VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT on

BIG DATA ANALYTICS (20CS6PEBDA)

Submitted by

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in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING BENGALURU-560019 May-2022 to July-2022

(Autonomous Institution under VTU)

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 **Ravi Sajjanar(1BM19CS127),** 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 Big data analytics - (20CS6PEBDA) work prescribed for the said degree.

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Index Sheet

Course Outcome

CO1	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO2	Analyze the Big Data and obtain insight using data analytics mechanisms.
CO3	Design and implement Big data applications by applying NoSQL, Hadoop or Spark

Hadoop Commands

```
bmsce@bmsce-Precision-T1700:~$ sudo su hduser
[sudo] password for bmsce:
hduser@bmsce-Precision-T1700:/home/bmsce$ 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
bmhduser@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:/home/bmsce$ jps
5489 ResourceManager
5107 DataNode
5319 SecondaryNameNode
4935 NameNode
```

```
5944 Jps
5821 NodeManager

hduser@bmsce-Precision-T1700:/home/bmsce$ hdfs dfs -mkdir /max
hduser@bmsce-Precision-T1700:/home/bmsce$ hadoop fs -ls/
-ls/: Unknown command
hduser@bmsce-Precision-T1700:/home/bmsce$ hadoop fs -ls /
Found 19 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:10 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:59 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:04 /Welcome
drwxr-xr-x   - hduser supergroup          0 2022-06-04 10:17 /abc
drwxr-xr-x   - hduser supergroup          0 2022-06-04 10:18 /abc1
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:44 /cs185
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:58 /cse
drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:04 /dishagubald
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:35 /duplicate
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:03 /file1
drwxr-xr-x   - hduser supergroup          0 2022-06-06 14:23 /max
drwxr-xr-x   - hduser supergroup          0 2022-06-01 14:56 /hello
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:40 /new
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:28 /praveen138
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:33 /sajjan
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:37 /sajjan2
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:03 /test
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:19 /user
hduser@bmsce-Precision-T1700:/home/bmsce$ hdfs dfs -put
/home/hduser/Desktop/Welcome.txt /max/WC.txt
```

```
hduser@bmsce-Precision-T1700:/home/bmsce$ hdfs dfs -cat /max/WC.txt
Bda Lab assignment

hduser@bmsce-Precision-T1700:~/Desktop$ cat Welcome.txt
Bda Lab assignment

hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -put
/home/hduser/Desktop/Welcome.txt /max/WC1.txt
put: `/max/WC1.txt': File exists
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -put
/home/hduser/Desktop/Welcome.txt /max/WC21.txt
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -cat /max/WC21.txt
\yo yo honey singh

hduser@bmsce-Precision-T1700:~/Desktop$ hadoop fs -ls /max
Found 3 items
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:28 /max/WC.txt
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:44 /max/WC1.txt
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:51 /max/WC21.txt
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -get /max/WC.txt
/home/hduser/Downloads/WWC.txt
get: `/home/hduser/Downloads/WWC.txt': File exists
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -get /max/WC.txt
/home/hduser/Downloads/WWE.txt
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -getmerge /max/WC1.txt
/max/WC21.txt /home/hduser/Desktop/new.txt
hduser@bmsce-Precision-T1700:~/Desktop$ cat new.txt
Bda Lab assignment
Bda Lab assignment
```

```
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -copyToLocal /max/WC1.txt
/home/hduser/Desktop
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -cat /max/WC1.txt
yo yo honey singh

hduser@bmsce-Precision-T1700:~/Desktop$ hadoop fs -mv /max /vj
hduser@bmsce-Precision-T1700:~/Desktop$ hadoop fs -ls /vj



Found 3 items
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:28 /vj/WC.txt
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:44 /vj/WC1.txt
-rw-r--r--   1 hduser supergroup         19 2022-06-06 14:51 /vj/WC21.txt
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs -cp /CSE/  /Ravi
Error: Could not find or load main class .Ravi
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -ls/
-ls/: Unknown command
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs dfs -ls /
Found 19 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:10 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:59 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:04 /Welcome
drwxr-xr-x   - hduser supergroup          0 2022-06-04 10:17 /abc
drwxr-xr-x   - hduser supergroup          0 2022-06-04 10:18 /abc1
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:44 /cs185
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:58 /cse
drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:04 /dishagubald
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:35 /duplicate
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:03 /file1
```

```
drwxr-xr-x   - hduser supergroup          0 2022-06-01 14:56 /hello
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:40 /new
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:28 /praveen138
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:33 /sajjan
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:37 /sajjan2
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:03 /test
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:19 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-06 14:51 /vj
hduser@bmsce-Precision-T1700:~/Desktop$ hdfs -cp /CSE/ /LLL
Error: Could not find or load main class .LLL

hduser@bmsce-Precision-T1700:~/Desktop$ hadoop fs -cp /cse/ /LLL
hduser@bmsce-Precision-T1700:~/Desktop$ hadoop fs -ls /LLL
Found 3 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:59 /LLL/FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:59 /LLL/LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:59 /LLL/cse
hduser@bmsce-Precision-T1700:~/Desktop$
```

Hadoop Programs

1) Word Count

WCMapper Java Class file.

```
// 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));
            }     }       }   }
```

Reducer Code

```
// 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));
    }
}
```

Driver Code:

```
// 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);
    }
}
```

Output :

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /input_ ravi
Found 2 items
drwxr-xr-x   - hduser supergroup          0 2022-06-20 15:16 /input_ ravi/output_ ravi
-rw-r--r--   1 hduser supergroup         52 2022-06-20 15:15 /input_ ravi /sample.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /input_ ravi /output_ ravi
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-20 15:16 /input_manoj/output_ ravi
/_SUCCESS
-rw-r--r--   1 hduser supergroup         63 2022-06-20 15:16 / input_ravi /output_ravi /part-00000
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /input_ravi/output_ ravi /part-0000
cat: `/input_khushil/output_khushil/part-0000': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /input_ravi/output_ ravi /part-00000
am        1
awesome        1
hadoop        2
hi        1
i        1
im        1
is        1
ravi        1
learing        1
```

2) Top N

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("Usage: TopN <in>
            <out>"); System.exit(2);
        }
        Job job = Job.getInstance(conf); job.setJobName("Top N");
        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<Object, Text,
Text, IntWritable> {
        private static final IntWritable one = new IntWritable(1);

        private Text word = new Text();

        private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-
:()?!\"']";

        public void map(Object key, Text value, Mapper<Object, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
            String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, "
");
            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<Text, IntWritable, Text, IntWritable> {
    public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
        int sum = 0;
        for (IntWritable val : values) sum += val.get();
        context.write(key, new IntWritable(sum));
    }

    }
```

TopNMapper.class

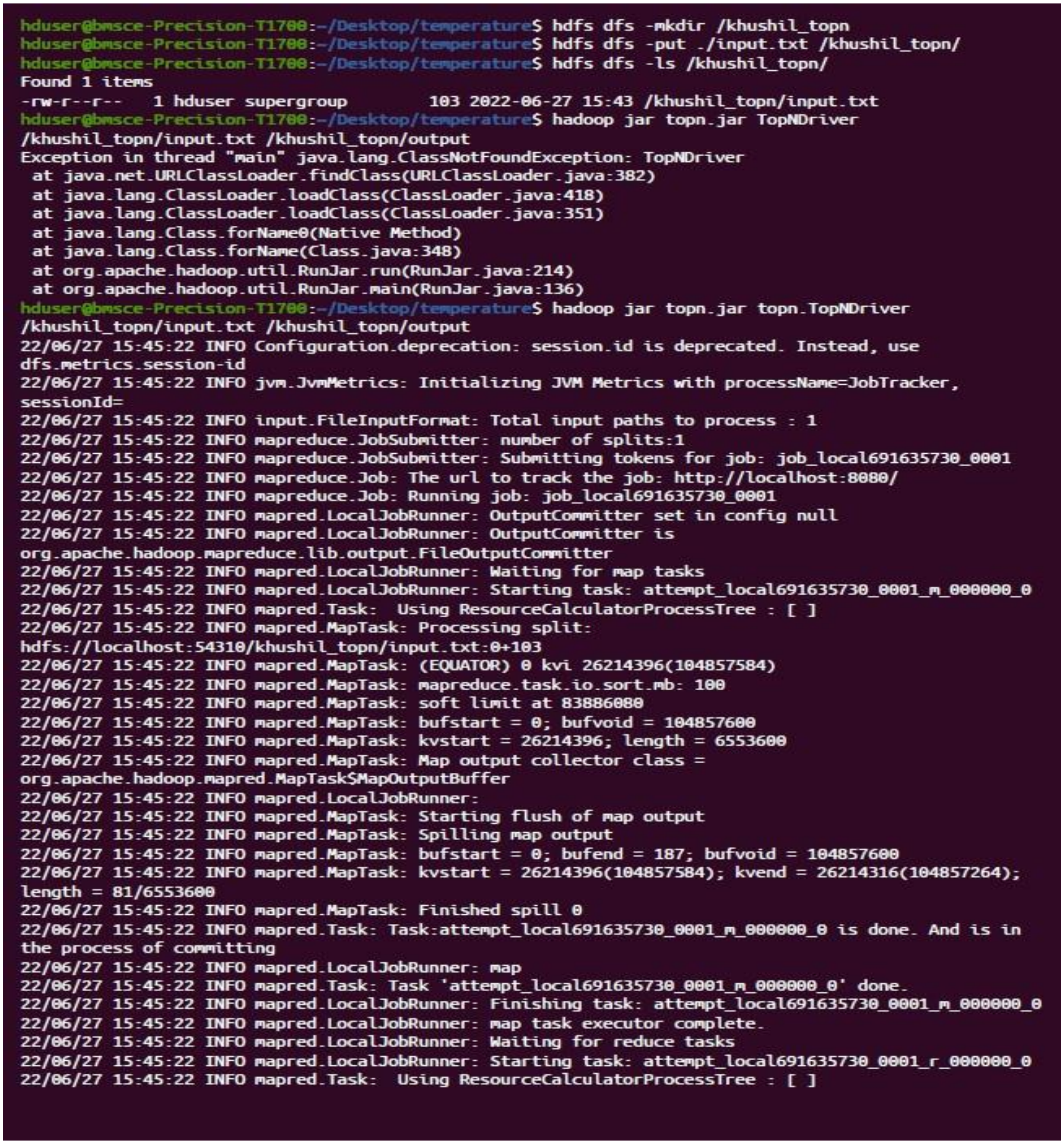
```
package samples.topn;

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<Object, Text, Text, IntWritable> {
    private static final IntWritable one = new IntWritable(1);

    private Text word = new Text();

    private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-
:()?!\"']";

    public vo```\\id map(Object key, Text value, Mapper<Object, Text, Text, 
IntWritable>.Context context) throws IOException, InterruptedException {
        String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, " ");
        StringTokenizer itr = new StringTokenizer(cleanLine);
        while (itr.hasMoreTokens()) { this.word.set(itr.nextToken().trim());
            context.write(this.word, one);
        }
    }
}
```

TopNReducer.class

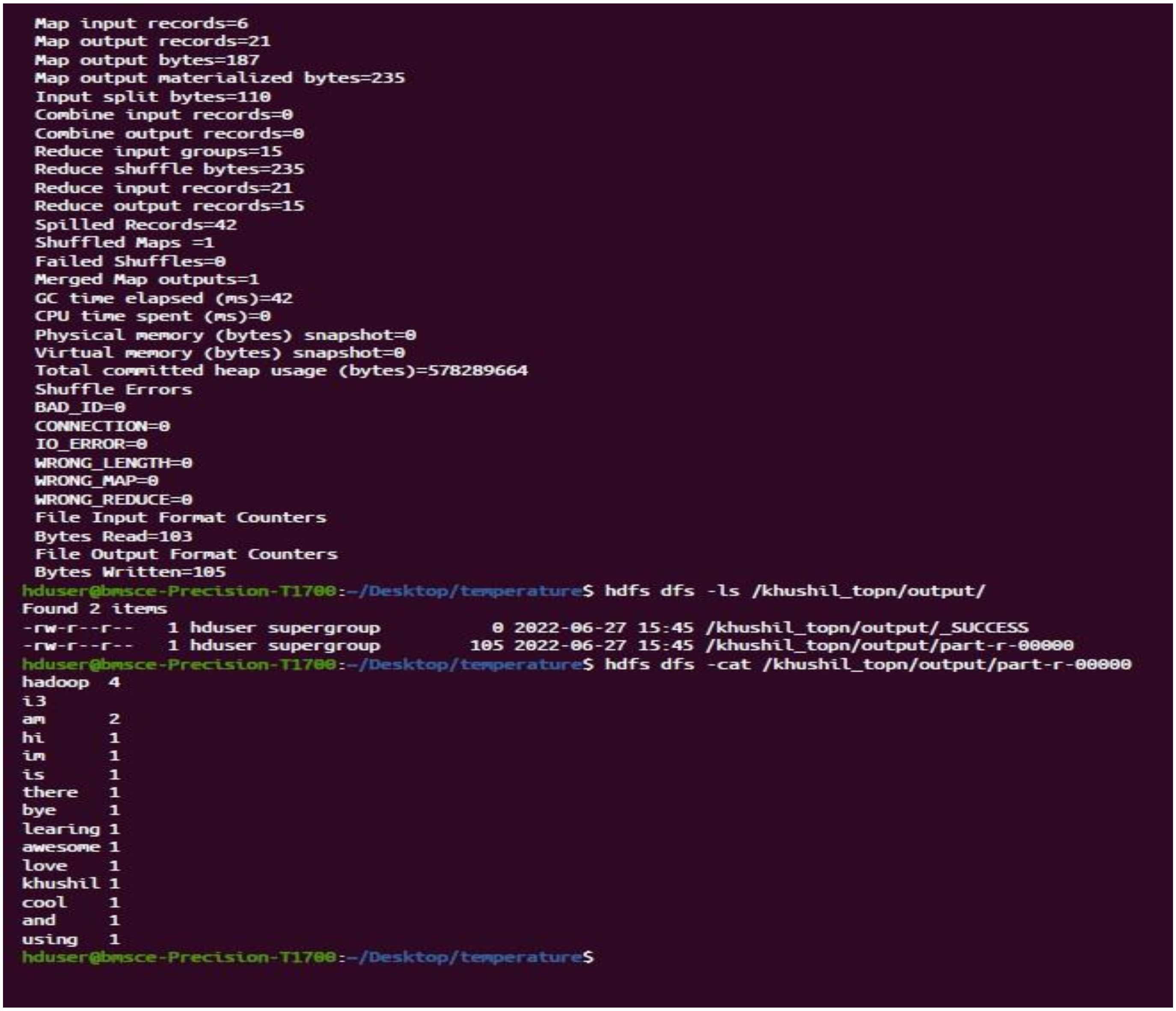
```
package samples.topn;

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<Text, IntWritable, Text, IntWritable> {
    private Map<Text, IntWritable> countMap = new HashMap<>();

    public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text,
IntWritable>.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<Text, IntWritable, Text, IntWritable>.Context context)
throws IOException, InterruptedException {
        Map<Text, IntWritable> sortedMap = MiscUtils.sortByValues(this.countMap);
        int counter = 0;
        for (Text key : sortedMap.keySet()) {
            if (counter++ == 20)
                break;
            context.write(key, sortedMap.get(key));
        }
    }
}
```

Output:



```
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -mkdir /khushil_topn
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./input.txt /khushil_topn/
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_topn/
Found 1 items
-rw-r--r--   1 hduser supergroup        103 2022-06-27 15:43 /khushil_topn/input.txt
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar topn.jar TopNDriver
/khushil_topn/input.txt /khushil_topn/output
Exception in thread "main" java.lang.ClassNotFoundException: TopNDriver
 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:~/Desktop/temperature$ hadoop jar topn.jar topn.TopNDriver
/khushil_topn/input.txt /khushil_topn/output
22/06/27 15:45:22 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 15:45:22 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 15:45:22 INFO input.FileInputFormat: Total input paths to process : 1
22/06/27 15:45:22 INFO mapreduce.JobSubmitter: number of splits:1
22/06/27 15:45:22 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local691635730_0001
22/06/27 15:45:22 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 15:45:22 INFO mapreduce.Job: Running job: job_local691635730_0001
22/06/27 15:45:22 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 15:45:22 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Starting task: attempt_local691635730_0001_m_000000_0
22/06/27 15:45:22 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:45:22 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_topn/input.txt:0+103
22/06/27 15:45:22 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:45:22 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 15:45:22 INFO mapred.MapTask: soft limit at 83886080
22/06/27 15:45:22 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 15:45:22 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 15:45:22 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 15:45:22 INFO mapred.LocalJobRunner:
22/06/27 15:45:22 INFO mapred.MapTask: Starting flush of map output
22/06/27 15:45:22 INFO mapred.MapTask: Spilling map output
22/06/27 15:45:22 INFO mapred.MapTask: bufstart = 0; bufend = 187; bufvoid = 104857600
22/06/27 15:45:22 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26214316(104857264);
length = 81/6553600
22/06/27 15:45:22 INFO mapred.MapTask: Finished spill 0
22/06/27 15:45:22 INFO mapred.Task: Task:attempt_local691635730_0001_m_000000_0 is done. And is in
the process of committing
22/06/27 15:45:22 INFO mapred.LocalJobRunner: map
22/06/27 15:45:22 INFO mapred.Task: Task 'attempt_local691635730_0001_m_000000_0' done.
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Finishing task: attempt_local691635730_0001_m_000000_0
22/06/27 15:45:22 INFO mapred.LocalJobRunner: map task executor complete.
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Waiting for reduce tasks
22/06/27 15:45:22 INFO mapred.LocalJobRunner: Starting task: attempt_local691635730_0001_r_000000_0
22/06/27 15:45:22 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
```



```
  Map input records=6
  Map output records=21
  Map output bytes=187
  Map output materialized bytes=235
  Input split bytes=110
  Combine input records=0
  Combine output records=0
  Reduce input groups=15
  Reduce shuffle bytes=235
  Reduce input records=21
  Reduce output records=15
  Spilled Records=42
  Shuffled Maps =1
  Failed Shuffles=0
  Merged Map outputs=1
  GC time elapsed (ms)=42
  CPU time spent (ms)=0
  Physical memory (bytes) snapshot=0
  Virtual memory (bytes) snapshot=0
  Total committed heap usage (bytes)=578289664
  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=103
  File Output Format Counters
  Bytes Written=105
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_topn/output/
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-27 15:45 /khushil_topn/output/_SUCCESS
-rw-r--r--   1 hduser supergroup        105 2022-06-27 15:45 /khushil_topn/output/part-r-00000
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -cat /khushil_topn/output/part-r-00000
hadoop  4
i3
am      2
hi      1
im      1
is      1
there   1
bye     1
learing 1
awesome 1
love    1
khushil 1
cool    1
and     1
using   1
hduser@bmsce-Precision-T1700:~/Desktop/temperature$
```

3) Average Temperature

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("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

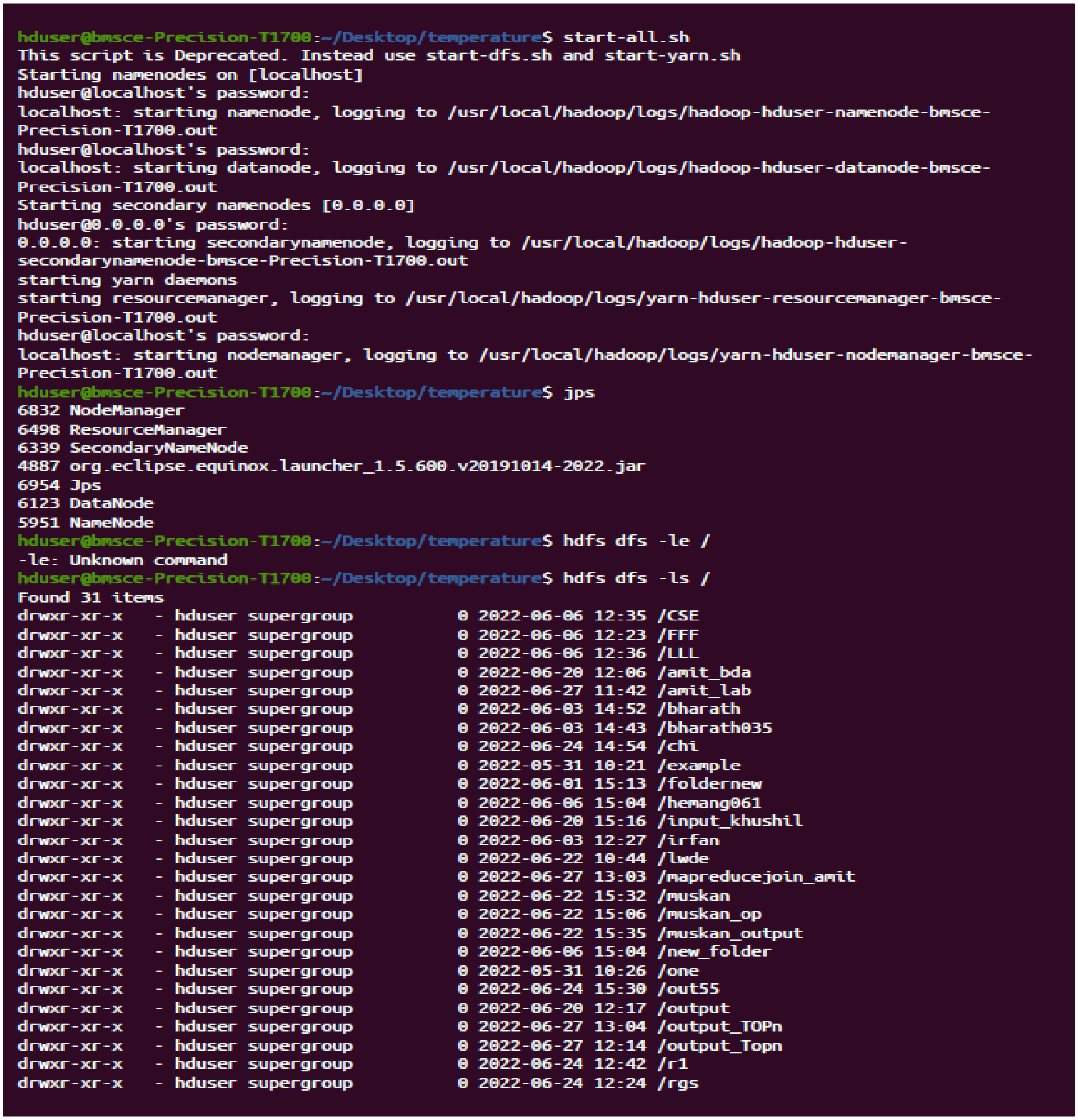
```
package temp;

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) == '+') {
            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));
    }
}
```

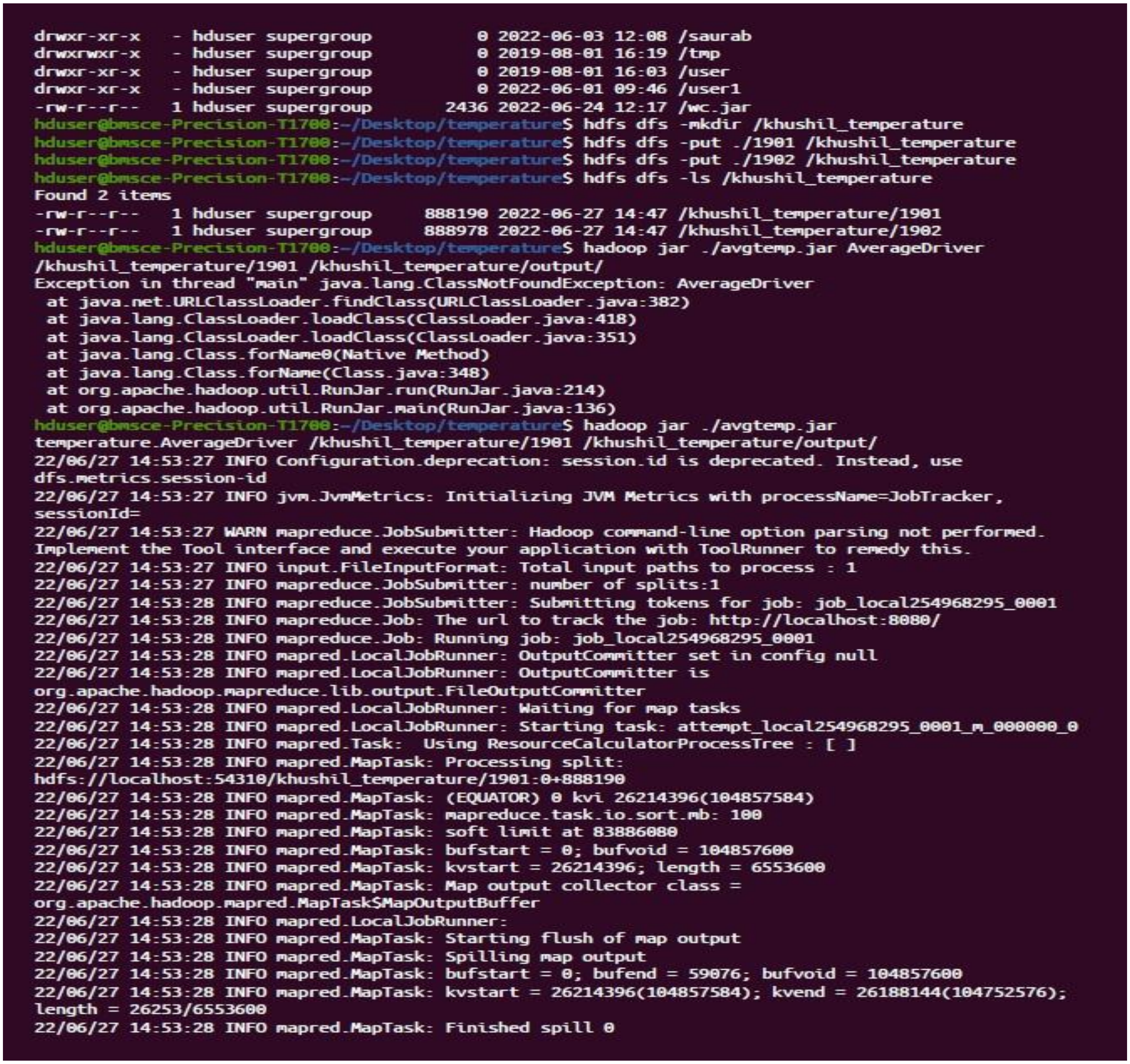
AverageReducer

```
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));
    }
}
```

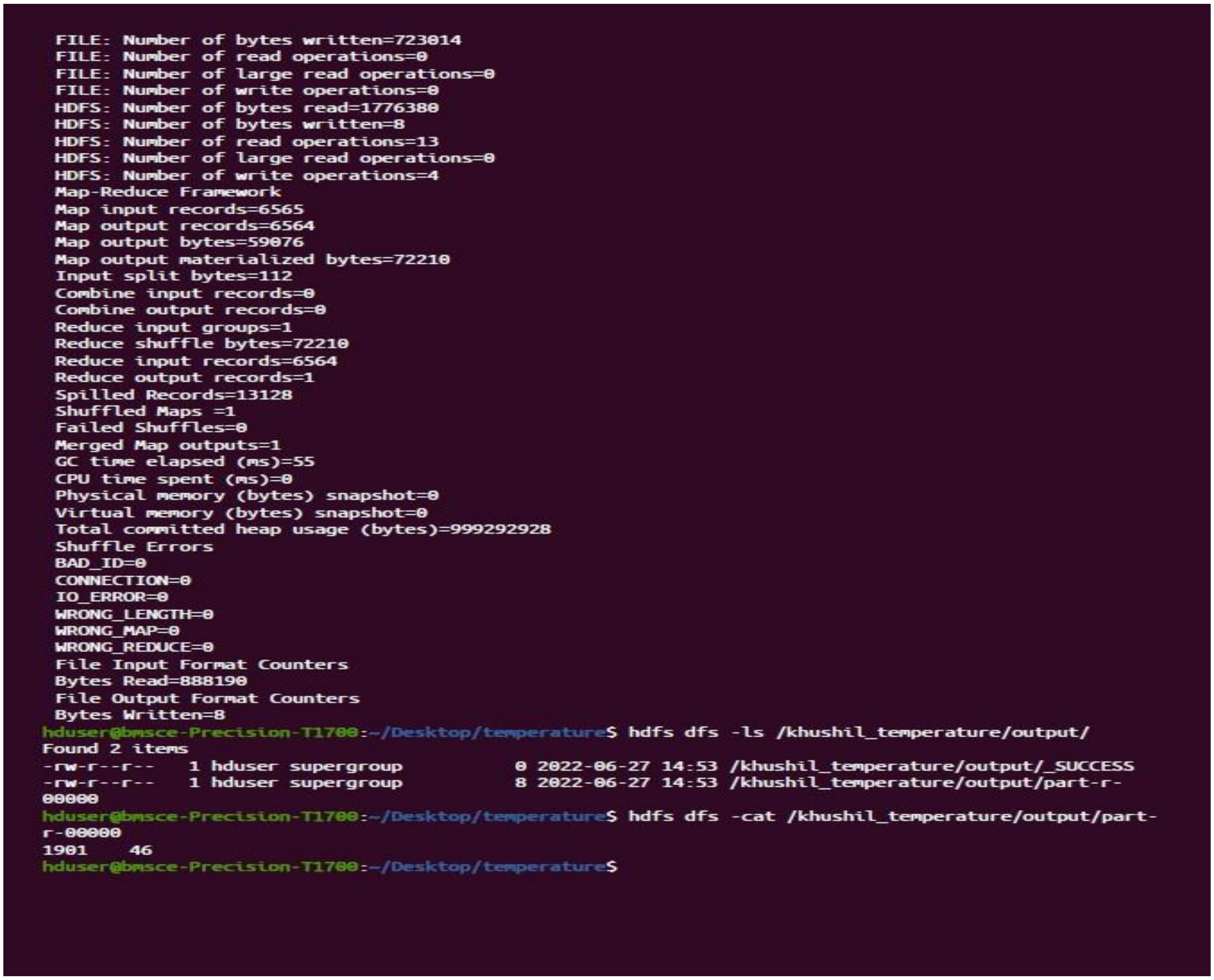
Output:



```
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ 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:~/Desktop/temperature$ jps
6832 NodeManager
6498 ResourceManager
6339 SecondaryNameNode
4887 org.eclipse.equinox.launcher_1.5.600.v20191014-2022.jar
6954 Jps
6123 DataNode
5951 NameNode
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -le /
-le: Unknown command
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /
Found 31 items
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:35 /CSE
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:23 /FFF
drwxr-xr-x   - hduser supergroup          0 2022-06-06 12:36 /LLL
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:06 /amit_bda
drwxr-xr-x   - hduser supergroup          0 2022-06-27 11:42 /amit_lab
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:52 /bharath
drwxr-xr-x   - hduser supergroup          0 2022-06-03 14:43 /bharath035
drwxr-xr-x   - hduser supergroup          0 2022-06-24 14:54 /chi
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:21 /example
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:13 /foldernew
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /hemang061
drwxr-xr-x   - hduser supergroup          0 2022-06-20 15:16 /input_khushil
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:27 /irfan
drwxr-xr-x   - hduser supergroup          0 2022-06-22 10:44 /lwde
drwxr-xr-x   - hduser supergroup          0 2022-06-27 13:03 /mapreducejoin_amit
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:32 /muskan
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:06 /muskan_op
drwxr-xr-x   - hduser supergroup          0 2022-06-22 15:35 /muskan_output
drwxr-xr-x   - hduser supergroup          0 2022-06-06 15:04 /new_folder
drwxr-xr-x   - hduser supergroup          0 2022-05-31 10:26 /one
drwxr-xr-x   - hduser supergroup          0 2022-06-24 15:30 /out55
drwxr-xr-x   - hduser supergroup          0 2022-06-20 12:17 /output
drwxr-xr-x   - hduser supergroup          0 2022-06-27 13:04 /output_TOPn
drwxr-xr-x   - hduser supergroup          0 2022-06-27 12:14 /output_Topn
drwxr-xr-x   - hduser supergroup          0 2022-06-24 12:42 /r1
drwxr-xr-x   - hduser supergroup          0 2022-06-24 12:24 /rgs
```



```
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:08 /saurab
drwxrwxr-x   - hduser supergroup          0 2019-08-01 16:19 /tmp
drwxr-xr-x   - hduser supergroup          0 2019-08-01 16:03 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-01 09:46 /user1
-rw-r--r--   1 hduser supergroup       2436 2022-06-24 12:17 /wc.jar
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -mkdir /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./1901 /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -put ./1902 /khushil_temperature
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -ls /khushil_temperature
Found 2 items
-rw-r--r--   1 hduser supergroup     888190 2022-06-27 14:47 /khushil_temperature/1901
-rw-r--r--   1 hduser supergroup     888978 2022-06-27 14:47 /khushil_temperature/1902
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hadoop jar ./avgtemp.jar AverageDriver
/khushil_temperature/1901 /khushil_temperature/output/
Exception in thread "main" java.lang.ClassNotFoundException: 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:~/Desktop/temperature$ hadoop jar ./avgtemp.jar
temperature.AverageDriver /khushil_temperature/1901 /khushil_temperature/output/
22/06/27 14:53:27 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 14:53:27 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 14:53:27 WARN mapreduce.JobSubmitter: Hadoop command-line option parsing not performed.
Implement the Tool interface and execute your application with ToolRunner to remedy this.
22/06/27 14:53:27 INFO input.FileInputFormat: Total input paths to process : 1
22/06/27 14:53:27 INFO mapreduce.JobSubmitter: number of splits:1
22/06/27 14:53:28 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local254968295_0001
22/06/27 14:53:28 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 14:53:28 INFO mapreduce.Job: Running job: job_local254968295_0001
22/06/27 14:53:28 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 14:53:28 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
22/06/27 14:53:28 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 14:53:28 INFO mapred.LocalJobRunner: Starting task: attempt_local254968295_0001_m_000000_0
22/06/27 14:53:28 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 14:53:28 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_temperature/1901:0+888190
22/06/27 14:53:28 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 14:53:28 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 14:53:28 INFO mapred.MapTask: soft limit at 83886080
22/06/27 14:53:28 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 14:53:28 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 14:53:28 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 14:53:28 INFO mapred.LocalJobRunner:
22/06/27 14:53:28 INFO mapred.MapTask: Starting flush of map output
22/06/27 14:53:28 INFO mapred.MapTask: Spilling map output
22/06/27 14:53:28 INFO mapred.MapTask: bufstart = 0; bufend = 59076; bufvoid = 104857600
22/06/27 14:53:28 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188144(104752576);
length = 26253/6553600
22/06/27 14:53:28 INFO mapred.MapTask: Finished spill 0
```



```
  FILE: Number of bytes written=723014
  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=112
  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)=55
  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:~/Desktop/temperature$ hdfs dfs -ls /khushil_temperature/output/
Found 2 items
-rw-r--r--   1 hduser supergroup          0 2022-06-27 14:53 /khushil_temperature/output/_SUCCESS
-rw-r--r--   1 hduser supergroup          8 2022-06-27 14:53 /khushil_temperature/output/part-r-
00000
hduser@bmsce-Precision-T1700:~/Desktop/temperature$ hdfs dfs -cat /khushil_temperature/output/part-
r-00000
1901    46
hduser@bmsce-Precision-T1700:~/Desktop/temperature$
```

4) Join

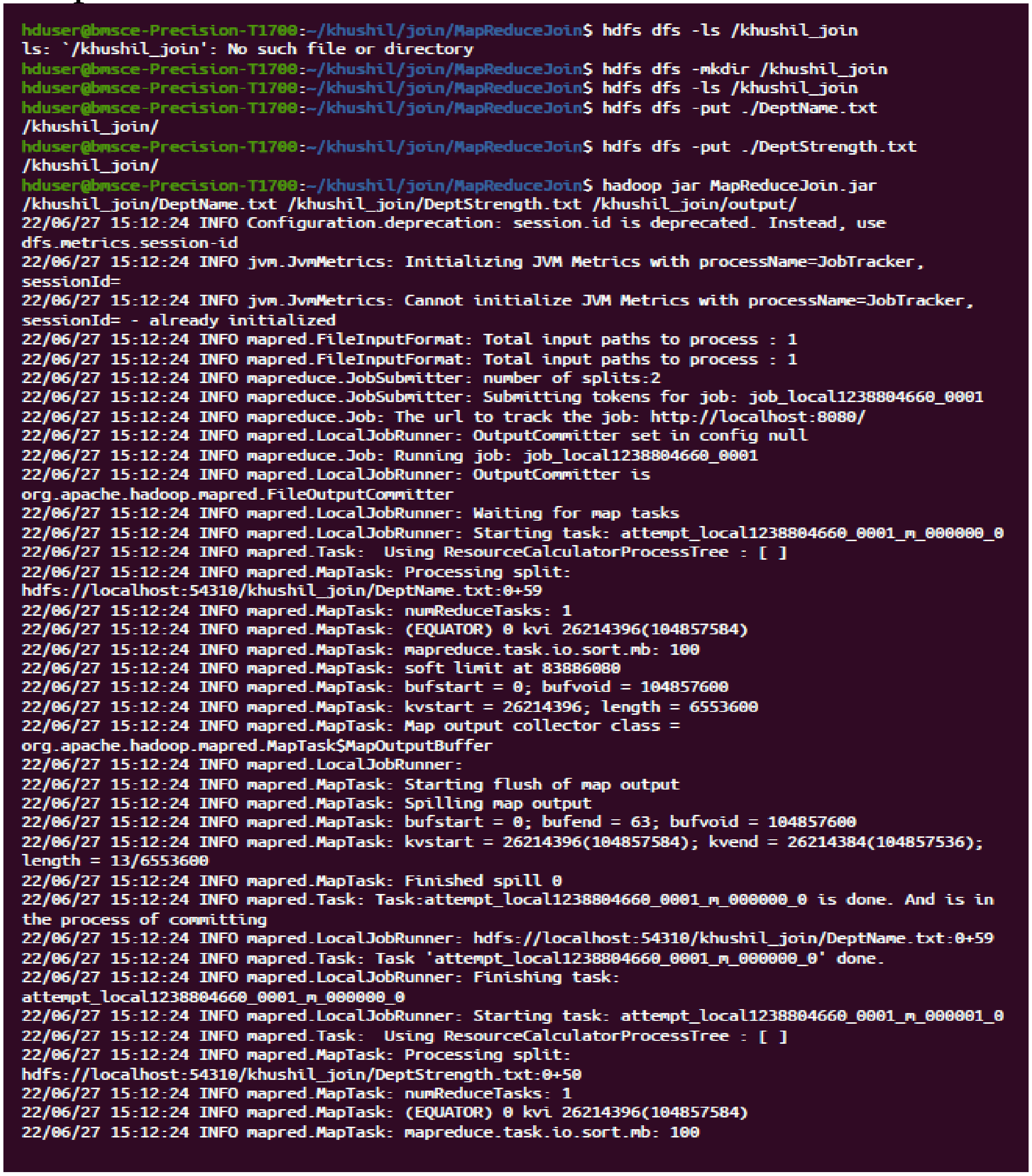
```
// JoinDriver.java
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
import org.apache.hadoop.mapred.lib.MultipleInputs;
import org.apache.hadoop.util.*;

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 'Department Emp Strength input' with 'Department Name
input'");

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
import java.io.*;

import org.apache.hadoop.io.*;

public class TextPair implements WritableComparable<TextPair> {

    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) && second.equals(tp.second);
        }
        return false;
    }

    @Override
    public String toString() {
        return first + "\t" + second;
    }

    @Override
    public int compareTo(TextPair tp) {
        int cmp = first.compareTo(tp.first);
        if (cmp != 0) {
            return cmp;
        }
        return second.compareTo(tp.second);
    }
    // ^^ TextPair

    // vv TextPairComparator
    public static class Comparator extends WritableComparator {

        private static final Text.Comparator TEXT_COMPARATOR = new Text.Comparator();

        public Comparator() {
            super(TextPair.class);
        }
```

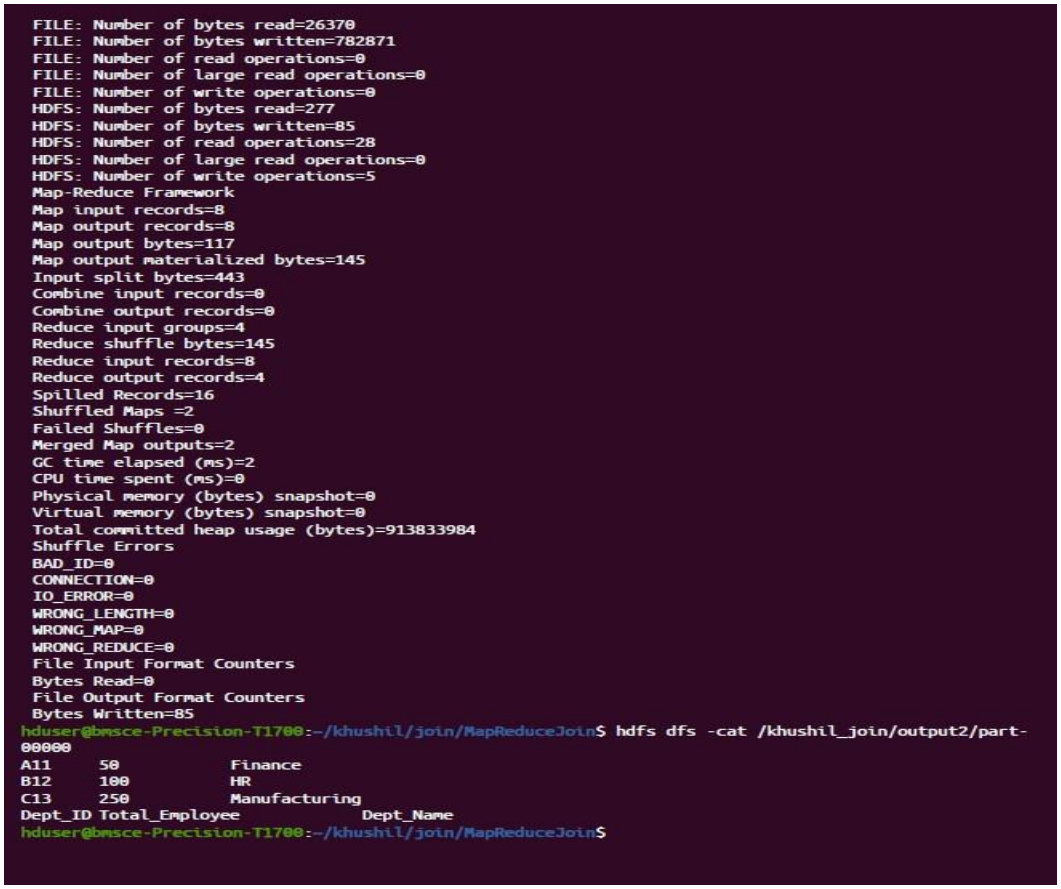
```
  @Override
  public int compare(byte[] b1, int s1, int l1,
      byte[] b2, int s2, int l2) {

    try {
      int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
      int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
      int cmp = TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
      if (cmp != 0) {
        return cmp;
      }
      return TEXT_COMPARATOR.compare(b1, s1 + firstL1, l1 - firstL1,

          b2, s2 + firstL2, l2 - firstL2);
    } catch (IOException e) {
      throw new IllegalArgumentException(e);
    }
  }
}

static {
  WritableComparator.define(TextPair.class, new Comparator());
}

public static class FirstComparator extends WritableComparator {

  private static final Text.Comparator TEXT_COMPARATOR = new Text.Comparator();

  public FirstComparator() {
    super(TextPair.class);
  }

  @Override
  public int compare(byte[] b1, int s1, int l1,
      byte[] b2, int s2, int l2) {

    try {
      int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
      int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
      return TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
    } catch (IOException e) {
      throw new IllegalArgumentException(e);
    }
  }
```

```
        @Override
        public int compare(WritableComparable a, WritableComparable b) {
            if (a instanceof TextPair && b instanceof TextPair) {
                return ((TextPair) a).first.compareTo(((TextPair) b).first);
            }
            return super.compare(a, b);
        }
    }
}
```

Output:



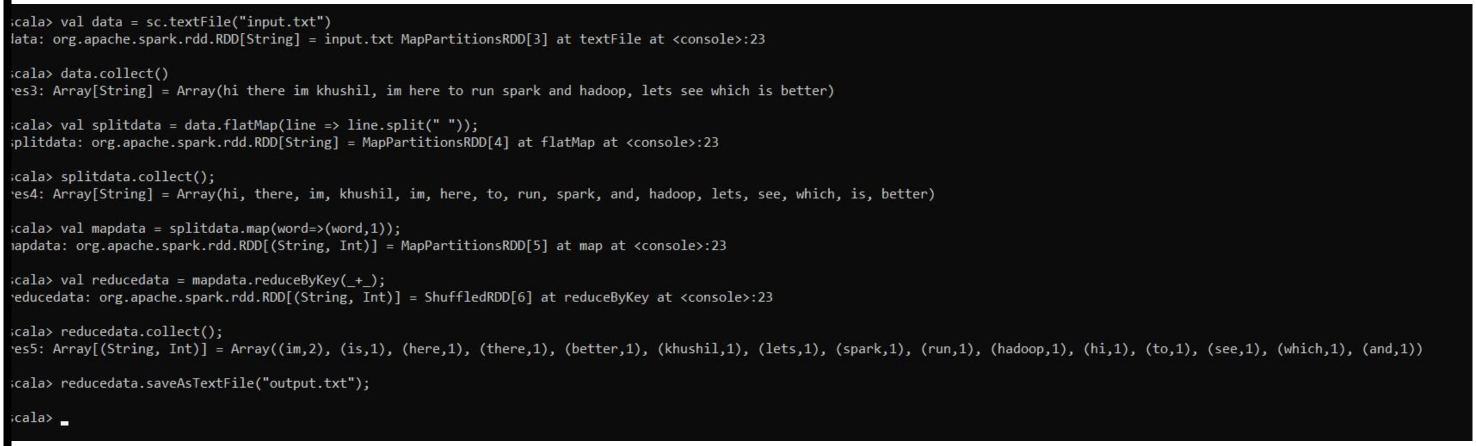
```
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -ls /khushil_join
ls: `/khushil_join': No such file or directory
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -mkdir /khushil_join
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -ls /khushil_join
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -put ./DeptName.txt
/khushil_join/
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hdfs dfs -put ./DeptStrength.txt
/khushil_join/
hduser@bmsce-Precision-T1700:~/khushil/join/MapReduceJoin$ hadoop jar MapReduceJoin.jar
/khushil_join/DeptName.txt /khushil_join/DeptStrength.txt /khushil_join/output/
22/06/27 15:12:24 INFO Configuration.deprecation: session.id is deprecated. Instead, use
dfs.metrics.session-id
22/06/27 15:12:24 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker,
sessionId=
22/06/27 15:12:24 INFO jvm.JvmMetrics: Cannot initialize JVM Metrics with processName=JobTracker,
sessionId= - already initialized
22/06/27 15:12:24 INFO mapred.FileInputFormat: Total input paths to process : 1
22/06/27 15:12:24 INFO mapred.FileInputFormat: Total input paths to process : 1
22/06/27 15:12:24 INFO mapreduce.JobSubmitter: number of splits:2
22/06/27 15:12:24 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1238804660_0001
22/06/27 15:12:24 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
22/06/27 15:12:24 INFO mapred.LocalJobRunner: OutputCommitter set in config null
22/06/27 15:12:24 INFO mapreduce.Job: Running job: job_local1238804660_0001
22/06/27 15:12:24 INFO mapred.LocalJobRunner: OutputCommitter is
org.apache.hadoop.mapred.FileOutputCommitter
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Waiting for map tasks
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Starting task: attempt_local1238804660_0001_m_000000_0
22/06/27 15:12:24 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:12:24 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_join/DeptName.txt:0+59
22/06/27 15:12:24 INFO mapred.MapTask: numReduceTasks: 1
22/06/27 15:12:24 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:12:24 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
22/06/27 15:12:24 INFO mapred.MapTask: soft limit at 83886080
22/06/27 15:12:24 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
22/06/27 15:12:24 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
22/06/27 15:12:24 INFO mapred.MapTask: Map output collector class =
org.apache.hadoop.mapred.MapTask$MapOutputBuffer
22/06/27 15:12:24 INFO mapred.LocalJobRunner:
22/06/27 15:12:24 INFO mapred.MapTask: Starting flush of map output
22/06/27 15:12:24 INFO mapred.MapTask: Spilling map output
22/06/27 15:12:24 INFO mapred.MapTask: bufstart = 0; bufend = 63; bufvoid = 104857600
22/06/27 15:12:24 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26214384(104857536);
length = 13/6553600
22/06/27 15:12:24 INFO mapred.MapTask: Finished spill 0
22/06/27 15:12:24 INFO mapred.Task: Task:attempt_local1238804660_0001_m_000000_0 is done. And is in
the process of committing
22/06/27 15:12:24 INFO mapred.LocalJobRunner: hdfs://localhost:54310/khushil_join/DeptName.txt:0+59
22/06/27 15:12:24 INFO mapred.Task: Task 'attempt_local1238804660_0001_m_000000_0' done.
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Finishing task:
attempt_local1238804660_0001_m_000000_0
22/06/27 15:12:24 INFO mapred.LocalJobRunner: Starting task: attempt_local1238804660_0001_m_000001_0
22/06/27 15:12:24 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
22/06/27 15:12:24 INFO mapred.MapTask: Processing split:
hdfs://localhost:54310/khushil_join/DeptStrength.txt:0+50
22/06/27 15:12:24 INFO mapred.MapTask: numReduceTasks: 1
22/06/27 15:12:24 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
22/06/27 15:12:24 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
```



```
  FILE: Number of bytes read=26370
  FILE: Number of bytes written=782871
  FILE: Number of read operations=0
  FILE: Number of large read operations=0
  FILE: Number of write operations=0
  HDFS: Number of bytes read=277
  HDFS: Number of bytes written=85
  HDFS: Number of read operations=28
  HDFS: Number of large read operations=0
  HDFS: Number of write operations=5
  Map-Reduce Framework
  Map input records=8
  Map output records=8
  Map output bytes=117
  Map output materialized bytes=145
  Input split bytes=443
  Combine input records=0
  Combine output records=0
  Reduce input groups=4
  Reduce shuffle bytes=145
  Reduce input records=8
  Reduce output records=4
  Spilled Records=16
  Shuffled Maps =2
  Failed Shuffles=0
  Merged Map outputs=2
  GC time elapsed (ms)=2
  CPU time spent (ms)=0
  Physical memory (bytes) snapshot=0
  Virtual memory (bytes) snapshot=0
  Total committed heap usage (bytes)=913833984
  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$
```

Scala Programming:
Lab 9:

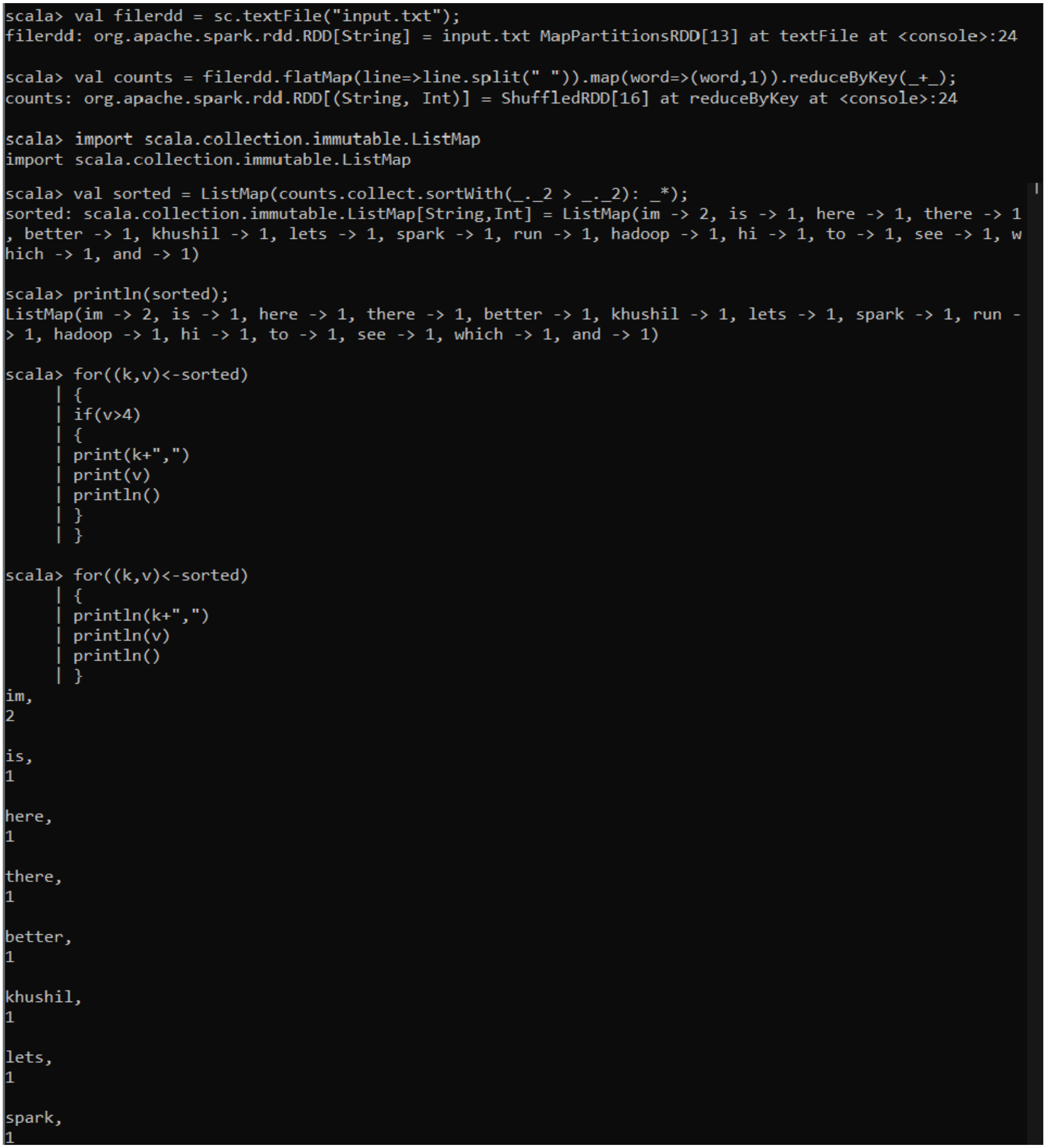
```
val data=sc.textFile("sparkdata.txt") data.collect;
val splitdata = data.flatMap(line => line.split(" ")); splitdata.collect;
val mapdata = splitdata.map(word => (word,1)); mapdata.collect;
val reducedata = mapdata.reduceByKey(_+_); reducedata.collect;
```



```
scala> val data = sc.textFile("input.txt")
data: org.apache.spark.rdd.RDD[String] = input.txt MapPartitionsRDD[3] at textFile at <console>:23

scala> data.collect()
res3: Array[String] = Array(hi there im khushil, im here to run spark and hadoop, lets see which is better)

scala> val splitdata = data.flatMap(line => line.split(" "));
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[4] at flatMap at <console>:23

scala> splitdata.collect();
res4: Array[String] = Array(hi, there, im, khushil, im, here, to, run, spark, and, hadoop, lets, see, which, is, better)

scala> val mapdata = splitdata.map(word=>(word,1));
mapdata: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[5] at map at <console>:23

scala> val reducedata = mapdata.reduceByKey(_+_);
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[6] at reduceByKey at <console>:23

scala> reducedata.collect();
res5: Array[(String, Int)] = Array((im,2), (is,1), (here,1), (there,1), (better,1), (khushil,1), (lets,1), (spark,1), (run,1), (hadoop,1), (hi,1), (to,1), (see,1), (which,1), (and,1))

scala> reducedata.saveAsTextFile("output.txt");

scala>
```

Lab 10:

```
val textFile = sc.textFile("/home/bhoom/Desktop/wc.txt")
val counts = textFile.flatMap(line => line.split(" ")).map(word => (word,
1)).reduceByKey(_ + _)
import scala.collection.immutable.ListMap
val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)// sort in descending
order based on values
println(sorted)
for((k,v)<-sorted)
{
if(v>4)
{
print(k+",")
print(v)
println()
}}
```



```
scala> val filerdd = sc.textFile("input.txt");
filerdd: org.apache.spark.rdd.RDD[String] = input.txt MapPartitionsRDD[13] at textFile at <console>:24

scala> val counts = filerdd.flatMap(line=>line.split(" ")).map(word=>(word,1)).reduceByKey(_+_);
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[16] at reduceByKey at <console>:24

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] = ListMap(im -> 2, is -> 1, here -> 1, there -> 1
, better -> 1, khushil -> 1, lets -> 1, spark -> 1, run -> 1, hadoop -> 1, hi -> 1, to -> 1, see -> 1, w
hich -> 1, and -> 1)

scala> println(sorted);
ListMap(im -> 2, is -> 1, here -> 1, there -> 1, better -> 1, khushil -> 1, lets -> 1, spark -> 1, run -
> 1, hadoop -> 1, hi -> 1, to -> 1, see -> 1, which -> 1, and -> 1)

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

scala> for((k,v)<-sorted)
     | {
     | println(k+",")
     | println(v)
     | println()
     | }
im,
2

is,
1

here,
1

there,
1

better,
1

khushil,
1

lets,
1

spark,
1
```