

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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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**



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CERTIFICATE

This is to certify that the Lab work entitled “Big Data and Analytics” carried out by Shravanth J(1BM21CS206), 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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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

```
Command Prompt
Microsoft Windows [Version 10.0.17134.648]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\hp>hadoop version
Hadoop 3.1.0
source_code_repository: https://github.com/apache/hadoop - p.16b78619a24cdc5d3b0fcf4b58c377238cbe5d
```

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

1. mkdir

2. ls

```
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [bmscece-HP-Elite-Tower-800-G9-Desktop-PC]
Starting resourcemanager
Starting nodemanagers
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -mkdir /bda_hadoop
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -ls /
Found 1 items
drwxr-xr-x  - hadoop supergroup          0 2024-05-13 14:37 /bda_hadoop
```

3. put

```
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -put /home/hadoop/Desktop/bda_local.txt /bda_hadoop/file.txt
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -ls /bda_hadoop
Found 1 items
-rw-r--r--  1 hadoop supergroup          9 2024-05-13 14:42 /bda_hadoop/file.txt
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/file.txt
Hello!!!
```

4. copyFromLocal

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

5. get

```
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -get /bda_hadoop/file.txt /home/hadoop/Desktop/downloaded_file.txt
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hdfs dfs -getmerge /bda_hadoop/file.txt /bda_hadoop/file_cp_local.txt /home/hadoop/Desktop/downloaded_file.txt
hadoop@bmscece-HP-Elite-Tower-800-G9-Desktop-PC:~$ hadoop fs -getfacl /bda_hadoop/
# file: /bda_hadoop
# owner: hadoop
# group: supergroup
user::rwx
group::r-x
other::r-x
```

6. copyToLocal

```

hadoop@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $ hdfs dfs -copyToLocal /bda_hadoop/file.txt /home/hadoop/Desktop
hadoop@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $ hadoop fs -mv /bda_hadoop /abc
hadoop@bmscscse-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@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $ hadoop fs -cp /hello/ /hadoop_lab
cp: '/hello/': No such file or directory
hadoop@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $

```

7. cat

```

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

```

8.mv

```

hadoop@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $ hadoop fs -mv /bda_hadoop /abc
hadoop@bmscscse-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@bmscscse-HP-Elite-Tower-800-G9-Desktop-PC: $ hadoop fs -cp /hello/ /hadoop_lab
cp: '/hello/': No such file or directory
hadoop@bmscscse-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<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("&quot; &quot;;))
{
if (word.length() > 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<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: 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 <
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


```

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
000000000000 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.DefaultNoHARMAFailoverProxyProvider: 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<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

```
C:\hadoop-3.3.0\sbin>hadoop jar C:\avgtemp.jar temp.AverageDriver /input_dir/temp.txt /avgtemp_outputdir
2021-05-15 14:52:50,635 INFO client.DefaultHadoopFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-15 14:52:51,005 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2021-05-15 14:52:51,111 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1621060230696_0005
2021-05-15 14:52:51,735 INFO input.FileInputFormat: Total input files to process : 1
2021-05-15 14:52:52,751 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-15 14:52:53,073 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1621060230696_0005
2021-05-15 14:52:53,073 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-15 14:52:53,237 INFO conf.Configuration: resource-types.xml not found
2021-05-15 14:52:53,238 INFO resource.ResourceMills: Unable to find 'resource-types.xml'.
2021-05-15 14:52:53,312 INFO impl.YarnClientImpl: Submitted application application_1621060230696_0005
2021-05-15 14:52:53,352 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1621060230696_0005/
2021-05-15 14:52:53,353 INFO mapreduce.Job: Running job: job_1621060230696_0005
2021-05-15 14:53:06,640 INFO mapreduce.Job: Job job_1621060230696_0005 running in uber mode : false
2021-05-15 14:53:06,643 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-15 14:53:12,758 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-15 14:53:19,860 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-15 14:53:25,967 INFO mapreduce.Job: Job job_1621060230696_0005 completed successfully
2021-05-15 14:53:26,096 INFO mapreduce.Job: Counters: 54
    File System Counters
      FILE: Number of bytes read=72210
      FILE: Number of bytes written=674341
      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=8
      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)=3782
```

```
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-000000

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /avgtemp_outputdir/part-r-000000
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<LongWritable, Text, Text, IntWritable>
{ public static final int MISSING =
9999;
public void map(LongWritable key, Text value, Mapper<LongWritable, Text,
Text, IntWritable>.Context context) throws IOException, InterruptedException {
int temperature;
String line = value.toString(); String
month = line.substring(19, 21); if
(line.charAt(87) == '+') {
temperature = Integer.parseInt(line.substring(88, 92));
} else { temperature =
Integer.parseInt(line.substring(87, 92)); }
String quality = line.substring(92, 93);
if (temperature != 9999 && quality.matches("[01459]"))
context.write(new Text(month), new IntWritable(temperature));
}
}

```

MeanMaxReducer.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<Text, IntWritable, Text, IntWritable>
{
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text,
IntWritable,

```



```

Text, IntWritable>.Context context) throws IOException, InterruptedException
{ int max_temp = 0; int total_temp = 0; int count = 0; int days = 0; for
(IntWritable value : values) { int temp = value.get(); if (temp > max_temp)
max_temp = temp; count++; if (count == 3) { total_temp += max_temp;
max_temp = 0; count = 0; days++;
} } context.write(key, new IntWritable(total_temp /
days));
}
}
}

```

OUTPUT

```

C:\hadoop-3.3.0\bin\hadoop jar C:\neerax.jar neerax.HadoopDriver /input_dir/temp.txt /neerax_output
2021-05-21 20:28:05,250 INFO client.DefaultHadoopFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-21 20:28:06,562 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/krusree/staging/job_1621608943095_0001
2021-05-21 20:28:08,426 INFO input.FileInputFormat: Total input files to process : 1
2021-05-21 20:28:09,167 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 20:28:10,636 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-JG29ESD:8080/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 user 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 20:28:59,178 INFO mapreduce.Job: Counters: 34
  File System Counters
    FILE: Number of bytes read=59082
    FILE: Number of bytes written=643091
    FILE: Number of read operations=0
    FILE: Number of large read operations=0
    FILE: Number of write operations=0
    HDFS: Number of bytes read=894050
    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)=8877
    Total time spent by all reduces in occupied slots (ms)=7511
    Total time spent by all map tasks (ms)=8877
    Total time spent by all reduce tasks (ms)=7511
    Total vcore-milliseconds taken by all map tasks=8877
    Total vcore-milliseconds taken by all reduce tasks=7511
    Total megabyte-milliseconds taken by all map tasks=8278048
    Total megabyte-milliseconds taken by all reduce tasks=7091264

```

```

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);
}
}

```



```

IntWritable>.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<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

```

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.DefaultHadoopFailoverProxyProvider: 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 19:54:57,587 INFO mapreduce.Job: The url to track the job: http://LAPTOP-36329ESD: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>
```