VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Big Data and 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 and Analytics" carried out by **Sanjana Niranjan Amadalli (1BM22CS418), 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 2024. The Lab report has been approved as it satisfies the academic requirements in respect of a **Big Data and Analytics - (22CS6PEBDA)** work prescribed for the said degree.

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Index Sheet

1 Perform the following DB operations using Cassandra.

1. Create a keyspace by name Employee

```
cqlsh:library> CREATE KEYSPACE Employee WITH REPLICATION = { 'class' : 'SimpleStrategy', 'replication_factor' : 1 };
cqlsh:library>
```

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>
cqlsh:employee> CREATE TABLE Employee_Info (
           ...     Emp_Id int PRIMARY KEY,
           ...     Emp_Name text,
           ...     Designation text,
           ...     Date_of_Joining date,
           ...     Salary decimal,
           ...     Dept_Name text
           ... );
```

```
cqlsh:employee> BEGIN BATCH
           ... INSERT INTO Employee_Info (Emp_Id, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name)
           ... VALUES (101, 'John Doe', 'Manager', '2023-01-01', 50000, 'HR');
           ... INSERT INTO Employee_Info (Emp_Id, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name)
           ... VALUES (121, 'Jane Smith', 'Developer', '2023-02-01', 60000, 'IT');
           ... APPLY BATCH;
```

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

```
cqlsh:employee> UPDATE Employee_Info SET Emp_Name = 'Jane Johnson', Dept_Name = 'Engineering' WHERE Emp_Id = 121;
cqlsh:employee> SELECT * FROM Employee_Info;

 emp_id | date_of_joining | dept_name   | designation | emp_name     | salary
--------+-----------------+-------------+-------------+--------------+--------
    121 |      2023-02-01 | Engineering |   Developer | Jane Johnson |  60000
    101 |      2023-01-01 |          HR |     Manager |     John Doe |  50000

(2 rows)
```

3. Sort the details of Employee records based on salary

```
cqlsh:employee> paging off
Disabled Query paging.
cqlsh:employee> SELECT * FROM Employee_Info WHERE Emp_Id IN (121,101) ORDER BY Salary ALLOW FILTERING;

 emp_id | salary | date_of_joining | dept_name | designation | emp_name
--------+--------+-----------------+-----------+-------------+------------
    101 |  50000 |      2023-01-01 |        HR |     Manager |   John Doe
    121 |  60000 |      2023-02-01 |        IT |   Developer | Jane Smith

(2 rows)
```

4. 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.

```
cqlsh:employee> UPDATE Employee_Info SET Projects = {'ProjectA', 'ProjectB'} WHERE Emp_Id = 101 and salary=50000;
cqlsh:employee> UPDATE Employee_Info SET Projects = {'ProjectC'} WHERE Emp_Id = 121 and salary=60000;
cqlsh:employee> select * from Employee_Info;

 emp_id | salary | date_of_joining | dept_name | designation | emp_name   | projects
--------+--------+-----------------+-----------+-------------+------------+--------------------------
    121 |  60000 |      2023-02-01 |        IT |   Developer | Jane Smith |              {'ProjectC'}
    101 |  50000 |      2023-01-01 |        HR |     Manager |   John Doe | {'ProjectA', 'ProjectB'}

(2 rows)
```

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

```
cqlsh:employee> INSERT INTO Employee_Info (Emp_Id, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name) VALUES (102, 'Jane Smit
h', 'Developer', '2022-06-03', 60000, 'IT') USING TTL 15;
cqlsh:employee> select ttl(Emp_Name) from Employee_Info where Emp_id=102;

 ttl(emp_name)
---------------
            14

(1 rows)
```

2 Perform the following DB operations using Cassandra.

1. Create a keyspace by name Library

```
cqlsh> CREATE KEYSPACE Library WITH REPLICATION = { 'class' : 'SimpleStrategy', 'replication_factor' : 1 };
cqlsh> show keyspaces;
Improper show command.
cqlsh> use Library;
cqlsh: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

```
cqlsh:library> CREATE TABLE Library_Info (Stud_Id int PRIMARY KEY,Counter_value counter,Stud_Name text,Book_Name text,Book_Id text,Da
te_of_issue timestamp);
InvalidRequest: Error from server: code=2200 [Invalid query] message="Cannot mix counter and non counter columns in the same table"
cqlsh:library> CREATE TABLE Library_Info (
           ...     Stud_Id int PRIMARY KEY,
           ...     Stud_Name text,
           ...     Book_Name text,
           ...     Book_Id text,
           ...     Date_of_issue timestamp
           ... );
cqlsh:library> CREATE TABLE Library_Counters (
           ...     Stud_Id int PRIMARY KEY,
           ...     Counter_value counter
           ... );
cqlsh:library>
```

3. Insert the values into the table in batch

```
cqlsh:library> BEGIN BATCH
           ... INSERT INTO Library_Info (Stud_Id, Stud_Name, Book_Name, Book_Id, Date_of_issue) VALUES (112, 'John Doe', 'BDA', 'B001
', '2023-01-01');
           ... INSERT INTO Library_Info (Stud_Id, Stud_Name, Book_Name, Book_Id, Date_of_issue) VALUES (113, 'Jane Smith', 'ML', 'B00
2', '2023-01-02');
           ... APPLY BATCH;
```

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

```
cqlsh:library> SELECT * FROM Library_Info;

 stud_id | book_id | book_name | date_of_issue                   | stud_name
---------+---------+-----------+---------------------------------+------------
     113 |    B002 |        ML | 2023-01-02 00:00:00.000000+0000 | Jane Smith
     112 |    B001 |       BDA | 2023-01-01 00:00:00.000000+0000 |   John Doe

(2 rows)
cqlsh:library> SELECT * FROM Library_Counters;

 stud_id | counter_value
---------+---------------
     113 |             1
     112 |             1

(2 rows)
```

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

```
cqlsh:library> UPDATE Library_Counters SET Counter_value = Counter_value + 1 WHERE Stud_Id = 112;
cqlsh:library> SELECT * FROM Library_Counters WHERE Stud_Id = 112;

 stud_id | counter_value
---------+---------------
     112 |             2

(1 rows)
```

6. Export the created column to a csv file

```
cqlsh:library> COPY Library_Info (Stud_Id, Stud_Name, Book_Name, Book_Id, Date_of_issue) TO 'file.csv' WITH HEADER = TRUE;
Using 11 child processes

Starting copy of library.library_info with columns [stud_id, stud_name, book_name, book_id, date_of_issue].
Processed: 2 rows; Rate:      10 rows/s; Avg. rate:       6 rows/s
2 rows exported to 1 files in 0.374 seconds.
cqlsh:library> COPY Library_Counters (Stud_Id, Counter_value) FROM 'library_counters.csv' WITH HEADER = TRUE;
Using 11 child processes
```

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

```
cqlsh:library> copy library_info(Stud_Id,Stud_Name,Book_Name,Book_Id,Date_of_issue) from 'file.csv' with header=true;
Using 7 child processes

Starting copy of library.library_info with columns [stud_id, stud_name, book_name, book_id, date_of_issue].
Processed: 2 rows; Rate:       2 rows/s; Avg. rate:       4 rows/s
2 rows imported from 1 files in 0.513 seconds (0 skipped).
cqlsh:library> select * from library_info;

 stud_id | book_id | book_name | date_of_issue                   | stud_name
---------+---------+-----------+---------------------------------+-----------
     113 |    B002 |        ML | 2023-01-02 00:00:00.000000+0000 | Jane Smith
     112 |    B001 |       BDA | 2023-01-01 00:00:00.000000+0000 |   John Doe
```

3. MongoDB- CRUD Demonstration

SETUP:

```
Enter password: *************
Current Mongosh Log ID: 660a82917c840f42b4a0552f
Connecting to:          mongodb+srv://<credentials>@cluster0.ddhftxd.mongodb.net/?appName=mongosh+2.0.0
Using MongoDB:          7.0.7 (API Version 1)
Using Mongosh:          2.0.0
mongosh 2.2.2 is available for download: https://www.mongodb.com/try/download/shell

For mongosh info see: https://docs.mongodb.com/mongodb-shell/
```

1. Create a database “Student” with the following attributes Rollno, Age, ContactNo, Email-Id.

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.createCollection("Student");
{ ok: 1 }
```

2. Insert appropriate values(at least 5)

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:1,Age:21,Cont:9876,email:"antara.de9@gmail.com"});
DeprecationWarning: Collection.insert() is deprecated. Use insertOne, insertMany, or bulkWrite.
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a82ec7c840f42b4a05530") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:2,Age:22,Cont:9976,email:"anushka.de9@gmail.com"});

{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a82ed7c840f42b4a05531") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:3,Age:21,Cont:5576,email:"anubhav.de9@gmail.com"});

{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a82ed7c840f42b4a05532") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:4,Age:20,Cont:4476,email:"pani.de9@gmail.com"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a82ed7c840f42b4a05533") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:10,Age:23,Cont:2276,email:"rekha.de9@gmail.com"});
{
  acknowledged: true,
```

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.insert({RollNo:10,Age:23,Cont:2276,email:"rekha.de9@gmail.com"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a82f47c840f42b4a05534") }
}
```

3. View the data

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.find()
[
  {
    _id: ObjectId("660a82ec7c840f42b4a05530"),
    RollNo: 1,
    Age: 21,
    Cont: 9876,
    email: 'antara.de9@gmail.com'
  },
  {
    _id: ObjectId("660a82ed7c840f42b4a05531"),
    RollNo: 2,
    Age: 22,
    Cont: 9976,
    email: 'anushka.de9@gmail.com'
  },
  {
    _id: ObjectId("660a82ed7c840f42b4a05532"),
    RollNo: 3,
    Age: 21,
    Cont: 5576,
    email: 'anubhav.de9@gmail.com'
  },
  {
    _id: ObjectId("660a82ed7c840f42b4a05533"),
    RollNo: 4,
    Age: 20,
    Cont: 4476,
    email: 'pani.de9@gmail.com'
  },
  {
    _id: ObjectId("660a82f47c840f42b4a05534"),
    RollNo: 10,
    Age: 23,
    Cont: 2276,
    email: 'rekha.de9@gmail.com'
  }
]
```

4. Write query to update Email-Id of a student with rollno 10.

```
  },
  {
    _id: ObjectId("660a83337c840f42b4a05535"),
    RollNo: 11,
    Age: 22,
    Name: 'ABC',
    Cont: 2276,
    email: 'rea.de9@gmail.com'
  }
]
```

5. Replace the student name from “ABC” to “FEM” of rollno 11.

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.update({RollNo:11,Name:"ABC"},{$set:{Name:"FEM"}})
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

6. Drop the table

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Student.drop();
true
```

1. Create a collection by name Customers with the following attributes.
   Cust_id, Acc_Bal, Acc_Type

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.createCollection("Customers");
{ ok: 1 }
```

2. Insert at least 5 values into the table

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:1,Balance:200, Type:"S"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b47c840f42b4a05536") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:1,Balance:1000, Type:"Z"})
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b47c840f42b4a05537") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:2,Balance:100, Type:"Z"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b47c840f42b4a05538") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:2,Balance:1000, Type:"C"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b57c840f42b4a05539") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:2,Balance:500, Type:"C"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b57c840f42b4a0553a") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:2,Balance:50, Type:"S"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b57c840f42b4a0553b") }
}
Atlas atlas-b6pfyk-shard-0 [primary] test>

Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:3,Balance:500, Type:"Z"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b77c840f42b4a0553c") }
}
```

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.insert({cust_id:2,Balance:50, Type:"S"});
{
  acknowledged: true,
  insertedIds: { '0': ObjectId("660a83b57c840f42b4a0553b") }
}
```

3. Write a query to display those records whose total account balance is greater than 1200 of account type ‘Z’ for each customer_id.

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.aggregate (
... {$match:{Type:"Z"}},
...
... {$group : { _id : "$cust_id",
...
... TotAccBal :{$sum:"$Balance"} } },
... {$match:{TotAccBal:{$gt:1200}}});
```

4. Determine Minimum and Maximum account balance for each customer_id.

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.aggregate (
...
... {$group : { _id : "$cust_id",
...
... minAccBal :{$min:"$Balance"},
... maxAccBal :{$max:"$Balance"} }});
[
  { _id: 2, minAccBal: 50, maxAccBal: 1000 },
  { _id: 1, minAccBal: 200, maxAccBal: 1000 },
  { _id: 3, minAccBal: 500, maxAccBal: 500 }
]
```

5. Drop the table

```
Atlas atlas-b6pfyk-shard-0 [primary] test> db.Customers.drop()
true
```

4. Screenshot of Hadoop installed

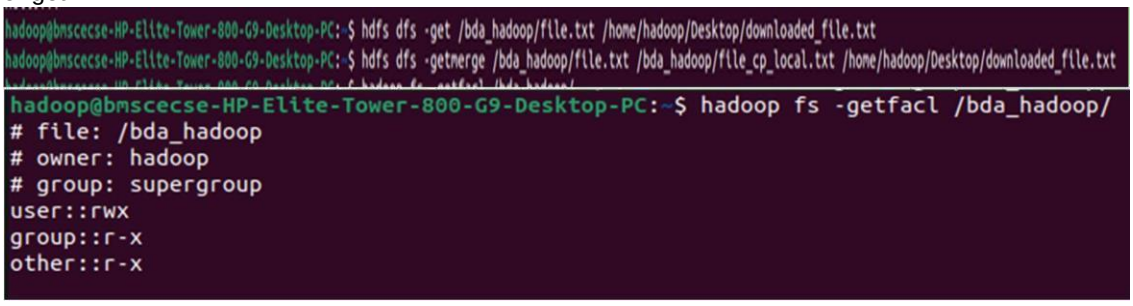
5. Execution of HDFS Commands for interaction with Hadoop Environment. (Minimum 10 commands to be executed)

1. mkdir
2.ls

3. put

4. copyFromLocal

5. get



6. copyToLocal

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -copyToLocal /bda_hadoop/file.txt /home/hadoop/Desktop
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -mv /bda_hadoop /abc
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -ls /abc
Found 2 items
-rw-r--r--   1 hadoop supergroup          9 2024-05-13 14:42 /abc/file.txt
-rw-r--r--   1 hadoop supergroup          9 2024-05-13 14:52 /abc/file_cp_local.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -cp /hello/ /hadoop_lab
cp: `/hello/': No such file or directory
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$
```

7. cat

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/file_cp_local.txt
Hello!!!
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$
```

8. mv

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -mv /bda_hadoop /abc
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -ls /abc
Found 2 items
-rw-r--r--   1 hadoop supergroup          9 2024-05-13 14:42 /abc/file.txt
-rw-r--r--   1 hadoop supergroup          9 2024-05-13 14:52 /abc/file_cp_local.txt
```

9. cp

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -cp /hello/ /hadoop_lab
cp: `/hello/': No such file or directory
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$
```

6. Implement WordCount Program on Hadoop framework

```
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&lt;LongWritable,
Text, Text,

IntWritable&gt; {
// Map function
public void map(LongWritable key, Text value, OutputCollector&lt;Text,
IntWritable&gt; output, Reporter rep) throws IOException

{
String line = value.toString();
// Splitting the line on spaces
for (String word : line.split(&quot; &quot;))
{
if (word.length() &gt; 0)
{
output.collect(new Text(word), new IntWritable(1));
```

```
} } } }
```

Reducer Code: You have to copy paste this program into the WCReducer Java Class file

```
// 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&lt;Text,

IntWritable, Text, IntWritable&gt; {

// Reduce function
public void reduce(Text key, Iterator&lt;IntWritable&gt; value,

OutputCollector&lt;Text, IntWritable&gt; 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: You have to copy paste this program into the WCDriver Java Class file.

```
//  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 &lt; 2)
{
System.out.println(&quot;Please give valid inputs&quot;);
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

```
2021-04-24 14:55:13,844 INFO common.Storage: Storage directory C:\hadoop-3.3.0\data\namenode has been successfully formatted.
2021-04-24 14:55:13,895 INFO namenode.FSImageFormatProtobuf: Saving image file C:\hadoop-3.3.0\data\namenode\current\fsimage.ckpt_000000
0000000000000 using no compression
2021-04-24 14:55:14,002 INFO namenode.FSImageFormatProtobuf: Image file C:\hadoop-3.3.0\data\namenode\current\fsimage.ckpt_000000000000
000000 of size 402 bytes saved in 0 seconds .
2021-04-24 14:55:14,115 INFO namenode.NNStorageRetentionManager: Going to retain 1 images with txid >= 0
2021-04-24 14:55:14,121 INFO namenode.FSImage: FSImageSaver clean checkpoint: txid=0 when meet shutdown.
2021-04-24 14:55:14,121 INFO namenode.NameNode: SHUTDOWN_MSG:
/************************************************************
SHUTDOWN_MSG: Shutting down NameNode at LAPTOP-JG329ESD/192.168.56.1
************************************************************/

C:\hadoop-3.3.0\sbin>start-dfs

C:\hadoop-3.3.0\sbin>start-yarn
starting yarn daemons

C:\hadoop-3.3.0\sbin>jps
12276 NameNode
14776 DataNode
15512 NodeManager
1800 Jps
6764 ResourceManager

C:\hadoop-3.3.0\sbin>hdfs dfs -mkdir /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -ls /
Found 1 items
drwxr-xr-x   - Anusree supergroup          0 2021-04-24 14:56 /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -copyFromLocal C:\input_file.txt /input_dir
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /input_dir/input_file.txt
Hello World
Hello Hadoop
This is Hadoop test file
C:\hadoop-3.3.0\sbin>hadoop jar C:\MapReduceClient.jar wordcount /input_dir /output_dir
2021-04-24 15:24:57,242 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-04-24 15:24:57,714 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging
/job_1619256355508_0002
2021-04-24 15:24:58,387 INFO input.FileInputFormat: Total input files to process : 1
2021-04-24 15:24:58,809 INFO mapreduce.JobSubmitter: number of splits:1
2021-04-24 15:24:59,255 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1619256355508_0002
2021-04-24 15:24:59,255 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-04-24 15:24:59,450 INFO conf.Configuration: resource-types.xml not found
2021-04-24 15:24:59,451 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-04-24 15:24:59,533 INFO impl.YarnClientImpl: Submitted application application_1619256355508_0002
2021-04-24 15:24:59,581 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1619256355508_0002/
2021-04-24 15:24:59,582 INFO mapreduce.Job: Running job: job_1619256355508_0002
2021-04-24 15:25:12,857 INFO mapreduce.Job: Job job_1619256355508_0002 running in uber mode : false
2021-04-24 15:25:12,861 INFO mapreduce.Job:  map 0% reduce 0%
2021-04-24 15:25:19,985 INFO mapreduce.Job:  map 100% reduce 0%
2021-04-24 15:25:26,077 INFO mapreduce.Job:  map 100% reduce 100%
2021-04-24 15:25:32,181 INFO mapreduce.Job: Job job_1619256355508_0002 completed successfully
2021-04-24 15:25:32,284 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=85
                FILE: Number of bytes written=530945
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=162
                HDFS: Number of bytes written=51
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /output_dir/*
Hadoop  2
Hello   2
This    1
World   1
file    1
is      1
test    1

C:\hadoop-3.3.0\sbin>
```

7. 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 average temperature for each year from NCDC data set.

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&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) == '+';) {
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("[01459]";))
context.write(new Text(year), new IntWritable(temperature));
}
}
```

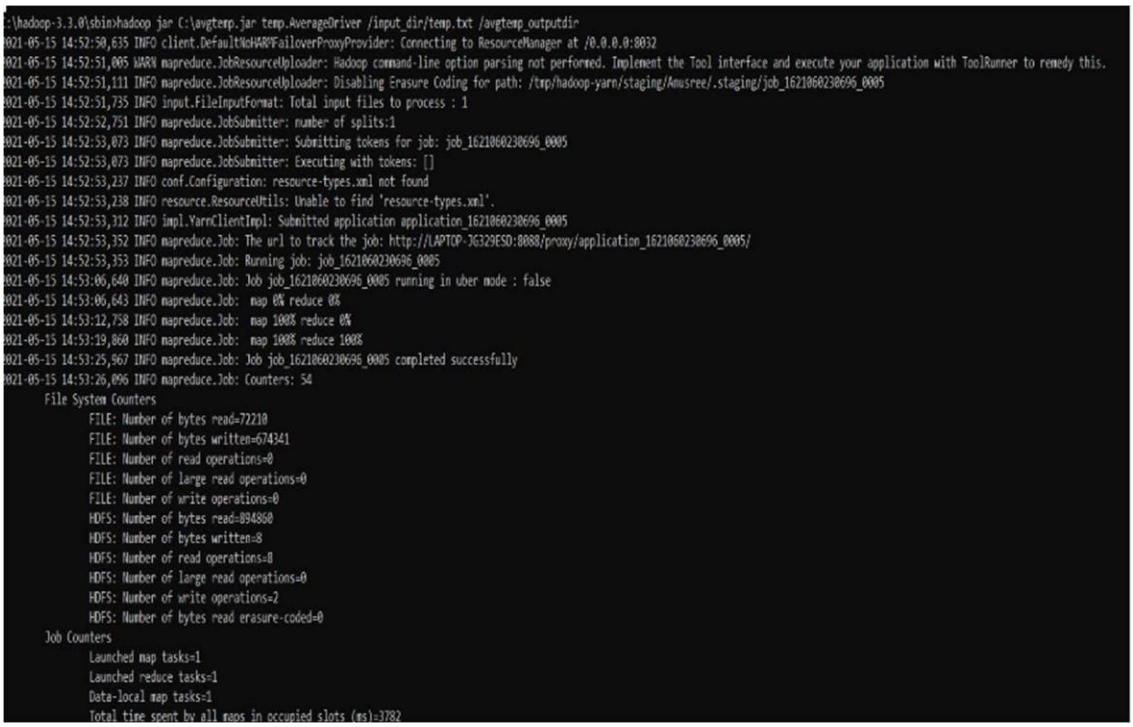
AverageReducer

```
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&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




```
C:\hadoop-3.3.0\sbin>hdfs dfs -ls /avgtemp_outputdir
Found 2 items
-rw-r--r--   1 Anusree supergroup          0 2021-05-15 14:53 /avgtemp_outputdir/_SUCCESS
-rw-r--r--   1 Anusree supergroup          8 2021-05-15 14:53 /avgtemp_outputdir/part-r-00000

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /avgtemp_outputdir/part-r-00000
1901    46

C:\hadoop-3.3.0\sbin>
```

b) find the mean max temperature for every month

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("Please Enter the input and output parameters");
System.exit(-1);
}
Job job = new Job();
job.setJarByClass(MeanMaxDriver.class);
job.setJobName("Max temperature");
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
job.setMapperClass(MeanMaxMapper.class);
job.setReducerClass(MeanMaxReducer.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
}
```

MeanMaxMapper.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) == '+') {
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("[01459]"))
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

```
C:\hadoop-3.3.0\sbin>hadoop jar C:\meanmax.jar meanmax.MeanMaxDriver /input_dir/temp.txt /meanmax_output
2021-05-21 20:28:05,250 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-21 20:28:06,662 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2021-05-21 20:28:06,916 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1621608943095_0001
2021-05-21 20:28:08,426 INFO input.FileInputFormat: Total input files to process : 1
2021-05-21 20:28:09,107 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-21 20:28:09,741 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1621608943095_0001
2021-05-21 20:28:09,741 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-21 20:28:10,029 INFO conf.Configuration: resource-types.xml not found
2021-05-21 20:28:10,030 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-21 20:28:10,676 INFO impl.YarnClientImpl: Submitted application application_1621608943095_0001
2021-05-21 20:28:11,005 INFO mapreduce.Job: The url to track the job: http://LAPTOP-3G329ESD:8088/proxy/application_1621608943095_0001/
2021-05-21 20:28:11,006 INFO mapreduce.Job: Running job: job_1621608943095_0001
2021-05-21 20:28:29,385 INFO mapreduce.Job: Job job_1621608943095_0001 running in uber mode : false
2021-05-21 20:28:29,389 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-21 20:28:40,664 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-21 20:28:50,832 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-21 20:28:50,965 INFO mapreduce.Job: Job job_1621608943095_0001 completed successfully
2021-05-21 20:28:50,178 INFO mapreduce.Job: Counters: 54
      File System Counters
            FILE: Number of bytes read=59082
            FILE: Number of bytes written=648091
            FILE: Number of read operations=0
            FILE: Number of large read operations=0
            FILE: Number of write operations=0
            HDFS: Number of bytes read=894860
            HDFS: Number of bytes written=74
            HDFS: Number of read operations=8
            HDFS: Number of large read operations=0
            HDFS: Number of write operations=2
            HDFS: Number of bytes read erasure-coded=0
      Job Counters
            Launched map tasks=1
            Launched reduce tasks=1
            Data-local map tasks=1
            Total time spent by all maps in occupied slots (ms)=8077
            Total time spent by all reduces in occupied slots (ms)=7511
            Total time spent by all map tasks (ms)=8077
            Total time spent by all reduce tasks (ms)=7511
            Total vcore-milliseconds taken by all map tasks=8077
            Total vcore-milliseconds taken by all reduce tasks=7511
            Total megabyte-milliseconds taken by all map tasks=8270848
            Total megabyte-milliseconds taken by all reduce tasks=7691264
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /meanmax_output/*
01      4
02      0
03      7
04      44
05      100
06      168
07      219
08      198
09      141
10      100
11      19
12      3

C:\hadoop-3.3.0\sbin>
```

8. 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.

```
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&lt;Object, Text, Text, IntWritable&gt; {
private static final IntWritable one = new IntWritable(1);
private Text word = new Text();
private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']"
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 = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']"
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);
}
}
}
```

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

```
C:\hadoop-3.3.0\sbin>jps
11072 DataNode
20528 Jps
5620 ResourceManager
15532 NodeManager
5140 NameNode

C:\hadoop-3.3.0\sbin>hdfs dfs -mkdir /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -ls /
Found 1 items
drwxr-xr-x   - Anusree supergroup          0 2021-05-08 19:46 /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -copyFromLocal C:\input.txt /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -ls /input_dir
Found 1 items
-rw-r--r--   1 Anusree supergroup         36 2021-05-08 19:48 /input_dir/input.txt

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /input_dir/input.txt
hello
world
hello
hadoop
bye
```

```
C:\hadoop-3.3.0\sbin>hadoop jar C:\sort.jar samples.topn.TopN /input_dir/input.txt /output_dir
2021-05-08 19:54:54,582 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-08 19:54:55,291 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1620483374279_0001
2021-05-08 19:54:55,821 INFO input.FileInputFormat: Total input files to process : 1
2021-05-08 19:54:56,261 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1620483374279_0001
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-08 19:54:56,843 INFO conf.Configuration: resource-types.xml not found
2021-05-08 19:54:56,843 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-08 19:54:57,387 INFO impl.YarnClientImpl: Submitted application application_1620483374279_0001
2021-05-08 19:54:57,507 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1620483374279_0001/
2021-05-08 19:54:57,508 INFO mapreduce.Job: Running job: job_1620483374279_0001
2021-05-08 19:55:13,792 INFO mapreduce.Job: Job job_1620483374279_0001 running in uber mode : false
2021-05-08 19:55:13,794 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-08 19:55:20,020 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-08 19:55:27,116 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-08 19:55:33,199 INFO mapreduce.Job: Job job_1620483374279_0001 completed successfully
2021-05-08 19:55:33,334 INFO mapreduce.Job: Counters: 54
      File System Counters
            FILE: Number of bytes read=65
            FILE: Number of bytes written=530397
            FILE: Number of read operations=0
            FILE: Number of large read operations=0
            FILE: Number of write operations=0
            HDFS: Number of bytes read=142
            HDFS: Number of bytes written=31
            HDFS: Number of read operations=8
            HDFS: Number of large read operations=0
            HDFS: Number of write operations=2
            HDFS: Number of bytes read erasure-coded=0
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /output_dir/*
hello   2
hadoop  1
world   1
bye     1

C:\hadoop-3.3.0\sbin>
```