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
(Autonomous Institution under VTU)
BENGALURU-560019
Mar-2023 to July-2023
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 Rakesh B N**(1BM20CS121),** 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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Assistant Professor

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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' whereEmplID=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 | 2020-12-0118:30:00.000000+0000 | dept2 |
              designation4 | employee4 | null | 90000 102 | 2020-06-0318:30:00.000000+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 = 161and salary =
95000;
```

```
ttl(emp_name)
---------------
53

(1 rows)
```

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 - hadoopsupergroup 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 thenhit 'Ctrl+D'

```
#cat command
echo "hello world bda lab" | hdfs dfs -appendToFile - /bda/hello.txt

hdfs dfs -cat /bda/hello.txthello world
bda lab


#put & copyFromLocal command
hdfs dfs -put Desktop/hadooplocal.txt /bda/hadoop.txt hdfs dfs

-copyFromLocal Desktop/hadooplocal.txt /bda/hadoop.txthdfs 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.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);
    }
}
```

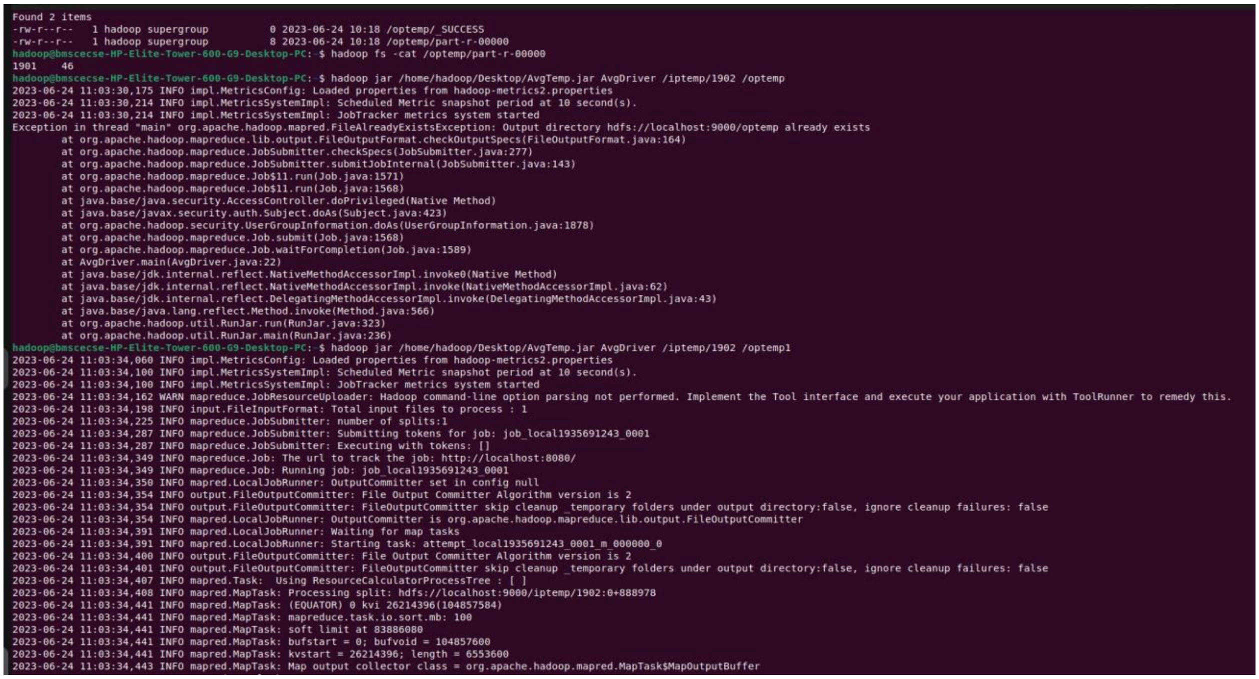
WCMapper.java

```
// 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-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 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

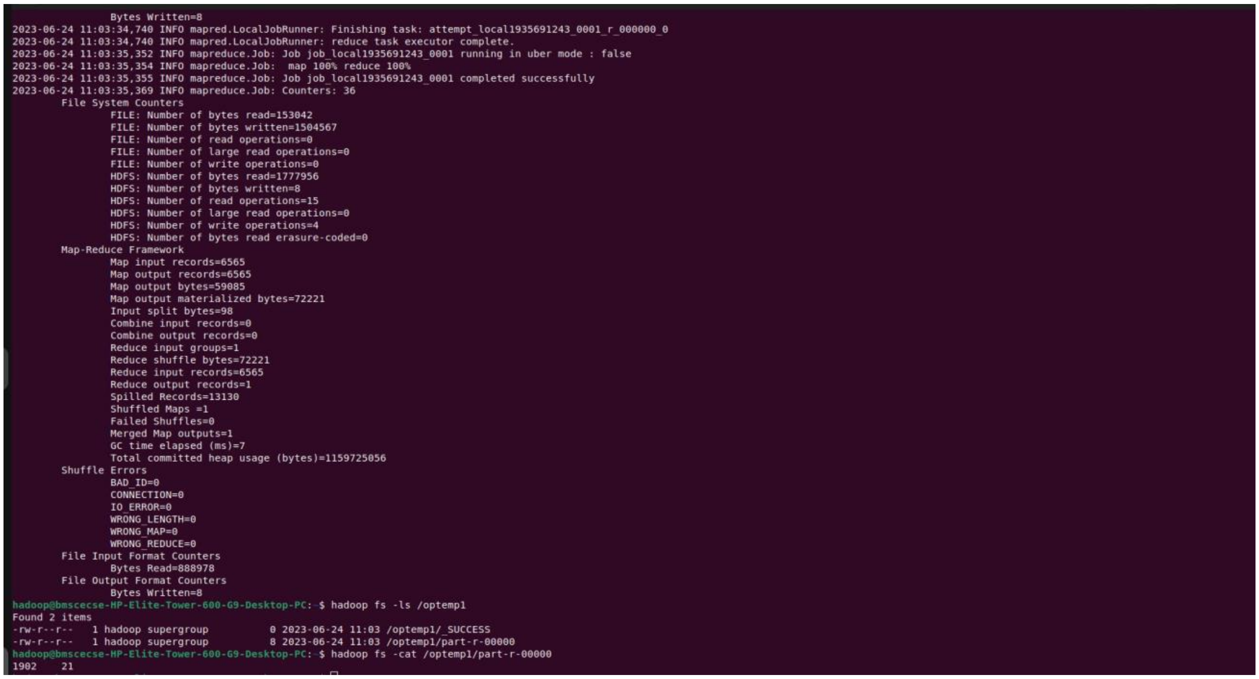
```
 package temp;
 import java.io.IOException;
 import org.apache.hadoop.io.IntWritable;
```

```
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=8
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=1777956
                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=8
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /optemp1
Found 2 items
-rw-r--r--   1 hadoop supergroup          0 2023-06-24 11:03 /optemp1/_SUCCESS
-rw-r--r--   1 hadoop supergroup          8 2023-06-24 11:03 /optemp1/part-r-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -cat /optemp1/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);
  }
}
```

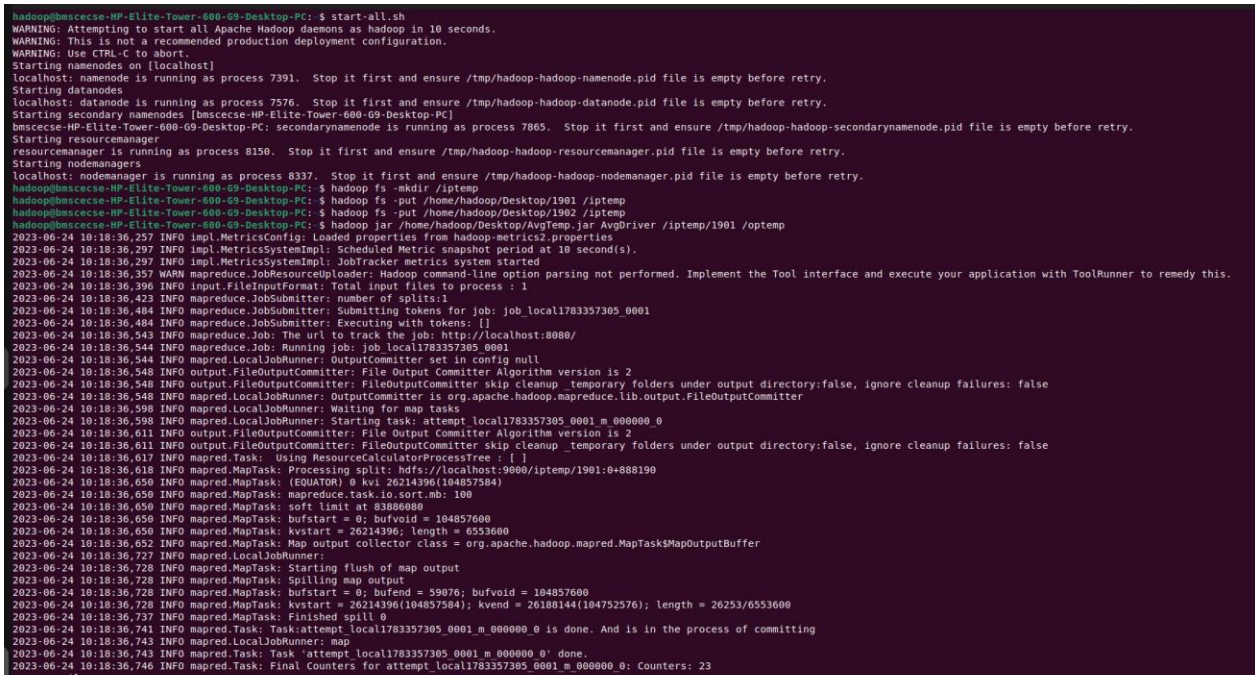
MeanMaxMapper.java

```
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@bmscecse-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 [bmscecse-HP-Elite-Tower-600-G9-Desktop-PC]
bmscecse-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 resourcemanager
resourcemanager is running as process 8150.  Stop it first and ensure /tmp/hadoop-hadoop-resourcemanager.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@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -mkdir /iptemp
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -put /home/hadoop/Desktop/1901 /iptemp
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -put /home/hadoop/Desktop/1902 /iptemp
hadoop@bmscecse-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 10:18:36,396 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: soft limit at 83886080
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.lib.MultipleInputs;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]));
}
}
```

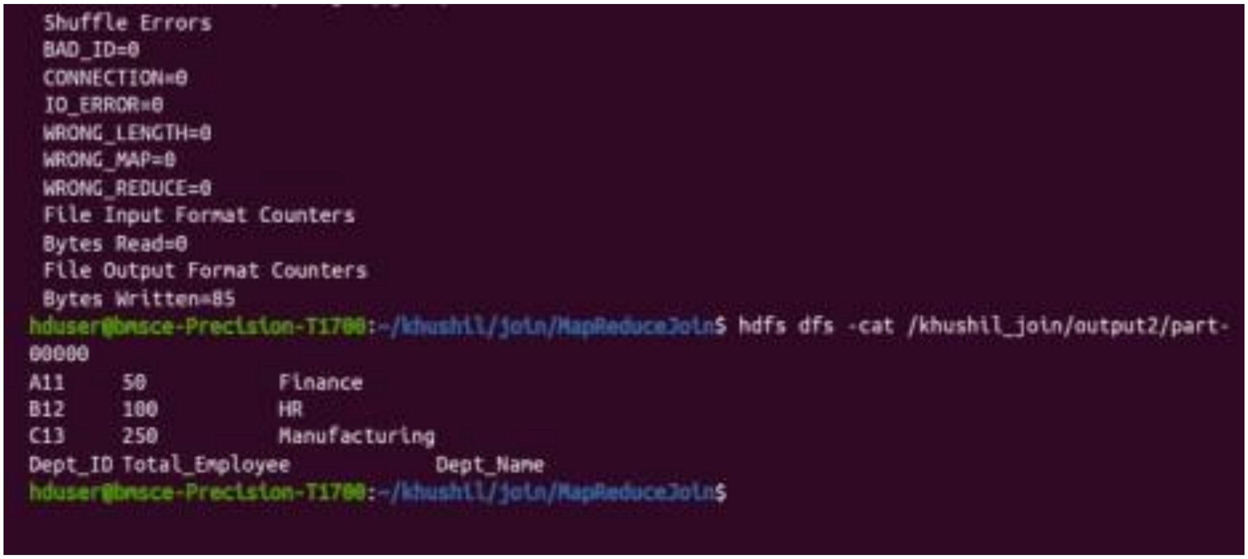
```
// TextPair.java
}
public Text getFirst() {return
first;
}

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) &amp;&amp; second.equals(tp.second);
}
return false;
}
@Override
public String toString() {
return first + &quot;\t&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; 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@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$
```

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] atflatMap 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] atreduceByKey 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
```