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

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(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 **SHASHANKA G (1BM20CS147),** who is a bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **Big Data Analytics - (20CS6PEBDA)** work prescribed for the said degree.

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Program 01: MongoDB commands

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

```
$mongosh

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

test> use database1

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

database1> show 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)
```

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 11:36
/1BM20CS147
# 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);
      }
}
```

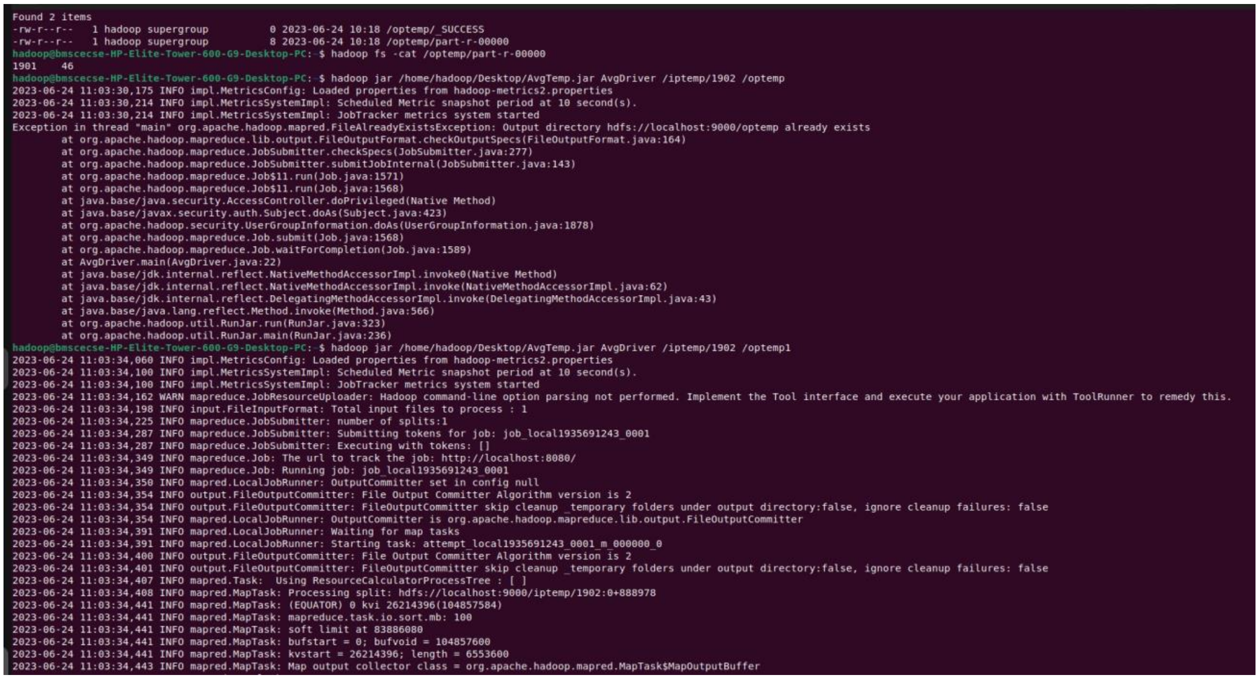
WCMapper.java

```
// 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

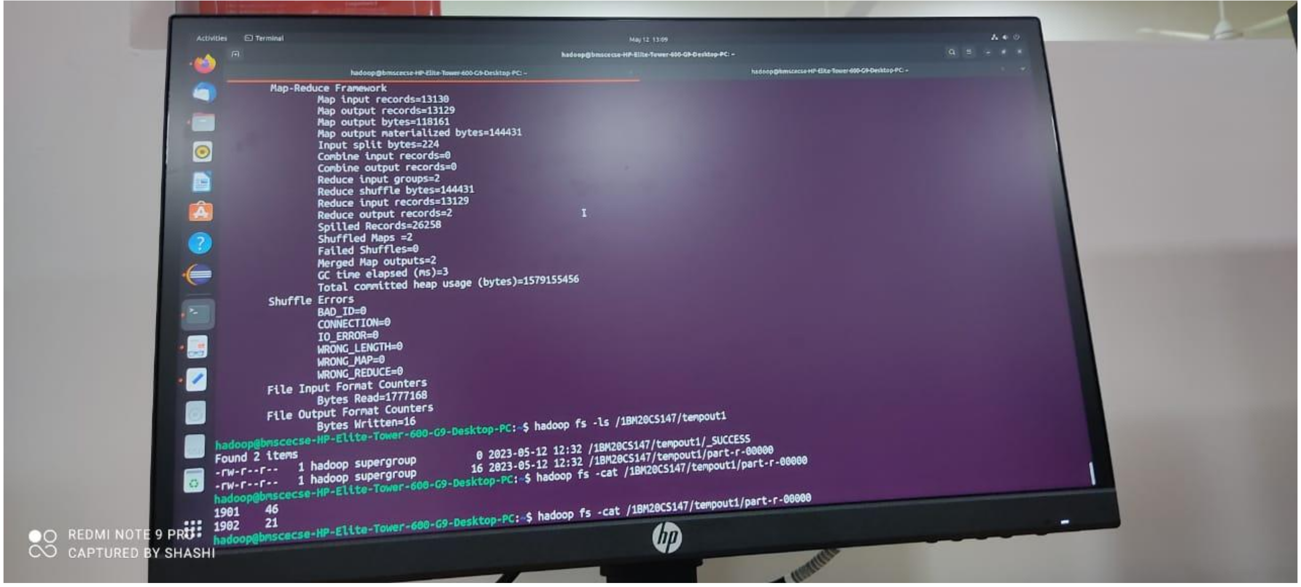
```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class AverageMapper extends Mapper<LongWritable, Text, Text,
IntWritable> {
public static 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



```
        Map-Reduce Framework
                Map input records=13130
                Map output records=13129
                Map output bytes=118161
                Map output materialized bytes=144431
                Input split bytes=224
                Combine input records=0
                Combine output records=0
                Reduce input groups=2
                Reduce shuffle bytes=144431
                Reduce input records=13129
                Reduce output records=2
                Spilled Records=26258
                Shuffled Maps =2
                Failed Shuffles=0
                Merged Map outputs=2
                GC time elapsed (ms)=3
                Total committed heap usage (bytes)=1579155456
        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=1777168
        File Output Format Counters
                Bytes Written=16
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /1BM20CS147/tempout1
Found 2 items
-rw-r--r--   1 hadoop supergroup          0 2023-05-12 12:32 /1BM20CS147/tempout1/_SUCCESS
-rw-r--r--   1 hadoop supergroup         16 2023-05-12 12:32 /1BM20CS147/tempout1/part-r-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -cat /1BM20CS147/tempout1/part-r-00000
1901    46
1902    21
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -cat /1BM20CS147/tempout1/part-r-00000
```

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

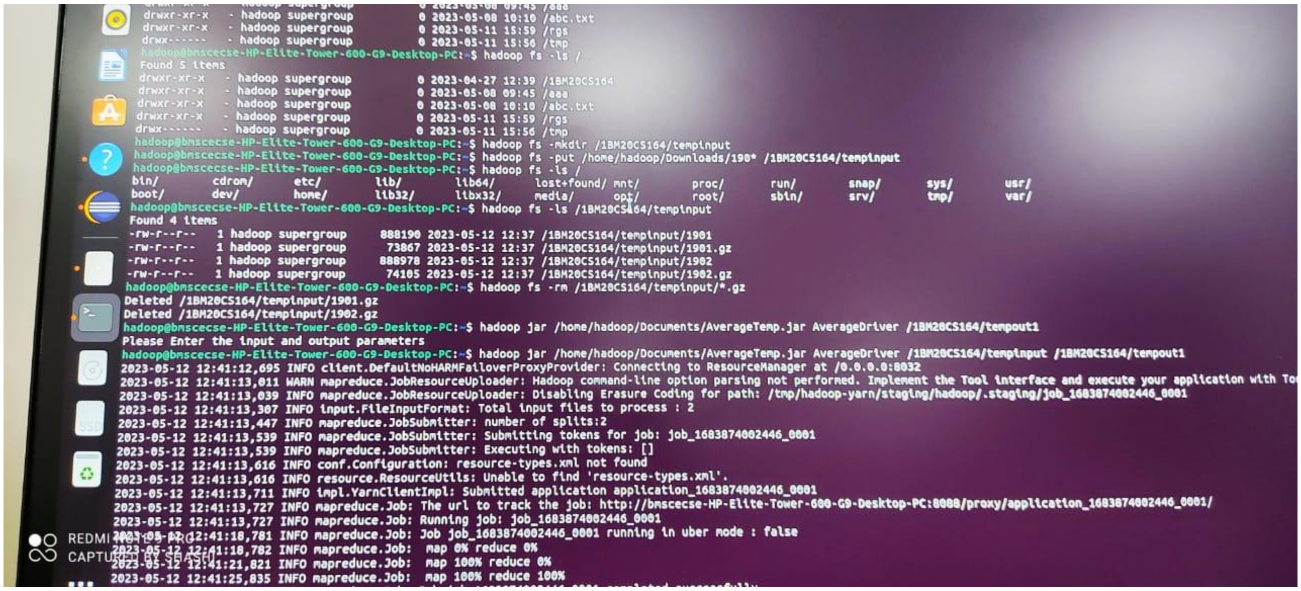
```
import org.apache.hadoop.mapreduce.Mapper;

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:



```
drwxr-xr-x   - hadoop supergroup          0 2023-05-08 09:45 /aaa
drwxr-xr-x   - hadoop supergroup          0 2023-05-08 10:10 /abc.txt
drwxr-xr-x   - hadoop supergroup          0 2023-05-11 15:59 /rgs
drwx------   - hadoop supergroup          0 2023-05-11 15:56 /tmp
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /
Found 5 items
drwxr-xr-x   - hadoop supergroup          0 2023-04-27 12:39 /1BM20CS164
drwxr-xr-x   - hadoop supergroup          0 2023-05-08 09:45 /aaa
drwxr-xr-x   - hadoop supergroup          0 2023-05-08 10:10 /abc.txt
drwxr-xr-x   - hadoop supergroup          0 2023-05-11 15:59 /rgs
drwx------   - hadoop supergroup          0 2023-05-11 15:56 /tmp
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -mkdir /1BM20CS164/tempinput
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -put /home/hadoop/Downloads/190* /1BM20CS164/tempinput
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /
bin/       cdrom/     etc/       lib/       lib64/     lost+found/ mnt/       proc/      run/       snap/      sys/       usr/
boot/      dev/       home/      lib32/     libx32/    media/      opt/       root/      sbin/      srv/       tmp/       var/
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /1BM20CS164/tempinput
Found 4 items
-rw-r--r--   1 hadoop supergroup     888190 2023-05-12 12:37 /1BM20CS164/tempinput/1901
-rw-r--r--   1 hadoop supergroup      73867 2023-05-12 12:37 /1BM20CS164/tempinput/1901.gz
-rw-r--r--   1 hadoop supergroup     888978 2023-05-12 12:37 /1BM20CS164/tempinput/1902
-rw-r--r--   1 hadoop supergroup      74105 2023-05-12 12:37 /1BM20CS164/tempinput/1902.gz
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -rm /1BM20CS164/tempinput/*.gz
Deleted /1BM20CS164/tempinput/1901.gz
Deleted /1BM20CS164/tempinput/1902.gz
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Documents/AverageTemp.jar AverageDriver /1BM20CS164/tempout1
Please Enter the input and output parameters
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Documents/AverageTemp.jar AverageDriver /1BM20CS164/tempinput /1BM20CS164/tempout1
2023-05-12 12:41:12,695 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2023-05-12 12:41:13,011 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with To
2023-05-12 12:41:13,039 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/hadoop/.staging/job_1683874002446_0001
2023-05-12 12:41:13,307 INFO input.FileInputFormat: Total input files to process : 2
2023-05-12 12:41:13,447 INFO mapreduce.JobSubmitter: number of splits:2
2023-05-12 12:41:13,539 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1683874002446_0001
2023-05-12 12:41:13,539 INFO mapreduce.JobSubmitter: Executing with tokens: []
2023-05-12 12:41:13,616 INFO conf.Configuration: resource-types.xml not found
2023-05-12 12:41:13,616 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2023-05-12 12:41:13,711 INFO impl.YarnClientImpl: Submitted application application_1683874002446_0001
2023-05-12 12:41:13,727 INFO mapreduce.Job: The url to track the job: http://bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:8088/proxy/application_1683874002446_0001/
2023-05-12 12:41:13,727 INFO mapreduce.Job: Running job: job_1683874002446_0001
2023-05-12 12:41:18,781 INFO mapreduce.Job: Job job_1683874002446_0001 running in uber mode : false
2023-05-12 12:41:18,782 INFO mapreduce.Job:  map 0% reduce 0%
2023-05-12 12:41:21,821 INFO mapreduce.Job:  map 100% reduce 0%
2023-05-12 12:41:25,835 INFO mapreduce.Job:  map 100% reduce 100%
```

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

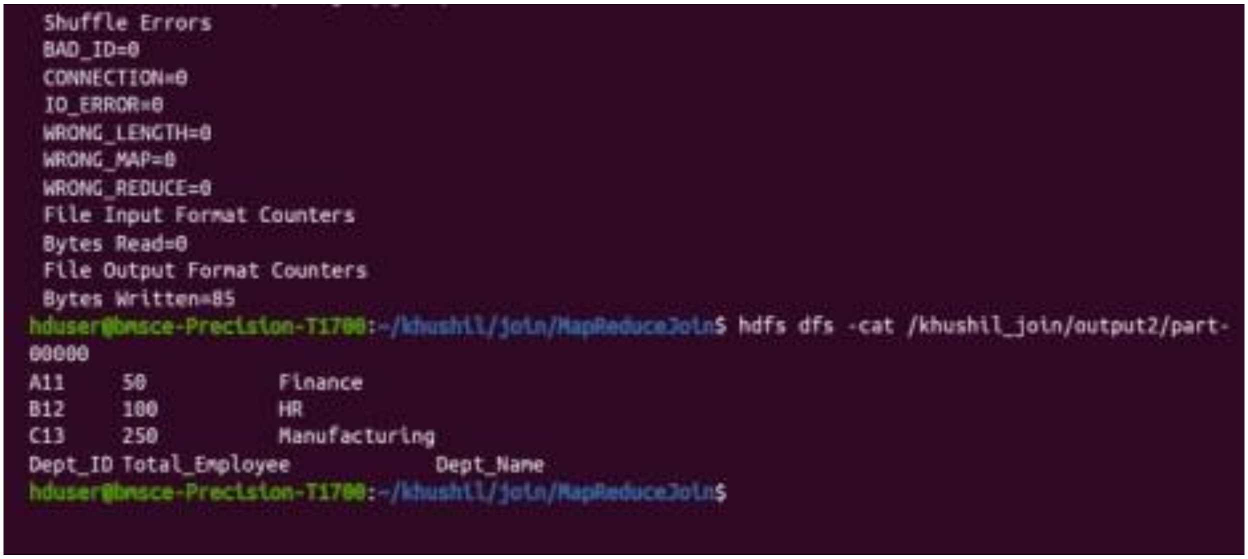
```
}
public Text getFirst() {
return first;
}

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; 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("shashankag/sparkdata.txt")
data:org.apache.spark.rdd.RDD[String] =
shashankaG/sparkdata.txt
MapPartitionsRDD[1] at textFile at <console>:24

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

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

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

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

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

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

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

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

```
scala> val textFile = sc.textFile("shashankaG/word.txt")
textFile: org.apache.spark.rdd.RDD[String] =
shashankaG/word.txtMapPartitionsRDD[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
```