage tables for daily load.
3. Target_healthcare_analysis– Pyspark File that creates final target tables for daily load.

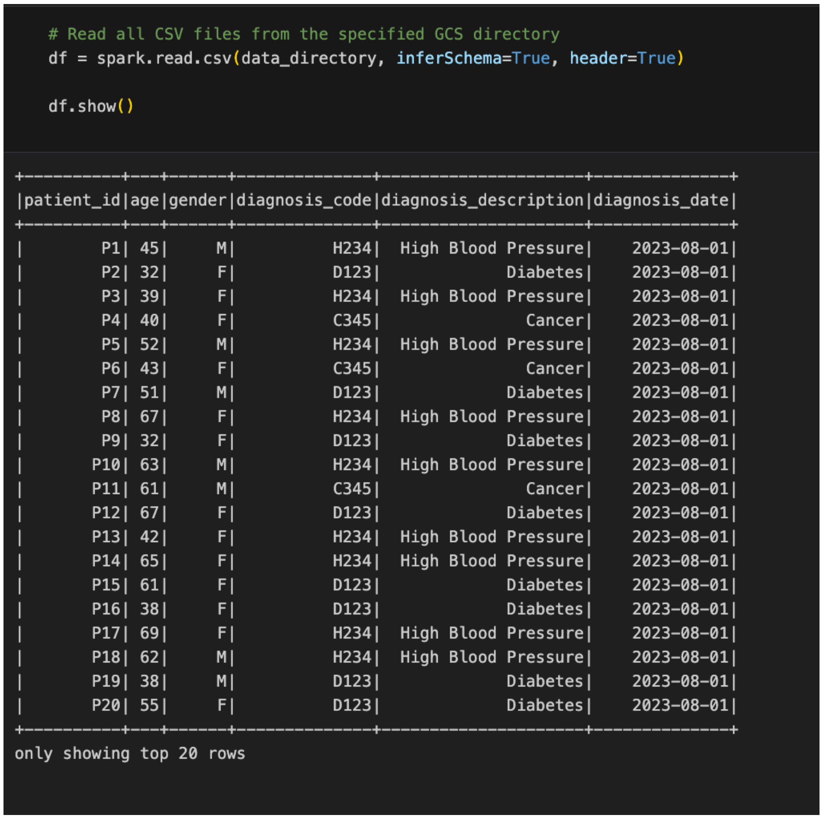
Process and File Descriptions:

Step 1:

I first created a spark job that takes the daily file from the healthcare_analysis bucket and input folder. I made sure that there is authentication between databricks and GCP cloud storage, by placing the keys in the dbfs location.



```
# Path to the service account JSON key in DBFS
service_account_path = "/dbfs/FileStore/shared_uploads/auth/noob2_bootcamp_407704_058a42626b1b.json"


# Configure Spark to use the service account JSON key for GCS authentication
spark.conf.set("fs.gs.auth.service.account.json.keyfile", service_account_path)


# GCS bucket details
bucket_name = "healthcare_analysis"
data_directory = f"gs://{bucket_name}/input/"
archive_directory = f"gs://{bucket_name}/archive/"
```

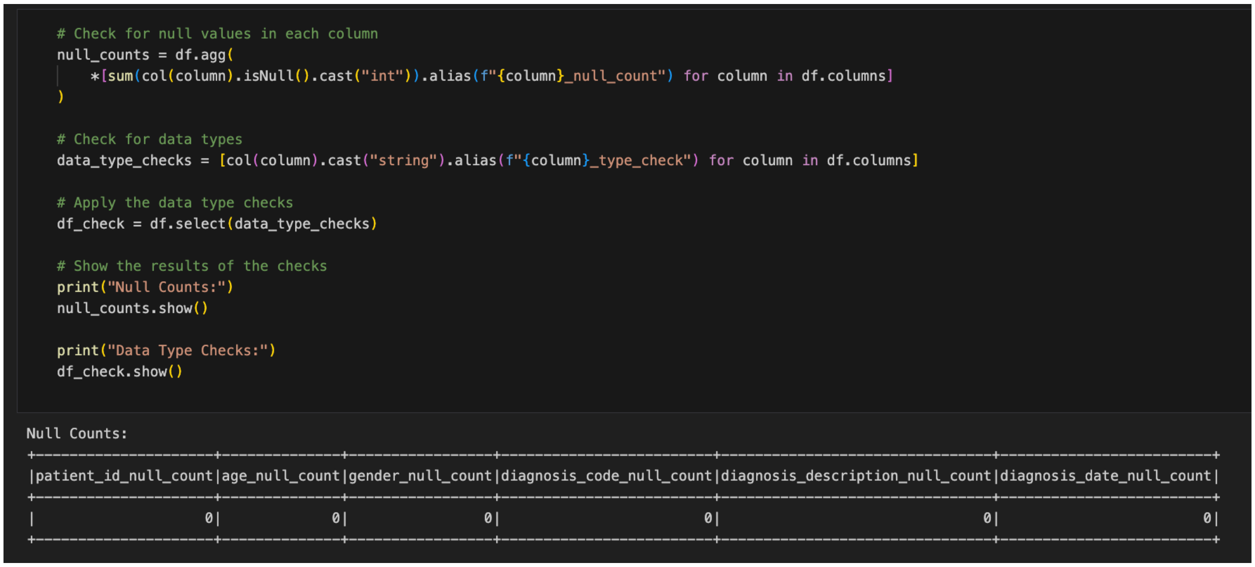


```
# Read all CSV files from the specified GCS directory
df = spark.read.csv(data_directory, inferSchema=True, header=True)

df.show()
```

```
+----------+---+------+--------------+---------------------+--------------+
|patient_id|age|gender|diagnosis_code|diagnosis_description|diagnosis_date|
+----------+---+------+--------------+---------------------+--------------+
|        P1| 45|     M|          H234|  High Blood Pressure|    2023-08-01|
|        P2| 32|     F|          D123|             Diabetes|    2023-08-01|
|        P3| 39|     F|          H234|  High Blood Pressure|    2023-08-01|
|        P4| 40|     F|          C345|               Cancer|    2023-08-01|
|        P5| 52|     M|          H234|  High Blood Pressure|    2023-08-01|
|        P6| 43|     F|          C345|               Cancer|    2023-08-01|
|        P7| 51|     M|          D123|             Diabetes|    2023-08-01|
|        P8| 67|     F|          H234|  High Blood Pressure|    2023-08-01|
|        P9| 32|     F|          D123|             Diabetes|    2023-08-01|
|       P10| 63|     M|          H234|  High Blood Pressure|    2023-08-01|
|       P11| 61|     M|          C345|               Cancer|    2023-08-01|
|       P12| 67|     F|          D123|             Diabetes|    2023-08-01|
|       P13| 42|     F|          H234|  High Blood Pressure|    2023-08-01|
|       P14| 65|     F|          H234|  High Blood Pressure|    2023-08-01|
|       P15| 61|     F|          D123|             Diabetes|    2023-08-01|
|       P16| 38|     F|          D123|             Diabetes|    2023-08-01|
|       P17| 69|     F|          H234|  High Blood Pressure|    2023-08-01|
|       P18| 62|     M|          H234|  High Blood Pressure|    2023-08-01|
|       P19| 38|     M|          D123|             Diabetes|    2023-08-01|
|       P20| 55|     F|          D123|             Diabetes|    2023-08-01|
+----------+---+------+--------------+---------------------+--------------+
only showing top 20 rows
```

Step 2:

I made sure to include data quality checks so that the data is in the correct format.

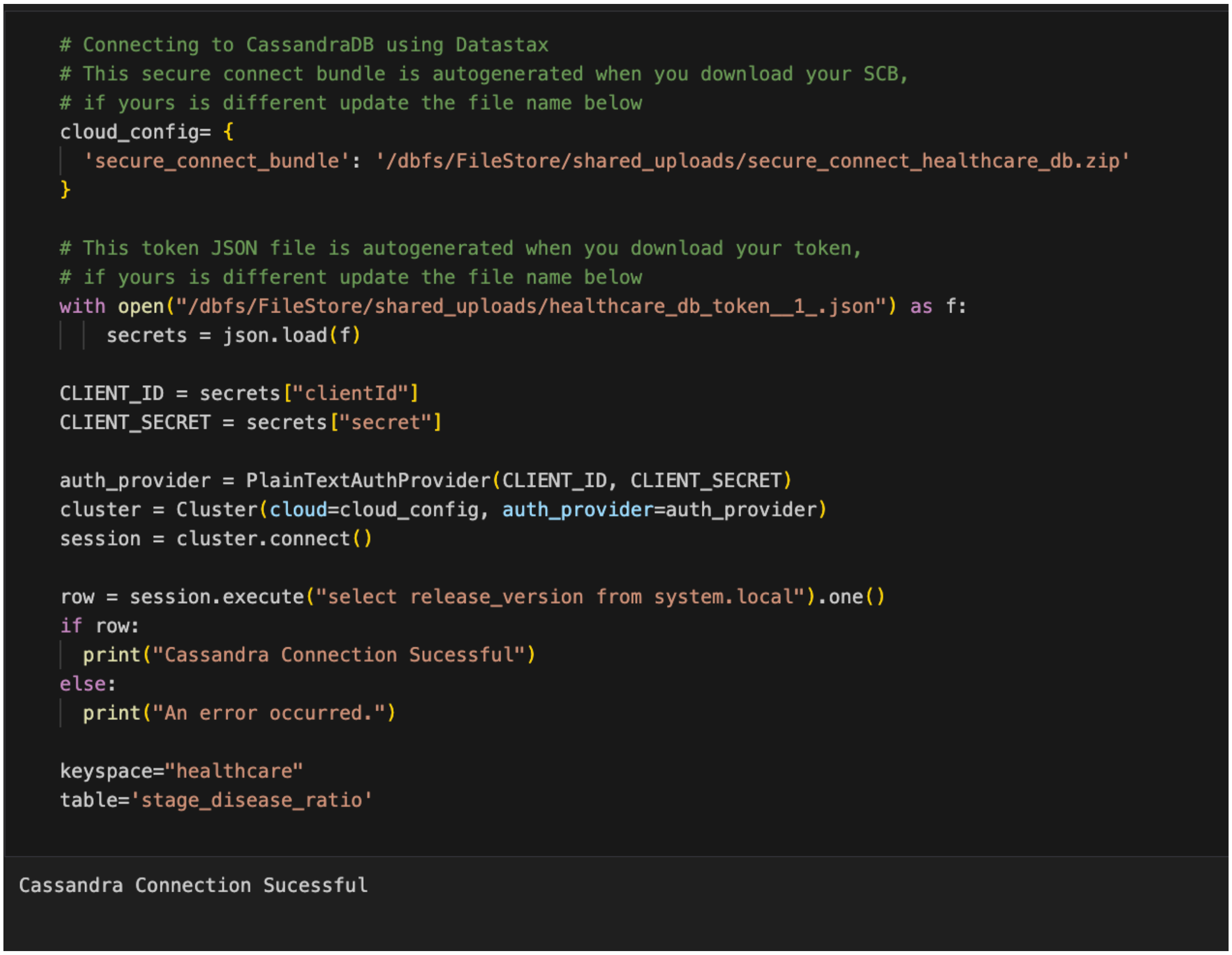


```
# Check for null values in each column
null_counts = df.agg(
    *[sum(col(column).isNull().cast("int")).alias(f"{column}_null_count") for column in df.columns]
)

# Check for data types
data_type_checks = [col(column).cast("string").alias(f"{column}_type_check") for column in df.columns]

# Apply the data type checks
df_check = df.select(data_type_checks)

# Show the results of the checks
print("Null Counts:")
null_counts.show()

print("Data Type Checks:")
df_check.show()
```

```
Null Counts:
+---------------------+--------------+-----------------+-------------------------+--------------------------------+-------------------------+
|patient_id_null_count|age_null_count|gender_null_count|diagnosis_code_null_count|diagnosis_description_null_count|diagnosis_date_null_count|
+---------------------+--------------+-----------------+-------------------------+--------------------------------+-------------------------+
|                    0|             0|                0|                        0|                               0|                        0|
+---------------------+--------------+-----------------+-------------------------+--------------------------------+-------------------------+
```

Step 3:

I then went ahead and performed the necessary transformations/queries on it, post which I followed the documentation for Datastax AstraDB to generate a connection between databricks and the Cassandra DB. This involved downloading a ‘secure bundle’ as well as the key/token which was then placed in the DBFS location.

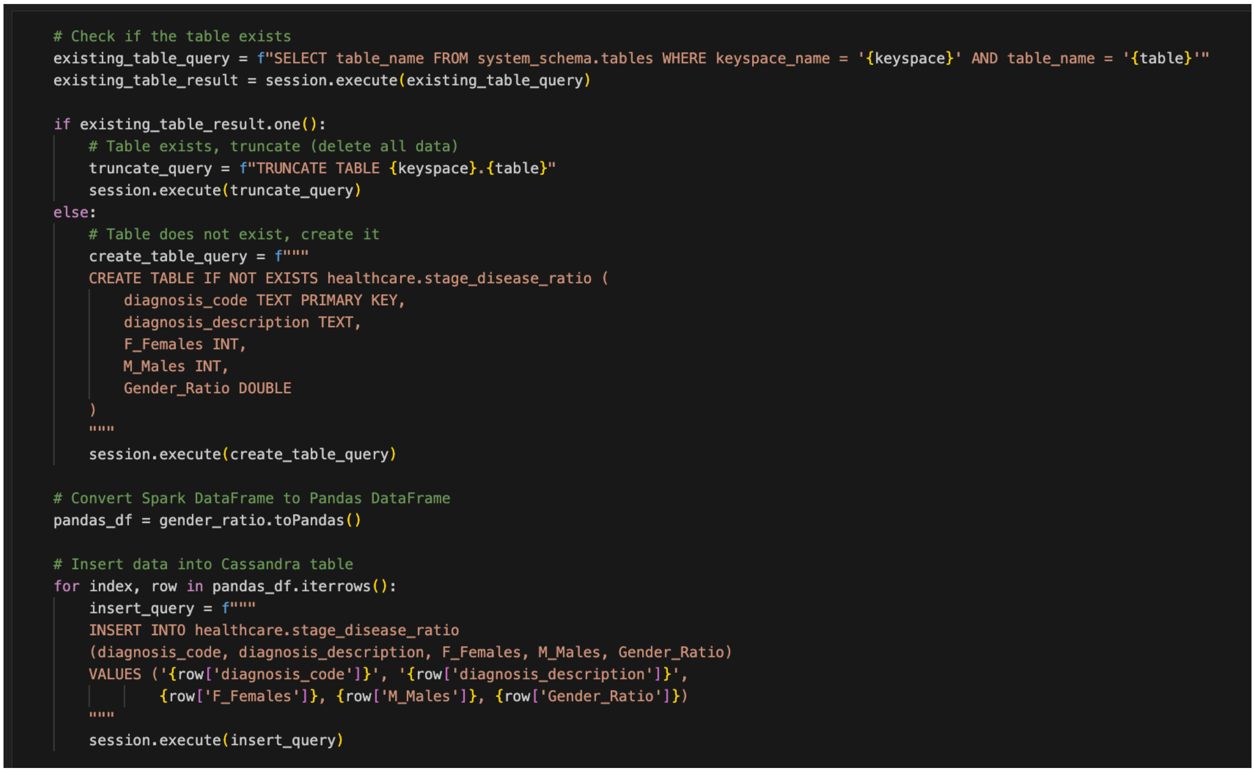


```
# Connecting to CassandraDB using Datastax
# This secure connect bundle is autogenerated when you download your SCB,
# if yours is different update the file name below
cloud_config= {
  'secure_connect_bundle': '/dbfs/FileStore/shared_uploads/secure_connect_healthcare_db.zip'
}

# This token JSON file is autogenerated when you download your token,
# if yours is different update the file name below
with open("/dbfs/FileStore/shared_uploads/healthcare_db_token__1_.json") as f:
    secrets = json.load(f)

CLIENT_ID = secrets["clientId"]
CLIENT_SECRET = secrets["secret"]

auth_provider = PlainTextAuthProvider(CLIENT_ID, CLIENT_SECRET)
cluster = Cluster(cloud=cloud_config, auth_provider=auth_provider)
session = cluster.connect()

row = session.execute("select release_version from system.local").one()
if row:
  print("Cassandra Connection Sucessful")
else:
  print("An error occurred.")

keyspace="healthcare"
table='stage_disease_ratio'
```

```
Cassandra Connection Sucessful
```

Step 4:

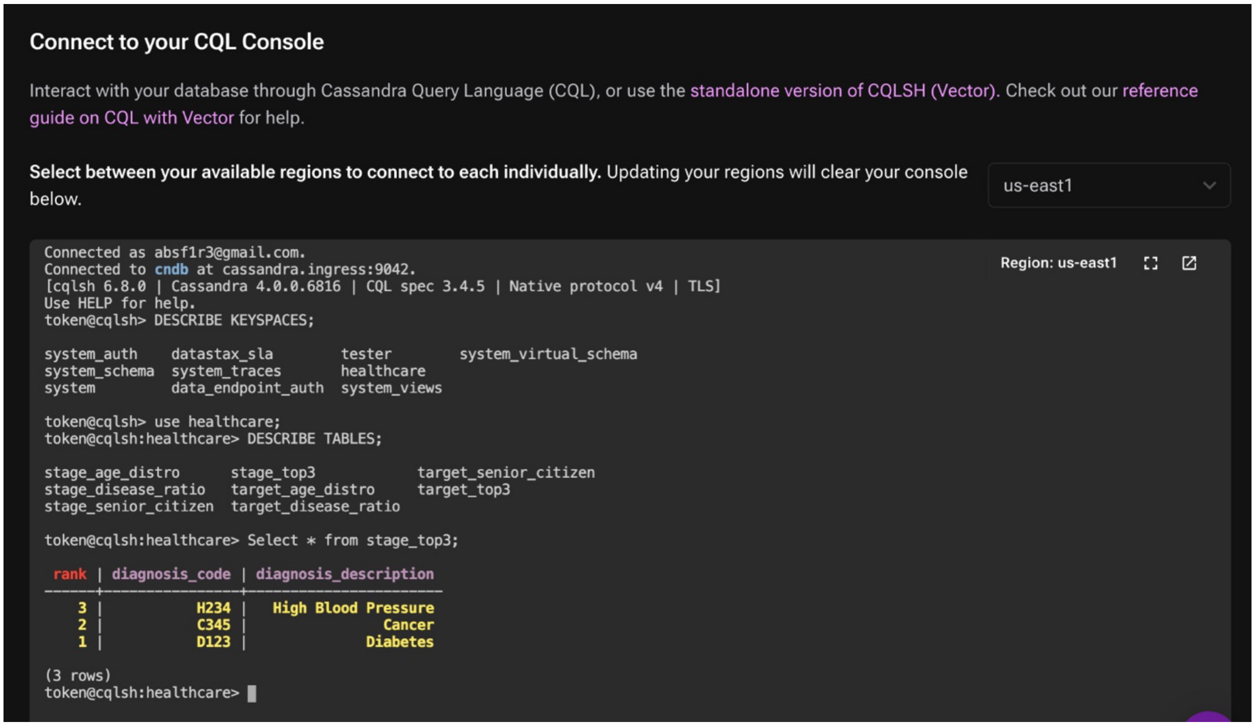
After that using CQL I then checked if there was any table (respective table) in the keyspace. If not I created a new table and then pushed the data into it. If there was an existing table then I truncated all the data and loaded the new data. (This is like forming a daily staging table)



```
# Check if the table exists
existing_table_query = f"SELECT table_name FROM system_schema.tables WHERE keyspace_name = '{keyspace}' AND table_name = '{table}'"
existing_table_result = session.execute(existing_table_query)

if existing_table_result.one():
    # Table exists, truncate (delete all data)
    truncate_query = f"TRUNCATE TABLE {keyspace}.{table}"
    session.execute(truncate_query)
else:
    # Table does not exist, create it
    create_table_query = f"""
    CREATE TABLE IF NOT EXISTS healthcare.stage_disease_ratio (
        diagnosis_code TEXT PRIMARY KEY,
        diagnosis_description TEXT,
        F_Females INT,
        M_Males INT,
        Gender_Ratio DOUBLE
    )
    """
    session.execute(create_table_query)

# Convert Spark DataFrame to Pandas DataFrame
pandas_df = gender_ratio.toPandas()

# Insert data into Cassandra table
for index, row in pandas_df.iterrows():
    insert_query = f"""
    INSERT INTO healthcare.stage_disease_ratio
    (diagnosis_code, diagnosis_description, F_Females, M_Males, Gender_Ratio)
    VALUES ('{row['diagnosis_code']}', '{row['diagnosis_description']}',
            {row['F_Females']}, {row['M_Males']}, {row['Gender_Ratio']})
    """
    session.execute(insert_query)
```

Step 5:

I also checked using the CQL UI from datastax to see if data is present in the tables. I created stage tables for each of the scenarios and also made sure to archive the input files.



Connect to your CQL Console

Interact with your database through Cassandra Query Language (CQL), or use the standalone version of CQLSH (Vector). Check out our reference guide on CQL with Vector for help.

Select between your available regions to connect to each individually. Updating your regions will clear your console below.

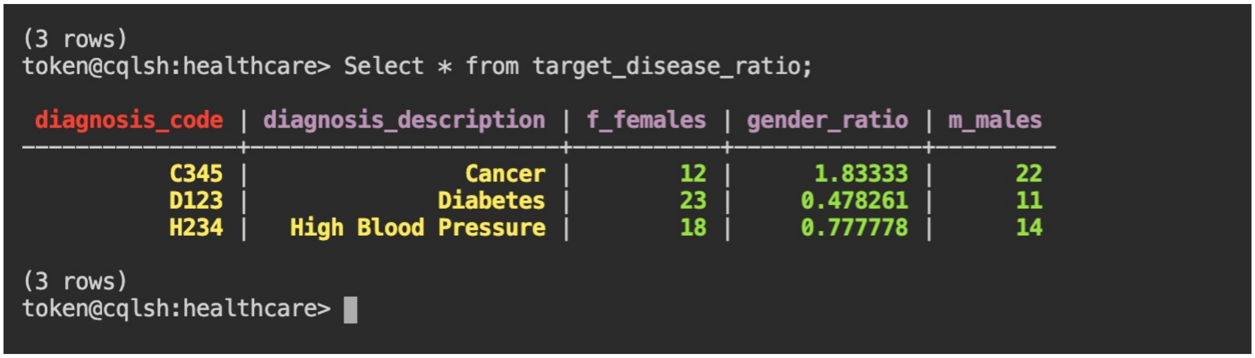
us-east1

Region: us-east1

```
Connected as absf1r3@gmail.com.
Connected to cndb at cassandra.ingress:9042.
[cqlsh 6.8.0 | Cassandra 4.0.0.6816 | CQL spec 3.4.5 | Native protocol v4 | TLS]
Use HELP for help.
token@cqlsh> DESCRIBE KEYSPACES;

system_auth    datastax_sla        tester        system_virtual_schema
system_schema  system_traces       healthcare
system         data_endpoint_auth  system_views

token@cqlsh> use healthcare;
token@cqlsh:healthcare> DESCRIBE TABLES;

stage_age_distro      stage_top3             target_senior_citizen
stage_disease_ratio   target_age_distro      target_top3
stage_senior_citizen  target_disease_ratio

token@cqlsh:healthcare> Select * from stage_top3;

 rank | diagnosis_code | diagnosis_description
------+----------------+-----------------------
    3 |           H234 |   High Blood Pressure
    2 |           C345 |                Cancer
    1 |           D123 |              Diabetes

(3 rows)
token@cqlsh:healthcare> ▋
```

Step 6:

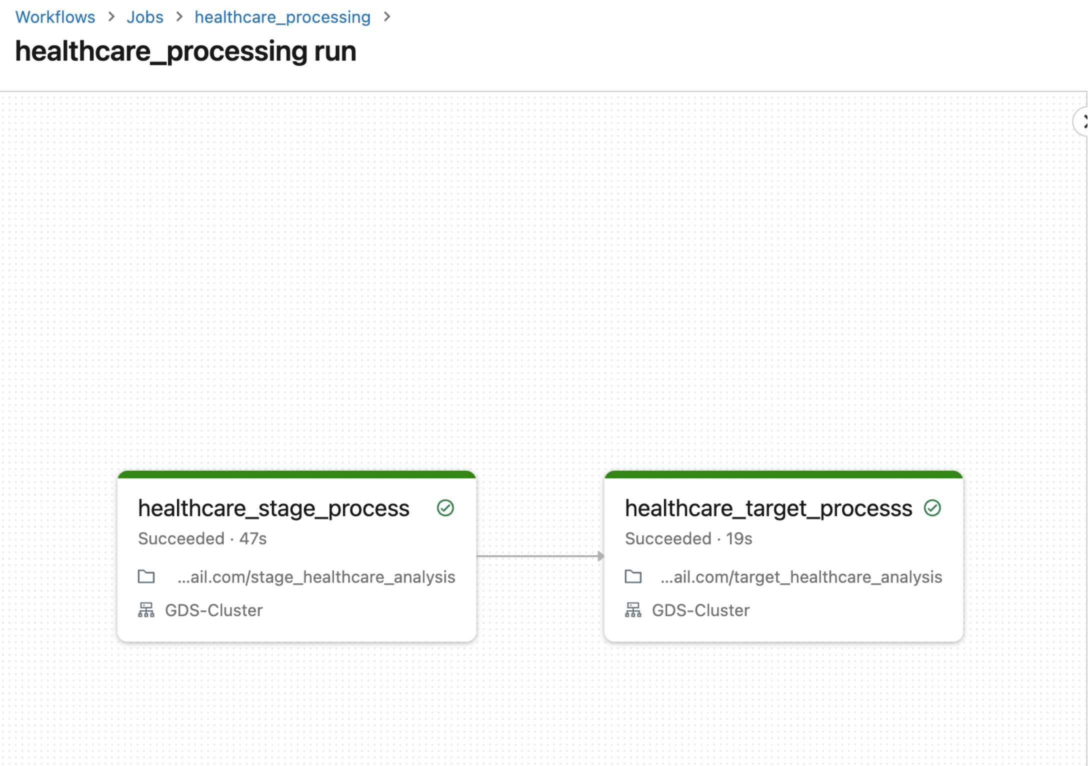
In another script I created target tables for each of the stage tables where data is inserted in the 'upsert' mode. The idea is for the target tables, data is moved from the respective stage table→ if no target table exists then a new target table is created and data from the stage table is pushed , else if a target table already exists then upsert is peformed. I made sure to select appropriate keys to match for each of those tables.



```
(3 rows)
token@cqlsh:healthcare> Select * from target_disease_ratio;

 diagnosis_code | diagnosis_description | f_females | gender_ratio | m_males
----------------+-----------------------+-----------+--------------+---------
           C345 |                Cancer |        12 |      1.83333 |      22
           D123 |              Diabetes |        23 |     0.478261 |      11
           H234 |   High Blood Pressure |        18 |     0.777778 |      14

(3 rows)
token@cqlsh:healthcare> 
```

Step 7:

I then created a healthcare_processing workflow for the two scripts. The second job is triggered only when the staging process is finished. This way there is a dependency between the two jobs. I also made sure to implement notifications for any failures.



Workflows > Jobs > healthcare_processing >

healthcare_processing run

healthcare_stage_process ✓
Succeeded · 47s
...ail.com/stage_healthcare_analysis
GDS-Cluster

healthcare_target_processs ✓
Succeeded · 19s
...ail.com/target_healthcare_analysis
GDS-Cluster

Challenges:

1. It required creating a datastax account since Cassandra cannot be running on local but on the cloud.
2. It was not possible to get the Cassandra-spark connector to work (Lots of time spent on trying to get the correct jar/jdbc drivers) and had to resort to the ‘session_execute’ method of loading data row by row.