VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS
(20CS6PEBDA)

Submitted by

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

B.M.S. COLLEGE OF ENGINEERING
(Autonomous Institution under VTU)
BENGALURU-560019
May-2022 to July-2022

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 **MD IBADUDDIN SAFFAN (1BM19CS085),** 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**Course Title - (Course code)** work prescribed for the said degree.

Name of the Lab-Incharge
Designation
Department of CSE
BMSCE, Bengaluru

Prof. Pallavi G B
Assistant Professor
Department of CSE
BMSCE, Bengaluru

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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

1 MongoDB CRUD Operations

I. CREATE DATABASE IN MONGODB

>use saffanDB

switched to db saffanDB

II. CRUD (CREATE, READ, UPDATE, DELETE) OPERATIONS

>db.createCollection("Student");

{ "ok" : 1 }

>db.Student.insert({_id:1,name:"Saffan",grade:9});

WriteResult({ "nInserted" : 1 })

>db.Student.update({_id:6,name:"qwert"},{$set:{grade:4}},{upsert:true});

WriteResult({ "nMatched" : 0, "nUpserted" : 1, "nModified" : 0, "_id" : 6 })

>db.Student.find();

{ "_id" : 1, "name" : "Saffan", "grade" : 9 }

{ "_id" : 2, "name" : "Abc", "grade" : 10 }

{ "_id" : 3, "name" : "Mno", "grade" : 5 }

{ "_id" : 4, "name" : "Pqr", "grade" : 8 }

> show collections;

Student

III. Save Method

> db.Student.save({name:"zzz",_id:10,grade:8});

WriteResult({ "nMatched" : 0, "nUpserted" : 1, "nModified" : 0, "_id" : 10 })

IV. COUNT

> db.Student.count();

6

> db.Student.count({grade:9});

1

V FIND

> db.Student.find({grade:{$lt:5}},{name:1,grade:1,_id:0});

{ "grade" : 2, "name" : "qwert" }

> db.Student.find({name:{$in:["Saffan","Abc","Mno"]}},{name:1,grade:1,_id:0});

{ "name" : "Saffan", "grade" : 9 }

{ "name" : "Abc", "grade" : 10 }

{ "name" : "Mno", "grade" : 5 }

> db.Student.find({name:/^S/},{name:1,grade:1,_id:0});

{ "name" : "Saffan", "grade" : 9 }

> db.Student.find({name:/.b/},{name:1,grade:1,_id:0});

{ "name" : "Abc", "grade" : 10 }

> db.Student.find().sort({name:1});

{ "_id" : 2, "name" : "Abc", "grade" : 10 }

{ "_id" : 3, "name" : "Mno", "grade" : 5 }

{ "_id" : 4, "name" : "Pqr", "grade" : 8 }

{ "_id" : 1, "name" : "Saffan", "grade" : 9 }

{ "_id" : 7, "name" : "kkk", "grade" : 6 }

{ "_id" : 6, "grade" : 2, "name" : "qwert" }

> db.Student.find().sort({name:1,grade:-1});

{ "_id" : 2, "name" : "Abc", "grade" : 10 }

{ "_id" : 3, "name" : "Mno", "grade" : 5 }

{ "_id" : 4, "name" : "Pqr", "grade" : 8 }

{ "_id" : 1, "name" : "Saffan", "grade" : 9 }

{ "_id" : 7, "name" : "kkk", "grade" : 6 }

{ "_id" : 6, "grade" : 2, "name" : "qwert" }

> db.Student.find({grade:8}).limit(3);

{ "_id" : 4, "name" : "Pqr", "grade" : 8 }

{ "_id" : 10, "name" : "zzz", "grade" : 8 }

> db.Student.find().skip(2);

{ "_id" : 3, "name" : "Mno", "grade" : 5 }

{ "_id" : 4, "name" : "Pqr", "grade" : 8 }

{ "_id" : 6, "grade" : 2, "name" : "qwert" }

{ "_id" : 7, "name" : "kkk", "grade" : 6 }

{ "_id" : 10, "name" : "zzz", "grade" : 8 }

VI.AGGREGATE FUNCTIONS

> db.faculty.aggregate ({$match:{department:"mech"}}, {$group : {_id : "$designation", AverageSal :{$avg:"$salary"} } },
{$match:{AverageSal:{$gt:50000}}});

{ "_id" : " associate prof", "AverageSal" : 85000 }

{ "_id" : "assistant prof", "AverageSal" : 70000 }

VII. ARRAYS

> db.food.insert({_id:1,fruits:['apple','mango']});

WriteResult({ "nInserted" : 1 })

> db.food.find({fruits:['pineapple','mango','orange']});

{ "_id" : 3, "fruits" : ["pineapple", "mango", "orange"] }

> db.food.find({fruits:{$all:['pineapple']}});

{ "_id" : 2, "fruits" : ["pineapple", "mango", "grapes"] }

{ "_id" : 3, "fruits" : ["pineapple", "mango", "orange"] }

> db.food.update({_id:2},{$set:{'fruits.1':'apple'}});

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

> db.food.update({_id:2},{$push:{price:{grapes:80,mango:200,cherry:100}}});

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

2. MongoDB Operations

1)Faculty DB

i) Create a database for Faculty and Create a Faculty Collection(Faculty_id, Name, Designation ,Department, Age, Salary, Specialization(Set)).

```
>use Faculty
```

```
> db.createCollection("faculty")
```

ii) Insert required documents to the collection.

```
> db.faculty.insert({_id:1,name:"abc",designation:"assistant prof",department:"mech",age:31,salary:90000,specialization:['python','mysql','autocad']});
```

iii) First Filter on "Dept_Name:MECH" and then group it on "Designation" and compute the Average Salary for that Designation and filter those documents where the "Avg_Sal" is greater than 650000.

```
> db.faculty.aggregate ( {$match:{department:"mech"}}, {$group : {_id : "$designation", AverageSal :{$avg:"$salary"} } },
{$match:{AverageSal:{$gt:50000}}});
```

```
{ "_id" : " associate prof", "AverageSal" : 85000 }
{ "_id" : "assistant prof", "AverageSal" : 70000 }
```

2) Consider a table "Product" with the following columns:
Product _id
ProductName
ManufacturingDate
Price
Quantity
Write MongoDB queries for the following:

```
> use Products switched to db Products
```

```
> db.createCollection("product");
```

```
{ "ok" : 1 }
```

>
db.product.insert({pid:1,pname:"keyboard",mdate:2001,price:1800,quantity:2})
;

WriteResult({ "nInserted" : 1 })

i)To display only the product name from all the documents of the product collection.

> db.product.find({},{pname:1,_id:0});

{ "pname" : "keyboard" }

{ "pname" : "mouse" }

{ "pname" : "motherboard" }

ii)To display only the Product ID, ExpiryDate as well as the quantity from the document of the product collection where the _id column is 1.

> db.product.find({pid:1},

{pid:1,_id:0,mdate:1,quantity:1});

{ "pid" : 1, "mdate" : 2001, "quantity" : 2 }

iii)To find those documents where the price is not set to 45000.

> db.product.find({price:{$ne:45000}},{pname:1,_id:0});

{ "pname" : "keyboard" }

{ "pname" : "mouse" }

{ "pname" : "motherboard" }

iv)To find those documents from the Product collection where the quantity is set to 30 and the product name is set to 'LEDTV'.

> db.product.find({$and:[{quantity:{$eq:30}},{pname:{$eq:"LED TV"}}]},{pname:1,_id:0})8

{ "pname" : "LED TV" }

v)To find documents from the Product collection where the Product name ends in 'r'.

> db.product.find({pname:/d$/},{pname:1,quantity:1,_id:0})

{ "pname" : "keyboard", "quantity" : 2 }

{ "pname" : "motherboard", "quantity" : 150 }

3)Create a mongodb collection Hospital. Demonstrate the following by choosing fields of your choice.

> use Hospital switched to db Hospital

> db.createCollection("hospital");

{ "ok" : 1 }

> db.hospital.insert({_id:1,name:"xyz",diseases:["diabetes","high bp","fever"]});

WriteResult({ "nInserted" : 1 })

1. Insert three documents

> db.hospital.updateMany({},{$pull:{diseases:"fever"}});

{ "acknowledged" : true, "matchedCount" : 3, "modifiedCount" : 2 }

2. Use Arrays(Use Pull and Pop operation)

> db.hospital.updateOne({_id:1},{$pop:{diseases:-1}});

{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }

3. Use Index

> db.hospital.find({"diseases.2":"nausea"});

{ "_id" : 3, "name" : "mno", "diseases" : ["covid", "sarscov", "nausea"] }

4. Use Cursors

> db.hospital.find({}).count();

3

> db.hospital.find({}).limit(2);

{ "_id" : 1, "name" : "xyz", "diseases" : ["high bp"] } { "_id" : 2, "name" : "abc", "diseases" : ["typhoid", "cholera"] }

> db.hospital.find({}).size();

3

5. Updation

> db.hospital.update({_id:3},{$set:{'diseases.1':'sarscov'}});

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

3. Cassandra Lab 1

1. Create a key space by name Employee

```
cqlsh:saf> create keyspace Employee with
replication={'class':'SimpleStrategy','replication_factor':1}; cqlsh:saf> use
Employee ;
```

2. Create a column family by name Employee-Info with attributes Emp_Id Primary Key, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name

```
cqlsh:employee> create table empInfo( emp_id int PRIMARY KEY, emp_name
text,desig text,dpj timestamp,salary int,dept_name text );
```

3. Insert the values into the table in batch

```
cqlsh:employee> insert into
empInfo(emp_id,emp_name,desig,dpj,salary,dept_name) values( 1, 'saffan',
'sde', '2022-05-05', 200000, 'cse' );
```

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

```
cqlsh:employee> update empInfo set emp_name='zzz',dept_name='ie'where
emp_id=2;
```

5. Sort the details of Employee records based on salary

```
.cqlsh:employee> select * from emp_Info where emp_id in (1,2,3) order by
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.

```
cqlsh:employee> alter table empInfo add project set
```

7. Update the altered table to add project names.

```
cqlsh:employee> update empInfo set project={'reactJs','Ml'} where emp_id=1;
```

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

```
cqlsh:employee> insert into
empInfo(emp_id,emp_name,desig,dpj,salary,dept_name) values( 5, 'wxy', 'sde',
'2022-02-05', 250000, 'cse' ) using ttl 30; cqlsh:employee> select ttl(emp_name)
from empInfo;
```

4. Cassandra Lab 2

1 Create a key space by name Library

CREATE keyspace library1 with replication={ 'class':'SimpleStrategy', 'replication_factor':1 };

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

CREATE TABLE lib.libinfo1 (s_id int, sname text, book text, bid int, doi timestamp, counter_val counter, PRIMARY KEY (s_id, sname, book, bid, doi));

3. Insert the values into the table in batch

update libinfo set counter_val=counter_val+1 where s_id=1 and sname='saf' and book='harry potter1' and bid=1 and doi='2022-05-05';

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

cqlsh:lib> update libinfo set counter_val=counter_val+1 where s_id=1 and sname='saf' and book='harry potter1'; cqlsh:lib> select * from libinfo;

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

cqlsh:lib> select counter_val from libinfo where s_id=1 and sname='saf' and book='harry potter1';

counter_val

2

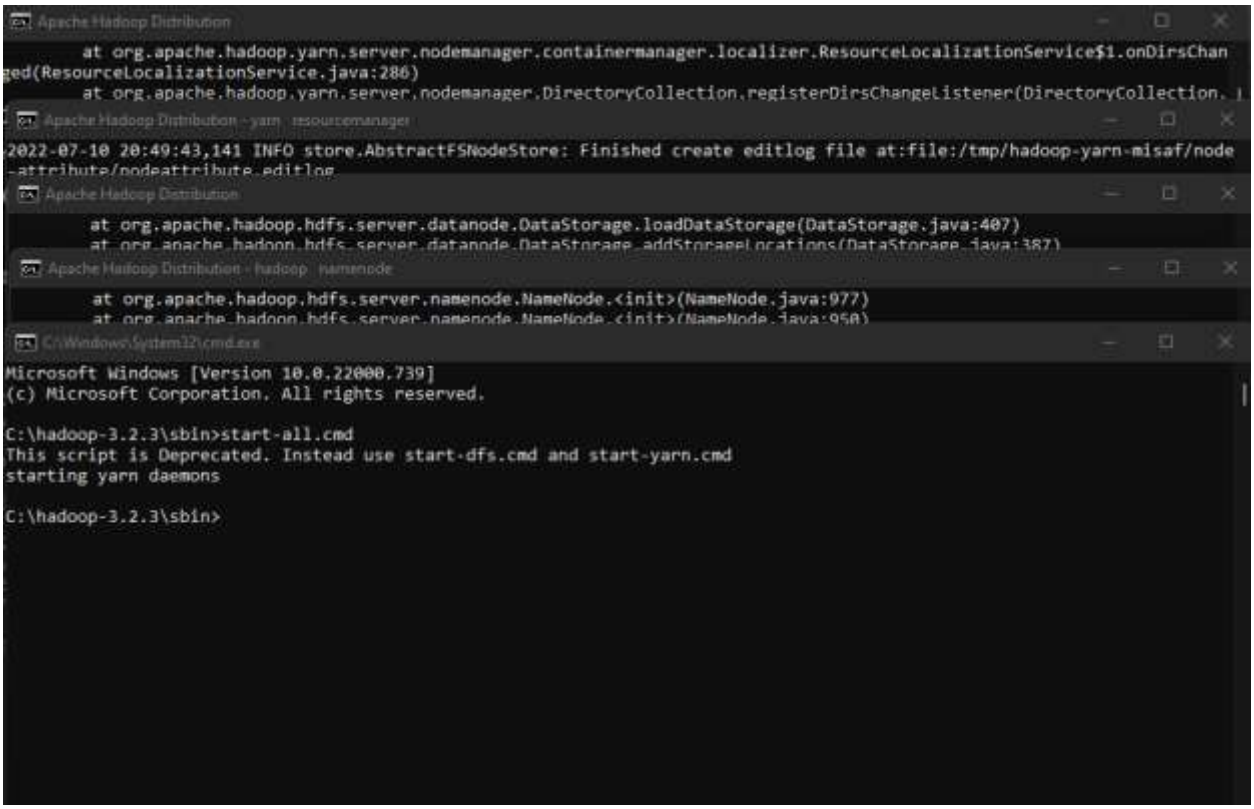
6. Export the created column to a csv file

COPY libinfo(s_id,sname,book,bid,doi,counter_val) TO 'data1.csv' WITH HEADER = TRUE;

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

COPY libinfo(s_id,sname,book,bid,doi) FROM 'libdata.csv' WITH HEADER = TRUE;

5. Screenshot of Hadoop Installation



6. HDFS Commands

>C:\hadoop_new\sbin>hdfs dfs -mkdir /lab1

>C:\hadoop_new\sbin>hdfs dfs -ls /
Found 2 items
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:47 /lab1
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:46 /sample

>C:\hadoop_new\sbin>hdfs dfs -copyFromLocal E:\Desktop\sample.txt \lab1

>C:\hadoop_new\sbin>hdfs dfs -ls
/lab1Found 1 items
-rw-r--r-- 1 Admin supergroup 19 2022-06-19 14:51 /lab1/sample.txt

>C:\hadoop_new\sbin>hdfs dfs -cat
\lab1\sample.txtsample text for lab

//create a folder sample in desktop
>C:\hadoop_new\sbin>hdfs dfs -get \lab1\sample.txt E:\Desktop\sample

>C:\hadoop_new\sbin>hdfs dfs -put E:\Desktop\samplefolder \lab1

>C:\hadoop_new\sbin>hdfs dfs -ls
/lab1Found 2 items
-rw-r--r-- 1 Admin supergroup 19 2022-06-19 14:51 /lab1/sample.txt
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:58

/lab1/samplefolder

C:\hadoop_new\sbin>hdfs dfs -mv /sample /lab1

C:\hadoop_new\sbin>hdfs dfs -ls
/lab1Found 3 items
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:50 /lab1/sample
-rw-r--r-- 1 Admin supergroup 19 2022-06-19 14:51 /lab1/sample.txt
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:58

/lab1/samplefolder**C:\hadoop_new\sbin>hdfs dfs -cp**

/lab1/sample /

C:\hadoop_new\sbin>hdfs dfs -ls /
Found 2 items
drwxr-xr-x - Admin supergroup 0 2022-06-19 15:00 /lab1
drwxr-xr-x - Admin supergroup 0 2022-06-19 15:01 /sample
C:\hadoop_new\sbin>hdfs dfs -rm
/lab1/sample.txtDeleted /lab1/sample.txt

C:\hadoop_new\sbin>hdfs dfs -ls
/lab1Found 2 items
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:50 /lab1/sample
drwxr-xr-x - Admin supergroup 0 2022-06-19 14:58 /lab1/samplefolder

C:\hadoop_new\sbin>hdfs dfs -copyFromLocal E:\Desktop\sample.txt

\lab1 C:\hadoop_new\sbin>hdfs dfs -copyToLocal \lab1\sample.txt

E:\Desktop\sample1.txt

7. Mean/Max temperature of weather data

Driver class:

```
package temperatureMax;
import org.apache.hadoop.io.*;
import org.apache.hadoop.fs.*;
import org.apache.hadoop.mapreduce.*;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;

public class TempDriver
{
	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(TempDriver.class);
		job.setJobName("Max temperature");
		FileInputFormat.addInputPath(job,new Path(args[0]));
		FileOutputFormat.setOutputPath(job,new Path (args[1]));
		job.setMapperClass(TempMapper.class);
		job.setReducerClass(TempReducer.class);
		job.setOutputKeyClass(Text.class);
		job.setOutputValueClass(IntWritable.class);
		System.exit(job.waitForCompletion(true)?0:1);
	}
```

```
}
```

Mapper Class

```
package temperatureMax;


import org.apache.hadoop.io.*;
import org.apache.hadoop.mapreduce.*;
import java.io.IOException;


public class TempMapper extends Mapper <LongWritable, Text, Text, IntWritable>
{
public static final int MISSING = 9999;


public void map(LongWritable key, Text value, Context context) throws IOException,
InterruptedException
{
        String line = value.toString();
        String month = line.substring(19,21);
        int temperature;
        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 != MISSING && quality.matches("[01459]"))
                context.write(new Text(month),new IntWritable(temperature));
        }
}
```

Reducer class

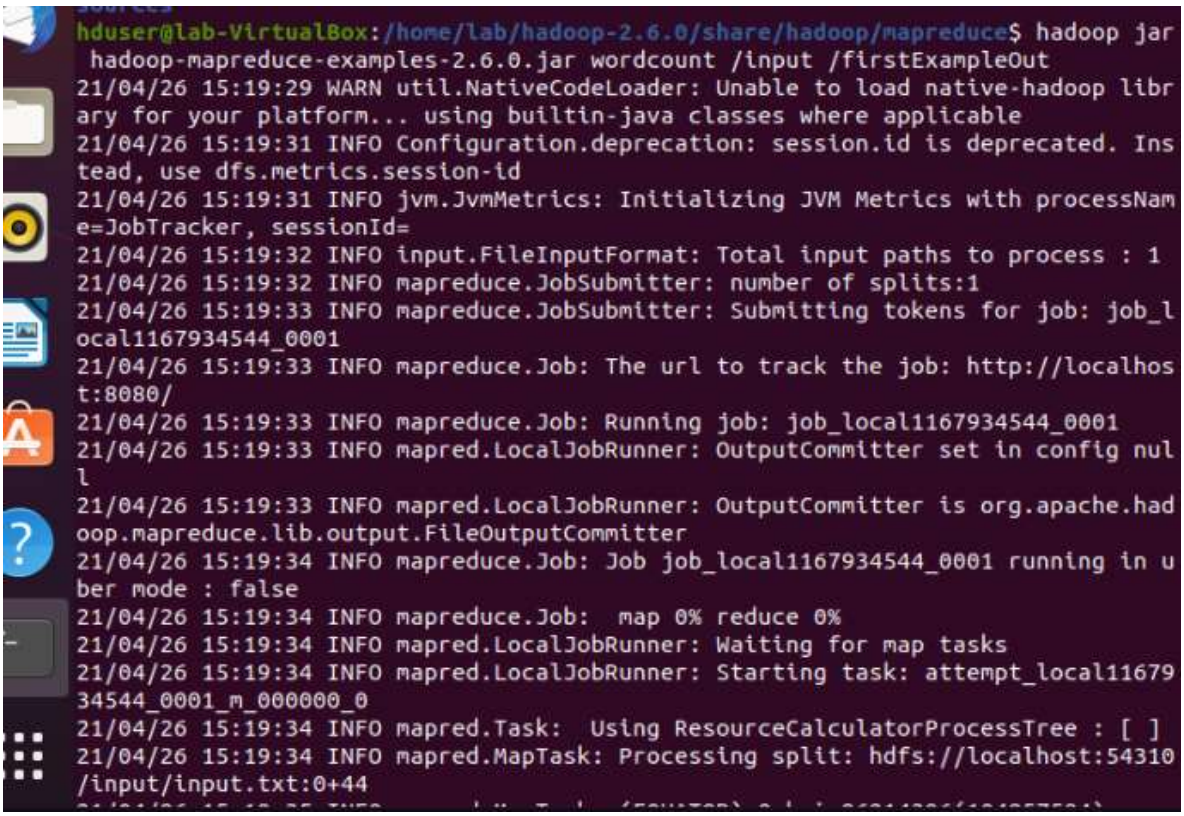
```
package temperatureMax;


import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.io.Text;

import org.apache.hadoop.mapreduce.*;

import java.io.IOException;


public class TempReducer extends Reducer <Text, IntWritable,Text, IntWritable>

{

	public void reduce(Text key, Iterable<IntWritable> values, Context context) throws
IOException,InterruptedException

	{

		int max_temp = 0;

		for (IntWritable value : values)

		{

			if(max_temp<value.get()) {

				max_temp = value.get();

			}

		}

		context.write(key, new IntWritable(max_temp));

	}

}
```

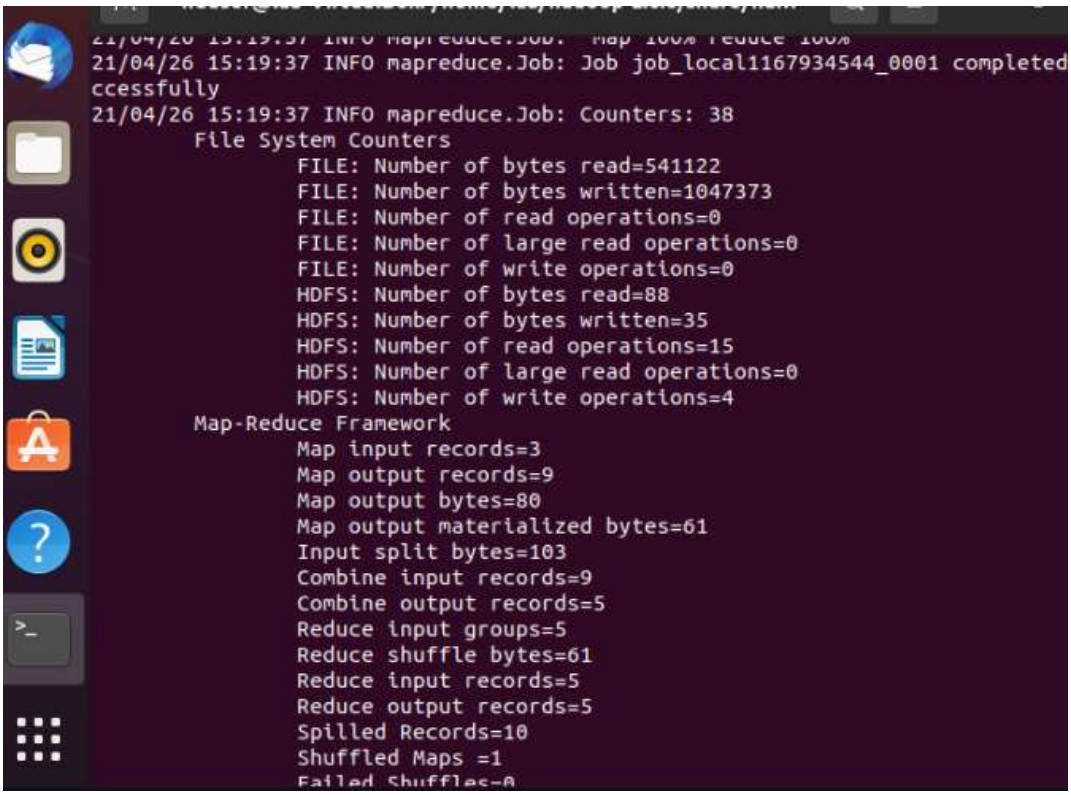
Output:

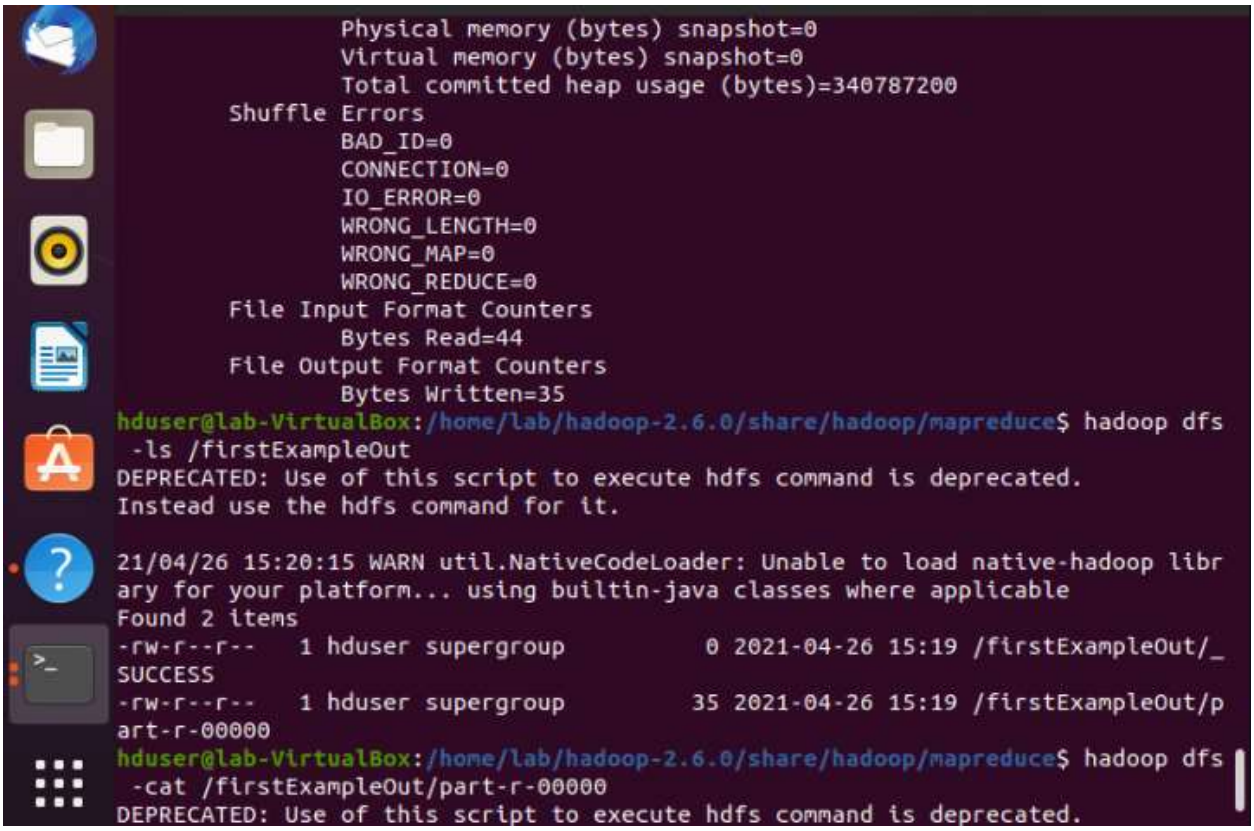
```
hduser@lab-VirtualBox:/home/lab$ hadoop dfs -cat /tempmax/part-r-00000
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.

WARNING: An illegal reflective access operation has occurred
WARNING: Illegal reflective access by org.apache.hadoop.security.authentication
.util.KerberosUtil (file:/usr/local/hadoop/share/hadoop/common/lib/hadoop-auth-
2.6.0.jar) to method sun.security.krb5.Config.getInstance()
WARNING: Please consider reporting this to the maintainers of org.apache.hadoop
.security.authentication.util.KerberosUtil
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflec
tive access operations
WARNING: All illegal access operations will be denied in a future release
21/05/10 16:08:48 WARN util.NativeCodeLoader: Unable to load native-hadoop libr
ary for your platform... using builtin-java classes where applicable
03      111
05      22
```

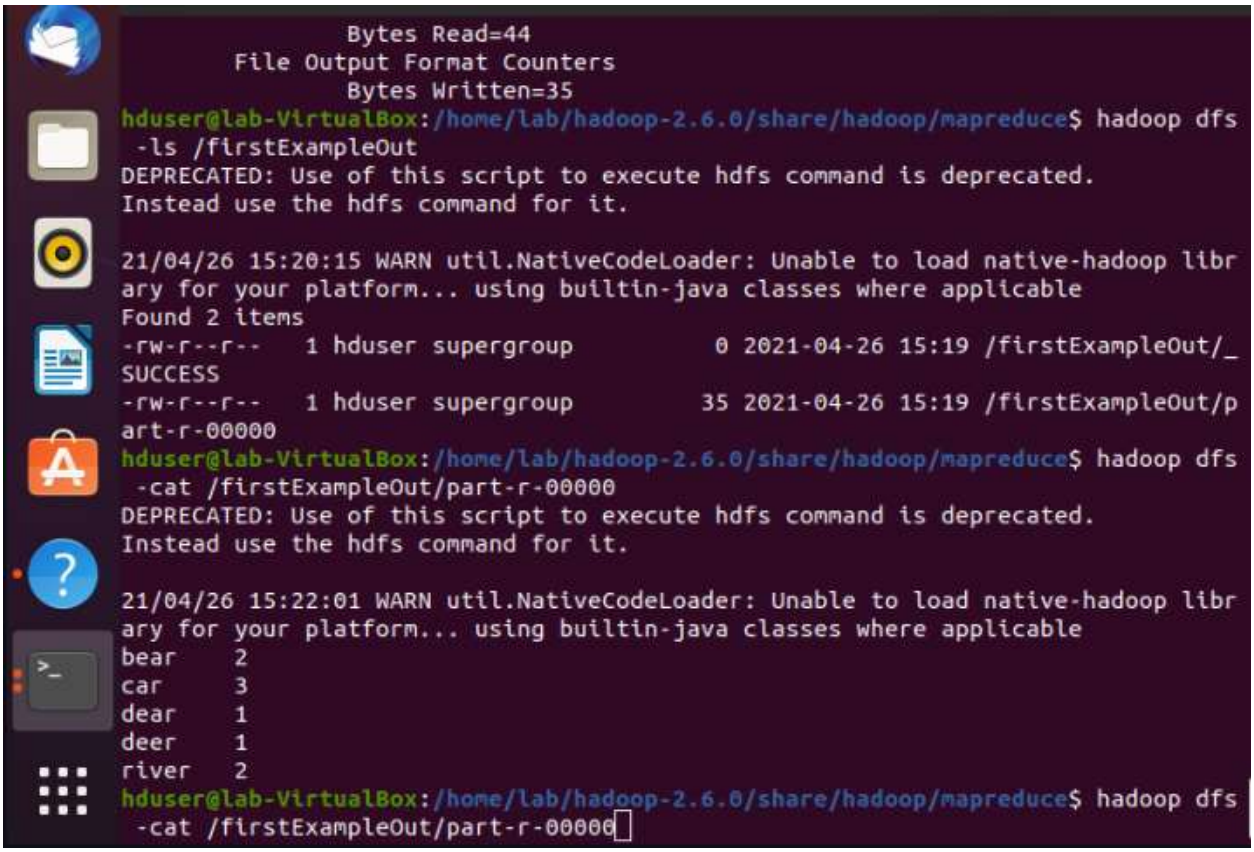
```
hduser@lab-VirtualBox:/home/lab$ hadoop dfs -ls  /tempmax
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.

WARNING: An illegal reflective access operation has occurred
WARNING: Illegal reflective access by org.apache.hadoop.security.authentication
.util.KerberosUtil (file:/usr/local/hadoop/share/hadoop/common/lib/hadoop-auth-
2.6.0.jar) to method sun.security.krb5.Config.getInstance()
WARNING: Please consider reporting this to the maintainers of org.apache.hadoop
.security.authentication.util.KerberosUtil
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflec
tive access operations
WARNING: All illegal access operations will be denied in a future release
21/05/10 16:08:23 WARN util.NativeCodeLoader: Unable to load native-hadoop libr
ary for your platform... using builtin-java classes where applicable
```

8. Word Occurences






Physical memory (bytes) snapshot=0
Virtual memory (bytes) snapshot=0
Total committed heap usage (bytes)=340787200
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=44
File Output Format Counters
Bytes Written=35
hduser@lab-VirtualBox:/home/lab/hadoop-2.6.0/share/hadoop/mapreduce$ hadoop dfs -ls /firstExampleOut
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.
21/04/26 15:20:15 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r-- 1 hduser supergroup 0 2021-04-26 15:19 /firstExampleOut/_SUCCESS
-rw-r--r-- 1 hduser supergroup 35 2021-04-26 15:19 /firstExampleOut/part-r-00000
hduser@lab-VirtualBox:/home/lab/hadoop-2.6.0/share/hadoop/mapreduce$ hadoop dfs -cat /firstExampleOut/part-r-00000
DEPRECATED: Use of this script to execute hdfs command is deprecated.


Bytes Read=44
File Output Format Counters
Bytes Written=35
hduser@lab-VirtualBox:/home/lab/hadoop-2.6.0/share/hadoop/mapreduce$ hadoop dfs -ls /firstExampleOut
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.
21/04/26 15:20:15 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r-- 1 hduser supergroup 0 2021-04-26 15:19 /firstExampleOut/_SUCCESS
-rw-r--r-- 1 hduser supergroup 35 2021-04-26 15:19 /firstExampleOut/part-r-00000
hduser@lab-VirtualBox:/home/lab/hadoop-2.6.0/share/hadoop/mapreduce$ hadoop dfs -cat /firstExampleOut/part-r-00000
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.
21/04/26 15:22:01 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
bear 2
car 3
dear 1
deer 1
river 2
hduser@lab-VirtualBox:/home/lab/hadoop-2.6.0/share/hadoop/mapreduce$ hadoop dfs -cat /firstExampleOut/part-r-00000

9. Use of Join

Driver Class

```
package MapReduceJoin;

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,
DeptNameMapper.class);
		MultipleInputs.addInputPath(conf, BInputPath, TextInputFormat.class,
DeptEmpStrengthMapper.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);
	}
}
```

Mapper Class

```
package MapReduceJoin;

import java.io.IOException;

import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;

public class DeptNameMapper 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], "0"), new Text(SingleNodeData[1]));
	}
}
```

Reducer Class

```
package MapReduceJoin;

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);
		}
	}
}
```

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

```
object HelloWorld {
   def main(args: Array[String]) {
      println("Hello world")
   }
}
```

```
Hello world
```

HelloWorld.Scala (~)

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HelloWorld.Scala

```
object HelloWorld
{
    def main(args: Array[String])
    {
        //This is a Hello World function in Scala
        println("Hello World!")
    }
}
```

```
scala> val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)
[Stage 0:>                                                          (0 + 1) / 1

sorted: scala.collection.immutable.ListMap[String,Int] = ListMap(test -> 6, Hel
lo -> 6, Hadoop -> 3, is -> 2, This -> 2, world -> 1, Test -> 1, a -> 1, to ->
1, see -> 1, bye -> 1, file -> 1, the -> 1)

scala> println(sorted)
ListMap(test -> 6, Hello -> 6, Hadoop -> 3, is -> 2, This -> 2, world -> 1, Tes
t -> 1, a -> 1, to -> 1, see -> 1, bye -> 1, file -> 1, the -> 1)

scala> for((k,v)<-sorted)
     |  {
     |    if(v>4)
     |    {
     |       print(k+",")
     |       print(v)
     |       println()
     |     }
     |  }
test,6
Hello,6
```

11. Using RDD and FlatMap

Code:

```
>val text = sc.textFile("abc.txt")

 >val counts = text.flatMap(line => line.split(" ")).map(word => (word,1)).reduceByKey(_+_)
counts.collect

>val greaterThan4=counts.filter(x=>x._2>4);

>greaterThan4.collect().forEach(println)
```

Input file:

Hello Hello World Hello Hello Xyz Xyz Xyz Hello World Hello Xyz World World Xyz Hello World

Output:

Hello 7

World 5

Xyz 5