VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS
(20CS6PEBDA)

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,
Bull Temple Road, Bangalore 560019
(Affiliated To Visvesvaraya Technological University, Belgaum)
Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "BIG DATA ANALYSIS LAB" carried out by **YASHASWINI SHAH(1BM19CS216),** who is a bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **BIG DATA ANALYSIS - (20CS6PEBDA)** work prescribed for the said degree.

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Index Sheet

Course Outcome

CO1	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO2	Analyze the Big Data and obtain insight using data analytics mechanisms.
CO3	Design and implement Big data applications by applying NoSQL, Hadoop or Spark

LAB 1:

I.CREATE DATABASE IN MONGODB. > use khushilDB

switched to db khushilDB

db;

khushilDB

show dbs;

admin 0.000GB

config 0.000GB

local 0.000GB

II. CRUD (CREATE, READ, UPDATE, DELETE) OPERATIONS

1. To create a collection by the name “Student”. Let us take a look at the collection list prior to the creation of the new collection
“Student”.

db.createCollection(“Student”); => *sql equivalent* **CREATE TABLE STUDENT(…);**

{ "ok" : 1 }

2.To drop a collection by the name “Student”.

db.Student.drop(); 3.Create a collection by the name “Students” and store the following data in it. **db.Student.insert({_id:1,StudName:"MichelleJacintha",Grade:"VII",Hobbies:"InternetSurfing"});**

WriteResult({ "nInserted" : 1 })

4.Insert the document for “AryanDavid” in to the Students collection only if it does not already exist in the collection. However, if it is already present in the collection, then update the document with new values. (Update his Hobbies from “Skating” to “Chess”.) Use “Update else insert” (if there is an existing document, it will attempt to update it, if there is no existing document then it will insert it).

db.Student.update({_id:3,StudName:"AryanDavid",Grade:"VII"},{$set:{Hobbies:"Skating"}},{upsert:true});

WriteResult({ "nMatched" : 0, "nUpserted" : 1, "nModified" : 0, "_id" : 3 })

5.FIND METHOD

A. To search for documents from the “Students” collection based on certain search criteria.

db.Student.find({StudName:"AryanDavid"}); ({cond..},{columns.. column:1, columnname:0})

{ "_id" : 3, "Grade" : "VII", "StudName" : "AryanDavid",
"Hobbies" : "Skating" }

B. To display only the StudName and Grade from all the documents of the Students collection. The identifier_id should be suppressed and NOT displayed.
db.Student.find({},{StudName:1,Grade:1,_id:0});

{ "StudName" : "MichelleJacintha", "Grade" : "VII" }
{ "Grade" : "VII", "StudName" : "AryanDavid" }

C. To find those documents where the Grade is set to ‘VII’

db.Student.find({Grade:{$eq:'VII'}}).pretty();

```
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating"
}
```

D. To find those documents from the Students collection where the Hobbies is set to either ‘Chess’ or is set to ‘Skating’.

db.Student.find({Hobbies :{ $in: ['Chess','Skating']}}).pretty ();

```
{
   "_id" : 3,
   "Grade" : "VII",
   "StudName" : "AryanDavid",
   "Hobbies" : "Skating"
}
```

E. To find documents from the Students collection where the StudName begins with “M”.

db.Student.find({StudName:/^M/}).pretty();

```
{
   "_id" : 1,
   "StudName" : "MichelleJacintha",
   "Grade" : "VII",
   "Hobbies" : "InternetSurfing"
}
```

F. To find documents from the Students collection where the StudNamehas an “e” in any position.

db.Student.find({StudName:/e/}).pretty();

```
{
   "_id" : 1,
   "StudName" : "MichelleJacintha",
   "Grade" : "VII",
   "Hobbies" : "InternetSurfing"
}
```

G. To find the number of documents in the Students collection.

db.Student.count();

2

H. To sort the documents from the Students collection in the descending order of StudName.

```
db.Student.find().sort({StudName:-1}).pretty();
{
  "_id" : 1,
  "StudName" : "MichelleJacintha",
  "Grade" : "VII",
  "Hobbies" : "InternetSurfing"
}
{
  "_id" : 3,
  "Grade" : "VII",
  "StudName" : "AryanDavid",
  "Hobbies" : "Skating"
}
```

III. Import data from a CSV file

Given a CSV file "sample.txt" in the D:drive, import the file into the MongoDB collection, "SampleJSON". The collection is in the database "test".

mongoimport --db Student --collection airlines --type csv – headerline --file /home/hduser/Desktop/airline.csv

IV. Export data to a CSV file

This command used at the command prompt exports MongoDB JSON documents from "Customers" collection in the "test" database into a CSV file "Output.txt" in the D:drive.

mongoexport --host localhost --db Student --collection airlines --csv --out /home/hduser/Desktop/output.txt – fields "Year","Quarter"

V. Save Method :

Save() method will insert a new document, if the document with the _id does not exist. If it exists it will replace the exisiting document.

db.Student.save({StudName:"Vamsi", Grade:"VI"})

WriteResult({ "nInserted" : 1 })

VI. Add a new field to existing Document:

db.Student.update({_id:ObjectId("625695cc7d129fb98b44c8a1")},
{$set:{Location:"Network"}})

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

VII. Remove the field in an existing Document
db.Student.update({_id:ObjectId("625695cc7d129fb98b44c8a1")},
{$unset:{Location:"Network"}})

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

VIII. Finding Document based on search criteria suppressing few fields

db.Student.find({_id:1},{StudName:1,Grade:1,_id:0});

{ "StudName" : "MichelleJacintha", "Grade" : "VII" }

To find those documents where the Grade is not set to 'VII'

db.Student.find({Grade:{$ne:'VII'}}).pretty();

{
"_id" : ObjectId("625695cc7d129fb98b44c8a1"),
"StudName" : "Vamsi",
"Grade" : "VI"
}

To find documents from the Students collection where the StudName ends with s.

```
db.Student.find({StudName:/s$/}).pretty();

{
   "_id" : 1,
   "StudName" : "MichelleJacintha",
   "Grade" : "VII",
   "Hobbies" : "InternetSurfing"
}
```

IX. to set a particular field value to NULL

```
db.Student.update({_id:3},{$set:{Location:null}})

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
```

X. Count the number of documents in Student Collections

```
db.Student.count()

3
```

XI. Count the number of documents in Student Collections with grade :VII

```
db.Student.count({Grade:"VII"})

    2 retrieve first 3 documents

db.Student.find({Grade:"VII"}).limit(1).pretty();

{
 "_id" : 1,
 "StudName" : "MichelleJacintha",
 "Grade" : "VII",
 "Hobbies" : "InternetSurfing"
}
```

Sort the document in Ascending order

```
db.Student.find().sort({StudName:1}).pretty();

{
   "_id" : 3,
   "Grade" : "VII",
   "StudName" : "AryanDavid",
   "Hobbies" : "Skating",
   "Location" : null
}
{
   "_id" : 1,
   "StudName" : "MichelleJacintha",
   "Grade" : "VII",
   "Hobbies" : "InternetSurfing"
}
{
   "_id" : ObjectId("625695cc7d129fb98b44c8a1"),
   "StudName" : "Vamsi",
   "Grade" : "VI"
}
```

Note: for desending order : db.Students.find().sort({StudName:-1}).pretty();

to Skip the 1st two documents from the Students Collections

```
db.Student.find().skip(2).pretty()

{
   "_id" : ObjectId("625695cc7d129fb98b44c8a1"),
   "StudName" : "Vamsi",
   "Grade" : "VI"
}
```

XII. Create a collection by name “food” and add to each document add a “fruits” array

db.food.insert({ _id:1, fruits:['grapes','mango','apple'] }) db.food.insert({ _id:2, fruits:['grapes','mango','cherry'] }) db.food.insert({ _id:3, fruits:['banana','mango'] })

{ "_id" : 1, "fruits" : ["grapes", "mango", "apple"] }
{ "_id" : 2, "fruits" : ["grapes", "mango", "cherry"] }
{ "_id" : 3, "fruits" : ["banana", "mango"] }

To find those documents from the "food" collection which has the "fruits array" constitute of "grapes", "mango" and "apple".

db.food.find ({fruits: ['grapes','mango','apple'] }). pretty();

{ "_id" : 1, "fruits" : ["grapes", "mango", "apple"] }

To find in "fruits" array having "mango" in the first index position.

db.food.find ({"fruits.1":grapes'})

To find those documents from the "food" collection where the size of the array is two.

db.food.find ({"fruits": {$size:2}})

{ "_id" : 3, "fruits" : ["banana", "mango"] }

To find the document with a particular id and display the first two elements from the array "fruits"

db.food.find({_id:1},{"fruits":{$slice:2}})

{ "_id" : 1, "fruits" : ["grapes", "mango"] }

To find all the documets from the food collection which have elements mango and grapes in the array "fruits"

db.food.find({fruits:{$all:["mango","grapes"]}})

{ "_id" : 1, "fruits" : ["grapes", "mango", "apple"] }

{ "_id" : 2, "fruits" : ["grapes", "mango", "cherry"] }

update on Array: using particular id replace the element present in the 1st index position of the fruits array with apple

db.food.update({_id:3},{$set:{'fruits.1':'apple'}})

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

insert new key value pairs in the fruits array

db.food.update({_id:2},{$push:{price:{grapes:80,mango:200,cherr y:100}}})

{ "_id" : 1, "fruits" : ["grapes", "mango", "apple"] }
{ "_id" : 2, "fruits" : ["grapes", "mango", "cherry"], "price" : [{
"grapes" : 80, "mango" : 200, "cherry" : 100 }] }
{ "_id" : 3, "fruits" : ["banana", "apple"] }

Note: perform query operations using - pop, addToSet, pullAll and pull

LAB 2:

Perform the following DB operations using Cassandra.

1. Create a key space by name Employee

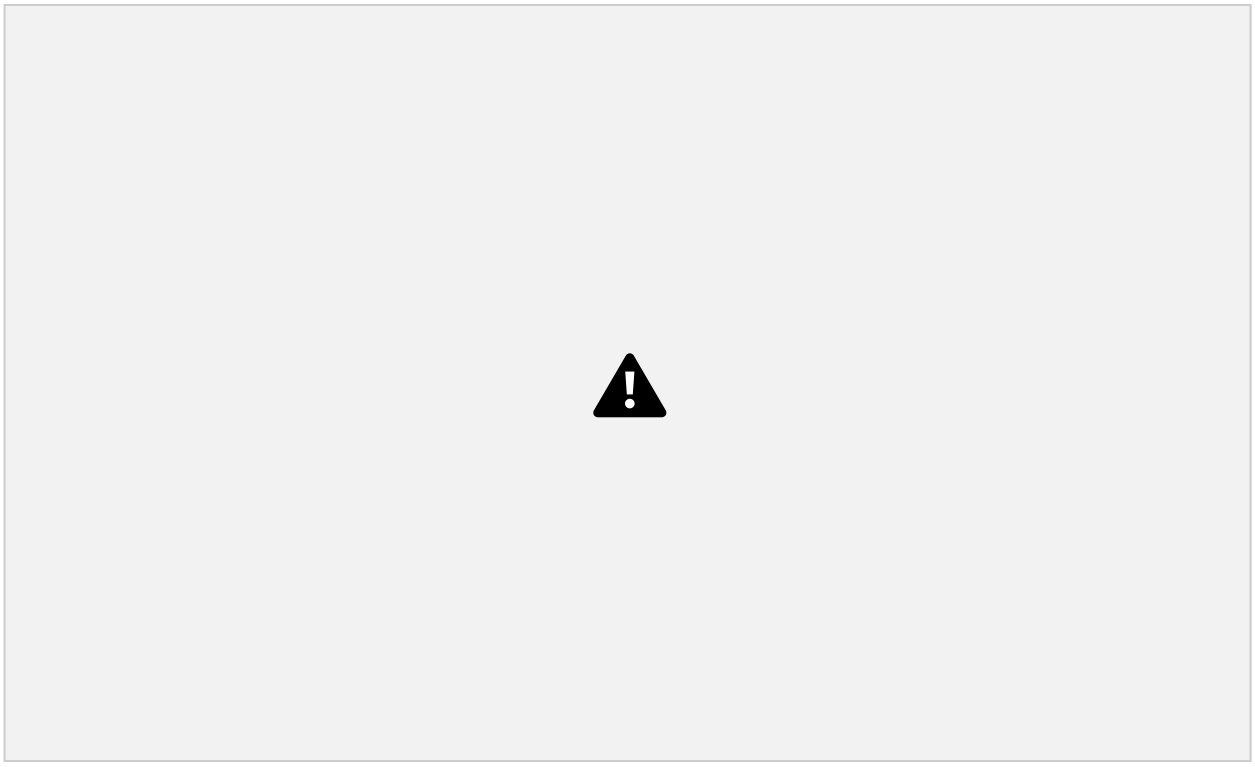
```
create keyspace "Employee" with replication = {'class':'SimpleStrategy','replication_factor':1}; cqlsh> use Employee;
```

2. Create a column family by name Employee-Info with attributes Emp_Id Primary Key, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name

```
create table Employee_Info(Emp_id int PRIMARY KEY,Emp_name text,Date_of_Joining timestamp,Salary float,Dept_Name text) ;
```

3. Insert the values into the table in batch

```
cqlsh:employee> begin batch
        ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(1,'Khushil','2021-04-23',50000,'CSE')
        ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(2,'Tarun','2020-06-21',10000,'ISE')
        ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(3,'Suresh','2011-02-12',30000,'ECE')
        ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(4,'Yuresh','2015-09-02',90000,'EEE')
        ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(5,'Dharmesh','2016-01-09',70000,'CSE')
        ... apply batch;
```



4. Update Employee name and Department of Emp-Id 1 update employee_info set Dept_Name='Mech',emp_name='Sreekar' where emp_id=1;
5. cqlsh:employee> select * from employee_info;

```
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining                 | dept_name | emp_name | salary
--------+---------------------------------+-----------+----------+--------
      5 | 2016-01-09 00:00:00.000000+0000 |       CSE | Dharmesh |  70000
      1 | 2021-04-23 00:00:00.000000+0000 |      Mech |  Sreekar |  50000
      2 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun |  10000
      4 | 2015-09-02 00:00:00.000000+0000 |       EEE |   Yuresh |  90000
      3 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh |  30000

(5 rows)
```

6. Sort the details of Employee records based on salary

```
(0 rows)
cqlsh:employee> begin batch
           ... insert into Employee_information(Emp_id,Emp_name,Date_of_Joi
ning,Salary,Dept_Name) values(1,'Nithin','2021-04-23',50000,'CSE')
           ... insert into Employee_information(Emp_id,Emp_name,Date_of_Joi
ning,Salary,Dept_Name) values(2,'Tarun','2020-06-21',10000,'ISE')
           ... insert into Employee_information(Emp_id,Emp_name,Date_of_Joi
ning,Salary,Dept_Name) values(3,'Suresh','2011-02-12',30000,'ECE')
           ... apply batch;
cqlsh:employee> select * from Employee_information;

 emp_id | salary | date_of_joining                 | dept_name | emp_name
--------+--------+---------------------------------+-----------+----------
      1 |  50000 | 2021-04-23 00:00:00.000000+0000 |       CSE |   Nithin
      2 |  10000 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun
      3 |  30000 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh

(3 rows)
cqlsh:employee> describe Employee_information;

CREATE TABLE employee.employee_information (
    emp_id int,
    salary float,
    date_of_joining timestamp,
    dept_name text,
    emp_name text,
    PRIMARY KEY (emp_id, salary)
) WITH CLUSTERING ORDER BY (salary ASC)
```

cqlsh:employee> select * from Employee_information where emp_id in (1,2,3) order by Salary;

```
cqlsh:employee> paging off
Disabled Query paging.
cqlsh:employee> select * from Employee_information where emp_id in (1,2,3) o
rder by Salary;

 emp_id | salary | date_of_joining                 | dept_name | emp_name
--------+--------+---------------------------------+-----------+----------
      2 |  10000 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun
      3 |  30000 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh
      1 |  50000 | 2021-04-23 00:00:00.000000+0000 |       CSE |   Nithin

(3 rows)
```

7. Alter the schema of the table Employee_Info to add a column Projects which stores a set of Projects done by the corresponding Employee.

cqlsh:employee> alter table employee_info add projects set<text>;

8. Update the altered table to add project names.

cqlsh:employee> update employee_info set projects=projects+{'project1','project2','project3'} where emp_id=1;

```
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining                 | dept_name | emp_name | projects                                  | salary
--------+---------------------------------+-----------+----------+-------------------------------------------+--------
      5 | 2016-01-09 00:00:00.000000+0000 |       CSE | Dharmesh |                                      null |  70000
      1 | 2021-04-23 00:00:00.000000+0000 |      Mech |  Sreekar | {'project1', 'project2', 'project3'} |  50000
      2 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun |                                      null |  10000
      4 | 2015-09-02 00:00:00.000000+0000 |       EEE |   Yuresh |                                      null |  90000
      3 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh |                                      null |  30000

(5 rows)
```

8 Create a TTL of 15 seconds to display the values of Employees.

```
cqlsh:employee> begin batch
           ... insert into Employee_Info(Emp_id,Emp_name,Date_of_Joining,Salary,Dept_Name) values(6,'Rahul','2021-05-03',10000,'ISE') USING TTL 15;
           ... apply batch;
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining                 | dept_name | emp_name | projects                                  | salary
--------+---------------------------------+-----------+----------+-------------------------------------------+--------
      5 | 2016-01-09 00:00:00.000000+0000 |       CSE | Dharmesh |                                      null |  70000
      1 | 2021-04-23 00:00:00.000000+0000 |      Mech |  Sreekar | {'project1', 'project2', 'project3'} |  50000
      2 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun |                {'project4', 'project5'} |  10000
      4 | 2015-09-02 00:00:00.000000+0000 |       EEE |   Yuresh |                                      null |  90000
      6 | 2021-05-03 00:00:00.000000+0000 |       ISE |    Rahul |                                      null |  10000
      3 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh |                                      null |  30000

(6 rows)
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining                 | dept_name | emp_name | projects                                  | salary
--------+---------------------------------+-----------+----------+-------------------------------------------+--------
      5 | 2016-01-09 00:00:00.000000+0000 |       CSE | Dharmesh |                                      null |  70000
      1 | 2021-04-23 00:00:00.000000+0000 |      Mech |  Sreekar | {'project1', 'project2', 'project3'} |  50000
      2 | 2020-06-21 00:00:00.000000+0000 |       ISE |    Tarun |                {'project4', 'project5'} |  10000
      4 | 2015-09-02 00:00:00.000000+0000 |       EEE |   Yuresh |                                      null |  90000
      3 | 2011-02-12 00:00:00.000000+0000 |       ECE |   Suresh |                                      null |  30000

(5 rows)
```

LAB 3:

1.Create a key space by name Library

```
cqlsh> create keyspace Library WITH REPLICATION = {'class' : 'SimpleStrategy','replication_factor' :
1};
cqlsh> use Library;
```

2.Create a column family by name Library-Info with attributes Stud_Id Primary Key, Counter_value of type Counter,

```
cqlsh:library> create table Library_Info(Stud_Id int,Counter_value counter,Stud_Name varchar,Book_nam
e varchar,Book_Id int,Date_of_Issue date,primary key(Stud_Id,Stud_name,Book_name,Book_Id,Date_of_Issu
e));
```

3. Insert the values into the table in batch

```
cqlsh:library> update Library_Info set Counter_value = Counter_value + 1 where Stud_Id = 1 AND Stud_n
ame = 'naman' AND Book_name='abc' AND Book_Id = 123 AND Date_of_Issue = '2022-05-04';
```

4.Display the details of the table created and increase the value of the counter

```
cqlsh:library> update library_info set Counter_value = Counter_value + 1 where Stud_Id = 1 AND Stud_n
ame = 'naman' AND Book_name='abc' AND Book_Id = 123 AND Date_of_Issue = '2022-05-04';
cqlsh:library> select * from Library_Info;

 stud_Id | stud_name | book_name | book_id | date_of_issue | counter_value
---------+-----------+-----------+---------+---------------+---------------
       1 |     naman |       abc |     123 |    2022-05-04 |             2
```

5.Write a query to show that a student with id 112 has taken a book “BDA” 2 times.

```
cqlsh:library> select counter_value as borrow_count from library_info where stud_id=1 AND book_id=123
;

 borrow_count
--------------
            2
```

6.Export the created column to a csv file

```
cqlsh:library> COPY library.library_info (Stud_Id,Book_Id,Counter_value,Stud_name,Book_name,Date_of_I
ssue) TO '/home/bmsce/CASSANDRA-NAMAN/data.csv' WITH HEADER = TRUE;
Using 11 child processes

Starting copy of library.library_info with columns [stud_id, book_id, counter_value, stud_name, book_
name, date_of_issue].
Processed: 1 rows; Rate:       0 rows/s; Avg. rate:       0 rows/s
1 rows exported to 1 files in 0.176 seconds.
```

7.Import a given csv dataset from local file system into Cassandra column family

```
cqlsh:library> COPY library.library_info (Stud_Id,Book_Id,Counter_value,Stud_name,Book_name,Date_of_I
ssue) FROM '/home/bmsce/CASSANDRA-NAMAN/data.csv' WITH HEADER = TRUE;
Using 11 child processes

Starting copy of library.library_info with columns [stud_id, book_id, counter_value, stud_name, book_
name, date_of_issue].
Processed: 1 rows; Rate:       2 rows/s; Avg. rate:       3 rows/s
1 rows imported from 1 files in 0.379 seconds (0 skipped).
```

Hadoop Installation

```
Microsoft Windows [Version 10.0.22000.739]
(c) Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>start-all.cmd
This script is Deprecated. Instead use start-dfs.cmd and start-yarn.cmd
starting yarn daemons

C:\WINDOWS\system32>jps
7072 DataNode
13492 Jps
15844 ResourceManager
16196 NameNode
1388 NodeManager

C:\WINDOWS\system32>hdfs dfs -ls -R /
drwxr-xr-x   - khush supergroup          0 2022-06-27 14:09 /input
drwxr-xr-x   - khush supergroup          0 2022-06-21 09:03 /input/inputtest
-rw-r--r--   1 khush supergroup         21 2022-06-21 09:03 /input/inputtest/output.txt
-rw-r--r--   1 khush supergroup         21 2022-06-21 08:19 /input/sample.txt
-rw-r--r--   1 khush supergroup         21 2022-06-27 14:09 /input/sample2.txt
drwxr-xr-x   - khush supergroup          0 2022-06-21 13:30 /test
-rw-r--r--   1 khush supergroup         19 2022-06-21 13:30 /test/sample.txt

C:\WINDOWS\system32>hadoop version
Hadoop 3.3.3
Source code repository https://github.com/apache/hadoop.git -r d37586cbda38c338d9fe481addda5a05fb516f71
Compiled by stevel on 2022-05-09T16:36Z
Compiled with protoc 3.7.1
From source with checksum eb96dd4a797b6989ae0cdb9db6efc6
This command was run using /C:/hadoop-3.3.3/share/hadoop/common/hadoop-common-3.3.3.jar

C:\WINDOWS\system32>
```

Hadoop Commands

hdusersbmsce-OptiPlus-3000:-$ sudo su hduser
[sudo] password for hduser:

hdusersbmsce-OptiPlus-3000: $ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
22/06/06 14:43:45 WARN util.NativeCodeLoader: Unable to load native-hadoop
Library for your platform... using builtin-java classes where applicable

Starting namenodes on [localhost]
localhost: nanenade running as process 3396. Stop it first.
localhost: datanode running as process 3564, Stop it first.
starting secondary nanenodes [0.0.0.0)
0.0.0.0: secondarynamenode running as process 3773. Stop it first.
O22/06/06 14:43:47 WARN uttt.NativeCodeLoader: Unable to load native-hadoop library for your
starting yarn daemons
resource process 3932. Stop it first.
Localhost: running as process 4255. stop it first.
6003 Jps
3932 ResourceManager
3773 SecondaryNameNode
4255 NodeManager
hdusersbmsce-OptiPlus-3060:-$ hdfs dfs -mkdir /khushil
hdusersbmsce-OptiPlus-3060: $ hdfs dfs -ls /
22/06/06 14:45:30 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable Found 19 itens
drwxr-xr-x hduser supergroup
02022-06-06 11:44 /AAA
drwxr-xr-x -hduser supergroup
2022-06-03 12:17 /Army
drwxr-xr-x hduser supergroup
02022-06-06 11:40 /Avnit
drwxr-xr-x -hduser supergroup
02022-05-31 10:44 /88
drwxr-xr-x -hduser supergroup
02022-06-01 15:03 /Cath
drwxr-xr-x -hduser supergroup
drwxr-xr-x hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x -hduser supergroup
drwxr-xr-x - hduser supergroup
drwxr-xr-x -hduser supergroup

82022-06-04 10:06 /FFF
02022-06-06 14:40 /Kmrv
02022-06-06 14:44 /Khushil
02022-06-01 15:03 /Neha
02022-06-04 09:54 /WC.txt
0 2022-06-04 09:54 /welcone.txt
02022-06-06 11:36 /abc
62022-06-03 12:13 /akash
0 2022-06-03 15:12 /darshan
0 2022-06-04 09:31 /ghh
8 2022-06-06 11:45 /hello
drwxr-xr-x -hduser supergroup
62022-06-04 09:35 /rahul
drwxr-xr-x -hduser supergroup
02022-06-03 12:11 /shre
drwxr-xr-x .hduser supergroup
02022-06-03 12:41 /shreshtha
hdusersbmsce-OptiPlus-3060:-$ hdfs dfs put /home/hduser/Desktop/6b.txt /Khushil/WC.txt
22/05/06 14:46:40 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using butltin-java classes where applicable
hduserabesce-OptiPlex-3060:-$ hdfs dfs cat /Khushil/WC.txt
22/06/06 14:47:00 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable hello fron of
hdusersbmsce-OptiPlus-3040:-$ hdfs dfs-get /Khushil/WC.txt /home/hduser/Downloads/newic.txt
22/05/06 14:51:43 WARN util.NativeCodeLoader: Unable to load nattve-hadoop library for your platform... using builtin-java classes where applicable
hdusersbmsce-OptiPlus-3066:-$ cd Downloads
hdusersbmsce-OptiPlus-3060:-/Downloads$ cat newwMC.Ext
hello from 6E
hdusersbmsce-OptiPlus-3060:-$ hdfs dfs -1s /Khushil/
22/06/06 14:54:04 WARN util.NativeCodeLoader: Unable to load native-hadoop Library for your platform... using builtin java classes where applicable
Found 2 itens
-rw-r--r-- 1 hduser supergroup
23 2822-06-06 14:46 /Khushil/MC.txt
1 hduser supergroup
23 2022-06-06 14:58 /Khushil/newwc.txt

hdusersbmsce-OptiPlus-3060:-5 hdfs drs -getmerge /Khushil/wc.txt /Khushil/newwc.txt /bone/hduser/Desktop/newmerge.txt
22/06/06 14:55:18 NARN util.NativeCodeLoader: Unable to load nattve-hadoop library for your platform... using butitin-Java classes where applicable
hduserabesce-OptiPlex-3060:~$ cd Desktop
hduser@besce-OptiPlex-3060:-/Desktops cat newmerge.txt
hello from 68
D
B
hello from 68
D
B
hdusersbmsce-OptiPlus-3060:-/Desktops hadoop fs getfacl /Khushil/
22/06/06 14:56:24 WARN util.NativeCodeLoader: Unable to load native hadoop library for your platform... using builtin java classes where applicable
file: /Khushil
owner: hduser
group: supergroup
user::rwx
group::r-x
other::r-x
hdusersbmsce-OptiPlus-3060:-/Desktop5 hdfs dfs copyToLocal /Khushil/HC.txt /home/hduser/Desktop
22/05/06 14:58:09 WARN util.NativeCodeLoader: Unable to load native-hadoop Library for your platform... using butltin-java classes where applicable
hdusersbmsce-OptiPlus-3000:-/Desktop5 cat MC.txt
hello fron 68
hdusersbmsce-OptiPlus-3060:-/Desktops hdfs dfs -cat /Khushil/MC.txt
22/06/06 14:58:59 WARN util.NativeCodeLoader: Unable to load native-hadoop Library for your platform... ustng bulltin-Java classes where applicable hello from GB
B
hdusersbmsce-OptiPlus-3060:-/Desktop5 hadoop fs - /Khushil /FFF 22/06/06 14:59:46 WARN util.NativeCodeLoader: Unable to load native-hadoop Library for your platform... using builtin-java classes where applicable hduseransce-OptiPlex-3060:-/Desktops hadoop fs-Ls /FFF 22/05/06 15:00:00 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using butltin-java classes where applicable Found 2 itens drwxr-xr-x -hduser supergroup TWEE 1 hduser supergroup 02022-05-06 14:50 /FFF/Khushil 17 2022-05-04 10:06 /FFF/MC.txt

hdusersbmsce-OptiPlus-3060:-/Desktops hadoop fs cp /FFF/ /LLL
22/06/06 15:09:34 WARN util.NativeCodeLoader: Unable to load native hadoop library for your platform... using butltin-java classes where applicable
hdusersbmsce-OptiPlus-3060:-/Desktops hadoop fs -Ls /LLL
22/06/06 15:10:07 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 1tens
drwxr-xr-x -hduser supergroup
hdusersbmsce-OptiPlus-3000:-/Desktops
02022-06-06 15:09 /LLL/KHUSHIL
17 2022-00-00 15:09 /LLL/MC.txt

Hadoop Programs

1) Word Count

WCMapper Java Class file.

```
// Importing libraries
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.Mapper;
```

```
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reporter;

public class WCMapper extends MapReduceBase implements Mapper<LongWritable,
                                    Text, Text, IntWritable> {

   // Map function
   public void map(LongWritable key, Text value, OutputCollector<Text,
            IntWritable> output, Reporter rep) throws IOException
   {

      String line = value.toString();

      // Splitting the line on spaces
      for (String word : line.split(" "))
      {
         if (word.length() > 0)
         {
            output.collect(new Text(word), new IntWritable(1));
         }    }     }  }
```

Reducer Code

```
// Importing libraries
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;

public class WCReducer extends MapReduceBase implements Reducer<Text,
                            IntWritable, Text, IntWritable> {

   // Reduce function
   public void reduce(Text key, Iterator<IntWritable> value,
            OutputCollector<Text, IntWritable> output,
                     Reporter rep) throws IOException
   {

      int count = 0;
```

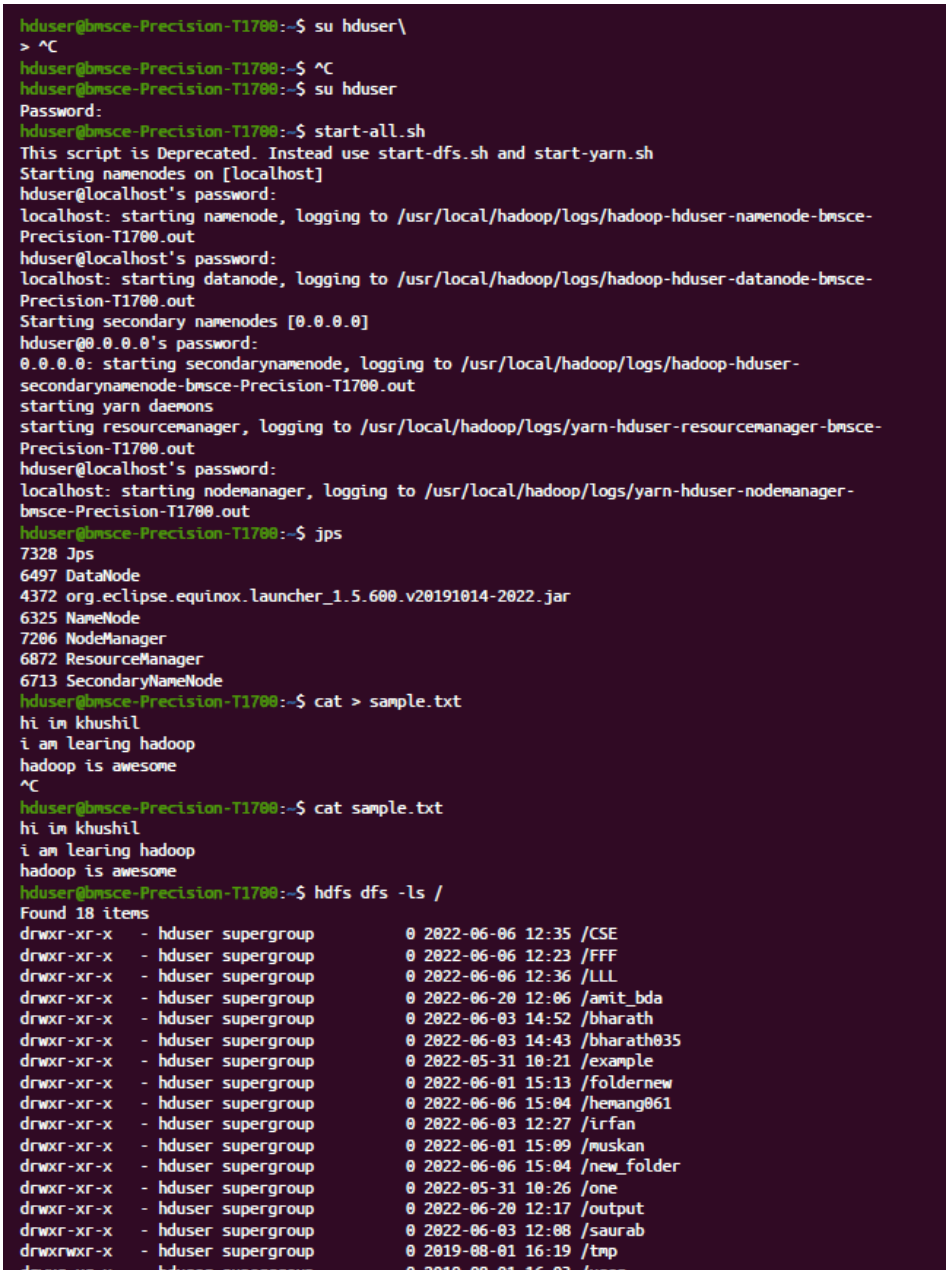
```
        // Counting the frequency of each words
        while (value.hasNext())
        {
            IntWritable i = value.next();
            count += i.get();
        }

        output.collect(key, new IntWritable(count));
    }
}
```

Driver Code:

```
// Importing libraries
import java.io.IOException;
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.FileInputFormat;
import org.apache.hadoop.mapred.FileOutputFormat;
import org.apache.hadoop.mapred.JobClient;
import org.apache.hadoop.mapred.JobConf;
import org.apache.hadoop.util.Tool;
import org.apache.hadoop.util.ToolRunner;

public class WCDriver extends Configured implements Tool {

    public int run(String args[]) throws IOException
    {
        if (args.length < 2)
        {
            System.out.println("Please give valid inputs");
            return -1;
        }

        JobConf conf = new JobConf(WCDriver.class);
        FileInputFormat.setInputPaths(conf, new Path(args[0]));
        FileOutputFormat.setOutputPath(conf, new Path(args[1]));
        conf.setMapperClass(WCMapper.class);
        conf.setReducerClass(WCReducer.class);
```

```
        conf.setMapOutputKeyClass(Text.class);
        conf.setMapOutputValueClass(IntWritable.class);
        conf.setOutputKeyClass(Text.class);
        conf.setOutputValueClass(IntWritable.class);
        JobClient.runJob(conf);
        return 0;
    }

    // Main Method
    public static void main(String args[]) throws Exception
    {
        int exitCode = ToolRunner.run(new WCDriver(), args);
        System.out.println(exitCode);
    }
}
```

Output :



```
hduser@bmsce-Precision-T1700:~$ su hduser\
> ^C
hduser@bmsce-Precision-T1700:~$ ^C
hduser@bmsce-Precision-T1700:~$ su hduser
Password:
hduser@bmsce-Precision-T1700:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-
Precision-T1700.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-
Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hduser-
secondarynamenode-bmsce-Precision-T1700.out
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-
Precision-T1700.out
hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-nodemanager-
bmsce-Precision-T1700.out
hduser@bmsce-Precision-T1700:~$ jps
7328 Jps
6497 DataNode
4372 org.eclipse.equinox.launcher_1.5.600.v20191014-2022.jar
6325 NameNode
7206 NodeManager
6872 ResourceManager
6713 SecondaryNameNode
hduser@bmsce-Precision-T1700:~$ cat > sample.txt
hi im khushil
i am learing hadoop
hadoop is awesome
^C
hduser@bmsce-Precision-T1700:~$ cat sample.txt
hi im khushil
i am learing hadoop
hadoop is awesome
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 18 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:35 /CSE
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:23 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:36 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:06 /amit_bda
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:52 /bharath
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:43 /bharath035
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:21 /example
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:13 /foldernew
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /hemang061
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:27 /irfan
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:09 /muskan
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /new_folder
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:26 /one
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:17 /output
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:08 /saurab
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
```

```
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:46 /user1
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /input_khushil
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 19 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:35 /CSE
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:23 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:36 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:06 /amit_bda
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:52 /bharath
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:43 /bharath035
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:21 /example
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:13 /foldernew
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /hemang061
drwxr-xr-x   - hduser supergroup          0 2022-06-20 15:13 /input_khushil
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:27 /irfan
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:09 /muskan
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /new_folder
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:26 /one
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:17 /output
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:08 /saurab
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:46 /user1
hduser@bmsce-Precision-T1700:~$ hdfs dfs -put /home/hduser/sample.txt /input_khushil
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /input_khushil
Found 1 items
-rw-r--r--   1 hduser supergroup         52 2022-06-20 15:15 /input_khushil/sample.txt
hduser@bmsce-Precision-T1700:~$ hadoop jar /home/hduser/khushil/WordCount.jar WCDriver
/input_khushil /input_khushil/output_khushil
22/06/20 15:16:44 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/20 15:16:44 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/20 15:16:44 INFO jvm.JvmMetrics: Cannot initialize JVM Metrics with
processName=JobTracker, sessionId= - already initialized
22/06/20 15:16:44 WARN mapreduce.JobSubmitter: Hadoop command-line option parsing not
performed. Implement the Tool interface and execute your application with ToolRunner to remedy
this.
22/06/20 15:16:44 INFO mapred.FileInputFormat: Total input paths to process : 1
22/06/20 15:16:44 INFO mapreduce.JobSubmitter: number of splits:1
22/06/20 15:16:44 INFO mapreduce.JobSubmitter: Submitting tokens for job:
job_local230197290_0001
22/06/20 15:16:44 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/20 15:16:44 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/20 15:16:44 INFO mapreduce.Job: Running job: job_local230197290_0001
22/06/20 15:16:44 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapred.FileOutputCommitter
22/06/20 15:16:44 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/20 15:16:44 INFO mapred.LocalJobRunner: Starting task:
attempt_local230197290_0001_m_000000_0
22/06/20 15:16:44 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/20 15:16:44 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/input_khushil/sample.txt:0+52
22/06/20 15:16:44 INFO mapred.MapTask: numReduceTasks: 1
22/06/20 15:16:44 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/20 15:16:44 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/20 15:16:44 INFO mapred.MapTask: soft limit at 83886080
22/06/20 15:16:44 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/20 15:16:44 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
```

```
                CPU time spent (ms)=0
                Physical memory (bytes) snapshot=0
                Virtual memory (bytes) snapshot=0
                Total committed heap usage (bytes)=471859200
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=52
        File Output Format Counters
                Bytes Written=63
0
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /input_khushil
Found 2 items
drwxr-xr-x   - hduser supergroup          0 2022-06-20 15:16 /input_khushil/output_khushil
-rw-r--r--   1 hduser supergroup         52 2022-06-20 15:15 /input_khushil/sample.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /input_khushil/output_khushil
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-20 15:16
/input_khushil/output_khushil/_SUCCESS
```

```
-rw-r--r--   1 hduser supergroup         63 2022-06-20 15:16
/input_khushil/output_khushil/part-00000
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /input_khushil/output_khushil/part-0000
cat: `/input_khushil/output_khushil/part-0000': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /input_khushil/output_khushil/part-00000
am      1
awesome 1
hadoop  2
hi      1
i       1
im      1
is      1
khushil 1
learing 1
```

2) Top N

Driver-TopN.class

```
package samples.topn;

import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.GenericOptionsParser;

public class TopN {
  public static void main(String[] args) throws Exception {
    Configuration conf = new Configuration();
    String[] otherArgs = (new GenericOptionsParser(conf, args)).getRemainingArgs();
    if (otherArgs.length != 2) {
      System.err.println("Usage: TopN <in> <out>");
      System.exit(2);
    }
    Job job = Job.getInstance(conf);
    job.setJobName("Top N");
    job.setJarByClass(TopN.class);
    job.setMapperClass(TopNMapper.class);
    job.setReducerClass(TopNReducer.class);
    job.setOutputKeyClass(Text.class);
    job.setOutputValueClass(IntWritable.class);
    FileInputFormat.addInputPath(job, new Path(otherArgs[0]));
    FileOutputFormat.setOutputPath(job, new Path(otherArgs[1]));
    System.exit(job.waitForCompletion(true) ? 0 : 1);
  }

  public static class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
    private static final IntWritable one = new IntWritable(1);

    private Text word = new Text();

    private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']";

        public void map(Object key, Text value, Mapper<Object, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
```

```
      String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, " ");
      StringTokenizer itr = new StringTokenizer(cleanLine);
      while (itr.hasMoreTokens()) {
        this.word.set(itr.nextToken().trim());
        context.write(this.word, one);
      }
    }
  }
}
```

TopNCombiner.class

```
package samples.topn;

import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;

public class TopNCombiner extends Reducer<Text, IntWritable, Text, IntWritable> {
  public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable,
Text, IntWritable>.Context context) throws IOException, InterruptedException {
    int sum = 0;
    for (IntWritable val : values)
      sum += val.get();
    context.write(key, new IntWritable(sum));
  }
}
```

TopNMapper.class

```
package samples.topn;

import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;

public class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
  private static final IntWritable one = new IntWritable(1);
```

```
  private Text word = new Text();

  private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']";

    public vo```\\id map(Object key, Text value, Mapper<Object, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
   String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, " ");
   StringTokenizer itr = new StringTokenizer(cleanLine);
   while (itr.hasMoreTokens()) {
    this.word.set(itr.nextToken().trim());
    context.write(this.word, one);
   }
  }
}
```

TopNReducer.class

```
package samples.topn;

import java.io.IOException;
import java.util.HashMap;
import java.util.Map;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
import utils.MiscUtils;

public class TopNReducer extends Reducer<Text, IntWritable, Text, IntWritable> {
  private Map<Text, IntWritable> countMap = new HashMap<>();

  public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable,
Text, IntWritable>.Context context) throws IOException, InterruptedException {
   int sum = 0;
   for (IntWritable val : values)
    sum += val.get();
   this.countMap.put(new Text(key), new IntWritable(sum));
  }

  protected void cleanup(Reducer<Text, IntWritable, Text, IntWritable>.Context context)
throws IOException, InterruptedException {
```

```
    Map<Text, IntWritable> sortedMap = MiscUtils.sortByValues(this.countMap);
    int counter = 0;
    for (Text key : sortedMap.keySet()) {
      if (counter++ == 20)
        break;
      context.write(key, sortedMap.get(key));
    }
  }
}
```

Output:

```
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -mkdir /khushil_topn
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./input.txt /khushil_topn/
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_topn/
Found 1 items
-rw-r--r--   1 hduser supergroup        103 2022-06-27 15:43 /khushil_topn/input.txt
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar topn.jar TopNDriver
/khushil_topn/input.txt /khushil_topn/output
Exception in thread "main" java.lang.ClassNotFoundException: TopNDriver
 at java.net.URLClassLoader.findClass(URLClassLoader.java:382)
 at java.lang.ClassLoader.loadClass(ClassLoader.java:418)
 at java.lang.ClassLoader.loadClass(ClassLoader.java:351)
 at java.lang.Class.forName0(Native Method)
 at java.lang.Class.forName(Class.java:348)
 at org.apache.hadoop.util.RunJar.run(RunJar.java:214)
 at org.apache.hadoop.util.RunJar.main(RunJar.java:136)
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar topn.jar topn.TopNDriver
/khushil_topn/input.txt /khushil_topn/output
22/06/27 15:45:22 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 15:45:22 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 15:45:22 INFO input.FileInputFormat: Total input paths to process : 1
22/06/27 15:45:22 INFO mapreduce.JobSubmitter: number of splits:1
22/06/27 15:45:22 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local691635730_0001
22/06/27 15:45:22 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 15:45:22 INFO mapreduce.Job: Running job: job_local691635730_0001
22/06/27 15:45:22 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 15:45:22 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Starting task: attempt_local691635730_0001_m_000000_0
22/06/27 15:45:22 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:45:22 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_topn/input.txt:0+103
22/06/27 15:45:22 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:45:22 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 15:45:22 INFO mapred.MapTask: soft limit at 83886080
22/06/27 15:45:22 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 15:45:22 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 15:45:22 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 15:45:22 INFO mapred.LocalJobRunner:
22/06/27 15:45:22 INFO mapred.MapTask: Starting flush of map output
22/06/27 15:45:22 INFO mapred.MapTask: Spilling map output
22/06/27 15:45:22 INFO mapred.MapTask: bufstart = 0; bufend = 187; bufvoid = 104857600
22/06/27 15:45:22 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26214316(104857264);
length = 81/6553600
22/06/27 15:45:22 INFO mapred.MapTask: Finished spill 0
22/06/27 15:45:22 INFO mapred.Task: Task:attempt_local691635730_0001_m_000000_0 is done. And is in
the process of committing
22/06/27 15:45:22 INFO mapred.LocalJobRunner: map
22/06/27 15:45:22 INFO mapred.Task: Task 'attempt_local691635730_0001_m_000000_0' done.
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Finishing task: attempt_local691635730_0001_m_000000_0
22/06/27 15:45:22 INFO mapred.LocalJobRunner: map task executor complete.
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Waiting for reduce tasks
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Starting task: attempt_local691635730_0001_r_000000_0
22/06/27 15:45:22 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
```

```
        Map input records=6
        Map output records=21
        Map output bytes=187
        Map output materialized bytes=235
        Input split bytes=110
        Combine input records=0
        Combine output records=0
        Reduce input groups=15
        Reduce shuffle bytes=235
        Reduce input records=21
        Reduce output records=15
        Spilled Records=42
        Shuffled Maps =1
        Failed Shuffles=0
        Merged Map outputs=1
        GC time elapsed (ms)=42
        CPU time spent (ms)=0
        Physical memory (bytes) snapshot=0
        Virtual memory (bytes) snapshot=0
        Total committed heap usage (bytes)=578289664
        Shuffle Errors
        BAD_ID=0
        CONNECTION=0
        IO_ERROR=0
        WRONG_LENGTH=0
        WRONG_MAP=0
        WRONG_REDUCE=0
        File Input Format Counters
        Bytes Read=103
        File Output Format Counters
        Bytes Written=105
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_topn/output/
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-27 15:45 /khushil_topn/output/_SUCCESS
-rw-r--r--   1 hduser supergroup        105 2022-06-27 15:45 /khushil_topn/output/part-r-00000
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -cat /khushil_topn/output/part-r-00000
hadoop  4
i3
am      2
hi      1
im      1
is      1
there   1
bye     1
learing 1
awesome 1
love    1
khushil 1
cool    1
and     1
using   1
hduser@bmsce-Precision-T1700:~/Desktop/temperature$
```

3) Average Temperature

AverageDriver

```
package temp;

import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;

public class AverageDriver {
  public static void main(String[] args) throws Exception {
    if (args.length != 2) {
      System.err.println("Please Enter the input and output parameters");
      System.exit(-1);
    }
    Job job = new Job();
    job.setJarByClass(AverageDriver.class);
    job.setJobName("Max temperature");
    FileInputFormat.addInputPath(job, new Path(args[0]));
    FileOutputFormat.setOutputPath(job, new Path(args[1]));
    job.setMapperClass(AverageMapper.class);
    job.setReducerClass(AverageReducer.class);
    job.setOutputKeyClass(Text.class);
    job.setOutputValueClass(IntWritable.class);
    System.exit(job.waitForCompletion(true) ? 0 : 1);
  }
}
```

AverageMapper

```
package temp;

import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;

public class AverageMapper extends Mapper<LongWritable, Text, Text, IntWritable> {
  public static final int MISSING = 9999;
```

```
  public void map(LongWritable key, Text value, Mapper<LongWritable, Text, Text, IntWritable>.Context context) throws IOException, InterruptedException {
    int temperature;
    String line = value.toString();
    String year = line.substring(15, 19);
    if (line.charAt(87) == '+') {
      temperature = Integer.parseInt(line.substring(88, 92));
    } else {
      temperature = Integer.parseInt(line.substring(87, 92));
    }
    String quality = line.substring(92, 93);
    if (temperature != 9999 && quality.matches("[01459]"))
      context.write(new Text(year), new IntWritable(temperature));
  }
}
```

AverageReducer

```
package temp;

import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;

public class AverageReducer extends Reducer<Text, IntWritable, Text, IntWritable> {
  public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text, IntWritable>.Context context) throws IOException, InterruptedException {
    int max_temp = 0;
    int count = 0;
    for (IntWritable value : values) {
      max_temp += value.get();
      count++;
    }
    context.write(key, new IntWritable(max_temp / count));
  }
}
```

Output:

```
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-
Precision-T1700.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-
Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hduser-
secondarynamenode-bmsce-Precision-T1700.out
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-
Precision-T1700.out
hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-nodemanager-bmsce-
Precision-T1700.out
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ jps
6832 NodeManager
6498 ResourceManager
6339 SecondaryNameNode
4887 org.eclipse.equinox.launcher_1.5.600.v20191014-2022.jar
6954 Jps
6123 DataNode
5951 NameNode
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -le /
-le: Unknown command
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /
Found 31 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:35 /CSE
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:23 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:36 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:06 /amit_bda
drwxr-xr-x   - hduser supergroup          0 2022-06-27 11:42 /amit_lab
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:52 /bharath
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:43 /bharath035
drwxr-xr-x   - hduser supergroup          0 2022-06-24 14:54 /chi
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:21 /example
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:13 /foldernew
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /hemang061
drwxr-xr-x   - hduser supergroup          0 2022-06-20 15:16 /input_khushil
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:27 /irfan
drwxr-xr-x   - hduser supergroup          0 2022-06-22 10:44 /lwde
drwxr-xr-x   - hduser supergroup          0 2022-06-27 13:03 /mapreducejoin_amit
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:32 /muskan
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:06 /muskan_op
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:35 /muskan_output
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /new_folder
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:26 /one
drwxr-xr-x   - hduser supergroup          0 2022-06-24 15:30 /out55
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:17 /output
drwxr-xr-x   - hduser supergroup          0 2022-06-27 13:04 /output_TOPn
drwxr-xr-x   - hduser supergroup          0 2022-06-27 12:14 /output_Topn
drwxr-xr-x   - hduser supergroup          0 2022-06-24 12:42 /r1
drwxr-xr-x   - hduser supergroup          0 2022-06-24 12:24 /rgs
```

```
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:08 /saurab
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:46 /user1
-rw-r--r--   1 hduser supergroup       2436 2022-06-24 12:17 /wc.jar
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -mkdir /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./1901 /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./1902 /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_temperature
Found 2 items
-rw-r--r--   1 hduser supergroup     888190 2022-06-27 14:47 /khushil_temperature/1901
-rw-r--r--   1 hduser supergroup     888978 2022-06-27 14:47 /khushil_temperature/1902
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar ./avgtemp.jar AverageDriver
/khushil_temperature/1901 /khushil_temperature/output/
Exception in thread "main" java.lang.ClassNotFoundException: AverageDriver
 at java.net.URLClassLoader.findClass(URLClassLoader.java:382)
 at java.lang.ClassLoader.loadClass(ClassLoader.java:418)
 at java.lang.ClassLoader.loadClass(ClassLoader.java:351)
 at java.lang.Class.forName0(Native Method)
 at java.lang.Class.forName(Class.java:348)
 at org.apache.hadoop.util.RunJar.run(RunJar.java:214)
 at org.apache.hadoop.util.RunJar.main(RunJar.java:136)
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar ./avgtemp.jar
temperature.AverageDriver /khushil_temperature/1901 /khushil_temperature/output/
22/06/27 14:53:27 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 14:53:27 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 14:53:27 WARN mapreduce.JobSubmitter: Hadoop command-line option parsing not performed.
Implement the Tool interface and execute your application with ToolRunner to remedy this.
22/06/27 14:53:27 INFO input.FileInputFormat: Total input paths to process : 1
22/06/27 14:53:27 INFO mapreduce.JobSubmitter: number of splits:1
22/06/27 14:53:28 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local254968295_0001
22/06/27 14:53:28 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 14:53:28 INFO mapreduce.Job: Running job: job_local254968295_0001
22/06/27 14:53:28 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 14:53:28 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/27 14:53:28 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 14:53:28 INFO mapred.LocalJobRunner: Starting task: attempt_local254968295_0001_m_000000_0
22/06/27 14:53:28 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 14:53:28 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_temperature/1901:0+888190
22/06/27 14:53:28 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 14:53:28 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 14:53:28 INFO mapred.MapTask: soft limit at 83886080
22/06/27 14:53:28 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 14:53:28 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 14:53:28 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 14:53:28 INFO mapred.LocalJobRunner:
22/06/27 14:53:28 INFO mapred.MapTask: Starting flush of map output
22/06/27 14:53:28 INFO mapred.MapTask: Spilling map output
22/06/27 14:53:28 INFO mapred.MapTask: bufstart = 0; bufend = 59076; bufvoid = 104857600
22/06/27 14:53:28 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188144(104752576);
length = 26253/6553600
22/06/27 14:53:28 INFO mapred.MapTask: Finished spill 0
```

```
        FILE: Number of bytes written=723014
        FILE: Number of read operations=0
        FILE: Number of large read operations=0
        FILE: Number of write operations=0
        HDFS: Number of bytes read=1776380
        HDFS: Number of bytes written=8
        HDFS: Number of read operations=13
        HDFS: Number of large read operations=0
        HDFS: Number of write operations=4
    Map-Reduce Framework
        Map input records=6565
        Map output records=6564
        Map output bytes=59076
        Map output materialized bytes=72210
        Input split bytes=112
        Combine input records=0
        Combine output records=0
        Reduce input groups=1
        Reduce shuffle bytes=72210
        Reduce input records=6564
        Reduce output records=1
        Spilled Records=13128
        Shuffled Maps =1
        Failed Shuffles=0
        Merged Map outputs=1
        GC time elapsed (ms)=55
        CPU time spent (ms)=0
        Physical memory (bytes) snapshot=0
        Virtual memory (bytes) snapshot=0
        Total committed heap usage (bytes)=999292928
    Shuffle Errors
        BAD_ID=0
        CONNECTION=0
        IO_ERROR=0
        WRONG_LENGTH=0
        WRONG_MAP=0
        WRONG_REDUCE=0
    File Input Format Counters
        Bytes Read=888190
    File Output Format Counters
        Bytes Written=8
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_temperature/output/
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-27 14:53 /khushil_temperature/output/_SUCCESS
-rw-r--r--   1 hduser supergroup          8 2022-06-27 14:53 /khushil_temperature/output/part-r-
00000
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -cat /khushil_temperature/output/part-
r-00000
1901    46
hduser@bmsce-Precision-T1700:~/Desktop/temperature$
```

4) Join

```
// JoinDriver.java
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
import org.apache.hadoop.mapred.lib.MultipleInputs;
import org.apache.hadoop.util.*;

public class JoinDriver extends Configured implements Tool {

   public static class KeyPartitioner implements Partitioner<TextPair, Text> {
      @Override
      public void configure(JobConf job) {
      }

      @Override
      public int getPartition(TextPair key, Text value, int numPartitions) {
         return (key.getFirst().hashCode() & Integer.MAX_VALUE) %
               numPartitions;
      }
   }

@Override

public int run(String[] args) throws Exception {

if (args.length != 3) {
System.out.println("Usage: <Department Emp Strength input>

<Department Name input> <output>");
return -1;
}

JobConf conf = new JobConf(getConf(), getClass());

conf.setJobName("Join 'Department Emp Strength input' with 'Department Name
input'");

Path AInputPath = new Path(args[0]);
```

```
Path BInputPath = new Path(args[1]);
Path outputPath = new Path(args[2]);

MultipleInputs.addInputPath(conf, AInputPath, TextInputFormat.class,

Posts.class);
MultipleInputs.addInputPath(conf, BInputPath, TextInputFormat.class,
User.class);
FileOutputFormat.setOutputPath(conf, outputPath);
conf.setPartitionerClass(KeyPartitioner.class);
conf.setOutputValueGroupingComparator(TextPair.FirstComparator.class);
conf.setMapOutputKeyClass(TextPair.class);
conf.setReducerClass(JoinReducer.class);
conf.setOutputKeyClass(Text.class);
JobClient.runJob(conf);

return 0;
}

   public static void main(String[] args) throws Exception {

      int exitCode = ToolRunner.run(new JoinDriver(), args);
      System.exit(exitCode);
   }
}

// JoinReducer.java
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
public class JoinReducer extends MapReduceBase implements Reducer<TextPair, Text, Text,
Text> {
@Override
public void reduce (TextPair key, Iterator<Text> values, OutputCollector<Text, Text>
output, Reporter reporter)
throws IOException
{

Text nodeId = new Text(values.next());
```

```
while (values.hasNext()) {

Text node = values.next();
Text outValue = new Text(nodeId.toString() + "\t\t" + node.toString());
output.collect(key.getFirst(), outValue);
}
}
}

// User.java
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.FSDataInputStream;
import org.apache.hadoop.fs.FSDataOutputStream;
import org.apache.hadoop.fs.FileSystem;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;

import org.apache.hadoop.io.IntWritable;

public class User extends MapReduceBase implements Mapper<LongWritable, Text, TextPair,
Text> {

@Override
public void map(LongWritable key, Text value, OutputCollector<TextPair, Text> output,
Reporter reporter)

throws IOException

{

String valueString = value.toString();

String[] SingleNodeData = valueString.split("\t");
output.collect(new TextPair(SingleNodeData[0], "1"), new

Text(SingleNodeData[1]));
```

```
}
}

// Posts.java
import java.io.IOException;

import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;

public class Posts extends MapReduceBase implements Mapper<LongWritable, Text, TextPair,
Text> {

@Override
public void map(LongWritable key, Text value, OutputCollector<TextPair, Text> output,
Reporter reporter)
throws IOException
{
String valueString = value.toString();
String[] SingleNodeData = valueString.split("\t");
output.collect(new TextPair(SingleNodeData[3], "0"), new

Text(SingleNodeData[9]));
}
}

// TextPair.java
import java.io.*;

import org.apache.hadoop.io.*;

public class TextPair implements WritableComparable<TextPair> {

   private Text first;
   private Text second;

   public TextPair() {
      set(new Text(), new Text());
   }

   public TextPair(String first, String second) {
```

```
    set(new Text(first), new Text(second));
  }

  public TextPair(Text first, Text second) {
    set(first, second);
  }

  public void set(Text first, Text second) {
    this.first = first;
    this.second = second;
  }

  public Text getFirst() {
    return first;
  }

  public Text getSecond() {
    return second;
  }

  @Override
  public void write(DataOutput out) throws IOException {
    first.write(out);
    second.write(out);
  }

  @Override
  public void readFields(DataInput in) throws IOException {
    first.readFields(in);
    second.readFields(in);
  }

  @Override
  public int hashCode() {
    return first.hashCode() * 163 + second.hashCode();
  }

  @Override
  public boolean equals(Object o) {
    if (o instanceof TextPair) {
```

```
      TextPair tp = (TextPair) o;
      return first.equals(tp.first) && second.equals(tp.second);
    }
    return false;
  }

  @Override
  public String toString() {
    return first + "\t" + second;
  }

  @Override
  public int compareTo(TextPair tp) {
    int cmp = first.compareTo(tp.first);
    if (cmp != 0) {
      return cmp;
    }
    return second.compareTo(tp.second);
  }
  // ^^ TextPair

  // vv TextPairComparator
  public static class Comparator extends WritableComparator {

    private static final Text.Comparator TEXT_COMPARATOR = new Text.Comparator();

    public Comparator() {
      super(TextPair.class);
    }

    @Override
    public int compare(byte[] b1, int s1, int l1,
        byte[] b2, int s2, int l2) {

      try {
        int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
        int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
        int cmp = TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
        if (cmp != 0) {
          return cmp;
```

```
        }
        return TEXT_COMPARATOR.compare(b1, s1 + firstL1, l1 - firstL1,

                b2, s2 + firstL2, l2 - firstL2);
      } catch (IOException e) {
        throw new IllegalArgumentException(e);
      }
    }
}

static {
  WritableComparator.define(TextPair.class, new Comparator());
}

public static class FirstComparator extends WritableComparator {

  private static final Text.Comparator TEXT_COMPARATOR = new Text.Comparator();

  public FirstComparator() {
    super(TextPair.class);
  }

  @Override
  public int compare(byte[] b1, int s1, int l1,
      byte[] b2, int s2, int l2) {

    try {
      int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
      int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
      return TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
    } catch (IOException e) {
      throw new IllegalArgumentException(e);
    }
  }

  @Override
  public int compare(WritableComparable a, WritableComparable b) {
    if (a instanceof TextPair && b instanceof TextPair) {
      return ((TextPair) a).first.compareTo(((TextPair) b).first);
    }
```

```
        return super.compare(a, b);
      }
    }
}
```

Output:

```
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -ls /khushil_join
ls: `/khushil_join': No such file or directory
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -mkdir /khushil_join
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -ls /khushil_join
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -put ./DeptName.txt
/khushil_join/
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -put ./DeptStrength.txt
/khushil_join/
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hadoop jar MapReduceJoin.jar
/khushil_join/DeptName.txt /khushil_join/DeptStrength.txt /khushil_join/output/
22/06/27 15:12:24 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 15:12:24 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 15:12:24 INFO jvm.JvmMetrics: Cannot initialize JVM Metrics with processName=JobTracker,
sessionId= - already initialized
22/06/27 15:12:24 INFO mapred.FileInputFormat: Total input paths to process : 1
22/06/27 15:12:24 INFO mapred.FileInputFormat: Total input paths to process : 1
22/06/27 15:12:24 INFO mapreduce.JobSubmitter: number of splits:2
22/06/27 15:12:24 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1238804660_0001
22/06/27 15:12:24 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 15:12:24 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 15:12:24 INFO mapreduce.Job: Running job: job_local1238804660_0001
22/06/27 15:12:24 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapred.FileOutputCommitter
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Starting task: attempt_local1238804660_0001_m_000000_0
22/06/27 15:12:24 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:12:24 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_join/DeptName.txt:0+59
22/06/27 15:12:24 INFO mapred.MapTask: numReduceTasks: 1
22/06/27 15:12:24 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:12:24 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 15:12:24 INFO mapred.MapTask: soft limit at 83886080
22/06/27 15:12:24 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 15:12:24 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 15:12:24 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 15:12:24 INFO mapred.LocalJobRunner:
22/06/27 15:12:24 INFO mapred.MapTask: Starting flush of map output
22/06/27 15:12:24 INFO mapred.MapTask: Spilling map output
22/06/27 15:12:24 INFO mapred.MapTask: bufstart = 0; bufend = 63; bufvoid = 104857600
22/06/27 15:12:24 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26214384(104857536);
length = 13/6553600
22/06/27 15:12:24 INFO mapred.MapTask: Finished spill 0
22/06/27 15:12:24 INFO mapred.Task: Task:attempt_local1238804660_0001_m_000000_0 is done. And is in
the process of committing
22/06/27 15:12:24 INFO mapred.LocalJobRunner: hdfs://localhost:54310/khushil_join/DeptName.txt:0+59
22/06/27 15:12:24 INFO mapred.Task: Task 'attempt_local1238804660_0001_m_000000_0' done.
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Finishing task:
attempt_local1238804660_0001_m_000000_0
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Starting task: attempt_local1238804660_0001_m_000001_0
22/06/27 15:12:24 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:12:24 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_join/DeptStrength.txt:0+50
22/06/27 15:12:24 INFO mapred.MapTask: numReduceTasks: 1
22/06/27 15:12:24 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:12:24 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
```

```
FILE: Number of bytes read=26370
FILE: Number of bytes written=782871
FILE: Number of read operations=0
FILE: Number of large read operations=0
FILE: Number of write operations=0
HDFS: Number of bytes read=277
HDFS: Number of bytes written=85
HDFS: Number of read operations=28
HDFS: Number of large read operations=0
HDFS: Number of write operations=5
Map-Reduce Framework
Map input records=8
Map output records=8
Map output bytes=117
Map output materialized bytes=145
Input split bytes=443
Combine input records=0
Combine output records=0
Reduce input groups=4
Reduce shuffle bytes=145
Reduce input records=8
Reduce output records=4
Spilled Records=16
Shuffled Maps =2
Failed Shuffles=0
Merged Map outputs=2
GC time elapsed (ms)=2
CPU time spent (ms)=0
Physical memory (bytes) snapshot=0
Virtual memory (bytes) snapshot=0
Total committed heap usage (bytes)=913833984
Shuffle Errors
BAD_ID=0
CONNECTION=0
IO_ERROR=0
WRONG_LENGTH=0
WRONG_MAP=0
WRONG_REDUCE=0
File Input Format Counters
Bytes Read=0
File Output Format Counters
Bytes Written=85
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -cat /khushil_join/output2/part-
00000
A11     50          Finance
B12     100         HR
C13     250         Manufacturing
Dept_ID Total_Employee          Dept_Name
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$
```

Scala Programming:

Lab 9:

```
val data=sc.textFile("sparkdata.txt")
data.collect;
val splitdata = data.flatMap(line => line.split(" "));
splitdata.collect;
val mapdata = splitdata.map(word => (word,1));
mapdata.collect;
val reducedata = mapdata.reduceByKey(_+_); reducedata.collect;
```

```
scala> val data = sc.textFile("input.txt")
data: org.apache.spark.rdd.RDD[String] = input.txt MapPartitionsRDD[3] at textFile at <console>:23

scala> data.collect()
res3: Array[String] = Array(hi there im khushil, im here to run spark and hadoop, lets see which is better)

scala> val splitdata = data.flatMap(line => line.split(" "));
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[4] at flatMap at <console>:23

scala> splitdata.collect();
res4: Array[String] = Array(hi, there, im, khushil, im, here, to, run, spark, and, hadoop, lets, see, which, is, better)

scala> val mapdata = splitdata.map(word=>(word,1));
mapdata: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[5] at map at <console>:23

scala> val reducedata = mapdata.reduceByKey(_+_);
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[6] at reduceByKey at <console>:23

scala> reducedata.collect();
res5: Array[(String, Int)] = Array((im,2), (is,1), (here,1), (there,1), (better,1), (khushil,1), (lets,1), (spark,1), (run,1), (hadoop,1), (hi,1), (to,1), (see,1), (which,1), (and,1))

scala> reducedata.saveAsTextFile("output.txt");

scala>
```

Lab 10:

```
val textFile = sc.textFile("/home/bhoom/Desktop/wc.txt")
val counts = textFile.flatMap(line => line.split(" ")).map(word => (word, 1)).reduceByKey(_ + _)
import scala.collection.immutable.ListMap
val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)// sort in descending order based on values
println(sorted)
for((k,v)<-sorted)
{
if(v>4)
```

```
{
print(k+",")
print(v)
println()
}}
```

```
scala> val filerdd = sc.textFile("input.txt");
filerdd: org.apache.spark.rdd.RDD[String] = input.txt MapPartitionsRDD[13] at textFile at <console>:24

scala> val counts = filerdd.flatMap(line=>line.split(" ")).map(word=>(word,1)).reduceByKey(_+_);
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[16] at reduceByKey at <console>:24

scala> import scala.collection.immutable.ListMap
import scala.collection.immutable.ListMap

scala> val sorted = ListMap(counts.collect.sortWith(_._2 > _._2): _*);
sorted: scala.collection.immutable.ListMap[String,Int] = ListMap(im -> 2, is -> 1, here -> 1, there -> 1
, better -> 1, khushil -> 1, lets -> 1, spark -> 1, run -> 1, hadoop -> 1, hi -> 1, to -> 1, see -> 1, w
hich -> 1, and -> 1)

scala> println(sorted);
ListMap(im -> 2, is -> 1, here -> 1, there -> 1, better -> 1, khushil -> 1, lets -> 1, spark -> 1, run -
> 1, hadoop -> 1, hi -> 1, to -> 1, see -> 1, which -> 1, and -> 1)

scala> for((k,v)<-sorted)
     | {
     | if(v>4)
     | {
     | print(k+",")
     | print(v)
     | println()
     | }
     | }

scala> for((k,v)<-sorted)
     | {
     | println(k+",")
     | println(v)
     | println()
     | }
im,
2

is,
1

here,
1

there,
1

better,
1

khushil,
1

lets,
1

spark,
1
```