VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS

Submitted by

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

B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019
(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled “BIG DATA ANALYTICS” carried out by Sannidhi Kasturi (1BM19CS143), who is bonafide student of B. M. S. College of Engineering. It is in partial fulfillment for the award of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a BIG DATA ANALYTICS - (20CS6PEBDA) work prescribed for the said degree.

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LAB-1

1 Perform the following DB operations using Cassandra.

1. Create a keyspace by name 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

3. Insert the values into the table in batch

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

5. Sort the details of Employee records based on salary

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.

7. Update the altered table to add project names.

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

- COMMANDS AND OUTPUT:

```
cqlsh> CREATE KEYSPACE Employee WITH
REPLICATION={'class':'SimpleStrategy','replication_factor':1};
USE employee;
cqlsh:employee> CREATE TABLE Employee_info(Emp_id int PRIMARY
KEY,Emp_name text,Desg text,Doj timestamp,Salary float,dept text);
cqlsh:employee> BEGIN BATCH
        ... INSERT INTO
        ... Employee_info(Emp_id,Emp_name,Desg,Doj,Salary,dept)
        ... VALUES(123,'Sakshi','Manager','2000-09-24',650000,'Export')
        ... INSERT INTO
Employee_info(Emp_id,Emp_name,Desg,Doj,Salary,dept)
```

```
          ...
VALUES(121,'Ritvika','AsstManager','2001-01-04',620000,'Export')
          ... INSERT INTO
Employee_info(Emp_id,Emp_name,Desg,Doj,Salary,dept)
          ... VALUES(131,'Priya','HR','1999-05-14',780000,'HR')
          ... APPLY BATCH;
cqlsh:employee> SELECT * FROM Employee_info;

 emp_id | dept   | desg        | doj                             | emp_name | salary
--------+--------+-------------+---------------------------------+----------+---------
    123 | Export |     Manager | 2000-09-24 00:00:00.000000+0000 |   Sakshi |
6.5e+05
    121 | Export | AsstManager | 2001-01-04 00:00:00.000000+0000 |  Ritvika
| 6.2e+05
    131 |     HR |          HR | 1999-05-14 00:00:00.000000+0000 |    Priya |
7.8e+05

(3 rows)
cqlsh:employee> UPDATE Employee_info SET Emp_name='Ritvika_Singh'
WHERE Emp_id=121;
cqlsh:employee> SELECT * FROM Employee_info;

 emp_id | dept   | desg        | doj                             | emp_name      | salary
--------+--------+-------------+---------------------------------+---------------+-------
--
    123 | Export |     Manager | 2000-09-24 00:00:00.000000+0000 |
Sakshi | 6.5e+05
    121 | Export | AsstManager | 2001-01-04 00:00:00.000000+0000 |
Ritvika_Singh | 6.2e+05
    131 |     HR |          HR | 1999-05-14 00:00:00.000000+0000 |         Priya |
7.8e+05

(3 rows)
cqlsh:employee> UPDATE Employee_info SET dept='import' WHERE
Emp_id=121;
cqlsh:employee> SELECT * FROM Employee_info;
```

```
 emp_id | dept   | desg        | doj                             | emp_name      | salary
--------+--------+-------------+---------------------------------+---------------+-------
--
    123 | Export |     Manager | 2000-09-24 00:00:00.000000+0000 |
Sakshi | 6.5e+05
    121 | import | AsstManager | 2001-01-04 00:00:00.000000+0000 |
Ritvika_Singh | 6.2e+05
    131 |     HR |          HR | 1999-05-14 00:00:00.000000+0000 |         Priya |
7.8e+05

    cqlsh:employee> ALTER TABLE Employee_info ADD projects
set<text>;
cqlsh:employee> SELECT * FROM Employee_info;

 emp_id | dept   | desg        | doj                             | emp_name      | projects |
salary
--------+--------+-------------+---------------------------------+---------------+-------
---+---------
    123 | Export |     Manager | 2000-09-24 00:00:00.000000+0000 |
Sakshi |     null | 6.5e+05
    121 | import | AsstManager | 2001-01-04 00:00:00.000000+0000 |
Ritvika_Singh |     null | 6.2e+05
    131 |     HR |          HR | 1999-05-14 00:00:00.000000+0000 |         Priya |
null | 7.8e+05

(3 rows)
cqlsh:employee> UPDATE Employee_info SET projects={'proj1','proj2'}
WHERE Emp_id=123;
cqlsh:employee> SELECT * FROM Employee_info;

 emp_id | dept   | desg        | doj                             | emp_name      | projects
| salary
--------+--------+-------------+---------------------------------+---------------+-------
-------------+---------
    123 | Export |     Manager | 2000-09-24 00:00:00.000000+0000 |
Sakshi | {'proj1', 'proj2'} | 6.5e+05
```

```
   121 | import | AsstManager | 2001-01-04 00:00:00.000000+0000 |
Ritvika_Singh |             null | 6.2e+05
   131 |     HR |          HR | 1999-05-14 00:00:00.000000+0000 |         Priya |
null | 7.8e+05

(3 rows)
```

LAB-2

2 Perform the following DB operations using Cassandra.

1.Create a keyspace by name Library

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

3. Insert the values into the table in batch

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

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

6. Export the created column to a csv file

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

- COMMANDS AND OUTPUT:

```
cqlsh> create keyspace library with
replication={'class':'SimpleStrategy','replication_factor':1};
cqlsh> use library;
cqlsh:library> create table library_info(stud_id varchar, counter_value
counter,stud_name text,book_name varchar,
book_id varchar, date_of_issue timestamp,primary
key(stud_id,stud_name,book_name,book_id,date_of_issue));
cqlsh:library> update library.library_info set
counter_value=counter_value+1 where stud_id='cs112' and
stud_name='kundana' and book_name='spooky' and book_id='bk121' and
date_of_issue='2020-11-19';cqlsh:library> update library.library_info set
counter_value=counter_value+1 where stud_id='cs121' and
stud_name='bobby' and book_name='spooky boy' and book_id='bk131' and
date_of_issue='2020-11-16';cqlsh:library> update library.library_info set
counter_value=counter_value+1 where stud_id='cs144' and
stud_name='felix' and book_name='spooky man' and book_id='bk141' and
date_of_issue='2019-03-03';
cqlsh:library> select * from library_info;
```

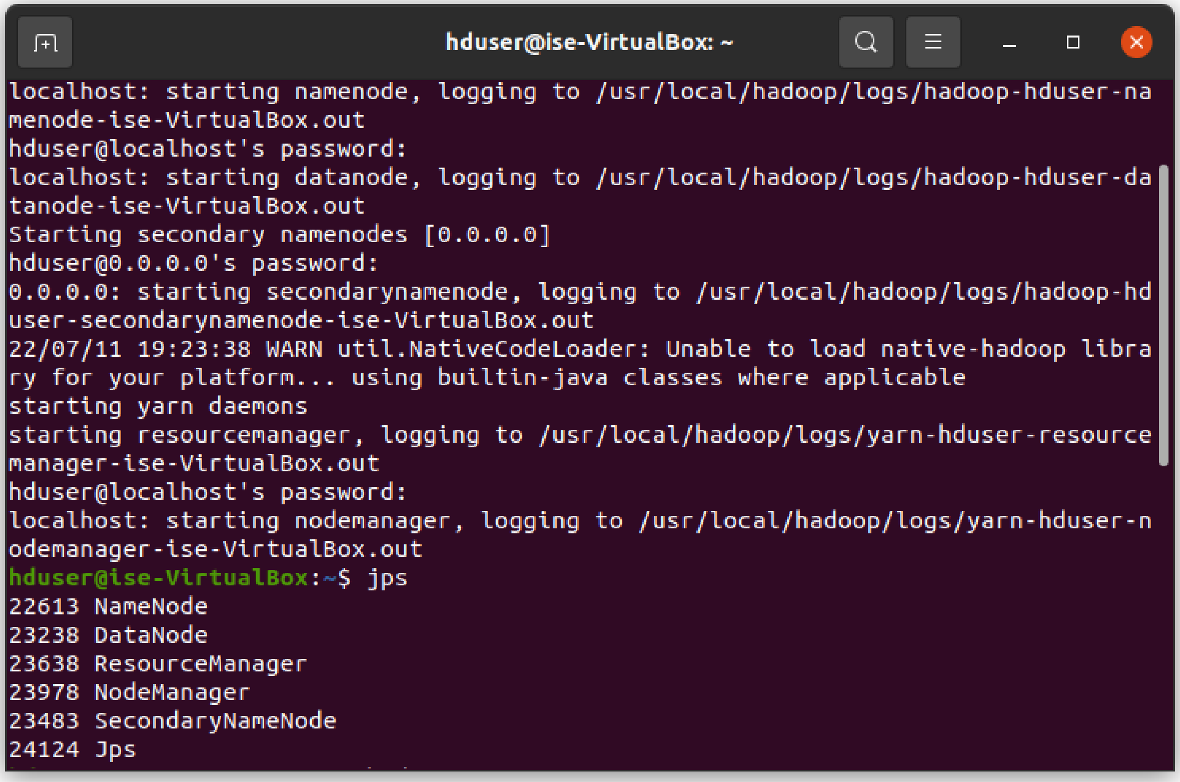
```
 stud_id | stud_name | book_name  | book_id | date_of_issue                   |
counter_value
---------+-----------+------------+---------+---------------------------------+----------
-----
   cs121 |     bobby | spooky boy |   bk131 | 2020-11-16
00:00:00.000000+0000 |             1
   cs112 |   kundana |     spooky |   bk121 | 2020-11-19 00:00:00.000000+0000
|             1
   cs144 |     felix | spooky man |   bk141 | 2019-03-03 00:00:00.000000+0000
|             1

(3 rows)
cqlsh:library> update library.library_info set
counter_value=counter_value+1 where stud_id='cs112' and
stud_name='kundana' and book_name='spooky' and book_id='bk121' and
date_of_issue='2020-11-19';
cqlsh:library> select * from library_info;
 stud_id | stud_name | book_name  | book_id | date_of_issue                   |
counter_value
---------+-----------+------------+---------+---------------------------------+----------
-----
   cs121 |     bobby | spooky boy |   bk131 | 2020-11-16
00:00:00.000000+0000 |             1
   cs112 |   kundana |     spooky |   bk121 | 2020-11-19 00:00:00.000000+0000
|             2
   cs144 |     felix | spooky man |   bk141 | 2019-03-03 00:00:00.000000+0000
|             1

(3 rows)
```

LAB-4

4. Screenshot of Hadoop installed.



```
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-na
menode-ise-VirtualBox.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-da
tanode-ise-VirtualBox.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hd
user-secondarynamenode-ise-VirtualBox.out
22/07/11 19:23:38 WARN util.NativeCodeLoader: Unable to load native-hadoop libra
ry for your platform... using builtin-java classes where applicable
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resource
manager-ise-VirtualBox.out
hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-n
odemanager-ise-VirtualBox.out
hduser@ise-VirtualBox:~$ jps
22613 NameNode
23238 DataNode
23638 ResourceManager
23978 NodeManager
23483 SecondaryNameNode
24124 Jps
```

LAB-5

5 Execution of HDFS Commands for interaction with Hadoop Environment.

```
hduser@bmsce-Precision-T1700:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-Precision-T1700.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hduser-secondarynamenode-bmsce-Precision-T1700.out
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-Precision-T1700.out
hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-nodemanager-bmsce-Precision-T1700.out
hduser@bmsce-Precision-T1700:~$ jps
4644 NameNode
5450 SecondaryNameNode
6666 NodeManager
4827 DataNode
```

```
5710 ResourceManager
6799 Jps
hduser@bmsce-Precision-T1700:~$ ls
 b                   'Packet Tracer 7.2.1 for Linux 64 bit.tar.gz'
 c                    Pictures
 derby.log            pig_1564816082257.log
 Desktop              pt
 Documents            PT72Installer
 Downloads            Public
 eclipse-workspace    R
 examples.desktop     snap
 hadoop-2.6.0.tar.gz  Templates
 hive                 toinstalledlist
 metastore_db         Videos
 Music
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /
Found 2 items
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /abc
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 3 items
drwxr-xr-x   - hduser supergroup          0 2022-05-31 09:38 /abc
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
hduser@bmsce-Precision-T1700:~$ hdfs dfs -touchz /abc/lab.txt
```

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /abc
Found 1 items
-rw-r--r--   1 hduser supergroup          0 2022-05-31 09:39 /abc/lab.txt
hduser@bmsce-Precision-T1700:~$ ls
 b                   'Packet Tracer 7.2.1 for Linux 64 bit.tar.gz'
 c                    Pictures
 derby.log            pig_1564816082257.log
 Desktop              pt
 Documents            PT72Installer
 Downloads            Public
 eclipse-workspace    R
 examples.desktop     snap
 hadoop-2.6.0.tar.gz  Templates
 hive                 toinstalledlist
 metastore_db         Videos
 Music
hduser@bmsce-Precision-T1700:~$ vi new.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -put new.txt /abc/newhadoop.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /abc/newhadoop.txt
Cbbbbb
fgggjyujyhcvdgrbghh
hduser@bmsce-Precision-T1700:~$ cd /Desktop
bash: cd: /Desktop: No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 3 items
drwxr-xr-x   - hduser supergroup          0 2022-05-31 09:48 /abc
```

```
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyFromLocal
/home/hduser/Desktop/Welcome.txt /abc/newWelcome.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /abc/newWelcome.txt
nnkjkdngdmglc
hduser@bmsce-Precision-T1700:~$ hdfs dfs -get /abc/wc.txt
/home/hduser/Downloads/wcc.txt
get: `/abc/wc.txt': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -get /abc/newWelcome.txt
/home/hduser/Downloads/wcc.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyToLocal /abc/newWelcome.txt
/home/hduser/Downloads
hduser@bmsce-Precision-T1700:~$ hadoop fs -mv /abc /FFF
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 3 items
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:08 /FFF
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
hduser@bmsce-Precision-T1700:~$ hadoop fs -cp /FFF/new.txt /tmp
cp: `/FFF/new.txt': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /FFF
Found 3 items
-rw-r--r--   1 hduser supergroup          0 2022-05-31 09:39 /FFF/lab.txt
-rw-r--r--   1 hduser supergroup         14 2022-05-31 10:08 /FFF/newWelcome.txt
-rw-r--r--   1 hduser supergroup         27 2022-05-31 09:48 /FFF/newhadoop.txt
hduser@bmsce-Precision-T1700:~$ hadoop fs -cp /FFF/lab.txt /tmp
```

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /tmp
Found 2 items
drwx-wx-wx   - hduser supergroup          0 2019-08-01 16:19 /tmp/hive
-rw-r--r--   1 hduser supergroup          0 2022-05-31 10:19 /tmp/lab.txt
hduser@bmsce-Precision-T1700:~$
```

LAB-6

6. From the following link extract the weather data https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all. Create a Map Reduce program to

a) Find the average temperature for each year from NCDC data set.

- Program

AverageDriver

```
package temp;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
public class AverageDriver {
public static void main(String[] args) throws Exception {
if (args.length != 2) {
System.err.println(&quot;Please Enter the input and output
parameters&quot;);
System.exit(-1);
}
Job job = new Job();
job.setJarByClass(AverageDriver.class);
job.setJobName(&quot;Max temperature&quot;);
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
job.setMapperClass(AverageMapper.class);
job.setReducerClass(AverageReducer.class);
job.setOutputKeyClass(Text.class);

job.setOutputValueClass(IntWritable.class);
System.exit(job.waitForCompletion(true) ? 0 : 1);}}
```

AverageMapper

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class AverageMapper extends Mapper&lt;LongWritable, Text,
Text, IntWritable&gt; {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value,
Mapper&lt;LongWritable, Text, Text, IntWritable&gt;.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 &amp;&amp;
quality.matches(&quot;[01459]&quot;))
context.write(new Text(year), new
IntWritable(temperature));}}
```

AverageReducer

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class AverageReducer extends Reducer&lt;Text, IntWritable,
Text, IntWritable&gt; {
public void reduce(Text key, Iterable&lt;IntWritable&gt; values,
Reducer&lt;Text, IntWritable, Text, IntWritable&gt;.Context context)
throws IOException, InterruptedException {
```

```
int max_temp = 0;
int count = 0;
for (IntWritable value : values) {
max_temp += value.get();
count++; }
context.write(key, new IntWritable(max_temp / count));}}
```

- Output

```
hduser@bmsce-Precision-T1700:~$ sudo su hduser
[sudo] password for hduser:
hduser@bmsce-Precision-T1700:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to
/usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-Precision-T1700.ou
t
hduser@localhost's password:
localhost: starting datanode, logging to
/usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to
/usr/local/hadoop/logs/hadoop-hduser-secondarynamenode-bmsce-Precision-
T1700.out
starting yarn daemons
starting resourcemanager, logging to
/usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-Precision-T170
0.out
hduser@localhost's password:
localhost: starting nodemanager, logging to
/usr/local/hadoop/logs/yarn-hduser-nodemanager-bmsce-Precision-T1700.ou
t
hduser@bmsce-Precision-T1700:~$ jps
7376 DataNode
8212 Jps
```

```
8090 NodeManager
3725 org.eclipse.equinox.launcher_1.5.600.v20191014-2022.jar
7758 ResourceManager
7199 NameNode
7599 SecondaryNameNode
hduser@bmsce-Precision-T1700:~$ hadoop fs -mkdir /input_kundana
hduser@bmsce-Precision-T1700:~$ hadoop fs -put Downloads/1901
/input_kundana/1901.txt
hduser@bmsce-Precision-T1700:~$ hadoop jar Desktop/temp.jar
Temperature.AverageDriver /input_kundana/1901.txt /output_1901
Exception in thread "main" java.lang.ClassNotFoundException:
Temperature.AverageDriver
        at java.net.URLClassLoader.findClass(URLClassLoader.java:382)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:418)
        at java.lang.ClassLoader.loadClass(ClassLoader.java:351)
        at java.lang.Class.forName0(Native Method)
        at java.lang.Class.forName(Class.java:348)
        at org.apache.hadoop.util.RunJar.run(RunJar.java:214)
        at org.apache.hadoop.util.RunJar.main(RunJar.java:136)
hduser@bmsce-Precision-T1700:~$ hadoop jar Desktop/temp.jar
AverageDriver /input_kundana/1901.txt /output_1901
22/06/21 10:26:05 INFO Configuration.deprecation: session.id is
deprecated. Instead, use dfs.metrics.session-id
22/06/21 10:26:05 INFO jvm.JvmMetrics: Initializing JVM Metrics with
processName=JobTracker, sessionId=
22/06/21 10:26:05 WARN mapreduce.JobSubmitter: Hadoop command-line
option parsing not performed. Implement the Tool interface and execute
your application with ToolRunner to remedy this.
22/06/21 10:26:05 INFO input.FileInputFormat: Total input paths to process
: 1
22/06/21 10:26:05 INFO mapreduce.JobSubmitter: number of splits:1
22/06/21 10:26:05 INFO mapreduce.JobSubmitter: Submitting tokens for
job: job_local1195965365_0001
22/06/21 10:26:05 INFO mapreduce.Job: The url to track the job:
http://localhost:8080/
22/06/21 10:26:05 INFO mapreduce.Job: Running job:
job_local1195965365_0001
```

```
22/06/21 10:26:05 INFO mapred.LocalJobRunner: OutputCommitter set in
config null
22/06/21 10:26:05 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/21 10:26:05 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/21 10:26:05 INFO mapred.LocalJobRunner: Starting task:
attempt_local1195965365_0001_m_000000_0
22/06/21 10:26:05 INFO mapred.Task:  Using
ResourceCalculatorProcessTree : [ ]
22/06/21 10:26:05 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/input_kundana/1901.txt:0+888190
22/06/21 10:26:06 INFO mapred.MapTask: (EQUATOR) 0 kvi
26214396(104857584)
22/06/21 10:26:06 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/21 10:26:06 INFO mapred.MapTask: soft limit at 83886080
22/06/21 10:26:06 INFO mapred.MapTask: bufstart = 0; bufvoid =
104857600
22/06/21 10:26:06 INFO mapred.MapTask: kvstart = 26214396; length =
6553600
22/06/21 10:26:06 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/21 10:26:06 INFO mapred.LocalJobRunner:
22/06/21 10:26:06 INFO mapred.MapTask: Starting flush of map output
22/06/21 10:26:06 INFO mapred.MapTask: Spilling map output
22/06/21 10:26:06 INFO mapred.MapTask: bufstart = 0; bufend = 59076;
bufvoid = 104857600
22/06/21 10:26:06 INFO mapred.MapTask: kvstart =
26214396(104857584); kvend = 26188144(104752576); length =
26253/6553600
22/06/21 10:26:06 INFO mapred.MapTask: Finished spill 0
22/06/21 10:26:06 INFO mapred.Task:
Task:attempt_local1195965365_0001_m_000000_0 is done. And is in the
process of committing
22/06/21 10:26:06 INFO mapred.LocalJobRunner: map
22/06/21 10:26:06 INFO mapred.Task: Task
'attempt_local1195965365_0001_m_000000_0' done.
```

```
22/06/21 10:26:06 INFO mapred.LocalJobRunner: Finishing task:
attempt_local1195965365_0001_m_000000_0
22/06/21 10:26:06 INFO mapred.LocalJobRunner: map task executor
complete.
22/06/21 10:26:06 INFO mapred.LocalJobRunner: Waiting for reduce tasks
22/06/21 10:26:06 INFO mapred.LocalJobRunner: Starting task:
attempt_local1195965365_0001_r_000000_0
22/06/21 10:26:06 INFO mapred.Task:  Using
ResourceCalculatorProcessTree : [ ]
22/06/21 10:26:06 INFO mapred.ReduceTask: Using
ShuffleConsumerPlugin:
org.apache.hadoop.mapreduce.task.reduce.Shuffle@65367f35
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: MergerManager:
memoryLimit=349752512, maxSingleShuffleLimit=87438128,
mergeThreshold=230836672, ioSortFactor=10,
memToMemMergeOutputsThreshold=10
22/06/21 10:26:06 INFO reduce.EventFetcher:
attempt_local1195965365_0001_r_000000_0 Thread started: EventFetcher
for fetching Map Completion Events
22/06/21 10:26:06 INFO reduce.LocalFetcher: localfetcher#1 about to
shuffle output of map attempt_local1195965365_0001_m_000000_0
decomp: 72206 len: 72210 to MEMORY
22/06/21 10:26:06 INFO reduce.InMemoryMapOutput: Read 72206 bytes
from map-output for attempt_local1195965365_0001_m_000000_0
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: closeInMemoryFile ->
map-output of size: 72206, inMemoryMapOutputs.size() -> 1,
commitMemory -> 0, usedMemory ->72206
22/06/21 10:26:06 INFO reduce.EventFetcher: EventFetcher is interrupted..
Returning
22/06/21 10:26:06 INFO mapred.LocalJobRunner: 1 / 1 copied.
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: finalMerge called with
1 in-memory map-outputs and 0 on-disk map-outputs
22/06/21 10:26:06 INFO mapred.Merger: Merging 1 sorted segments
22/06/21 10:26:06 INFO mapred.Merger: Down to the last merge-pass, with
1 segments left of total size: 72199 bytes
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: Merged 1 segments,
72206 bytes to disk to satisfy reduce memory limit
```

```
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: Merging 1 files, 72210
bytes from disk
22/06/21 10:26:06 INFO reduce.MergeManagerImpl: Merging 0 segments, 0
bytes from memory into reduce
22/06/21 10:26:06 INFO mapred.Merger: Merging 1 sorted segments
22/06/21 10:26:06 INFO mapred.Merger: Down to the last merge-pass, with
1 segments left of total size: 72199 bytes
22/06/21 10:26:06 INFO mapred.LocalJobRunner: 1 / 1 copied.
22/06/21 10:26:06 INFO Configuration.deprecation: mapred.skip.on is
deprecated. Instead, use mapreduce.job.skiprecords
22/06/21 10:26:06 INFO mapred.Task:
Task:attempt_local1195965365_0001_r_000000_0 is done. And is in the
process of committing
22/06/21 10:26:06 INFO mapred.LocalJobRunner: 1 / 1 copied.
22/06/21 10:26:06 INFO mapred.Task: Task
attempt_local1195965365_0001_r_000000_0 is allowed to commit now
22/06/21 10:26:06 INFO output.FileOutputCommitter: Saved output of task
'attempt_local1195965365_0001_r_000000_0' to
hdfs://localhost:54310/output_1901/_temporary/0/task_local1195965365_00
01_r_000000
22/06/21 10:26:06 INFO mapred.LocalJobRunner: reduce > reduce
22/06/21 10:26:06 INFO mapred.Task: Task
'attempt_local1195965365_0001_r_000000_0' done.
22/06/21 10:26:06 INFO mapred.LocalJobRunner: Finishing task:
attempt_local1195965365_0001_r_000000_0
22/06/21 10:26:06 INFO mapred.LocalJobRunner: reduce task executor
complete.
22/06/21 10:26:06 INFO mapreduce.Job: Job job_local1195965365_0001
running in uber mode : false
22/06/21 10:26:06 INFO mapreduce.Job:  map 100% reduce 100%
22/06/21 10:26:06 INFO mapreduce.Job: Job job_local1195965365_0001
completed successfully
22/06/21 10:26:06 INFO mapreduce.Job: Counters: 38
	File System Counters
		FILE: Number of bytes read=152940
		FILE: Number of bytes written=725372
		FILE: Number of read operations=0
```

```
        FILE: Number of large read operations=0
        FILE: Number of write operations=0
        HDFS: Number of bytes read=1776380
        HDFS: Number of bytes written=8
        HDFS: Number of read operations=13
        HDFS: Number of large read operations=0
        HDFS: Number of write operations=4
    Map-Reduce Framework
        Map input records=6565
        Map output records=6564
        Map output bytes=59076
        Map output materialized bytes=72210
        Input split bytes=110
        Combine input records=0
        Combine output records=0
        Reduce input groups=1
        Reduce shuffle bytes=72210
        Reduce input records=6564
        Reduce output records=1
        Spilled Records=13128
        Shuffled Maps =1
        Failed Shuffles=0
        Merged Map outputs=1
        GC time elapsed (ms)=63
        CPU time spent (ms)=0
        Physical memory (bytes) snapshot=0
        Virtual memory (bytes) snapshot=0
        Total committed heap usage (bytes)=999292928
    Shuffle Errors
        BAD_ID=0
        CONNECTION=0
        IO_ERROR=0
        WRONG_LENGTH=0
        WRONG_MAP=0
        WRONG_REDUCE=0
    File Input Format Counters
        Bytes Read=888190
        File Output Format Counters
                Bytes Written=8
hduser@bmsce-Precision-T1700:~$ hadoop fs -cat
/output_1901/part-r-00000
1901  46
hduser@bmsce-Precision-T1700:~$
```

b) Find the mean max temperature for every month

- Program

```
MeanMaxDriver.class
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(&quot;Please Enter the input and output
parameters&quot;);
System.exit(-1);
}
Job job = new Job();
job.setJarByClass(MeanMaxDriver.class);
job.setJobName(&quot;Max temperature&quot;);
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.class

```
package meanmax;
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 MeanMaxMapper extends Mapper&lt;LongWritable, Text,
Text, IntWritable&gt; {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value,
Mapper&lt;LongWritable, Text, Text, IntWritable&gt;.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 &amp;&amp;
quality.matches(&quot;[01459]&quot;))
context.write(new Text(month), new
IntWritable(temperature));
}
}
```

MeanMaxReducer.class

```
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 Reducer&lt;Text, IntWritable,
Text, IntWritable&gt; {
public void reduce(Text key, Iterable&lt;IntWritable&gt; values,
Reducer&lt;Text, IntWritable, Text, IntWritable&gt;.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 &gt; 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

```
hduser@bmsce-OptiPlex-3060:~$ hadoop jar
/home/hduser/Desktop/mean_max_temp.jar meanmax.MeanMaxDriver
/input_pranav/temp_1901.txt /avg_temp_output_meanmax_1901
22/06/21 10:17:01 INFO Configuration.deprecation: session.id is
deprecated. Instead, use dfs.metrics.session-id
22/06/21 10:17:01 INFO jvm.JvmMetrics: Initializing JVM Metrics with
processName=JobTracker, sessionId=
22/06/21 10:17:01 WARN mapreduce.JobSubmitter: Hadoop command-line
option parsing not performed. Implement the Tool interface and execute
your application with ToolRunner to remedy this.
22/06/21 10:17:01 INFO input.FileInputFormat: Total input paths to process
: 1
22/06/21 10:17:01 INFO mapreduce.JobSubmitter: number of splits:1
```

```
22/06/21 10:17:01 INFO mapreduce.JobSubmitter: Submitting tokens for
job: job_local232634845_0001
22/06/21 10:17:01 INFO mapreduce.Job: The url to track the job:
http://localhost:8080/
22/06/21 10:17:01 INFO mapreduce.Job: Running job:
job_local232634845_0001
22/06/21 10:17:01 INFO mapred.LocalJobRunner: OutputCommitter set in
config null
22/06/21 10:17:01 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Starting task:
attempt_local232634845_0001_m_000000_0
22/06/21 10:17:01 INFO mapred.Task:  Using
ResourceCalculatorProcessTree : [ ]
22/06/21 10:17:01 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/input_pranav/temp_1901.txt:0+888190
22/06/21 10:17:01 INFO mapred.MapTask: (EQUATOR) 0 kvi
26214396(104857584)
22/06/21 10:17:01 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/21 10:17:01 INFO mapred.MapTask: soft limit at 83886080
22/06/21 10:17:01 INFO mapred.MapTask: bufstart = 0; bufvoid =
104857600
22/06/21 10:17:01 INFO mapred.MapTask: kvstart = 26214396; length =
6553600
22/06/21 10:17:01 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/21 10:17:01 INFO mapred.LocalJobRunner:
22/06/21 10:17:01 INFO mapred.MapTask: Starting flush of map output
22/06/21 10:17:01 INFO mapred.MapTask: Spilling map output
22/06/21 10:17:01 INFO mapred.MapTask: bufstart = 0; bufend = 45948;
bufvoid = 104857600
22/06/21 10:17:01 INFO mapred.MapTask: kvstart =
26214396(104857584); kvend = 26188144(104752576); length =
26253/6553600
22/06/21 10:17:01 INFO mapred.MapTask: Finished spill 0
```

```
22/06/21 10:17:01 INFO mapred.Task:
Task:attempt_local232634845_0001_m_000000_0 is done. And is in the
process of committing
22/06/21 10:17:01 INFO mapred.LocalJobRunner: map
22/06/21 10:17:01 INFO mapred.Task: Task
'attempt_local232634845_0001_m_000000_0' done.
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Finishing task:
attempt_local232634845_0001_m_000000_0
22/06/21 10:17:01 INFO mapred.LocalJobRunner: map task executor
complete.
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Waiting for reduce tasks
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Starting task:
attempt_local232634845_0001_r_000000_0
22/06/21 10:17:01 INFO mapred.Task:  Using
ResourceCalculatorProcessTree : [ ]
22/06/21 10:17:01 INFO mapred.ReduceTask: Using
ShuffleConsumerPlugin:
org.apache.hadoop.mapreduce.task.reduce.Shuffle@1a055244
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: MergerManager:
memoryLimit=349752512, maxSingleShuffleLimit=87438128,
mergeThreshold=230836672, ioSortFactor=10,
memToMemMergeOutputsThreshold=10
22/06/21 10:17:01 INFO reduce.EventFetcher:
attempt_local232634845_0001_r_000000_0 Thread started: EventFetcher
for fetching Map Completion Events
22/06/21 10:17:01 INFO reduce.LocalFetcher: localfetcher#1 about to
shuffle output of map attempt_local232634845_0001_m_000000_0 decomp:
59078 len: 59082 to MEMORY
22/06/21 10:17:01 INFO reduce.InMemoryMapOutput: Read 59078 bytes
from map-output for attempt_local232634845_0001_m_000000_0
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: closeInMemoryFile ->
map-output of size: 59078, inMemoryMapOutputs.size() -> 1,
commitMemory -> 0, usedMemory ->59078
22/06/21 10:17:01 INFO reduce.EventFetcher: EventFetcher is interrupted..
Returning
22/06/21 10:17:01 INFO mapred.LocalJobRunner: 1 / 1 copied.
```

```
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: finalMerge called with
1 in-memory map-outputs and 0 on-disk map-outputs
22/06/21 10:17:01 INFO mapred.Merger: Merging 1 sorted segments
22/06/21 10:17:01 INFO mapred.Merger: Down to the last merge-pass, with
1 segments left of total size: 59073 bytes
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: Merged 1 segments,
59078 bytes to disk to satisfy reduce memory limit
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: Merging 1 files, 59082
bytes from disk
22/06/21 10:17:01 INFO reduce.MergeManagerImpl: Merging 0 segments, 0
bytes from memory into reduce
22/06/21 10:17:01 INFO mapred.Merger: Merging 1 sorted segments
22/06/21 10:17:01 INFO mapred.Merger: Down to the last merge-pass, with
1 segments left of total size: 59073 bytes
22/06/21 10:17:01 INFO mapred.LocalJobRunner: 1 / 1 copied.
22/06/21 10:17:01 INFO Configuration.deprecation: mapred.skip.on is
deprecated. Instead, use mapreduce.job.skiprecords
22/06/21 10:17:01 INFO mapred.Task:
Task:attempt_local232634845_0001_r_000000_0 is done. And is in the
process of committing
22/06/21 10:17:01 INFO mapred.LocalJobRunner: 1 / 1 copied.
22/06/21 10:17:01 INFO mapred.Task: Task
attempt_local232634845_0001_r_000000_0 is allowed to commit now
22/06/21 10:17:01 INFO output.FileOutputCommitter: Saved output of task
'attempt_local232634845_0001_r_000000_0' to
hdfs://localhost:54310/avg_temp_output_meanmax_1901/_temporary/0/task
_local232634845_0001_r_000000
22/06/21 10:17:01 INFO mapred.LocalJobRunner: reduce > reduce
22/06/21 10:17:01 INFO mapred.Task: Task
'attempt_local232634845_0001_r_000000_0' done.
22/06/21 10:17:01 INFO mapred.LocalJobRunner: Finishing task:
attempt_local232634845_0001_r_000000_0
22/06/21 10:17:01 INFO mapred.LocalJobRunner: reduce task executor
complete.
22/06/21 10:17:02 INFO mapreduce.Job: Job job_local232634845_0001
running in uber mode : false
22/06/21 10:17:02 INFO mapreduce.Job:  map 100% reduce 100%
```

```
22/06/21 10:17:02 INFO mapreduce.Job: Job job_local232634845_0001
completed successfully
22/06/21 10:17:02 INFO mapreduce.Job: Counters: 38
        File System Counters
                FILE: Number of bytes read=125588
                FILE: Number of bytes written=682332
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=1776380
                HDFS: Number of bytes written=74
                HDFS: Number of read operations=13
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=4
        Map-Reduce Framework
                Map input records=6565
                Map output records=6564
                Map output bytes=45948
                Map output materialized bytes=59082
                Input split bytes=114
                Combine input records=0
                Combine output records=0
                Reduce input groups=12
                Reduce shuffle bytes=59082
                Reduce input records=6564
                Reduce output records=12
                Spilled Records=13128
                Shuffled Maps =1
                Failed Shuffles=0
                Merged Map outputs=1
                GC time elapsed (ms)=54
                CPU time spent (ms)=0
                Physical memory (bytes) snapshot=0
                Virtual memory (bytes) snapshot=0
                Total committed heap usage (bytes)=999292928
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=888190
        File Output Format Counters
                Bytes Written=74
hduser@bmsce-OptiPlex-3060:~$ hdfs dfs -ls /avg_temp_meanmax_output
ls: `/avg_temp_meanmax_output': No such file or directory
hduser@bmsce-OptiPlex-3060:~$ hdfs dfs -ls
/avg_temp_output_meanmax_1901
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-21 10:17
/avg_temp_output_meanmax_1901/_SUCCESS
-rw-r--r--   1 hduser supergroup         74 2022-06-21 10:17
/avg_temp_output_meanmax_1901/part-r-00000
hduser@bmsce-OptiPlex-3060:~$ hdfs dfs -cat
/avg_temp_output_meanmax/part-r-00000
cat: `/avg_temp_output_meanmax/part-r-00000': No such file or directory
hduser@bmsce-OptiPlex-3060:~$ hdfs dfs -cat
/avg_temp_output_meanmax_1901/part-r-00000
01      4
02      0
03      7
04      44
05      100
06      168
07      219
08      198
09      141
10      100
11      19
12      3
```

LAB-7

For a given Text file, Create a Map Reduce program to sort the content in an alphabetic order listing only top 10 maximum occurrences of words.

- Program

```
Driver-TopN.class
package samples.topn;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.GenericOptionsParser;
public class TopN {
public static void main(String[] args) throws Exception {
Configuration conf = new Configuration();
String[] otherArgs = (new GenericOptionsParser(conf,
args)).getRemainingArgs();
if (otherArgs.length != 2) {
System.err.println(&quot;Usage: TopN &lt;in&gt; &lt;out&gt;&quot;);
System.exit(2);
}
Job job = Job.getInstance(conf);
job.setJobName(&quot;Top N&quot;);
job.setJarByClass(TopN.class);
job.setMapperClass(TopNMapper.class);
job.setReducerClass(TopNReducer.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
FileInputFormat.addInputPath(job, new Path(otherArgs[0]));
FileOutputFormat.setOutputPath(job, new
Path(otherArgs[1]));
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
public static class TopNMapper extends Mapper&lt;Object, Text,
Text, IntWritable&gt; {
private static final IntWritable one = new IntWritable(1);

private Text word = new Text();
private String tokens = &quot;[_|$#&lt;&gt;\\^=\\[\\]\\*/\\\\,;,.\\-
:()?!\&quot;&#39;]&quot;;
public void map(Object key, Text value, Mapper&lt;Object,
Text, Text, IntWritable&gt;.Context context) throws IOException,
InterruptedException {
String cleanLine =
value.toString().toLowerCase().replaceAll(this.tokens, &quot; &quot;);
StringTokenizer itr = new StringTokenizer(cleanLine);
while (itr.hasMoreTokens()) {
this.word.set(itr.nextToken().trim());
context.write(this.word, one);
}
}
}
}
```

TopNCombiner.class

```
package samples.topn;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class TopNCombiner extends Reducer&lt;Text, IntWritable,
Text, IntWritable&gt; {
public void reduce(Text key, Iterable&lt;IntWritable&gt; values,
Reducer&lt;Text, IntWritable, Text, IntWritable&gt;.Context context)
```

~~~~
throws IOException, InterruptedException {
int sum = 0;
for (IntWritable val : values)
sum += val.get();
context.write(key, new IntWritable(sum));
}
}
~~~~

TopNMapper.class

~~~~
package samples.topn;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class TopNMapper extends Mapper&lt;Object, Text, Text,
IntWritable&gt; {
private static final IntWritable one = new IntWritable(1);
private Text word = new Text();
private String tokens = &quot;[_|$#&lt;&gt;\\^=\\[\\]\\*/\\\\,;,.\\-
:()?!\&quot;&#39;]&quot;;
public vo```\\id map(Object key, Text value, Mapper&lt;Object,
Text, Text, IntWritable&gt;.Context context) throws IOException,
InterruptedException {
String cleanLine =
value.toString().toLowerCase().replaceAll(this.tokens, &quot; &quot;);
StringTokenizer itr = new StringTokenizer(cleanLine);
while (itr.hasMoreTokens()) {
this.word.set(itr.nextToken().trim());
context.write(this.word, one);
}
}
}
~~~~

TopNReducer.class

~~~~
package samples.topn;
import java.io.IOException;
~~~~

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

public class TopNReducer extends Reducer&lt;Text, IntWritable,
Text, IntWritable&gt; {
private Map&lt;Text, IntWritable&gt; countMap = new HashMap&lt;&gt;();
public void reduce(Text key, Iterable&lt;IntWritable&gt; values,
Reducer&lt;Text, IntWritable, Text, IntWritable&gt;.Context context)
throws IOException, InterruptedException {
int sum = 0;
for (IntWritable val : values)
sum += val.get();
this.countMap.put(new Text(key), new IntWritable(sum));
}
protected void cleanup(Reducer&lt;Text, IntWritable, Text,
IntWritable&gt;.Context context) throws IOException,
InterruptedException {
Map&lt;Text, IntWritable&gt; sortedMap =
MiscUtils.sortByValues(this.countMap);
int counter = 0;
for (Text key : sortedMap.keySet()) {
if (counter++ == 20)
break;
context.write(key, sortedMap.get(key));
}
}
}
```

- Output

LAB-8

Create a Map Reduce program to demonstrating join operation

- Program

```
// 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&lt;TextPair,
Text&gt; {
@Override
public void configure(JobConf job) {}
@Override
public int getPartition(TextPair key, Text value, int numPartitions) {
return (key.getFirst().hashCode() &amp; Integer.MAX_VALUE) %
numPartitions;
}
}
@Override
public int run(String[] args) throws Exception {
if (args.length != 3) {
System.out.println(&quot;Usage: &lt;Department Emp Strength input&gt;
&lt;Department Name input&gt; &lt;output&gt;&quot;);
return -1;
}
JobConf conf = new JobConf(getConf(), getClass());

conf.setJobName(&quot;Join &#39;Department Emp Strength input&#39;
with
&#39;Department Name
input&#39;&quot;);
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.cl
ass);
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&lt;TextPair, Text, Text,
Text&gt; {
@Override
public void reduce (TextPair key, Iterator&lt;Text&gt; values,
OutputCollector&lt;Text, Text&gt;
output, Reporter reporter)
```

```
throws IOException
{
Text nodeId = new Text(values.next());
while (values.hasNext()) {
Text node = values.next();
Text outValue = new Text(nodeId.toString() + &quot;\t\t&quot; +
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&lt;LongWritable, Text, TextPair,
Text&gt; {
@Override
public void map(LongWritable key, Text value,
OutputCollector&lt;TextPair, Text&gt; output,
Reporter reporter)
throws IOException
{
String valueString = value.toString();
String[] SingleNodeData = valueString.split(&quot;\t&quot;);
output.collect(new TextPair(SingleNodeData[0], &quot;1&quot;), 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&lt;LongWritable, Text, TextPair,
Text&gt; {
@Override
public void map(LongWritable key, Text value,
OutputCollector&lt;TextPair, Text&gt; output,
Reporter reporter)
throws IOException
{
String valueString = value.toString();
String[] SingleNodeData = valueString.split(&quot;\t&quot;);
output.collect(new TextPair(SingleNodeData[3], &quot;0&quot;), new
Text(SingleNodeData[9]));
}
}
// TextPair.java
import java.io.*;
import org.apache.hadoop.io.*;
public class TextPair implements WritableComparable&lt;TextPair&gt; {
private Text first;
private Text second;
public TextPair() {
set(new Text(), new Text());
}

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

```
}
public void set(Text first, Text second) {
this.first = first;
this.second = second;
}
public Text getFirst() {
return first;
}
public Text getSecond() {
return second;
}
@Override
public void write(DataOutput out) throws IOException {
first.write(out);
second.write(out);
}
@Override
public void readFields(DataInput in) throws IOException {
first.readFields(in);
second.readFields(in);
}
@Override
public int hashCode() {
return first.hashCode() * 163 + second.hashCode();

}
@Override
public boolean equals(Object o) {
if (o instanceof TextPair) {
TextPair tp = (TextPair) o;
return first.equals(tp.first) &amp;&amp; second.equals(tp.second);
}
return false;
}
@Override
public String toString() {
return first + &quot;\t&quot; + second;
```

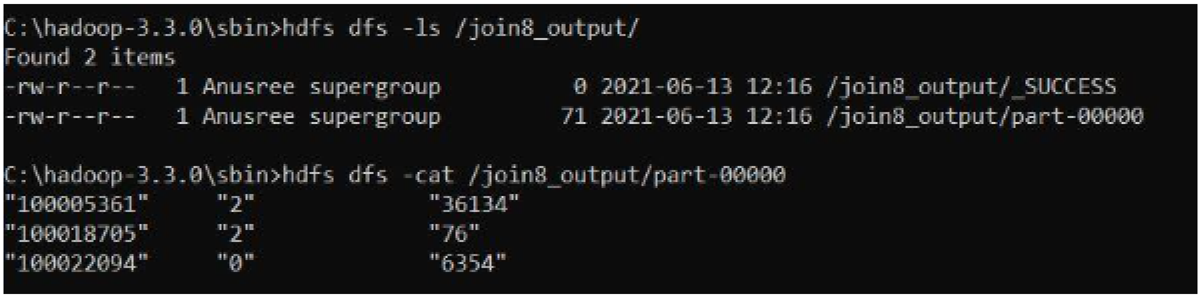
```
}
@Override
public int compareTo(TextPair tp) {
int cmp = first.compareTo(tp.first);
if (cmp != 0) {
return cmp;
}
return second.compareTo(tp.second);
}
// ^^ TextPair
// vv TextPairComparator
public static class Comparator extends WritableComparator {
private static final Text.Comparator TEXT_COMPARATOR = 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



```
C:\hadoop-3.3.0\sbin>hdfs dfs -ls /join8_output/
Found 2 items
-rw-r--r--   1 Anusree supergroup          0 2021-06-13 12:16 /join8_output/_SUCCESS
-rw-r--r--   1 Anusree supergroup         71 2021-06-13 12:16 /join8_output/part-00000

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /join8_output/part-00000
"100005361"     "2"             "36134"
"100018705"     "2"             "76"
"100022094"     "0"             "6354"
```

LAB-9

Program to print word count on scala shell and print “Hello world” on scala IDE

- commands and outline:

```
hduser@bmsce-OptiPlex-3060:~$ spark-shell
22/06/28 09:34:37 WARN Utils: Your hostname, bmsce-OptiPlex-3060 resolves to a loopback address: 127.0.1.1; using 10.124.7.72 instead (on interface enp1s0)
22/06/28 09:34:37 WARN Utils: Set SPARK_LOCAL_IP if you need to bind to another address
22/06/28 09:34:37 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
Spark context Web UI available at http://10.124.7.72:4040
Spark context available as 'sc' (master = local[*], app id = local-1656389082904).
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 2.4.8
      /_/
```

```
Using Scala version 2.11.12 (OpenJDK 64-Bit Server VM, Java 1.8.0_312)
Type in expressions to have them evaluated.
Type :help for more information.

scala> println("hello");
hello
scala> val data=sc.textFile("/home/hduser/Desktop/sample.txt");
data: org.apache.spark.rdd.RDD[String] = /home/hduser/Desktop/sample.txt
MapPartitionsRDD[1] at textFile at <console>:24

scala> data.collect;
res1: Array[String] = Array(hi hw are ypu, how is your job, how is your
family, how is your brother, how is your sister)

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;
res2: Array[String] = Array(hi, hw, are, ypu, how, is, your, job, how, is, your,
family, how, is, your, brother, how, is, your, sister)

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;
res3: Array[(String, Int)] = Array((hi,1), (hw,1), (are,1), (ypu,1), (how,1),
(is,1), (your,1), (job,1), (how,1), (is,1), (your,1), (family,1), (how,1), (is,1),
(your,1), (brother,1), (how,1), (is,1), (your,1), (sister,1))

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

scala> reducedata.collect;
```

```
res4: Array[(String, Int)] = Array((are,1), (brother,1), (is,4), (sister,1),
(family,1), (how,4), (ypu,1), (job,1), (hi,1), (hw,1), (your,4))

scala>
```

LAB-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

- commands and output:

```
cala> val textFile=sc.textFile("/home/hduser/Desktop/sample.txt");
textFile: org.apache.spark.rdd.RDD[String] =
/home/hduser/Desktop/sample.txt MapPartitionsRDD[8] at textFile at
<console>:24

scala> val counts=textFile.flatMap(line=>line.split("
")).map(word=>(word,1)).reduceByKey(_=_)
<console>:25: error: reassignment to val
       val counts=textFile.flatMap(line=>line.split("
")).map(word=>(word,1)).reduceByKey(_=_)
                                                    ^

scala> val counts=textFile.flatMap(line=>line.split("
")).map(word=>(word,1)).reduceByKey(_+_)
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[11] 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):_*)
```

```
sorted: scala.collection.immutable.ListMap[String,Int] = Map(is -> 4, how
-> 4, your -> 4, are -> 1, brother -> 1, sister -> 1, family -> 1, ypu -> 1, job
-> 1, hi -> 1, hw -> 1)

scala> println(sorted)
Map(is -> 4, how -> 4, your -> 4, are -> 1, brother -> 1, sister -> 1, family ->
1, ypu -> 1, job -> 1, hi -> 1, hw -> 1)

scala> for((k,v)<-sorted)
     | {
     |  if(v>4)
     |   {
     |    print(k+",")
     |     print(v)
     |     println()
     |   }
     | }
//SINCE SAMPLE TEXT FILE DOESNT HAVE WORD WITH
FREQUENCY >4,NO OUTPUT
```