

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



LAB REPORT
on

BIG DATA ANALYTICS

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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Department of Computer Science and Engineering



CERTIFICATE

This is to certify that the Lab work entitled "LAB COURSE **BIG DATA ANALYTICS** " was **carried** out by Rakesh R Shastri(**1BM21CS410**), 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 2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **Big Data Analytics - (20CS6PEBDA)** work prescribed for the said degree.

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Program 01: MongoDB commands

To execute create, insert, update, find and count commands of MongoDB

```
$mongosh
```

```
test> show dbs;
admin 40.00 KiB
config 60.00 KiB
local 72.00 KiB
```

```
test> use database1
```

```
database1> db.createCollection("student");
database1> db.student.insert({_id:1,StudName:"student1",Sem:6});
{ acknowledged: true, insertedIds: { '0': 1 } }
database1> db.student.insert({_id:2,StudName:"student2",Sem:6});
{ acknowledged: true, insertedIds: { '0': 2 } }
database1> db.student.insert({_id:3,StudName:"student3",Sem:6});
{ acknowledged: true, insertedIds: { '0': 3 } }
database1> db.student.insert({_id:4,StudName:"student4",Sem:6});
{ acknowledged: true, insertedIds: { '0': 4 } }
database1> db.student.insert({_id:5,StudName:"student5",Sem:6});
{ acknowledged: true, insertedIds: { '0': 5 } }
database1> db.student.insert({_id:6,StudName:"student6",Sem:6});
{ acknowledged: true, insertedIds: { '0': 6 } }
```

```
database1> show collectionsstudent
```

```
database1> db.student.find()[
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 6 },
  { _id: 5, StudName: 'student5', Sem: 6 },
  { _id: 6, StudName: 'student6', Sem: 6 }
]
```

```
database1> db.student.find({StudName:"student1"});[ { _id: 1,
StudName: 'student1', Sem: 6 } ]
```

```
database1> db.student.count()6
```

```
database1> db.student.find({Sem:6});[
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 6 },
  { _id: 5, StudName: 'student5', Sem: 6 },
  { _id: 6, StudName: 'student6', Sem: 6 }
]
```

```
database1>
```

```
db.student.update({_id:4,StudName:"student4"},{$set:{Sem:7}},{upsert:true});
```

```
database1> db.student.find()[
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5', Sem: 6 },
  { _id: 6, StudName: 'student6', Sem: 6 }
]
```

```
database1> db.student.find().pretty([
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5', Sem: 6 },
  { _id: 6, StudName: 'student6', Sem: 6 }
])
```

```
]
```

```
database1>
```

```
db.student.update({_id:5,StudName:"student5"},{$unset:{Sem:6}},{upsert:true});
```

```
database1> db.student.find().pretty()[
```

```
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5' },
  { _id: 6, StudName: 'student6', Sem: 6 }
]
```

```
database1> db.student.update({_id:6},{ $set:{OE:"OR"}},{upsert:true});database1>
db.student.find()
```

```
[
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5' },
  { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' }
]
```

```
database1> db.student.find({OE:"OR"});
```

```
[ { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' } ]
```

```
database1> db.student.count({Sem:6});4
```

```
database1> db.student.find({Sem:6}).limit(4);[
```

```
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' }
]
```

```
]
database1> db.student.find({StudName:"student2",Sem:6});[ { _id: 2,
StudName: 'student2', Sem: 6 } ]
```

```
database1> db.student.find().sort({StudName:1}).pretty();[
  { _id: 1, StudName: 'student1', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5' },
  { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' }
]
```

```
database1> db.student.find().sort({StudName:-1}).pretty();[
  { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' },
  { _id: 5, StudName: 'student5' },
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 3, StudName: 'student3', Sem: 6 },
  { _id: 2, StudName: 'student2', Sem: 6 },
  { _id: 1, StudName: 'student1', Sem: 6 }
]
```

```
database1> db.student.find().skip(3).pretty()[
  { _id: 4, StudName: 'student4', Sem: 7 },
  { _id: 5, StudName: 'student5' },
  { _id: 6, StudName: 'student6', Sem: 6, OE: 'OR' }
]
```

```
database1> db.student.count({Sem:7});1
```

Program 02: Cassandra Commands

Perform the following DB operations using Cassandra

1. Create a keyspace by name Employee

```
create keyspace Employee with replication = {  
    ... 'class':'SimpleStrategy',  
    ... 'replication_factor':1  
    ... };
```

```
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 EmployeeInfo (  
    ... EmplID int PRIMARY KEY,  
    ... EmplName text,  
    ... Designation text,  
    ... DateOfJoining timestamp,  
    ... Salary int,  
    ... DeptName text  
    ... );
```

3. Insert the values into the table in batch

```
begin batch
```

```
insert into EmployeeInfo (EmplID, EmplName, Designation,  
DateOfJoining, Salary, DeptName) values (101, 'employee1','designation1',  
'2020-03-29', 40000, 'dept1')
```

```
insert into EmployeeInfo (EmplID, EmplName, Designation,  
DateOfJoining, Salary, DeptName) values (102, 'employee2','designation2',  
'2020-06-04', 60000, 'dept1')
```

```
insert into EmployeeInfo (EmplID, EmplName, Designation,
```


DateOfJoining, Salary, DeptName) values (103,'employee3',
'designation3', '2020-04-21', 75000, 'dept1')

insert into EmployeeInfo (EmplID, EmplName, Designation,
DateOfJoining, Salary, DeptName) values (104, 'employee4','designation4',
'2020-12-02', 90000, 'dept2')

insert into EmployeeInfo (EmplID, EmplName, Designation,
DateOfJoining, Salary, DeptName) values (105, 'employee5','designation5',
'2020-09-11', 15000, 'dept2')

apply batch;

emplid	dateofjoining	deptname	designation	emplname	salary
105	2020-09-10 18:30:00.000000+0000	dept2	designation5	employee5	15000
104	2020-12-01 18:30:00.000000+0000	dept2	designation4	employee4	90000
102	2020-06-03 18:30:00.000000+0000	dept1	designation2	employee2	60000
101	2020-03-28 18:30:00.000000+0000	dept1	designation1	employee1	40000
103	2020-04-20 18:30:00.000000+0000	dept1	designation3	employee3	75000

4. Update Employee name and Department of Emp-Id 121

insert into EmployeeInfo (EmplID, EmplName, Designation,
DateOfJoining, Salary, DeptName) values (121, 'employee6','designation6',
'2020-10-18', 45000, 'dept1');

select * from EmployeeInfo;

emplid	dateofjoining	deptname	designation	emplname	salary
105	2020-09-10 18:30:00.000000+0000	dept2	designation5	employee5	15000
121	2020-10-17 18:30:00.000000+0000	dept1	designation6	employee6	45000
104	2020-12-01 18:30:00.000000+0000	dept2	designation4	employee4	90000
102	2020-06-03 18:30:00.000000+0000	dept1	designation2	employee2	60000
101	2020-03-28 18:30:00.000000+0000	dept1	designation1	employee1	40000
103	2020-04-20 18:30:00.000000+0000	dept1	designation3	employee3	75000

```
update EmployeeInfo SET EmplName='employee7', DeptName='dept2' where EmplID=121;
```

```
select * from EmployeeInfo;
```

	emplid	dateofjoining	deptname	designation	emplname	salary
	105	2020-09-10 18:30:00.000000+0000	dept2	designation5	employee5	15000 121
		2020-10-17 18:30:00.000000+0000	dept2	designation6	employee7	45000 104
		2020-12-01 18:30:00.000000+0000	dept2	designation4	employee4	90000 102
		2020-06-03 18:30:00.000000+0000	dept1	designation2	employee2	60000 101
	2020-03-28 18:30:00.000000+0000		dept1	designation1	employee1	40000 103
		2020-04-20 18:30:00.000000+0000	dept1	designation3	employee3	75000

5. Sort the details of Employee records based on salary

```
select * from Employee_info where Emp_id in(101,102,103,104,121,105)order by salary desc;
```

	emplid	dateofjoining	deptname	designation	emplname	salary
	105	2020-09-10 18:30:00.000000+0000	dept2	designation5	employee5	15000 121
		2020-10-17 18:30:00.000000+0000	dept2	designation6	employee7	45000 104
		2020-12-01 18:30:00.000000+0000	dept2	designation4	employee4	90000 102
		2020-06-03 18:30:00.000000+0000	dept1	designation2	employee2	60000 101
	2020-03-28 18:30:00.000000+0000		dept1	designation1	employee1	40000 103
		2020-04-20 18:30:00.000000+0000	dept1	designation3	employee3	75000

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

```
alter table EmployeeInfo add Projects text;select * from
```

```
EmployeeInfo;
```

	emplid	dateofjoining	deptname	designation	emplname	projects	salary
	105	2020-09-10 18:30:00.000000+0000	dept2	designation5	employee5	null	15000 121
	2020-10-17 18:30:00.000000+0000		dept2	designation6	employee7	null	45000 104
		2020-12-01 18:30:00.000000+0000	dept2	designation4	employee4	null	90000 102
		2020-06-03 18:30:00.000000+0000	dept1	designation2	employee2	null	60000 101
	2020-03-28						

18:30:00.000000+0000 | dept1 | designation1 | employee1 | null | 40000 103 | 2020-04-2018:30:00.000000+0000 | dept1 |
designation3 | employee3 | null | 75000

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

insert into EmployeeInfo (Emp_id, Emp_name, Designation, DOJ, salary,
Dept_name) values (161,'Ryan','Associate
professor','2022-05-11',95000,'ISE') using ttl 60;

select ttl(Emp_name) from Employee_info where Emp_id = 161 and salary =
95000;

ttl(emp_name)

53

(1 rows)

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Program 03: Cassandra Library Database

Perform the following DB operations using Cassandra.

1. Create a keyspace by name Library

```
create keyspace libInfo with replication = {  
    ... 'class':'SimpleStrategy',  
    ... 'replication_factor':1  
    ... };
```

```
use libInfo;
```

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

```
create table libInfo (  
    ... studID int,  
    ... studName text,  
    ... bookID int,  
    ... bookName text,  
    ... dateOfIssue timestamp,  
    ... counterValue counter,  
    ... primary key ((studID, bookID), studName, bookName,dateOfIssue)  
    ... );
```

3. Insert the values into the table in batch

```
update libInfo
```

```
    ... set counterValue=counterValue+1  
    ... where studID = 001 and studName = 'Raj' and bookID  
= 101 and bookName = 'The Midnight Library' and dateOfIssue ='2023-05-08';
```

```
update libInfo
```

```
    ... set counterValue=counterValue+1  
    ... where studID = 002 and studName = 'Krishna' and bookID  
= 102 and bookName = 'The Little Coffee Shop of Kabul' anddateOfIssue =  
'2023-03-07';
```

update libInfo

```
... set counterValue=counterValue+1
... where studID = 003 and studName = 'Trupti' and bookID =
103 and bookName = 'Tokyo Ueno Station' and dateOfIssue ='2022-12-26';
```

update libInfo

```
... set counterValue=counterValue+1
... where studID = 004 and studName = 'Arya' and bookID =
104 and bookName = 'A Thousand Splendid Suns' and dateOfIssue ='2022-10-03';
```

update libInfo

```
... set counterValue=counterValue+1
... where studID = 005 and studName = 'Karan' and bookID =
105 and bookName = 'Portrait of an Unknown Woman' and dateOfIssue ='2023-01-28';
```

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

select * from libInfo;

```
studid | bookid | studname | bookname | dateofissue | countervalue
-----+-----+-----+-----+-----+-----
1 | 101 | Raj | The Midnight Library | 2023-05-07 18:30:00.000000+0000 | 1
3 | 103 | Trupti | Tokyo Ueno Station | 2022-12-25 18:30:00.000000+0000 | 1
2 | 102 | Krishna | The Little Coffee Shop of Kabul | 2023-03-06 18:30:00.000000+0000 | 15 | 105 | Karan | Portrait of an
Unknown Woman | 2023-01-27 18:30:00.000000+0000 | 1
4 | 104 | Arya | A Thousand Splendid Suns | 2022-10-02 18:30:00.000000+0000 | 1
```

update libInfo

```
... set counterValue=counterValue+1
... where studID = 005 and studName = 'Karan' and bookID =
105 and bookName = 'Portrait of an Unknown Woman' and dateOfIssue ='2023-01-28';
select * from libInfo;
```

```
studid | bookid | studname | bookname | dateofissue | countervalue
```

```

-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
-----
1 | 101 | Raj | The Midnight Library | 2023-05-07 18:30:00.000000+0000 | 1
3 | 103 | Trupti | Tokyo Ueno Station | 2022-12-25 18:30:00.000000+0000 | 1
2 | 102 | Krishna | The Little Coffee Shop of Kabul | 2023-03-06 18:30:00.000000+0000 | 15 | 105 | Karan | Portrait of an
Unknown Woman | 2023-01-27 18:30:00.000000+0000 | 2
4 | 104 | Arya | A Thousand Splendid Suns | 2022-10-02 18:30:00.000000+0000 | 1

```

5. Write a query to show that a student with id 114 has taken a book “UNIX” 2 times.

```

select studID from libInfo where bookName = 'Portrait of an UnknownWoman' and
counterValue = 2 allow filtering;

```

```

studid
-----
5

```

6. Export the created column to a csv file

```

copy libInfo(studID, studName, bookID, bookName, dateOfIssue,counterValue) to
'c:\libInfo.csv';

```

Using 3 child processes

Starting copy of libinfo.libinfo with columns [studid, studname,bookid, bookname, dateofissue, countervalue].

Processed: 5 rows; Rate: 2 rows/s; Avg. rate: 1 rows/s 5 rowsexported to 1 files in 9.163 seconds.

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

```
truncate library_info;  
select * from library_info;
```

```
studid | bookid | studname | bookname | dateofissue | countervalue  
-----+-----+-----+-----+-----+-----  
-
```

(0 rows)

```
copy libInfo(studID, studName, bookID, bookName, dateOfIssue,counterValue) to  
'c:\libInfo.csv';  
Using 3 child processes
```

Starting copy of libinfo.libinfo with columns [studid, studname,bookid, bookname,
dateofissue, countervalue].

Processed: 5 rows; Rate: 2 rows/s; Avg. rate: 1 rows/s 5 rowsexported to 1 files in
9.163 seconds.

Program 04: Hadoop Commands

```
$start-all.sh
```

WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.

WARNING: This is not a recommended production deployment configuration.

WARNING: Use CTRL-C to abort.

Starting namenodes on [localhost]Starting datanodes

Starting secondary namenodes

[bmscecse-HP-Elite-Tower-600-G9-Desktop-PC]Starting resourcemanager

Starting nodemanagers

#to check all daemons have loaded successfully

```
$jps
```

```
9056 Jps
```

```
7475 ResourceManager
```

```
6709 NameNode
```

```
7160 SecondaryNameNode
```

```
7659 NodeManager
```

```
6875 DataNode
```

#mkdir command

```
hdfs dfs -mkdir /bda
```

ls command

```
hadoop fs -ls /Found
```

4 items

```
drwxr-xr-x - hadoop supergroup 0 2023-05-08 09:40 /abc drwxr-xr-x
```

```
- hadoop supergroup 0 2023-05-11 13:57 /bda drwxr-xr-x - hadoop supergroup 0 2023-05-04 12:49 /inputbda
```

```
drwxr-xr-x - hadoop supergroup 0 2023-04-27 11:44 /siri# to append text in a file in hdfs
```

```
echo "<Text to append>" | hdfs dfs -appendToFile -
```


/user/hduser/myfile.txt OR

hdfs dfs -appendToFile - /user/hduser/myfile.txt

and then type the text on the terminal. Once you are done typing then hit 'Ctrl+D'

#cat command

echo "hello world bda lab" | hdfs dfs -appendToFile - /bda/hello.txt

hdfs dfs -cat /bda/hello.txt

hello world
bda lab

#put & copyFromLocal command

hdfs dfs -put Desktop/hadooplocal.txt /bda/hadoop.txt

hdfs dfs -cat /bda/hadoop.txt

/bda/hadoop.txt

local file created in the desktop

get command

hdfs dfs -touchz /bda/labfile.txt

echo "copying hdfs file to a local file using get command" | hdfs dfs

-appendToFile - /bda/labfile.txt

hdfs dfs -cat /bda/labfile.txt

copying hdfs file to a local file using get command

hdfs dfs -get /bda/labfile.txt Desktop/getcmd.txt
Contents of
getcmd.txt file in Desktop is:

copying hdfs file to a local file using get command

command

hdfs dfs -touchz /bda/ghost.txt

```
echo "new hdfs file in hdfs folder" | hdfs dfs -appendToFile -  
/bda/ghost.txt
```

```
hdfs dfs -cat /bda/ghost.txtnew hdfs  
file in hdfs folder
```

```
hdfs dfs -copyToLocal /bda/ghost.txt Desktop/bigdata.txt
```

```
#Contents of bigdata.txt file in desktop is:new hdfs file in
```

```
hdfs folder
```

```
#mv command
```

```
hdfs dfs -ls /bdaFound
```

```
4 items
```

-rw-r--r-- 1 hadoop	supergroup	29	2023-05-11	14:39
/bda/ghost.txt				
-rw-r--r-- 1 hadoop	supergroup	34	2023-05-11	14:26
/bda/hadoop.txt				
-rw-r--r-- 1 hadoop	supergroup	20	2023-05-11	14:11
/bda/hello.txt				
-rw-r--r-- 1 hadoop	supergroup	52	2023-05-11	14:32
/bda/labfile.txt				

```
hadoop fs -mv /bda/hello.txt /dir
```

```
hdfs dfs -ls /bda
```

```
Found 3 items
```

-rw-r--r-- 1 hadoop	supergroup	29	2023-05-11	14:39
/bda/ghost.txt				
-rw-r--r-- 1 hadoop	supergroup	34	2023-05-11	14:26
/bda/hadoop.txt				
-rw-r--r-- 1 hadoop	supergroup	52	2023-05-11	14:32
/bda/labfile.txt				

```
hdfs dfs -ls /dir
```

```
-rw-r--r-- 1 hadoop supergroup 20 2023-05-11 14:11 /dir
```

```
#cp command
```

```
hadoop fs -cp /bda /rest
```

```
hdfs dfs -ls /bda
```

```
Found 3 items
```

```
-rw-r--r-- 1 hadoop supergroup 29 2023-05-11 14:39  
/bda/ghost.txt  
-rw-r--r-- 1 hadoop supergroup 34 2023-05-11 14:26  
/bda/hadoop.txt  
-rw-r--r-- 1 hadoop supergroup 52 2023-05-11 14:32  
/bda/labfile.txt
```

```
hdfs dfs -ls /rest
```

```
Found 3 items
```

```
-rw-r--r-- 1 hadoop supergroup 29 2023-05-11 14:50  
/rest/ghost.txt  
-rw-r--r-- 1 hadoop supergroup 34 2023-05-11 14:50  
/rest/hadoop.txt  
-rw-r--r-- 1 hadoop supergroup 52 2023-05-11 14:50  
/rest/labfile.txt
```

Program 05: Word Count Program in Hadoop

WCDriver.java

```
// 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);
    }
}

```

WCMapper.java

```

// 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));
            }
        }
    }
}

```

```

    }
}
}

```

WCReducer.java

```

// 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) throwsIOException

{
    int count = 0;
// Counting the frequency of each wordswhile
    (value.hasNext())
    {
        IntWritable i = value.next();count +=
        i.get();
    }
    output.collect(key, new IntWritable(count));
}
}

```

Output:

```
Found 2 items
-rw-r--r-- 1 hadoop supergroup 0 2023-06-24 10:18 /optemp/ SUCCESS
-rw-r--r-- 1 hadoop supergroup 8 2023-06-24 10:18 /optemp/part-r-000000
hadoop@bascesce-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -cat /optemp/part-r-000000
1901 46
hadoop@bascesce-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop jar /home/hadoop/Desktop/AvgTemp.jar AvgDriver /iptemp/1902 /optemp
2023-06-24 11:03:30.175 INFO Impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2023-06-24 11:03:30.214 INFO Impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2023-06-24 11:03:30.214 INFO Impl.MetricsSystemImpl: JobTracker metrics system started
Exception in thread "main" org.apache.hadoop.mapred.FileAlreadyExistsException: Output directory hdfs://localhost:9000/optemp already exists
    at org.apache.hadoop.mapreduce.lib.output.FileOutputFormat.checkOutputSpecs(FileOutputFormat.java:164)
    at org.apache.hadoop.mapreduce.JobSubmitter.checkSpecs(JobSubmitter.java:277)
    at org.apache.hadoop.mapreduce.JobSubmitter.submitJobInternal(JobSubmitter.java:143)
    at org.apache.hadoop.mapreduce.Job$11.run(Job.java:1571)
    at org.apache.hadoop.mapreduce.Job$11.run(Job.java:1568)
    at java.base/java.security.AccessController.doPrivileged(Native Method)
    at java.base/javax.security.auth.Subject.doAs(Subject.java:423)
    at org.apache.hadoop.mapreduce.Job.doAs(UserGroupInformation.java:1878)
    at org.apache.hadoop.mapreduce.Job.submit(Job.java:1568)
    at org.apache.hadoop.mapreduce.Job.waitForCompletion(Job.java:1589)
    at AvgDriver.main(AvgDriver.java:22)
    at java.base/jdk.internal.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
    at java.base/jdk.internal.reflect.NativeMethodAccessorImpl.invoke(NativeMethodAccessorImpl.java:62)
    at java.base/jdk.internal.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:43)
    at java.base/java.lang.reflect.Method.invoke(Method.java:566)
    at org.apache.hadoop.util.RunJar.run(RunJar.java:323)
    at org.apache.hadoop.util.RunJar.main(RunJar.java:236)
hadoop@bascesce-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop jar /home/hadoop/Desktop/AvgTemp.jar AvgDriver /iptemp/1902 /optemp1
2023-06-24 11:03:34.060 INFO Impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2023-06-24 11:03:34.100 INFO Impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2023-06-24 11:03:34.100 INFO Impl.MetricsSystemImpl: JobTracker metrics system started
2023-06-24 11:03:34.162 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2023-06-24 11:03:34.198 INFO Input.FileInputFormat: Total input files to process : 1
2023-06-24 11:03:34.225 INFO mapreduce.JobSubmitter: number of splits:1
2023-06-24 11:03:34.287 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1935691243_0001
2023-06-24 11:03:34.287 INFO mapreduce.JobSubmitter: Executing with tokens: []
2023-06-24 11:03:34.349 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2023-06-24 11:03:34.349 INFO mapreduce.Job: Running job: job_local1935691243_0001
2023-06-24 11:03:34.350 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2023-06-24 11:03:34.354 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-06-24 11:03:34.354 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup_temporary folders under output directory:false, ignore cleanup failures: false
2023-06-24 11:03:34.354 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
2023-06-24 11:03:34.391 INFO mapred.LocalJobRunner: Waiting for map tasks
2023-06-24 11:03:34.391 INFO mapred.LocalJobRunner: Starting task: attempt_local1935691243_0001_m_000000_0
2023-06-24 11:03:34.400 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-06-24 11:03:34.401 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup_temporary folders under output directory:false, ignore cleanup failures: false
2023-06-24 11:03:34.407 INFO mapred.Task: Using ResourceCalculatorProcessTree : [ ]
2023-06-24 11:03:34.408 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/iptemp/1902:0+888978
2023-06-24 11:03:34.441 INFO mapred.MapTask: EQUATOR 0 kvi 26214396(104857884)
2023-06-24 11:03:34.441 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2023-06-24 11:03:34.441 INFO mapred.MapTask: soft limit at 83886080
2023-06-24 11:03:34.441 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2023-06-24 11:03:34.441 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2023-06-24 11:03:34.443 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapOutputBuffer
```

Program 06: Average Temperature

AverageDriver.java

```
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 outputparameters");
        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.java

```
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) == &#39;+&#39;) {
        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.java

```

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) throwsIOException,
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

```

Bytes Written=0
2023-06-24 11:03:34.740 INFO mapred.LocalJobRunner: Finishing task: attempt local1935691243_0001_r_000000_0
2023-06-24 11:03:34.740 INFO mapred.LocalJobRunner: reduce task executor complete.
2023-06-24 11:03:35.352 INFO mapreduce.Job: Job job_local1935691243_0001 running in uber mode : false
2023-06-24 11:03:35.354 INFO mapreduce.Job: map 100% reduce 100%
2023-06-24 11:03:35.355 INFO mapreduce.Job: Job job_local1935691243_0001 completed successfully
2023-06-24 11:03:35.369 INFO mapreduce.Job: Counters: 36
  File System Counters
    FILE: Number of bytes read=153042
    FILE: Number of bytes written=1504567
    FILE: Number of read operations=0
    FILE: Number of large read operations=0
    FILE: Number of write operations=0
    HDFS: Number of bytes read=1772556
    HDFS: Number of bytes written=8
    HDFS: Number of read operations=15
    HDFS: Number of large read operations=0
    HDFS: Number of write operations=4
    HDFS: Number of bytes read erasure-coded=0
  Map-Reduce Framework
    Map input records=6565
    Map output records=6565
    Map output bytes=59085
    Map output materialized bytes=72221
    Input split bytes=98
    Combine input records=0
    Combine output records=0
    Reduce input groups=1
    Reduce shuffle bytes=72221
    Reduce input records=6565
    Reduce output records=1
    Spilled Records=13130
    Shuffled Maps =1
    Failed Shuffles=0
    Merged Map outputs=1
    GC time elapsed (ms)=7
    Total committed heap usage (bytes)=1159725056
  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=888978
  File Output Format Counters
    Bytes Written=0
hadoop@hscscce-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -ls /optempl
Found 2 items
-rw-r--r-- 1 hadoop supergroup          0 2023-06-24 11:03 /optempl/_SUCCESS
-rw-r--r-- 1 hadoop supergroup          0 2023-06-24 11:03 /optempl/part-r-00000
hadoop@hscscce-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -cat /optempl/part-r-00000
1902    21

```

Program 07: Mean Max Temperature in Hadoop

MeanMaxDriver.java

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

MeanMaxMapper.java

```
import org.apache.hadoop.mapreduce.Mapper;

public class MeanMaxMapper 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) throwsIOException,
InterruptedException {
        int temperature;
        String line = value.toString();
        String month = line.substring(19, 21);if
        (line.charAt(87) == &#39;+&#39;) {
            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(month), new IntWritable(temperature)); }
    }
```

MeanMaxReducer.java

```
package meanmax;

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

public class MeanMaxReducer extends <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 total_temp = 0;int
count = 0;
int days = 0;

for (IntWritable value : values) {int temp =
value.get();
if (temp > max_temp)
max_temp = temp;
count++;
if (count == 3) {
total_temp += max_temp;
max_temp = 0;
count = 0;
days++;
}
}
context.write(key, new IntWritable(total_temp / days));
}
}

```

Output:

```

hadoop@bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: $ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
localhost: namenode is running as process 7391. Stop it first and ensure /tmp/hadoop-hadoop-namenode.pid file is empty before retry.
Starting datanodes
localhost: datanode is running as process 7576. Stop it first and ensure /tmp/hadoop-hadoop-datanode.pid file is empty before retry.
Starting secondary namenodes [bsccscse-HP-Elite-Tower-600-G9-Desktop-PC]
bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: secondarynamenode is running as process 7865. Stop it first and ensure /tmp/hadoop-hadoop-secondarynamenode.pid file is empty before retry.
Starting resource manager
resource manager is running as process 8150. Stop it first and ensure /tmp/hadoop-hadoop-resource manager.pid file is empty before retry.
Starting nodemanagers
localhost: nodemanager is running as process 8337. Stop it first and ensure /tmp/hadoop-hadoop-nodemanager.pid file is empty before retry.
hadoop@bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -mkdir /iptemp
hadoop@bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -put /home/hadoop/Desktop/1901 /iptemp
hadoop@bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -put /home/hadoop/Desktop/1902 /iptemp
hadoop@bsccscse-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop jar /home/hadoop/Desktop/AvgTemp.jar AvgDriver /iptemp/1901 /optemp
2023-06-24 10:18:36,257 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2023-06-24 10:18:36,297 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2023-06-24 10:18:36,297 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2023-06-24 10:18:36,357 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2023-06-24 10:18:36,390 INFO input.FileInputFormat: Total input files to process : 1
2023-06-24 10:18:36,423 INFO mapreduce.JobSubmitter: number of splits:1
2023-06-24 10:18:36,484 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1783357305_0001
2023-06-24 10:18:36,484 INFO mapreduce.JobSubmitter: Executing with tokens: []
2023-06-24 10:18:36,543 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2023-06-24 10:18:36,544 INFO mapreduce.Job: Running job: job_local1783357305_0001
2023-06-24 10:18:36,544 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2023-06-24 10:18:36,548 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-06-24 10:18:36,548 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:false, ignore cleanup failures: false
2023-06-24 10:18:36,548 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
2023-06-24 10:18:36,598 INFO mapred.LocalJobRunner: Waiting for map tasks
2023-06-24 10:18:36,598 INFO mapred.LocalJobRunner: Starting task: attempt_local1783357305_0001_m_000000_0
2023-06-24 10:18:36,611 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-06-24 10:18:36,611 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:false, ignore cleanup failures: false
2023-06-24 10:18:36,617 INFO mapred.Task: Using ResourceCalculatorProcessTree : [ ]
2023-06-24 10:18:36,618 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/iptemp/1901:0+888190
2023-06-24 10:18:36,650 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
2023-06-24 10:18:36,650 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2023-06-24 10:18:36,650 INFO mapred.MapTask: sort limit at: 838860800
2023-06-24 10:18:36,650 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2023-06-24 10:18:36,650 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2023-06-24 10:18:36,652 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapOutputBuffer
2023-06-24 10:18:36,727 INFO mapred.LocalJobRunner:
2023-06-24 10:18:36,728 INFO mapred.MapTask: Starting flush of map output
2023-06-24 10:18:36,728 INFO mapred.MapTask: Spilling map output
2023-06-24 10:18:36,728 INFO mapred.MapTask: bufstart = 0; bufend = 59076; bufvoid = 104857600
2023-06-24 10:18:36,728 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188144(104752576); length = 26253/6553600
2023-06-24 10:18:36,737 INFO mapred.MapTask: Finished spill 0
2023-06-24 10:18:36,741 INFO mapred.Task: Task:attempt_local1783357305_0001_m_000000_0 is done. And is in the process of committing
2023-06-24 10:18:36,743 INFO mapred.LocalJobRunner: map
2023-06-24 10:18:36,743 INFO mapred.Task: Task 'attempt_local1783357305_0001_m_000000_0' done.
2023-06-24 10:18:36,746 INFO mapred.Task: Final Counters for attempt_local1783357305_0001_m_000000_0: Counters: 23

```

Program 08: Hadoop Map Reduce program to combine information from the users file along with Information from the posts file by using the concept of join and display user_id, Reputation and Score

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.libMultipleInputs;import
org.apache.hadoop.util.*;

public class JoinDriver extends Configured implements Tool { publicstatic class KeyPartitioner
implements Partitioner<TextPair, Text> {
    @Override

    public void configure(JobConf job) {} @Override
    public int getPartition(TextPair key, Text value, intnumPartitions) {
        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 &#39;Department Emp Strength input&#39; with
&#39;Department Name input&#39;");
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) throwsIOException {

```

```

    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) throwsIOException {
    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

```

}
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 + " " + 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:

```
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@bnsce-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@bnsce-Precision-T1700:~/khushil/Join/MapReduceJoin$
```

Program 09: Word Count in Spark

```
scala> val data = sc.textFile("swati/sparkdata.txt") data:  
org.apache.spark.rdd.RDD[String] = swati/sparkdata.txt  
MapPartitionsRDD[1] at textFile at <console>:24
```

```
scala> data.collect;  
res0: Array[String] = Array(hello world, this is BDA spark lab)
```

```
scala> val splitdata = data.flatMap(line => line.split(" "));  
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[2] at flatMap at  
<console>:25
```

```
scala> splitdata.collect;  
res1: Array[String] = Array(hello, world,, this, is, BDA, spark, lab)
```

```
scala> val mapdata = splitdata.map(word => (word,1));mapdata:  
org.apache.spark.rdd.RDD[(String, Int)] =  
MapPartitionsRDD[3] at map at <console>:25
```

```
scala> mapdata.collect;  
res2: Array[(String, Int)] = Array((hello,1), (world,,1), (this,1),  
(is,1), (BDA,1), (spark,1), (lab,1))
```

```
scala> val reducedata = mapdata.reduceByKey(_+_);  
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[4] at reduceByKey at  
<console>:25
```

```
scala> reducedata.collect;  
res3: Array[(String, Int)] = Array((this,1), (is,1), (hello,1),  
(world,,1), (lab,1), (spark,1), (BDA,1))
```

Program 10: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark.

```
scala> val textFile = sc.textFile("swati/word.txt")
textFile: org.apache.spark.rdd.RDD[String] = swati/word.txt
MapPartitionsRDD[1] at textFile at <console>:24

scala> val counts = textFile.flatMap(line => line.split(" ")).map(word
=> (word, 1)).reduceByKey(_ + _)
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[4] at reduceByKey at
<console>:25

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

scala> val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)//sort in descending order
based
sorted: scala.collection.immutable.ListMap[String,Int] =
ListMap(hello -> 6, world -> 5, this -> 2, is -> 2, lab -> 2, BDA ->2, word -> 1)

scala> println(sorted)
ListMap(hello -> 6, world -> 5, this -> 2, is -> 2, lab -> 2, BDA ->2, word -> 1)

scala> for((k,v)<-sorted){
  | if(v>4)
  | {
  | print(k+",")
  | print(v)
  | println()
  | }
  | }
hello,6
```