VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS

Submitted by

ROHIT MAHENDRAKAR
(1BM20CS129)

in partial fulfillment for the award of the degree of
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in
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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 "LAB COURSE **BIG DATA ANALYTICS '' was carried** out by **ROHIT MAHENDRAKAR (1BM20CS129),** 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.

RAJESHWARI MADLI
Assistant Professor

Dr. Jyothi S Nayak
Professor and Head of Department

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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 collections
student

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}},{upser
t: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 | 2020-04-20
                18:30:00.000000+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)

11
```

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' and
dateOfIssue = '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 | 1
      5 | 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 | 1
     5 | 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
Unknown Woman' 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 rows
exported 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 rows
exported 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

-copyFromLocal Desktop/hadooplocal.txt /bda/hadoop.txt

hdfs dfs -cat /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

#copyToLocal 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.txt
new 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 /bda
Found 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) 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));
      }
}
```

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-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC: $ hadoop fs -cat /optemp/part-r-00000
1901    46
hadoop@bmscecse-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.security.UserGroupInformation.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@bmscecse-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(104857584)
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 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.java

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
```

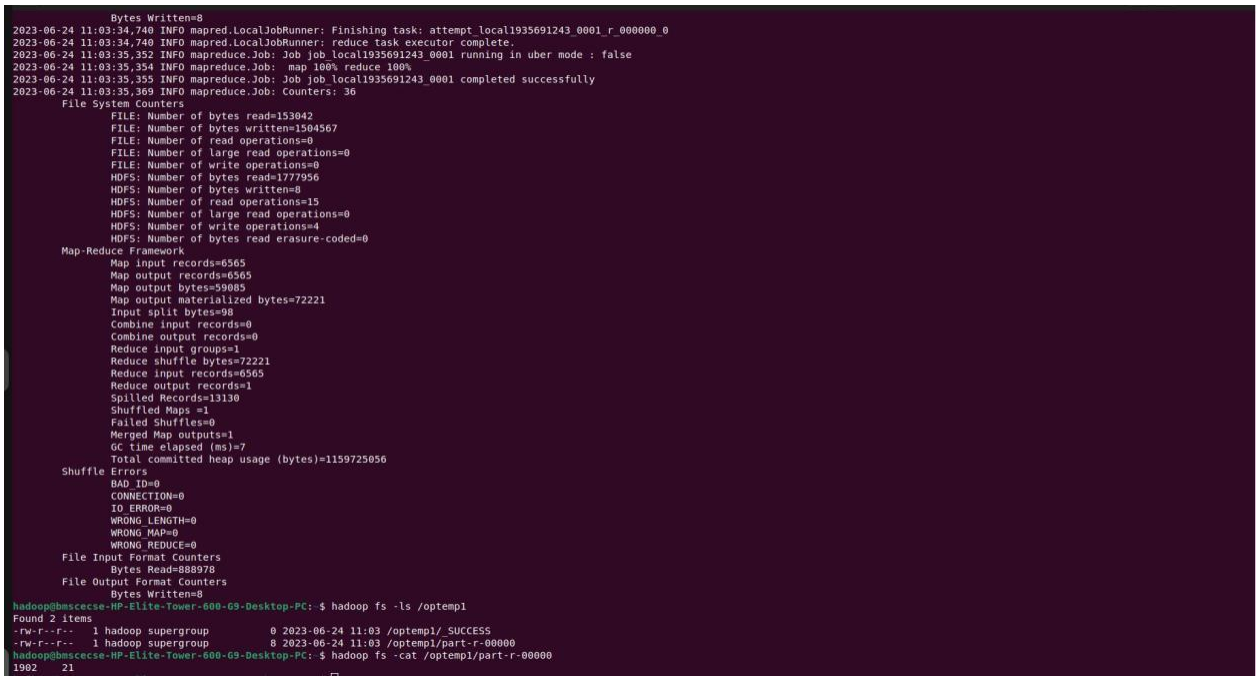
```
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class AverageMapper extends Mapper<LongWritable, Text,
Text, IntWritable> {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value,
Mapper<LongWritable, 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) 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



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 output
parameters");
      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

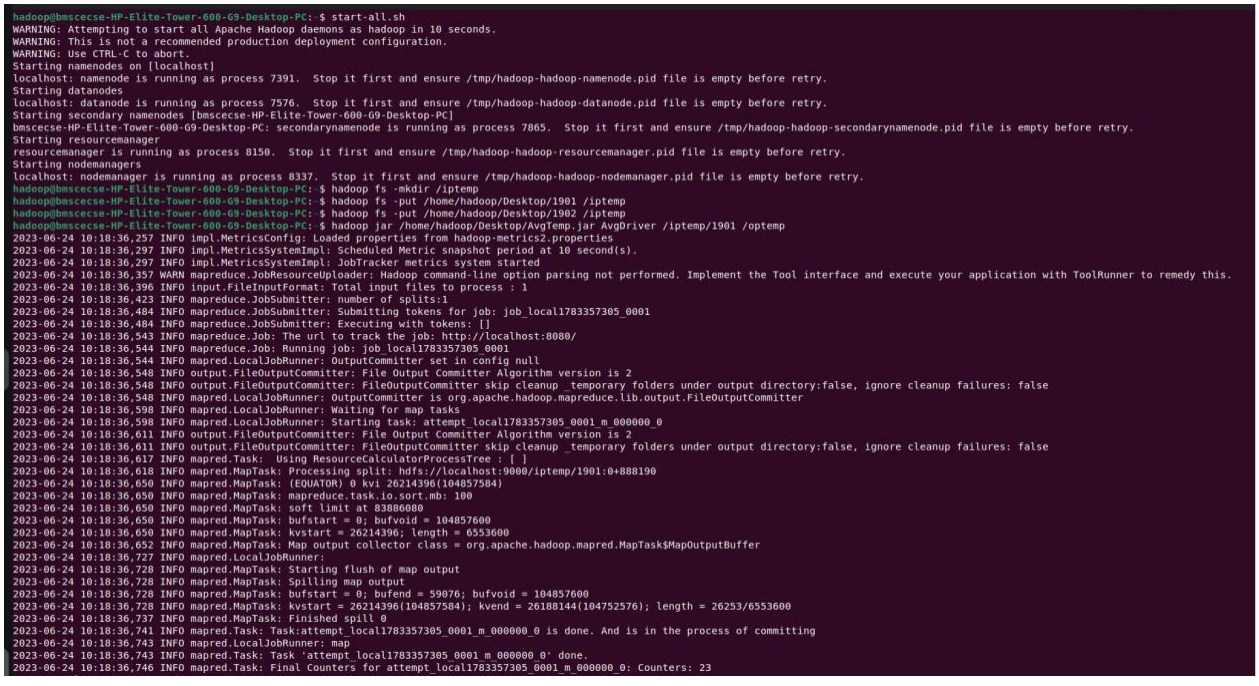
```
import org.apache.hadoop.mapreduce.Mapper;

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) throws
IOException, 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:



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.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 &#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)
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

```
}
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) &amp;amp;amp; second.equals(tp.second);
}
return false;
}
@Override
public String toString() {
return first + &amp;quot;\t&amp;quot; + 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 &amp;amp;&amp;amp; b instanceof TextPair) {
return ((TextPair) a).first.compareTo(((TextPair) b).first); }
return super.compare(a, b);
}
} }
```

Output:

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 FlaMap 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.ListMap
import 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
```