ASSIGNMENT -4

Part A : Assignments based on the Hadoop

4. Write an application using HBase and HiveQL for flight information system which will include
1) Creating, Dropping, and altering Database tables
2) Creating an external Hive table to connect to the HBase for Customer Information Table
3) Load table with data, insert new values and field in the table, Join tables with Hive
4) Create index on Flight information Table
5) Find the average departure delay per day in 2008.

HBase via Hive,

DOWNLOAD & COPY:

• Download hive on below path (nearly 93 MB): http://www.apache.org/dyn/closer.cgi/hive/
• Extract the .tar.gz file in Downloads/ and rename it to hive/ and move the folder to **/usr/lib/** path:

```
sudo mv Downloads/hive /usr/lib
```

CHANGE THE OWNER:

• Provide access to hive path by changing the owners and groups to hduser and hadoop respectively.

```
sudo chown -R hduser:hadoop /usr/lib/hive
```

CONFIGURE ENVIRONMENT VARIABLES:

• Configure environment variables in .bashrc file.

```
su - hduser
vim ~/.bashrc
```

• Add following lines at the end of file

```
export HIVE_HOME=/usr/lib/hive/
export PATH=$PATH:$HIVE_HOME/bin
export HADOOP_USER_CLASSPATH_FIRST=true
```

• Apply the changes:

```
source ~/.bashrc
```

MAKE DIRECTORIES:

• Create temporary and folder for data warehouse of hive in HDFS as well as change the permissions.

hadoop fs -mkdir /tmp
hadoop fs -mkdir -p /user/hive/warehouse
hadoop fs -chmod g+w /tmp
hadoop fs -chmod -R g+w /user/hive/warehouse

CONFIGURE HIVE:

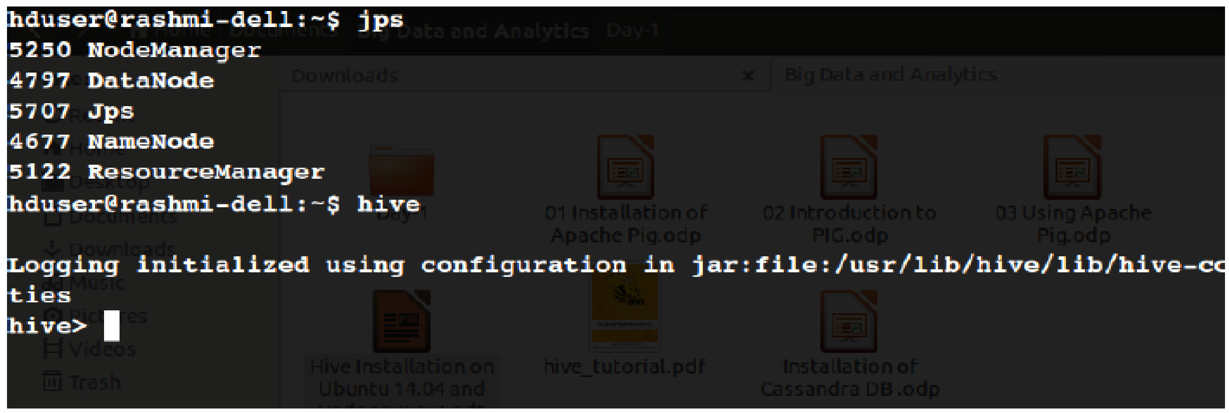
• To configure Hive with Hadoop, you need to edit the hive-env. sh file, which is placed in the $HIVE_HOME/conf directory. The following commands redirect to Hive config folder and copy the template file:
cd $HIVE_HOME/conf
cp hive-env.sh.template hive-env.sh

• Edit the hive-env.sh file by appending the following line:
export HADOOP_HOME=/usr/local/hadoop

RUN HIVE:

Make sure that Hadoop services are running.Then type
hive

```
hive
```



```
hduser@rashmi-dell:~$ jps
5250 NodeManager
4797 DataNode
5707 Jps
4677 NameNode
5122 ResourceManager
hduser@rashmi-dell:~$ hive

Logging initialized using configuration in jar:file:/usr/lib/hive/lib/hive-cc
ties
hive>
```

HADOOP ECOSYSTEM:

• The Hadoop ecosystem contains different subprojects (tools) such as Sqoop, Pig, and Hive that are used to help Hadoop modules.

– **Sqoop**: It is used to import and export data to and fro between HDFS and RDBMS.
– **Pig**: It is a procedural language platform used to develop a script for MapReduce operations.
– **Hive**: It is a platform used to develop SQL type scripts to do MapReduce operations.

DATABASE OPERATIONS;

Hive is a database 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. This chapter explains how to create Hive database. Hive contains a default database named **default**.

CREATE DATABASE:

• Create Database is a statement used to create a database in Hive.
• A database in Hive is a namespace or a collection of tables.
The syntax for this statement is as follows:
CREATE DATABASE|SCHEMA [IF NOT EXISTS]
<database name>;
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 mydb:
hive> **CREATE DATABASE [IF NOT EXISTS] mydb;**
or
hive> **CREATE SCHEMA mydb;**
• The following query is used to verify a databases list:
hive> **SHOW DATABASES;**
default
mydb

DROP DATABSE:

• Drop Database is a statement that drops all the tables and deletes the database.
– Its syntax is as follows:

DROP DATABASE StatementDROP
(DATABASE|SCHEMA) [IF EXISTS]
database_name [RESTRICT|CASCADE];

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

hive> **DROP DATABASE IF EXISTS mydb;**

CREATE TABLE:

- Create Table is a statement used to create a table in Hive. The syntax and example are as follows:
- Syntax:

```
CREATE [TEMPORARY] [EXTERNAL] TABLE [IF
NOT EXISTS] [db_name.] table_name
[(col_name data_type [COMMENT
col_comment], ...)]
[COMMENT table_comment]
[ROW FORMAT row_format]
[STORED AS file_format]
```

Example:::

Sr. No.	Field Name	Data type
1	Eid	Int
2	Name	String
3	Salary	Float
4	Designation	String

- The following query creates a table named employee using the above data.

```
hive> CREATE TABLE IF NOT EXISTS
employee ( eid int, name String,
> salary String, destination String)
> COMMENT ‘Employee details’
> ROW FORMAT DELIMITED
> FIELDS TERMINATED BY ‘\t’
> LINES TERMINATED BY ‘\n’
> STORED AS TEXTFILE;
```

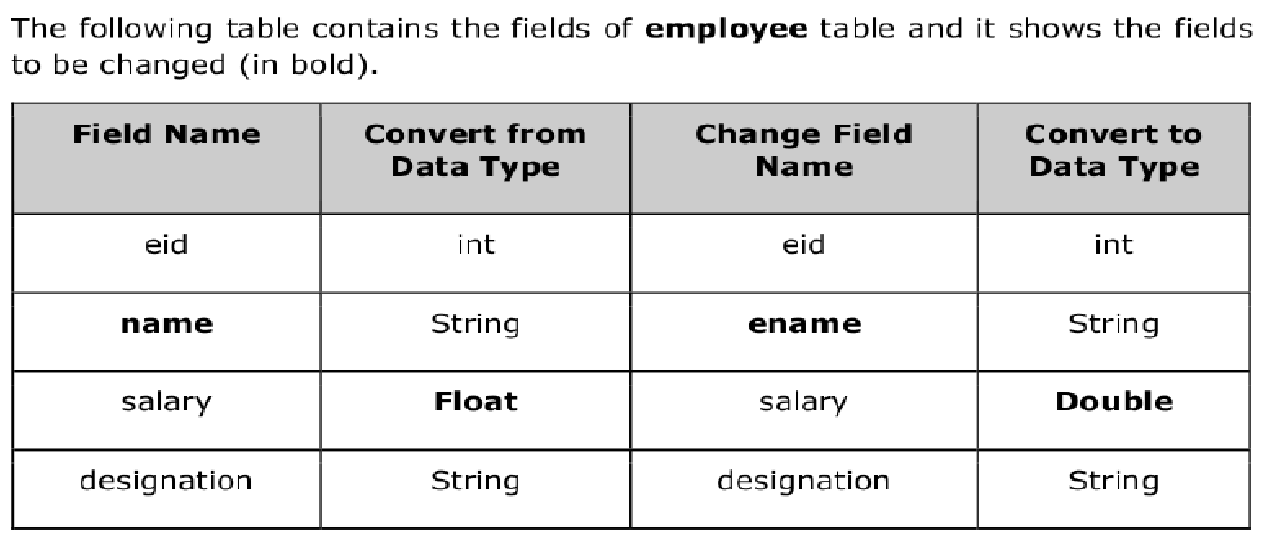
ALTER TABLE:

```
ALTER TABLE name RENAME TO new_name
ALTER TABLE name ADD COLUMNS (col_spec[, col_spec ...])
ALTER TABLE name DROP [COLUMN] column_name
ALTER TABLE name CHANGE column_name new_name
new_type
ALTER TABLE name REPLACE COLUMNS (col_spec[,
col_spec ...])
```

ALTER TABLE – RENAME TO:

ALTER TABLE employee RENAME TO emp;

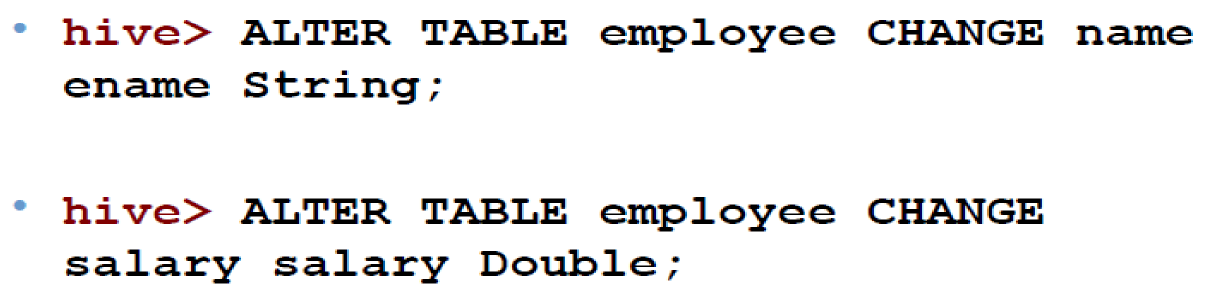
CHANGE STATEMENT:



The following table contains the fields of **employee** table and it shows the fields to be changed (in bold).

Field Name	Convert from Data Type	Change Field Name	Convert to Data Type
eid	int	eid	int
name	String	**ename**	String
salary	**Float**	salary	**Double**
designation	String	designation	String

CHANGE STATEMENT EXAMPLE:



- hive> ALTER TABLE employee CHANGE name ename String;
- hive> ALTER TABLE employee CHANGE salary salary Double;

ADD COLUMN STATEMENT:

-
  ```
  hive> ALTER TABLE employee ADD COLUMNS (
  > dept STRING COMMENT 'Department name');
  ```

REPLACE STATEMENT:

```
hive> ALTER TABLE employee REPLACE COLUMNS
(
> eid INT empid Int,
> ename STRING name String);
```

DROP TABLE STATEMENT:

- The syntax is as follows:
  - `DROP TABLE [IF EXISTS] table_name;`
- The following query drops a table named employee:
  - `hive> DROP TABLE IF EXISTS employee;`

INDEX:

- An Index is nothing but a pointer on a particular columnof a table.
- Creating an index means creating a pointer on a particular column of a table.
- hive> CREATE INDEX index_yoj ON TABLE file(yoj)

> AS 'org.apache.hadoop.hive.ql.index.compact.CompactIndexHandler'
WITH DEFERRED REBUILD;

DROP INDEX:

- The following syntax is used to drop an index:

```
DROP INDEX <index_name> ON <table_name>
```

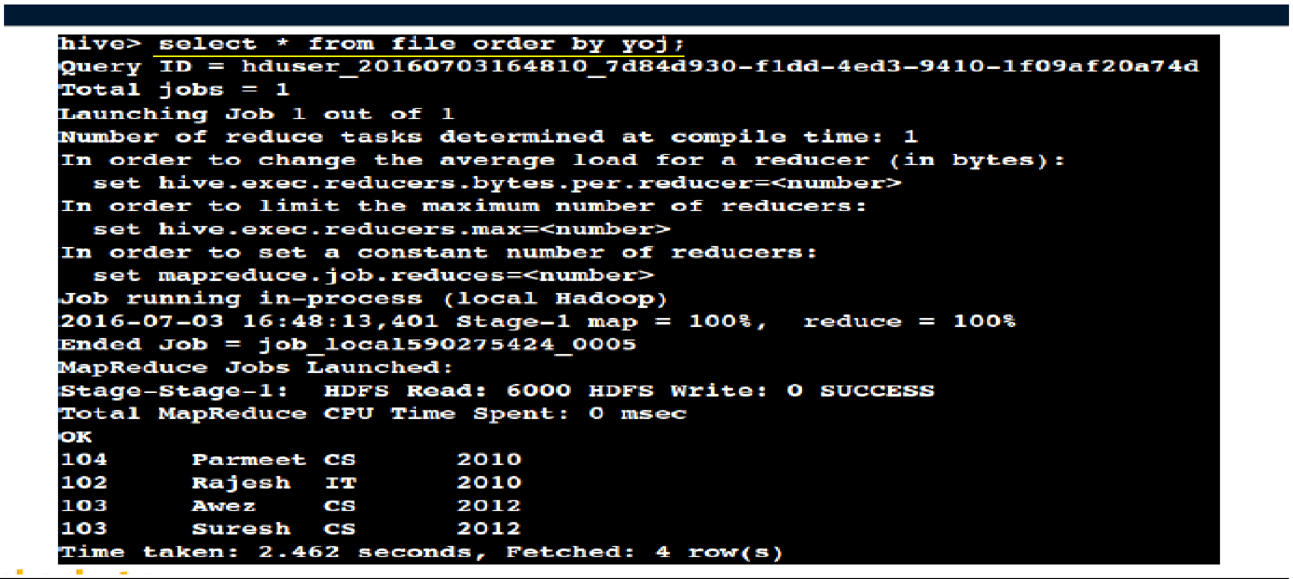
- The following query drops an index named index_salary:

```
hive> DROP INDEX index_salary ON employee;
```

Select…Order By:

• The ORDER BY clause is used to retrieve the details based on one column and sort the result set by ascending or descending order.
• Syntax:
SELECT [ALL | DISTINCT] select_expr, select_expr, ...
FROM table_reference
[WHERE where_condition]
[GROUP BY col_list]
[HAVING having_condition]
[ORDER BY col_list]]
[LIMIT number];

Example:

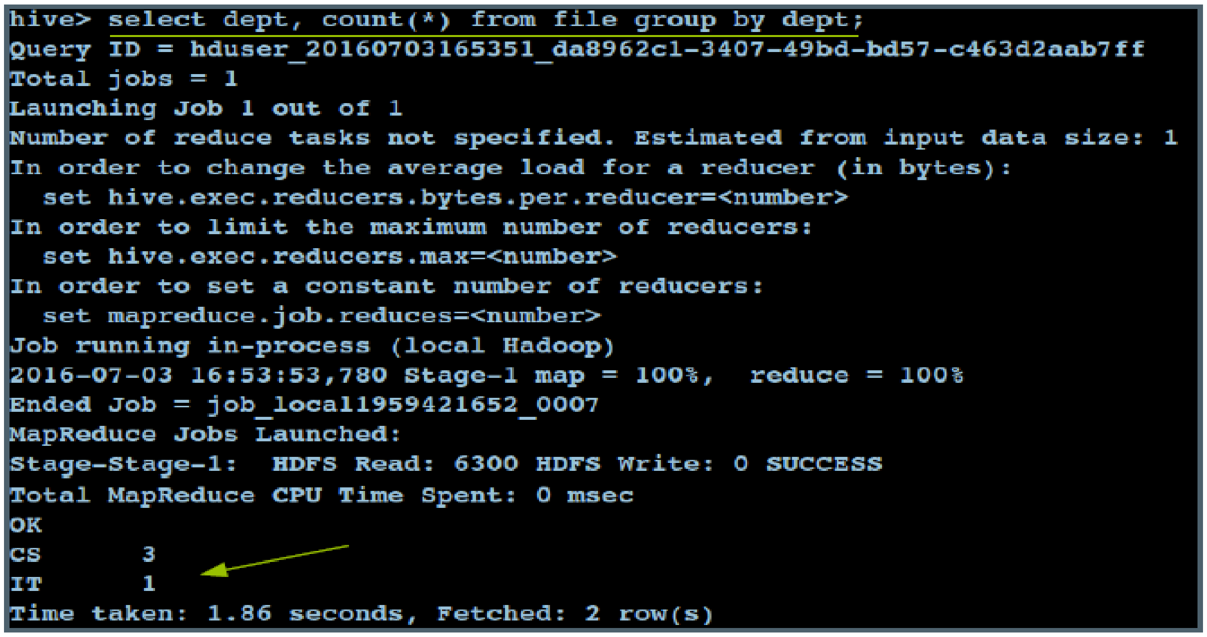


```
hive> select * from file order by yoj;
Query ID = hduser_20160703164810_7d84d930-f1dd-4ed3-9410-1f09af20a74d
Total jobs = 1
Launching Job 1 out of 1
Number of reduce tasks determined at compile time: 1
In order to change the average load for a reducer (in bytes):
  set hive.exec.reducers.bytes.per.reducer=<number>
In order to limit the maximum number of reducers:
  set hive.exec.reducers.max=<number>
In order to set a constant number of reducers:
  set mapreduce.job.reduces=<number>
Job running in-process (local Hadoop)
2016-07-03 16:48:13,401 Stage-1 map = 100%,  reduce = 100%
Ended Job = job_local590275424_0005
MapReduce Jobs Launched:
Stage-Stage-1:  HDFS Read: 6000 HDFS Write: 0 SUCCESS
Total MapReduce CPU Time Spent: 0 msec
OK
104     Parmeet CS      2010
102     Rajesh  IT      2010
103     Awez    CS      2012
103     Suresh  CS      2012
Time taken: 2.462 seconds, Fetched: 4 row(s)
```

Select…Group By:

• The GROUP BY clause is used to group all the records in a result set using a particular collection column. It is used to query a group of records.
• Syntax:
SELECT [ALL | DISTINCT] select_expr, select_expr, ...
FROM table_reference
[WHERE where_condition]
[GROUP BY col_list]
[HAVING having_condition]
[ORDER BY col_list]]
[LIMIT number];

Example:

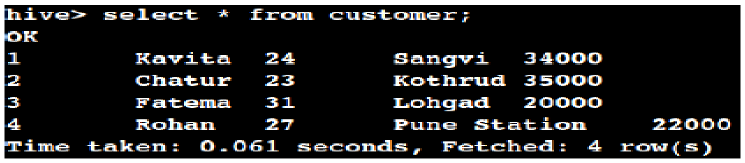


```
hive> select dept, count(*) from file group by dept;
Query ID = hduser_20160703165351_da8962c1-3407-49bd-bd57-c463d2aab7ff
Total jobs = 1
Launching Job 1 out of 1
Number of reduce tasks not specified. Estimated from input data size: 1
In order to change the average load for a reducer (in bytes):
  set hive.exec.reducers.bytes.per.reducer=<number>
In order to limit the maximum number of reducers:
  set hive.exec.reducers.max=<number>
In order to set a constant number of reducers:
  set mapreduce.job.reduces=<number>
Job running in-process (local Hadoop)
2016-07-03 16:53:53,780 Stage-1 map = 100%,  reduce = 100%
Ended Job = job_local1959421652_0007
MapReduce Jobs Launched:
Stage-Stage-1:  HDFS Read: 6300 HDFS Write: 0 SUCCESS
Total MapReduce CPU Time Spent: 0 msec
OK
CS      3
IT      1
Time taken: 1.86 seconds, Fetched: 2 row(s)
```

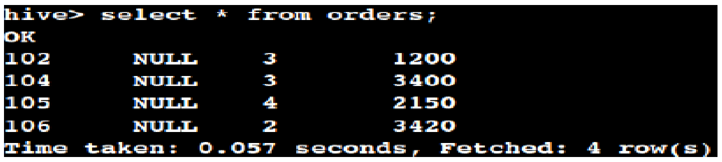
JOINS:

• JOINS is a clause that is used for combining specific fields from two tables by using values common to each one.
• It is used to combine records from two or more tables in the database.
• It is more or less similar to SQL JOINS.

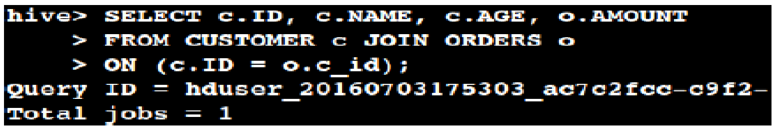
Example:;



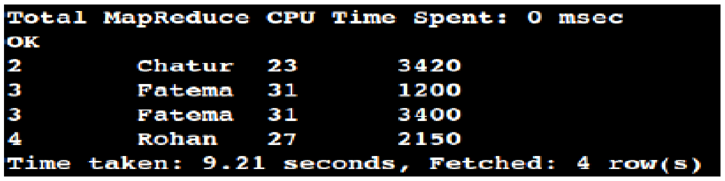
```
hive> select * from customer;
OK
1       Kavita  24      Sangvi  34000
2       Chatur  23      Kothrud 35000
3       Fatema  31      Lohgad  20000
4       Rohan   27      Pune Station    22000
Time taken: 0.061 seconds, Fetched: 4 row(s)
```



```
hive> select * from orders;
OK
102     NULL    3       1200
104     NULL    3       3400
105     NULL    4       2150
106     NULL    2       3420
Time taken: 0.057 seconds, Fetched: 4 row(s)
```



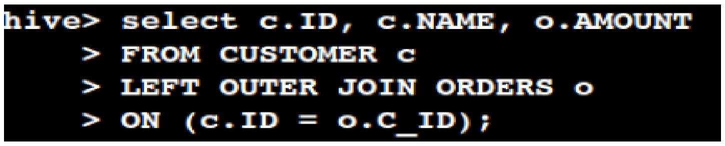
```
hive> SELECT c.ID, c.NAME, c.AGE, o.AMOUNT
    > FROM CUSTOMER c JOIN ORDERS o
    > ON (c.ID = o.c_id);
Query ID = hduser_20160703175303_ac7c2fcc-c9f2-
Total jobs = 1
```



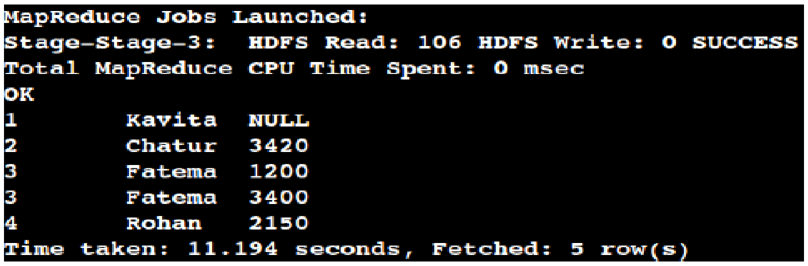
```
Total MapReduce CPU Time Spent: 0 msec
OK
2       Chatur  23      3420
3       Fatema  31      1200
3       Fatema  31      3400
4       Rohan   27      2150
Time taken: 9.21 seconds, Fetched: 4 row(s)
```

Left Outer Join:

• The HiveQL LEFT OUTER JOIN returns all the rows from the left table, even if there are no matches in the right table.
• This means, if the ON clause matches 0 (zero) records in the right table, the JOIN still returns a row in the result, but with NULL in each column from the right table.
• A LEFT JOIN returns all the values from the left table, plus the matched values from the right table, or NULL in case of no matching JOIN predicate.



```
hive> select c.ID, c.NAME, o.AMOUNT
    > FROM CUSTOMER c
    > LEFT OUTER JOIN ORDERS o
    > ON (c.ID = o.C_ID);
```



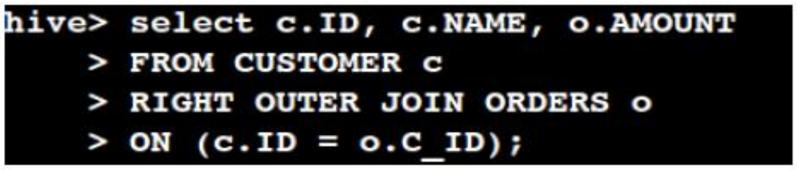
```
MapReduce Jobs Launched:
Stage-Stage-3:  HDFS Read: 106 HDFS Write: 0 SUCCESS
Total MapReduce CPU Time Spent: 0 msec
OK
1       Kavita  NULL
2       Chatur  3420
3       Fatema  1200
3       Fatema  3400
4       Rohan   2150
Time taken: 11.194 seconds, Fetched: 5 row(s)
```

Right Outer Join:

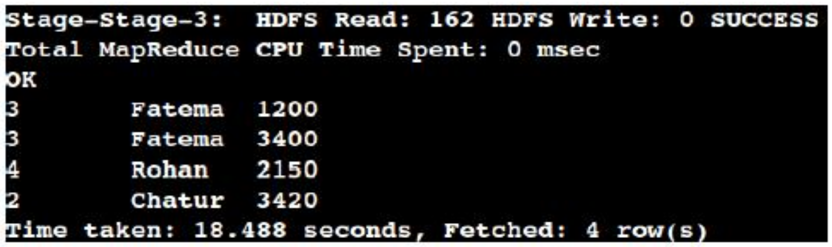
• The HiveQL RIGHT OUTER JOIN returns all the rows from the right table, even if there are no matches in the left table.

• If the ON clause matches 0 (zero) records in the left table, the JOIN still returns a row in the result, but with NULL in each column from the left table.

• A RIGHT JOIN returns all the values from the right table, plus the matched values from the left table, or NULL in case of no matching join predicate.



```
hive> select c.ID, c.NAME, o.AMOUNT
    > FROM CUSTOMER c
    > RIGHT OUTER JOIN ORDERS o
    > ON (c.ID = o.C_ID);
```



```
Stage-Stage-3:  HDFS Read: 162 HDFS Write: 0 SUCCESS
Total MapReduce CPU Time Spent: 0 msec
OK
3       Fatema  1200
3       Fatema  3400
4       Rohan   2150
2       Chatur  3420
Time taken: 18.488 seconds, Fetched: 4 row(s)
```

Conclusion: Thus we have learnt how to execute queries with hive and various operations related to database (like Creating Table/Database, Dropping Table ,Altering Table, Joins in Table, Index in Table)with HiveQL & HBase.