BIG DATA TECHNOLOGIES
ASSIGNMENT-12

Exercise 1

Answer:

Overview:

The article discusses classical data modeling, logical data and conceptual modeling,Cassandra data modeling, application workflow, query-driven mapping from a conceptual to a logical data model, and physical data modeling.

Conceptual data modeling and application workflow:

- When developing a Cassandra database schema, it is necessary to understand the data to be maintained as well as when a data-driven application would access it.
- The ER diagram is a representation of the previous Application workflow diagrams, that specify data entry patterns of application processes and represent both of these.

Cassandra Data Model:

- A CQL database is a collection of partitions having rows with comparable structures. The partition key is unique to each partition in a table, whereas a clustering key is unique to each row inside each partition.
- A table schema is a collection of columns that includes a primary key. A primary key is a combination of a partition key and a clustering key that uniquely identifies a database entry.Every column's data type is usually primitive (int, text, etc.), complex (set, list, or map), or counter.
- CQL, which has a syntax comparable to SQL, is used for expressing queries across tables. CQL does not handle binary operations such as joins and instead focuses on a set of query predicate statements rules to assure performance.

Mapping based on queries:

The four data modeling principles outlined below serve as a foundation for turning conceptual data models to logical data models.

DMP1 - Understanding the data, which is recorded using a conceptual data model, is the first stage in successful database design.

DMP2 - The second essential to a successful database design is to understand your queries recorded by an application process.

DMP3 - The third key to a successful database design is data nesting.

DMP4 - The fourth key to a successful database design is data duplication.

Mapping Patterns are utilized for automating Cassandra database schema designing.

Physical Data Modelling: The final phase is to evaluate and improve the data model's logic in a physical data model.

Mapping Rule:

The five mapping rules listed below assist a query-driven move from a conceptual one to a logical data model.

MR1 - Entities and relationships are mapped to table rows in MR1, while entity & relationship types are mapped to tables.

MR2 - Equality search attributes in a query predicate match with the prefix fields of a table's primary key.
MR3 - In a table clustering, a key column relates to an inequality search attribute utilized in a query predicate.
MR4 - Sorting attributes supplied in a query map to clustering key columns in the ascending or descending clustering order specified in the query.
MR5 - The primary key fields are associated with key attributes.

Exercise 2

Step B

EMR Connection

Enter the following two command:

wget https://archive.apache.org/dist/cassandra/3.11.2/apache-cassandra-3.11.2-bin.tar.gz

```
Last login: Sun Nov 26 11:32:14 on ttys008
(base) sailavanyanarthu@Sailavanyas-Air ~ % cd downloads
(base) sailavanyanarthu@Sailavanyas-Air downloads % chmod 400 keyPair.pem
(base) sailavanyanarthu@Sailavanyas-Air downloads % ssh -i keyPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com

Last login: Sun Nov 26 17:34:45 2023 from 207.237.235.14
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/


EEEEEEEEEEEEEEEEEEEE MMMMMMMM           MMMMMMMM RRRRRRRRRRRRRRR
E::::::::::::::::::E M:::::::M         M:::::::M R::::::::::::::R
EE:::::EEEEEEEEE:::E M::::::::M       M::::::::M R:::::RRRRRR:::::R
  E::::E       EEEEE M:::::::::M     M:::::::::M RR::::R      R::::R
  E::::E             M::::::M:::M   M:::M::::::M   R:::R      R::::R
  E:::::EEEEEEEEEE   M:::::M M:::M M:::M M:::::M   R:::RRRRRR:::::R
  E::::::::::::::E   M:::::M  M:::M:::M  M:::::M   R::::::::::::RR
  E:::::EEEEEEEEEE   M:::::M   M:::::M   M:::::M   R:::RRRRRR::::R
  E::::E             M:::::M    M:::M    M:::::M   R:::R      R::::R
  E::::E       EEEEE M:::::M     MMM     M:::::M   R:::R      R::::R
EE:::::EEEEEEEE::::E M:::::M             M:::::M   R:::R      R::::R
E::::::::::::::::::E M:::::M             M:::::M RR::::R      R::::R
EEEEEEEEEEEEEEEEEEEE MMMMMMM             MMMMMMM RRRRRRR      RRRRRR

[ec2-user@ip-172-31-12-156 ~]$ wget https://archive.apache.org/dist/cassandra/3.11.2/apache-cassandra-3.11.2-bin.tar.gz
--2023-11-26 17:39:38--  https://archive.apache.org/dist/cassandra/3.11.2/apache-cassandra-3.11.2-bin.tar.gz
Resolving archive.apache.org (archive.apache.org)... 65.108.204.189, 2a01:4f9:1a:a084::2
Connecting to archive.apache.org (archive.apache.org)|65.108.204.189|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 38436262 (37M) [application/x-gzip]
Saving to: 'apache-cassandra-3.11.2-bin.tar.gz'

100%[=============================================================================================================================================================>] 38,436,262  16.9MB/s   in 2.2s

2023-11-26 17:39:40 (16.9 MB/s) - 'apache-cassandra-3.11.2-bin.tar.gz' saved [38436262/38436262]
```

tar -xzvf apache-cassandra-3.11.2-bin.tar.gz

```
[ec2-user@ip-172-31-12-156 ~]$ tar -xzvf apache-cassandra-3.11.2-bin.tar.gz
apache-cassandra-3.11.2/bin/
apache-cassandra-3.11.2/conf/
apache-cassandra-3.11.2/conf/triggers/
apache-cassandra-3.11.2/doc/
apache-cassandra-3.11.2/doc/cql3/
apache-cassandra-3.11.2/doc/html/
apache-cassandra-3.11.2/doc/html/_images/
apache-cassandra-3.11.2/doc/html/_sources/
apache-cassandra-3.11.2/doc/html/_sources/architecture/
apache-cassandra-3.11.2/doc/html/_sources/configuration/
apache-cassandra-3.11.2/doc/html/_sources/cql/
apache-cassandra-3.11.2/doc/html/_sources/data_modeling/
apache-cassandra-3.11.2/doc/html/_sources/development/
apache-cassandra-3.11.2/doc/html/_sources/faq/
apache-cassandra-3.11.2/doc/html/_sources/getting_started/
apache-cassandra-3.11.2/doc/html/_sources/operating/
apache-cassandra-3.11.2/doc/html/_sources/tools/
apache-cassandra-3.11.2/doc/html/_sources/troubleshooting/
apache-cassandra-3.11.2/doc/html/_static/
apache-cassandra-3.11.2/doc/html/_static/css/
apache-cassandra-3.11.2/doc/html/_static/fonts/
apache-cassandra-3.11.2/doc/html/_static/js/
apache-cassandra-3.11.2/doc/html/architecture/
apache-cassandra-3.11.2/doc/html/configuration/
apache-cassandra-3.11.2/doc/html/cql/
apache-cassandra-3.11.2/doc/html/data_modeling/
apache-cassandra-3.11.2/doc/html/development/
apache-cassandra-3.11.2/doc/html/faq/
apache-cassandra-3.11.2/doc/html/getting_started/
apache-cassandra-3.11.2/doc/html/operating/
apache-cassandra-3.11.2/doc/html/tools/
apache-cassandra-3.11.2/doc/html/troubleshooting/
apache-cassandra-3.11.2/interface/
apache-cassandra-3.11.2/javadoc/
apache-cassandra-3.11.2/javadoc/org/
apache-cassandra-3.11.2/javadoc/org/apache/
```

apache-cassandra-3.11.2/bin/cassandra &

```
[ec2-user@ip-172-31-12-156 ~]$ apache-cassandra-3.11.2/bin/cassandra &
[1] 6214
[ec2-user@ip-172-31-12-156 ~]$ OpenJDK 64-Bit Server VM warning: Cannot open file apache-cassandra-3.11.2/bin/../logs/gc.log due to No such file or directory

CompilerOracle: dontinline org/apache/cassandra/db/Columns$Serializer.deserializeLargeSubset (Lorg/apache/cassandra/io/util/DataInputPlus;Lorg/apache/cassandra/db/Columns;I)Lorg/apache/cassandra/db/Columns;
CompilerOracle: dontinline org/apache/cassandra/db/Columns$Serializer.serializeLargeSubset (Ljava/util/Collection;ILorg/apache/cassandra/db/Columns;ILorg/apache/cassandra/io/util/DataOutputPlus;)V
CompilerOracle: dontinline org/apache/cassandra/db/Columns$Serializer.serializeLargeSubsetSize (Ljava/util/Collection;ILorg/apache/cassandra/db/Columns;I)I
CompilerOracle: dontinline org/apache/cassandra/db/commitlog/AbstractCommitLogSegmentManager.advanceAllocatingFrom (Lorg/apache/cassandra/db/commitlog/CommitLogSegment;)V
CompilerOracle: dontinline org/apache/cassandra/db/transform/BaseIterator.tryGetMoreContents ()Z
CompilerOracle: dontinline org/apache/cassandra/db/transform/StoppingTransformation.stop ()V
CompilerOracle: dontinline org/apache/cassandra/db/transform/StoppingTransformation.stopInPartition ()V
CompilerOracle: dontinline org/apache/cassandra/io/util/BufferedDataOutputStreamPlus.doFlush (I)V
CompilerOracle: dontinline org/apache/cassandra/io/util/BufferedDataOutputStreamPlus.writeExcessSlow ()V
CompilerOracle: dontinline org/apache/cassandra/io/util/BufferedDataOutputStreamPlus.writeSlow (JI)V
CompilerOracle: dontinline org/apache/cassandra/io/util/RebufferingInputStream.readPrimitiveSlowly (I)J
CompilerOracle: inline org/apache/cassandra/db/rows/UnfilteredSerializer.serializeRowBody (Lorg/apache/cassandra/db/rows/Row;ILorg/apache/cassandra/db/SerializationHeader;Lorg/apache/cassandra/io/util/DataOutputPlus;)V
CompilerOracle: inline org/apache/cassandra/io/util/Memory.checkBounds (JJ)V
CompilerOracle: inline org/apache/cassandra/io/util/SafeMemory.checkBounds (JJ)V
CompilerOracle: inline org/apache/cassandra/utils/AsymmetricOrdering.selectBoundary (Lorg/apache/cassandra/utils/AsymmetricOrdering/Op;II)I
CompilerOracle: inline org/apache/cassandra/utils/AsymmetricOrdering.strictnessOfLessThan (Lorg/apache/cassandra/utils/AsymmetricOrdering/Op;)I
CompilerOracle: inline org/apache/cassandra/utils/BloomFilter.indexes (Lorg/apache/cassandra/utils/IFilter/FilterKey;)[J
CompilerOracle: inline org/apache/cassandra/utils/BloomFilter.setIndexes (JJI[J)V
CompilerOracle: inline org/apache/cassandra/utils/ByteBufferUtil.compare (Ljava/nio/ByteBuffer;[B)I
CompilerOracle: inline org/apache/cassandra/utils/ByteBufferUtil.compare ([BLjava/nio/ByteBuffer;)I
CompilerOracle: inline org/apache/cassandra/utils/ByteBufferUtil.compareUnsigned (Ljava/nio/ByteBuffer;Ljava/nio/ByteBuffer;)I
CompilerOracle: inline org/apache/cassandra/utils/FastByteOperations$UnsafeOperations.compareTo (Ljava/lang/Object;JILjava/lang/Object;JI)I
CompilerOracle: inline org/apache/cassandra/utils/FastByteOperations$UnsafeOperations.compareTo (Ljava/lang/Object;JILjava/nio/ByteBuffer;)I
CompilerOracle: inline org/apache/cassandra/utils/FastByteOperations$UnsafeOperations.compareTo (Ljava/nio/ByteBuffer;Ljava/nio/ByteBuffer;)I
CompilerOracle: inline org/apache/cassandra/utils/vint/VIntCoding.encodeVInt (JI)[B
INFO  [main] 2023-11-26 17:41:05,080 YamlConfigurationLoader.java:89 - Configuration location: file:/home/ec2-user/apache-cassandra-3.11.2/conf/cassandra.yaml
INFO  [main] 2023-11-26 17:41:05,405 Config.java:495 - Node configuration:[allocate_tokens_for_keyspace=null; authenticator=AllowAllAuthenticator; authorizer=AllowAllAuthorizer; auto_bootstrap=true; auto_snapshot=true; back_pressure_enabled=false; back_pressure_strategy=org.apache.cassandra.net.RateBasedBackPressure{high_ratio=0.9, factor=5, flow=FAST}; batch_size_fail_threshold_in_kb=50; batch_size_warn_threshold_in_kb=5; batchlog_replay_throttle_in_kb=1024; broadcast_address=null; broadcast_rpc_address=null; buffer_pool_use_heap_if_exhausted=true; cas_contention_timeout_in_ms=1000; cdc_enabled=false; cdc_free_space_check_interval_ms=250; cdc_raw_directory=null; cdc_total_space_in_mb=0; client_encryption_options=<REDACTED>; cluster_name=Test Cluster; column_index_cache_size_in_kb=2; column_index_size_in_kb=64; commit_failure_policy=stop; commitlog_compression=null; commitlog_directory=null; commitlog_max_compression_buffers_in_pool=3; commitlog_periodic_queue_size=-1; commitlog_segment_size_in_mb=32; commitlog_sync=periodic; commitlog_sync_batch_window_in_ms=NaN; commitlog_sync_period_in_ms=10000; commitlog_total_space_in_mb=null; compaction_large_partition_warning_threshold_mb=100; compaction_throughput_mb_per_sec=16; concurrent_compactors=null; concurrent_counter_writes=32; concurrent_materialized_view_writes=32; concurrent_reads=32; concurrent_replicates=null; concurrent_writes=32; counter_cache_keys_to_save=2147483647; counter_cache_save_period=7200; counter_cache_size_in_mb=null; counter_write_request_timeout_in_ms=5000; credentials_cache_max_entries=1000; credentials_update_interval_in_ms=-1; credentials_validity_in_ms=2000; cross_node_timeout=false; data_file_directories=[Ljava.lang.String;@13c10b87; disk_access_mode=auto; disk_failure_policy=stop; disk_optimization_estimate_percentile=0.95; disk_optimization_page_cross_chance=0.1; disk_optimization_strategy=ssd; dynamic_snitch=true; dynamic_snitch_badness_threshold=0.1; dynamic_snitch_reset_interval_in_ms=600000; dynamic_snitch_update_interval_in_ms=100; enable_materialized_views=true; enable_scripted_user_defined_functions=false; enable_user_defined_functions=false; enable_user_defined_functions_threads=true; encryption_options=null; endpoint_snitch=SimpleSnitch; file_cache_round_up=null; file_cache_size_in_mb=null; gc_log_threshold_in_ms=200; gc_warn_threshold_in_ms=1000; hinted_handoff_disabled_datacenters=[]; hinted_handoff_enabled=true; hinted_handoff_throttle_in_kb=1024; hints_compression=null; hints_directory=null; hints_flush_period_in_ms=10000; incremental_backups=false; index_interval=null; index_summary_capacity_in_mb=null; index_summary_resize_interval_in_minutes=60; initial_token=null; inter_dc_stream_throughput_outbound_megabits_per_sec=200; inter_dc_tcp_nodelay=false; internode_authenticator=null; internode_compression=dc; internode_recv_buff_size_in_bytes=0; internode_send_buff_size_in_bytes=0; key_cache_keys_to_save=2147483647; key_cache_save_period=14400; key_cache_size_in_mb=null; listen_address=localhost; listen_interface=null; listen_interface_prefer_ipv6=false; listen_on_broadcast_address=false; max_hint_window_in_ms=10800000; max_hints_delivery_threads=2; max_hints_file_size_in_mb=128; max_mutation_size_in_kb=null; max_streaming_retries=3; max_value_size_in_mb=256; memtable_allocation_type=heap_buffers; memtable_cleanup_threshold=null; memtable_flush_writers=0; memtable_heap_space_in_mb=null; memtable_offheap_space_in_mb=null; min_free_space_per_drive_in_mb=50; native_transport_max_concurrent_connections=-1; native_transport_max_concurrent_connections_per_ip=-1; native_transport_max_frame_size_in_mb=256; native_transport_max_threads=128; native_transport_port=9042; native_transport_port_ssl=null; num_tokens=256; otc_backlog_expiration_interval_ms=200; otc_coalescing_enough_coalesced_messages=8; otc_coalescing_strategy=DISABLED; otc_coalescing_window_us=200; partitioner=org.apache.cassandra.dht.Murmur3Partitioner; permissions_cache_max_entries=1000; permissions_update_interval_in_ms=-1; permissions_validity_in_ms=2000; phi_convict_threshold=8.0; prepared_statements_cache_size_mb=null; range_request_timeout_in_ms=10000; read_request_timeout_in_ms=5000; request_scheduler=org.apache.cassandra.scheduler.NoScheduler; request_scheduler_id=null; request_scheduler_options=null; request_timeout_in_ms=10000; role_manager=CassandraRoleManager; roles_cache_max_entries=1000; roles_update_interval_in_ms=-1; roles_validity_in_ms=2000; row_cache_class_name=org.apache.cassandra.cache.OHCProvider; row_cache_keys_to_save=21474836
```

EMR Connection for Second Terminal

```
Last login: Sun Nov 26 11:37:19 on ttys008
(base) sailavanyanarthu@Sailavanyas-Air ~ % ssh -i keyPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com

Warning: Identity file keyPair.pem not accessible: No such file or directory.
ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com: Permission denied (publickey,gssapi-keyex,gssapi-with-mic).
(base) sailavanyanarthu@Sailavanyas-Air ~ % cd downloads
(base) sailavanyanarthu@Sailavanyas-Air downloads % chmod 400 keyPair.pem
(base) sailavanyanarthu@Sailavanyas-Air downloads % ssh -i keyPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com

Last login: Sun Nov 26 17:37:51 2023 from 207.237.235.14
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/


EEEEEEEEEEEEEEEEEEE MMMMMMMM           MMMMMMMM RRRRRRRRRRRRRRR
E::::::::::::::::::E M:::::::M         M:::::::M R::::::::::::::R
EE:::::EEEEEEEEE:::E M::::::::M       M::::::::M R:::::RRRRRR:::::R
  E::::E       EEEEE M:::::::::M     M:::::::::M RR::::R      R::::R
  E::::E             M::::::M:::M   M:::M::::::M   R:::R      R::::R
  E:::::EEEEEEEEEE   M:::::M M:::M M:::M M:::::M   R:::RRRRRR:::::R
  E::::::::::::::E   M:::::M  M:::M:::M  M:::::M   R::::::::::RR
  E:::::EEEEEEEEEE   M:::::M   M:::::M   M:::::M   R:::RRRRRR:::R
  E::::E             M:::::M    M:::M    M:::::M   R:::R      R::::R
  E::::E       EEEEE M:::::M     MMM     M:::::M   R:::R      R::::R
EE:::::EEEEEEEE::::E M:::::M             M:::::M   R:::R      R::::R
E::::::::::::::::::E M:::::M             M:::::M RR::::R      R::::R
EEEEEEEEEEEEEEEEEEE MMMMMMM             MMMMMMM RRRRRRR      RRRRRR
```

Step C
apache-cassandra-3.11.2/bin/cqlsh

```
[ec2-user@ip-172-31-12-156 ~]$ apache-cassandra-3.11.2/bin/cqlsh
Connected to Test Cluster at 127.0.0.1:9042.
[cqlsh 5.0.1 | Cassandra 3.11.2 | CQL spec 3.4.4 | Native protocol v4]
Use HELP for help.
```

Step D

a)

```
[ec2-user@ip-172-31-12-156 ~]$ vi init.cql
[ec2-user@ip-172-31-12-156 ~]$ cat init.cql
CREATE KEYSPACE A20516764 WITH REPLICATION = { 'class' : 'SimpleStrategy', 'replication_factor' : 1 };
[ec2-user@ip-172-31-12-156 ~]$
```

b) and c)

```
cqlsh> source './init.cql';
cqlsh> describe keyspaces;

system_schema  system_auth  system  system_distributed  system_traces  a20516764
```

d)

```
cqlsh> USE A20516764;
```

```
...yPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com   ...air.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com   ...r.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com
CREATE TABLE A20516764.Music (
        artistName text,
        albumName text,
        numberSold int,
        Cost int,
        PRIMARY KEY (artistName, albumName))
WITH CLUSTERING ORDER BY (albumName DESC);
-- INSERT --                                                    7,43          All
```

```
[ec2-user@ip-172-31-12-156 ~]$ vi ex2.cql
```

```
cqlsh:a20516764> source './ex2.cql';
cqlsh:a20516764> DESCRIBE TABLE Music;

CREATE TABLE a20516764.music (
    artistname text,
    albumname text,
    cost int,
    numbersold int,
    PRIMARY KEY (artistname, albumname)
) WITH CLUSTERING ORDER BY (albumname DESC)
    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.SizeTieredCompactionStrategy', 'max_threshold': '32', 'min_threshold': '4'}
    AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
    AND crc_check_chance = 1.0
    AND dclocal_read_repair_chance = 0.1
    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_chance = 0.0
    AND speculative_retry = '99PERCENTILE';
```

This is the EMR Connection for Third Terminal

```
Last login: Sun Nov 26 11:44:30 on ttys011
(base) sailavanyanarthu@Sailavanyas-Air ~ % cd downloads
(base) sailavanyanarthu@Sailavanyas-Air downloads % chmod 400 keyPair.pem
(base) sailavanyanarthu@Sailavanyas-Air downloads % ssh -i keyPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com

Last login: Sun Nov 26 17:45:13 2023 from 207.237.235.14
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/


EEEEEEEEEEEEEEEEEEEE MMMMMMMM           MMMMMMMM RRRRRRRRRRRRRRR
E::::::::::::::::::E M:::::::M         M:::::::M R::::::::::::::R
EE:::::EEEEEEEEE:::E M::::::::M       M::::::::M R:::::RRRRRR:::::R
  E::::E       EEEEE M:::::::::M     M:::::::::M RR::::R      R::::R
  E::::E             M::::::M:::M   M:::M::::::M   R:::R      R::::R
  E:::::EEEEEEEEEE   M:::::M M:::M M:::M M:::::M   R:::RRRRRR:::::R
  E::::::::::::::E   M:::::M  M:::M:::M  M:::::M   R:::::::::::RR
  E:::::EEEEEEEEEE   M:::::M   M:::::M   M:::::M   R:::RRRRRR::::R
  E::::E             M:::::M    M:::M    M:::::M   R:::R      R::::R
  E::::E       EEEEE M:::::M     MMM     M:::::M   R:::R      R::::R
EE:::::EEEEEEEE::::E M:::::M             M:::::M   R:::R      R::::R
E::::::::::::::::::E M:::::M             M:::::M RR::::R      R::::R
EEEEEEEEEEEEEEEEEEEE MMMMMMM             MMMMMMM RRRRRRR      RRRRRR
```

Exercise 3

a)

```
...yPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com | ...air.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com | ...r.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com
INSERT INTO Music (artistName, albumName, numberSold, Cost) values ('MOZART', 'Greatest Hits', 100000, 10);
INSERT INTO Music (artistName, albumName, numberSold, Cost) values ('Tayor Swift', 'Fearless', 2300000, 15);
INSERT INTO Music (artistName, albumName, numberSold, Cost) values ('Black Sabbath', 'Paranoid', 534000, 12);
INSERT INTO Music (artistName, albumName, numberSold, Cost) values ('Katy Perry', 'Prism', 800000, 16);
INSERT INTO Music (artistName, albumName, numberSold, Cost) values ('Katy Perry', 'Teenage Dream', 750000, 14);
~
~
~
-- INSERT --                                                              5,112          All
```

```
[ec2-user@ip-172-31-12-156 ~]$ vi ex3.cql
```

b)

```
cqlsh:a20516764> source './ex3.cql';
cqlsh:a20516764> SELECT * FROM Music;

 artistname     | albumname      | cost | numbersold
----------------+----------------+------+------------
   Tayor Swift |       Fearless |   15 |    2300000
        MOZART | Greatest Hits  |   10 |     100000
 Black Sabbath |       Paranoid |   12 |     534000
    Katy Perry | Teenage Dream  |   14 |     750000
    Katy Perry |          Prism |   16 |     800000

(5 rows)
```

Exercise 4

```
...yPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com ... ...air.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com ...r.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com +
SELECT * FROM Music WHERE artistName in ('Katy Perry');
~
~
~
~
~
~
~
```

```
[ec2-user@ip-172-31-12-156 ~]$ vi ex4.cql

cqlsh:a20516764> source './ex4.cql';

 artistname | albumname      | cost | numbersold
------------+----------------+------+------------
 Katy Perry | Teenage Dream  |   14 |     750000
 Katy Perry |          Prism |   16 |     800000

(2 rows)
```

Exercise 5

```
...yPair.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com ... ...air.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com ...r.pem ec2-user@ec2-3-144-12-121.us-east-2.compute.amazonaws.com +
SELECT * FROM Music WHERE numberSold >= 700000 allow filtering;
~
~
~
~
~
~
~
```

```
[ec2-user@ip-172-31-12-156 ~]$ vi ex5.cql
```

```
cqlsh:a20516764> source './ex5.cql';

 artistname  | albumname      | cost | numbersold
-------------+----------------+------+------------
 Tayor Swift |       Fearless |   15 |     2300000
  Katy Perry | Teenage Dream |   14 |      750000
  Katy Perry |          Prism |   16 |      800000

(3 rows)
cqlsh:a20516764>
```

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