

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



## LAB REPORT

on

## BIG DATA ANALYTICS LAB

*Submitted by*

**RAHUL RAJ(1BM20CS120)**

*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**

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**B. M. S. College of Engineering,  
Bull Temple Road, Bangalore 560019**  
(Affiliated To Visvesvaraya Technological University, Belgaum)  
**Department of Computer Science and Engineering**



**CERTIFICATE**

This is to certify that the Lab work entitled “BIG DATA ANALYTICS LAB” carried out by **RAHUL RAJ (1BM20CS120)**, 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 2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **RAHUL RAJ - (20CS6PEBDA)** work prescribed for the said degree.

Vikranth BM  
Assistant Professor  
Department of CSE  
BMSCE, Bengaluru

**Dr. Jyothi S Nayak**  
Professor and Head  
Department of CSE  
BMSCE, Bengaluru

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## Course Outcome

CO1	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO2	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO3	Apply the concept of NoSQL, Hadoop or Spark for a given task

**Program 1:** Create a Data set either structured/Semi-Structured/Unstructured from twitter/Facebook etc. to perform various DB operations using Cassandra.

```
cqlsh> CREATE KEYSPACE Employee WITH REPLICATION={'class':'SimpleStrategy','replication_factor':1};  
cqlsh> DESCRIBE KEYSPACES  
  
employee  system_auth      system_schema  system_views  
system    system_distributed  system_traces  system_virtual_schema  
  
cqlsh> USE employees;
```

```
cqlsh> USE Employee  
... ;  
cqlsh:employee> CREATE TABLE Employee_Info (Emp_id int PRIMARY KEY, Emp_Name text,Designation text,  
... Date_Of_Joining timestamp, salary double, Dept_name text);  
cqlsh:employee> DESCRIBE TABLES;  
  
employee_info
```

```
cqlsh:employee> select * from Employee_Info  
... ;  
  
emp_id | date_of_joining           | dept_name | designation | emp_name | salary  
-----+-----+-----+-----+-----+-----+  
120  | 2021-04-01 07:00:00.000000+0000 | CSE       | Manager    | Asha     | 30000  
123  | 2020-08-01 07:00:00.000000+0000 | CSE       | Emp        | Samarth   | 22500  
122  | 2019-05-01 07:00:00.000000+0000 | CSE       | Emp        | Tarun     | 22000  
121  | 2019-04-20 07:00:00.000000+0000 | CSE       | Emp        | Kiran     | 20000  
124  | 2019-06-01 07:00:00.000000+0000 | CSE       | Emp        | Rohan     | 21000  
  
(5 rows)
```

```
cqlsh:employee> ALTER TABLE Employee_Info ADD Projects text;  
cqlsh:employee> select * from Employee_Info;  
  
emp_id | salary | date_of_joining           | dept_name | designation | emp_name | projects  
-----+-----+-----+-----+-----+-----+  
120  | 30000  | 2021-04-01 07:00:00.000000+0000 | CSE       | Manager    | Asha     | null  
123  | 22500  | 2020-08-01 07:00:00.000000+0000 | CSE       | Emp        | Samarth   | null  
122  | 22000  | 2019-05-01 07:00:00.000000+0000 | CSE       | Emp        | Tarun     | null  
121  | 20000  | 2019-04-20 07:00:00.000000+0000 | CSE       | Emp        | Kiran     | null  
124  | 21000  | 2019-06-01 07:00:00.000000+0000 | CSE       | Emp        | Rohan     | null  
  
(5 rows)
```

```
cqlsh:employee> UPDATE Employee_Info SET Emp_Name='David', Dept_name='ECE' WHERE Emp_id=121;  
cqlsh:employee> select * from Employee_Info  
... ;  
  
emp_id | date_of_joining           | dept_name | designation | emp_name | salary  
-----+-----+-----+-----+-----+-----+  
120  | 2021-04-01 07:00:00.000000+0000 | CSE       | Manager    | Asha     | 30000  
123  | 2020-08-01 07:00:00.000000+0000 | CSE       | Emp        | Samarth   | 22500  
122  | 2019-05-01 07:00:00.000000+0000 | CSE       | Emp        | Tarun     | 22000  
121  | 2019-04-20 07:00:00.000000+0000 | ECE       | Emp        | David     | 20000  
124  | 2019-06-01 07:00:00.000000+0000 | CSE       | Emp        | Rohan     | 21000  
  
(5 rows)
```

```
cqlsh:employee> select ttl(Emp_Name) from Employee_Info Where Emp_id=125;  
ttl(emp_name)  
----  
6  
(1 rows)
```

```
cqlsh:employee> UPDATE Employee_Info SET Projects='Reporting'WHERE Emp_id=121 and salary=20000.0;  
cqlsh:employee> select * from Employee_Info;
```

emp_id	salary	date_of_joining	dept_name	designation	emp_name	projects
120	30000	2021-04-01 07:00:00.000000+0000	CSE	Manager	Asha	Research
123	22500	2020-08-01 07:00:00.000000+0000	CSE	Emp	Samarth	Data Migration
122	22000	2019-05-01 07:00:00.000000+0000	CSE	Emp	Tarun	Data analysis
121	20000	2019-04-20 07:00:00.000000+0000	CSE	Emp	Kiran	Reporting
124	21000	2019-06-01 07:00:00.000000+0000	CSE	Emp	Rohan	Research

```
(5 rows)
```

**Program 2:** Create a Data set either structured/Semi-Structured/Unstructured from twitter/Facebook etc. to perform various DB operations using Cassandra.

```
cqlsh> describe keyspaces;
employee  system_auth      system_schema  system_views
system    system_distributed system_traces   system_virtual_schema

cqlsh> CREATE KEYSPACE Library WITH REPLICATION={'class':'SimpleStrategy','replication_factor':1};
cqlsh> describe keyspaces;

employee  system      system_distributed  system_traces  system_virtual_schema
library   system_auth  system_schema       system_traces
```

```
cqlsh:library> CREATE TABLE Library_Info (student_id int, student_Name text,book_name text,book_id int,Date_of_Issue timestamp,primary key(student_id));
cqlsh:library> alter table Library_Info add counter_value counter;
cqlsh:library> describe tables;
```

```
library_info
```

```
cqlsh:library> select * from Library_Info;
student_id | book_id | book_name | counter_value | date_of_issue | student_name
-----+-----+-----+-----+-----+-----+
120 | 1000 | BDA | null | 2021-04-01 07:00:00.000000+0000 | shreya
123 | 1020 | ML | null | 2021-04-01 07:00:00.000000+0000 | kiran
122 | 1000 | BDA | null | 2021-04-01 07:00:00.000000+0000 | sakshi
121 | 1010 | OOMD | null | 2021-04-01 07:00:00.000000+0000 | asha
(4 rows)
```

```
cqlsh:library> select * from Library_Info;
student_id | book_id | book_name | counter_value | date_of_issue | student_name
-----+-----+-----+-----+-----+-----+
120 | 1000 | BDA | 2 | 2021-04-01 07:00:00.000000+0000 | shreya
123 | 1020 | ML | 2 | 2021-04-01 07:00:00.000000+0000 | kiran
122 | 1000 | BDA | 1 | 2021-04-01 07:00:00.000000+0000 | sakshi
121 | 1010 | OOMD | 1 | 2021-04-01 07:00:00.000000+0000 | asha
(4 rows)
```

```
cqlsh:library> select student_id from Library_Info where book_name='BDA' and counter_value=2 allow filtering;
student_id
-----
120
(1 rows)
```

```
cqlsh:library> copy Library_Info(student_id,student_Name,book_name,book_name,book_id,counter_value) to 'week2.csv';
Using 1 child processes

Starting copy of library.library_info with columns [student_id, student_name, book_name, book_name, book_id, counter_value].
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
Processed: 4 rows; Rate:    37 rows/s; Avg. rate:    37 rows/s
4 rows exported to 1 files in 0.113 seconds.
cqlsh:library> copy Library_Info(student_id,student_Name,book_name,book_name,book_id,counter_value) to 'd:\week2.csv';
Using 1 child processes

Starting copy of library.library_info with columns [student_id, student_name, book_name, book_name, book_id, counter_value].
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
Processed: 4 rows; Rate:    46 rows/s; Avg. rate:    46 rows/s
4 rows exported to 1 files in 0.090 seconds.
```

```
cqlsh:library> copy Library_Info(student_id,student_Name,book_name,book_name,book_id,counter_value) from 'd:\week2.csv';
Using 1 child processes

Starting copy of library.library_info with columns [student_id, student_name, book_name, book_name, book_id, counter_value].
cqlsh:library> copy Library_Info(student_id,student_Name,book_name,book_name,book_id,counter_value) to stdout;
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
122,sakshi,BDA,BDA,1000,1
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
120,shreya,BDA,BDA,1000,2
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
121,asha,OOMD,OOMD,1010,1
cqlshlib.copyutil.ExportProcess.write_rows_to_csv(): writing row
123,kiran,ML,ML,1020,2
cqlsh:library> █
```

### **Program 3:** Mongo DB CRUD Operations

#### CREATE DATABASE IN MONGODB:

```
bmsce@bmsce-Precision-T1700:~$ mongo sh
MongoDB shell version v3.6.8
connecting to: mongodb://127.0.0.1:27017/sh
Implicit session: session { "id" : UUID("1875dd28-6f10-4e6f-ae5c-4c2b351e2abe") }
MongoDB server version: 3.6.8
Server has startup warnings:
2023-04-01T15:22:28.307+0530 I STORAGE [initandlisten]
2023-04-01T15:22:28.307+0530 I STORAGE [initandlisten] ** WARNING: Using the
XFS filesystem is strongly recommended with the WiredTiger storage engine
2023-04-01T15:22:28.307+0530 I STORAGE [initandlisten] ** See
http://dochub.mongodb.org/core/prodnotes-filesystem
2023-04-01T15:22:35.278+0530 I CONTROL [initandlisten]
2023-04-01T15:22:35.278+0530 I CONTROL [initandlisten] ** WARNING: Access
control is not enabled for the database.
2023-04-01T15:22:35.278+0530 I CONTROL [initandlisten] ** Read and write
access to data and configuration is unrestricted.
2023-04-01T15:22:35.278+0530 I CONTROL [initandlisten]
> use yathri_db
      switched to db yathri_db
> db
      yathri_db
> show dbs
      Neha      0.000GB
      Niharika_db 0.000GB
      abcd      0.000GB
      admin      0.000GB
      config      0.000GB
      local      0.000GB
```

```
myDB      0.000GB
sec       0.000GB
student   0.000GB
test      0.000GB
```

### CRUD OPERATION:

```
> db.createCollection("Student")
    { "ok" : 1 }
> db.Student.drop()
    true
> show collections
> db.createCollection("Student")
    { "ok" : 1 }
> show collections
    Student
> db.Student.insert({ _id:1,Student_name:"AryaDavid",Grade:"VII",Hobbies:"InternetSurfing"})
    WriteResult({ "nInserted" : 1 })
> db.Student.find()
    { "_id" : 1, "Student_name" : "AryaDavid", "Grade" : "VII", "Hobbies" : "InternetSurfing"
}
>
db.Student.update({ _id:1,Student_name:"AryaDavid",Grade:"VII"},{$set:{Hobbies:"Chess"}},{
upsert:true})
    WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find()
    { "_id" : 1, "Student_name" : "AryaDavid", "Grade" : "VII", "Hobbies" : "Chess" }
> db.Student.find({Student_name: "AryaDavid"})
    { "_id" : 1, "Student_name" : "AryaDavid", "Grade" : "VII", "Hobbies" : "Chess" }
> db.Student.find({}, {_id:0,Student_name:1,Grade:1})
    { "Student_name" : "AryaDavid", "Grade" : "VII" }
> db.Student.find({Grade:{$eq:"VII"} }).pretty()
```

```

{
    "_id" : 1,
    "Student_name" : "AryaDavid",
    "Grade" : "VII",
    "Hobbies" : "Chess"
}

> db.Student.find({Hobbies:{$in:["Chess","Skating"]}}).pretty()
{
    "_id" : 1,
    "Student_name" : "AryaDavid",
    "Grade" : "VII",
    "Hobbies" : "Chess"
}

> db.Student.find({Student_name:/^M/}).pretty()
> db.Student.find({Student_name:/^A/}).pretty()
{
    "_id" : 1,
    "Student_name" : "AryaDavid",
    "Grade" : "VII",
    "Hobbies" : "Chess"
}

> db.Student.find({Student_name:/e/}).pretty()
> db.Student.find({Student_name:/i/}).pretty()
{
    "_id" : 1,
    "Student_name" : "AryaDavid",
    "Grade" : "VII",
    "Hobbies" : "Chess"
}

> db.Student.find().sort({Student_name: -1}).pretty()
{

```

```
        "_id" : 1,  
        "Student_name" : "AryaDavid",  
        "Grade" : "VII",  
        "Hobbies" : "Chess"  
    }  
    {  
        "_id" : 2,  
        "Student_name" : "Anu",  
        "Grade" : "VI",  
        "Hobbies" : "InternetSurfing"  
    }
```

## Program 4: Hadoop Installation

```
vinay@vinay-Compaq-15-Notebook-PC:~$ pwd
/home/vinay
vinay@vinay-Compaq-15-Notebook-PC:~$ cd Work
vinay@vinay-Compaq-15-Notebook-PC:~/Work$ cd hadoop-2.6.0/
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0$ ls
bin etc include lib libexec LICENSE.txt logs NOTICE.txt README.txt sbin share
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0$ cd etc
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc$ ls
hadoop
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc$ cd hadoop
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ ls
capacity-scheduler.xml      hadoop-env.sh.save1      httpsfs-signature.secret  mapred-env.cmd      slaves
configuration.xsl           hadoop-metrics2.properties  httpsfs-site.xml       mapred-env.sh      ssl-client.xml
container-executor.cfg      hadoop-metrics.properties   kms-acls.xml        mapred-queues.xml.template  ssl-server.xml
core-site.xml               hadoop-policy.xml       kms-env.sh          mapred-site.xml     yarn-env.cmd
hadoop-env.cmd              hdfs-site.xml         kms-log4j.properties  mapred-site.xml.save  yarn-env.sh
hadoop-env.sh               httpfs-env.sh        kms-site.xml       mapred-site.xml.template  yarn-site.xml
hadoop-env.sh.save          httpfs-log4j.properties log4j.properties    nano.save
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ sudo nano core-site.xml
[sudo] password for vinay:
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ sudo nano hdfs-site.xml
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ sudo nano yarn-site.xml
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ sudo nano .bashrc
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ sudo nano .bashrc
vinay@vinay-Compaq-15-Notebook-PC:~/Work/hadoop-2.6.0/etc/hadoop$ cd
vinay@vinay-Compaq-15-Notebook-PC:~$ pwd
/home/vinay
vinay@vinay-Compaq-15-Notebook-PC:~$ sudo nano .bashrc
vinay@vinay-Compaq-15-Notebook-PC:~$ source .bashrc
vinay@vinay-Compaq-15-Notebook-PC:~$ █
```

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
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 you may not use this file except in compliance with the License.
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 distributed under the License is distributed on an "AS IS" BASIS,
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 See the License for the specific language governing permissions and
 limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
  <name>fs.default.name</name>
  <value>hdfs://localhost:9000</value>
</property>
</configuration>
```

```

<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
    Licensed under the Apache License, Version 2.0 (the "License");
    you may not use this file except in compliance with the License.
    You may obtain a copy of the License at

        http://www.apache.org/licenses/LICENSE-2.0

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    WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
    See the License for the specific language governing permissions and
    limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
    <name>fs.replication</name>
    <value>1</value>
</property>
<property>
    <name>dfs.namenode.name.dir</name>
    <value>/home/vinay/Work/hdfs/namenode</value>
</property>
<property>
    <name>dfs.datanode.data.dir</name>
    <value>/home/vinay/Work/hdfs/datanode</value>
</property>
</configuration>

```

```

vinay@vinay-Compaq-15-Notebook-PC:~$ jps
4718 Jps
vinay@vinay-Compaq-15-Notebook-PC:~$ start-all.sh
starting org.apache.spark.deploy.master.Master, logging to /home/vinay/Work/spark-2.4.4-bin-hadoop2.7/logs/spark-vinay-org.apache.spark.deploy.master.Master-1-vinay-Compaq-15-Notebook-PC.out
localhost: starting org.apache.spark.deploy.worker.Worker, logging to /home/vinay/Work/spark-2.4.4-bin-hadoop2.7/logs/spark-vinay-org.apache.spark.deploy.worker.Worker-1-vinay-Compaq-15-Notebook-PC.out
vinay@vinay-Compaq-15-Notebook-PC:~$ start-dfs.sh
Starting namenodes on [localhost]
localhost: starting namenode, logging to /home/vinay/Work/hadoop-2.6.0/logs/hadoop-vinay-namenode-vinay-Compaq-15-Notebook-PC.out
localhost: starting datanode, logging to /home/vinay/Work/hadoop-2.6.0/logs/hadoop-vinay-datanode-vinay-Compaq-15-Notebook-PC.out
Starting secondary namenodes [0.0.0.0]
0.0.0.0: starting secondarynamenode, logging to /home/vinay/Work/hadoop-2.6.0/logs/hadoop-vinay-secondarynamenode-vinay-Compaq-15-Notebook-PC.out
vinay@vinay-Compaq-15-Notebook-PC:~$ start-yarn.sh
starting yarn daemons
starting resourcemanager, logging to /home/vinay/Work/hadoop-2.6.0/logs/yarn-vinay-resourcemanager-vinay-Compaq-15-Notebook-PC.out
localhost: starting nodemanager, logging to /home/vinay/Work/hadoop-2.6.0/logs/yarn-vinay-nodemanager-vinay-Compaq-15-Notebook-PC.out
vinay@vinay-Compaq-15-Notebook-PC:~$ jps
5697 ResourceManager
4753 Master
5538 SecondaryNameNode
6154 Jps
5290 DataNode
4893 Worker
5133 NameNode
5855 NodeManager
vinay@vinay-Compaq-15-Notebook-PC:~$ ■

```

## Program 5: Execution of HDFS Commands for interaction with Hadoop Environment.

```
hduser@bmsce-Precision-T1700:~$ hadoop-startssh
hadoop-startssh: command not found
hduser@bmsce-Precision-T1700:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-Precision-T1700.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hduser-secondarynamenode-bmsce-Precision-T1700.out
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-Precision-T1700.out

hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-nodemanager-bmsce-Precision-T1700.out

hduser@bmsce-Precision-T1700:~$ jps
6115 DataNode
6821 NodeManager
6487 ResourceManager
5944 NameNode
6328 SecondaryNameNode
6943 Jps
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /yathri
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /
Found 51 items
drwxr-xr-x  - hduser supergroup 0 2022-07-11 13:07 /ibm19cs015
drwxr-xr-x  - hduser supergroup 0 2022-06-03 12:20 /Nishu
drwxr-xr-x  - hduser supergroup 0 2022-06-03 12:45 /Shree
drwxr-xr-x  - hduser supergroup 0 2022-06-04 09:44 /abc
drwxr-xr-x  - hduser supergroup 0 2022-06-27 13:14 /anisha_bda
drwxr-xr-x  - hduser supergroup 0 2022-06-03 15:14 /bharath
drwxr-xr-x  - hduser supergroup 0 2022-06-03 15:14 /bhavya
drwxr-xr-x  - hduser supergroup 0 2022-06-29 10:06 /damnu
drwxr-xr-x  - hduser supergroup 0 2022-06-24 15:24 /dhruba
drwxr-xr-x  - hduser supergroup 0 2023-05-08 10:08 /ginn
drwxr-xr-x  - hduser supergroup 0 2022-07-11 16:16 /hritikdir
drwxr-xr-x  - hduser supergroup 0 2022-06-06 15:41 /ketan_076
drwxr-xr-x  - hduser supergroup 0 2023-05-11 14:46 /labi
drwxr-xr-x  - hduser supergroup 0 2022-07-11 13:14 /lab786
drwxr-xr-x  - hduser supergroup 0 2022-06-22 15:24 /nayana
drwxr-xr-x  - hduser supergroup 0 2022-06-22 15:07 /nayana_op
drwxr-xr-x  - hduser supergroup 0 2022-06-06 15:41 /new_folder
-rw-r--r--  1 hduser supergroup 33 2022-06-03 12:11 /nishu
drwxr-xr-x  - hduser supergroup 0 2022-06-27 13:05 /outfile
drwxr-xr-x  - hduser supergroup 0 2022-06-27 12:35 /output
drwxr-xr-x  - hduser supergroup 0 2022-07-11 12:53 /output_015
drwxr-xr-x  - hduser supergroup 0 2022-07-11 12:56 /output_015_2
drwxr-xr-x  - hduser supergroup 0 2022-07-11 13:05 /output_015_correct
drwxr-xr-x  - hduser supergroup 0 2022-07-11 13:07 /output_015_correct2
drwxr-xr-x  - hduser supergroup 0 2023-07-11 12:59 /output_015_corrected
drwxr-xr-x  - hduser supergroup 0 2022-07-11 14:01 /output_aml
drwxr-xr-x  - hduser supergroup 0 2022-07-11 13:15 /output_amit
drwxr-xr-x  - hduser supergroup 0 2022-06-22 15:30 /output_nayana
drwxr-xr-x  - hduser supergroup 0 2022-06-27 12:25 /outsomefile.txt
drwxr-xr-x  - hduser supergroup 0 2022-06-27 12:32 /outsomefile1
drwxr-xr-x  - hduser supergroup 0 2022-06-20 12:38 /rgs
drwxr-xr-x  - hduser supergroup 0 2022-07-11 14:28 /srav
drwxr-xr-x  - hduser supergroup 0 2022-07-11 14:48 /srav1
drwxr-xr-x  - hduser supergroup 0 2022-07-11 15:32 /srav2
drwxr-xr-x  - hduser supergroup 0 2022-06-20 15:23 /sravan
drwxr-xr-x  - hduser supergroup 0 2022-06-27 15:38 /sravan_join
drwxr-xr-x  - hduser supergroup 0 2022-06-27 15:48 /sravan_join_output
drwxr-xr-x  - hduser supergroup 0 2022-06-27 14:49 /sravan_temp
drwxr-xr-x  - hduser supergroup 0 2022-06-27 14:50 /sravan_temp_output
drwxr-xr-x  - hduser supergroup 0 2022-06-27 15:14 /sravan_topn
drwxr-xr-x  - hduser supergroup 0 2022-06-27 15:15 /sravan_topn_output
drwxr-xr-x  - hduser supergroup 0 2022-06-27 15:25 /sravan_topn_output1
drwxr-xr-x  - hduser supergroup 0 2022-06-22 10:41 /tarun
drwxr-xr-x  - hduser supergroup 0 2022-06-23 10:31 /temperature
drwxrwxr-x  - hduser supergroup 0 2019-08-01 16:19 /tmp
drwxr-xr-x  - hduser supergroup 0 2023-05-08 10:23 /ultron
drwxr-xr-x  - hduser supergroup 0 2019-08-01 16:03 /user
drwxr-xr-x  - hduser supergroup 0 2022-06-01 15:23 /user1
drwxr-xr-x  - hduser supergroup 0 2023-05-11 14:07 /vraj
drwxr-xr-x  - hduser supergroup 0 2022-07-13 15:54 /xyz
drwxr-xr-x  - hduser supergroup 0 2023-05-15 11:44 /yathri
```

```

hduser@bmsce-Precision-T1700:~$ hdfs dfs -put /home/hduser/sample.txt /yathri
put: `/home/hduser/sample.txt': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -put /home/hduser/sample1.txt /yathri
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /yathri
Found 1 items
-rw-r--r-- 1 hduser supergroup 6 2023-05-15 11:46 /yathri/sample1.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyFromLocal /home/hduser/file1.txt /yathri
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /yathri
Found 2 items
-rw-r--r-- 1 hduser supergroup 6 2023-05-15 11:47 /yathri/file1.txt
-rw-r--r-- 1 hduser supergroup 6 2023-05-15 11:46 /yathri/sample1.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -get /yathri /home/hduser/sample1.txt
get: `/home/hduser/sample1.txt': File exists
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /yathri/sample1.txt
cat: `/yathri/sample1.txt': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /yathri/sample1.txt
hello
hduser@bmsce-Precision-T1700:~$ hdfs dfs -getmerge /yathri/sample1.txt /yathri/file1.txt /home/hduser
getmerge: `/home/hduser': Is a directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -getmerge /yathri/sample1.txt /yathri/file1.txt /home/hduser/merge.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /home/hduser/merge.txt
cat: `/home/hduser/merge.txt': No such file or directory
hduser@bmsce-Precision-T1700:~$ cat /home/hduser/merge.txt
hello
hello
hduser@bmsce-Precision-T1700:~$ hdfs dfs -getfacl /yathri/
# file: /yathri
# owner: hduser
# group: supergroup
user::rwx
group::r-x
other::r-x

hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /yathri1
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /yathri
cat: `/yathri': Is a directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /yathri
Found 2 items
-rw-r--r-- 1 hduser supergroup 6 2023-05-15 11:47 /yathri/file1.txt
-rw-r--r-- 1 hduser supergroup 6 2023-05-15 11:46 /yathri/sample1.txt
hduser@bmsce-Precision-T1700:~$ hadoop fs -mv /yathri /yathri1
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /yathri1
ls: `/yathri': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /yathri1
Found 1 items
drwxr-xr-x - hduser supergroup 0 2023-05-15 11:47 /yathri1/yathri
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /yathri1
ls: `/yathri': No such file or directory
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /yathri1
Found 1 items
drwxr-xr-x - hduser supergroup 0 2023-05-15 11:47 /yathri1/yathri
hduser@bmsce-Precision-T1700:~$ hadoop fs -cp /yathri /yathri1/yathri
cp: `/yathri': No such file or directory
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /yathri1
hduser@bmsce-Precision-T1700:~$ hadoop fs -cp /yathri /yathri1/yathri

hduser@bmsce-Precision-T1700:~$ hadoop fs -cp /yathri1/yathri/ /yathri1
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls /yathri1
Found 1 items
drwxr-xr-x - hduser supergroup 0 2023-05-15 11:59 /yathri1/yathri

```

## **Program 6:** Create a Map Reduce program to

- a) find average temperature for each year from NCDC data set.

### AverageMapper:

```
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:

```
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));
    }
}
```

### AverageDriver:

```
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 = 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);
    }
}

hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/Desktop/weather.txt /yathri
hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /yathri
Found 3 items
drwxr-xr-x - hadoop supergroup          0 2023-05-17 09:33 /yathri/Desktop
-rw-r--r--  1 hadoop supergroup         97 2023-05-17 09:35 /yathri/wc.txt
-rw-r--r--  1 hadoop supergroup  888978 2023-05-17 10:30 /yathri/weather.txt
hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Documents/jar/Weather.jar AverageDriver /yathri/weather.txt /output2
2023-05-17 10:33:02,346 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2023-05-17 10:33:02,380 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2023-05-17 10:33:02,381 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2023-05-17 10:33:02,432 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your app!
2023-05-17 10:33:02,465 INFO input.FileInputFormat: Total input files to process : 1
2023-05-17 10:33:02,490 INFO mapreduce.JobSubmitter: number of splits:1
2023-05-17 10:33:02,546 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local212143084_0001
2023-05-17 10:33:02,546 INFO mapreduce.JobSubmitter: Executing with tokens: []
2023-05-17 10:33:02,599 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2023-05-17 10:33:02,599 INFO mapreduce.Job: Running job: job_local212143084_0001
2023-05-17 10:33:02,600 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2023-05-17 10:33:02,603 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-05-17 10:33:02,603 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:false, ignore cleanup failure
2023-05-17 10:33:02,603 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
2023-05-17 10:33:02,636 INFO mapred.LocalJobRunner: Waiting for map tasks
2023-05-17 10:33:02,636 INFO mapred.LocalJobRunner: Starting task: attempt_local212143084_0001_m_000000_0
2023-05-17 10:33:02,645 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2023-05-17 10:33:02,645 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:false, ignore cleanup failure
2023-05-17 10:33:02,651 INFO mapred.Task: Using ResourceCalculatorProcessTree : []
2023-05-17 10:33:02,652 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/yathri/weather.txt:0+888978
2023-05-17 10:33:02,681 INFO mapred.MapTask: (EQUATOR) 0 kv1 26214396(104857584)
2023-05-17 10:33:02,681 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2023-05-17 10:33:02,681 INFO mapred.MapTask: soft limit at 83886080
2023-05-17 10:33:02,681 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2023-05-17 10:33:02,681 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2023-05-17 10:33:02,683 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapOutputBuffer
2023-05-17 10:33:02,748 INFO mapred.LocalJobRunner:
2023-05-17 10:33:02,749 INFO mapred.MapTask: Starting flush of map output
2023-05-17 10:33:02,749 INFO mapred.MapTask: Spilling map output
2023-05-17 10:33:02,749 INFO mapred.MapTask: bufstart = 0; bufend = 59085; bufvoid = 104857600
2023-05-17 10:33:02,749 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188140(104752560); length = 26257/6553600
2023-05-17 10:33:02,756 INFO mapred.MapTask: Finished spill 0
2023-05-17 10:33:02,759 INFO mapred.Task: Task attempt_local212143084_0001_m_000000_0 is done. And is in the process of committing
2023-05-17 10:33:02,761 INFO mapred.Task: Task 'attempt_local212143084_0001_m_000000_0' done.
2023-05-17 10:33:02,763 INFO mapred.Task: Final counters for attempt_local212143084_0001_m_000000_0: Counters: 23
File System Counters
  FILE: Number of bytes read=4327
  FILE: Number of bytes written=713168
  FILE: Number of read operations=0
  FILE: Number of large read operations=0
  FILE: Number of write operations=0
  HDFS: Number of bytes read=888978
  HDFS: Number of bytes written=0
  HDFS: Number of read operations=5
  HDFS: Number of large read operations=0

Bytes Written=8
hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /output2
Found 2 items
-rw-r--r--  1 hadoop supergroup          0 2023-05-17 10:33 /output2/_SUCCESS
-rw-r--r--  1 hadoop supergroup         8 2023-05-17 10:33 /output2/part-r-00000
hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -cat /output2/part-r-00000
1902      21
hadoop@bnscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ 

```

b) find the mean max temperature for every month

MeanMaxMapper:

```
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:

```
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));
}
}

```

### MeanMaxDriver:

```

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.out.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);
    }
}

```

```

hduser@bmsce-Precision-T1700:~$ hadoop jar /home/hduser/Desktop/meanmaxtemp.jar MeanMaxDriver /yathri/weather1.txt outputtempmax
23/06/10 10:03:53 INFO Configuration.deprecation: session.id is deprecated. Instead, use dfs.metrics.session-id
23/06/10 10:03:53 INFO jvm.JvmMetrics: Initializing JVM Metrics with processName=JobTracker, sessionId=
23/06/10 10:03:53 WARN mapreduce.JobSubmitter: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with '-Tool class'
23/06/10 10:03:53 INFO input.FileInputFormat: Total input paths to process : 1
23/06/10 10:03:53 INFO mapreduce.JobSubmitter: number of splits:1
23/06/10 10:03:53 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local86685270_0001
23/06/10 10:03:53 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
23/06/10 10:03:53 INFO mapreduce.Job: Running job: job_local86685270_0001
23/06/10 10:03:53 INFO mapred.LocalJobRunner: OutputCommitter set in config null
23/06/10 10:03:53 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
23/06/10 10:03:53 INFO mapred.LocalJobRunner: Waiting for map tasks
23/06/10 10:03:53 INFO mapred.LocalJobRunner: Starting task: attempt_local86685270_0001_m_000000_0
23/06/10 10:03:53 INFO mapred.Task: Using ResourceCalculatorProcessTree : [ ]
23/06/10 10:03:53 INFO mapred.MapTask: Processing split: hdfs://localhost:54310/yathri/weather1.txt:0+888190
23/06/10 10:03:53 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
23/06/10 10:03:53 INFO mapred.MapTask: mapreduce.task.to.sort.mb: 100
23/06/10 10:03:53 INFO mapred.MapTask: soft limit at 83886080
23/06/10 10:03:53 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
23/06/10 10:03:53 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
23/06/10 10:03:53 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapOutputBuffer
23/06/10 10:03:53 INFO mapred.LocalJobRunner:
23/06/10 10:03:53 INFO mapred.MapTask: Starting flush of map output
23/06/10 10:03:53 INFO mapred.MapTask: Spilling map output
23/06/10 10:03:53 INFO mapred.MapTask: bufstart = 0; bufend = 45948; bufvoid = 104857600
23/06/10 10:03:53 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188144(104752576); length = 26253/6553600
23/06/10 10:03:53 INFO mapred.MapTask: Finished spill 0
23/06/10 10:03:53 INFO mapred.Task: Task:attempt_local86685270_0001_m_000000_0 is done. And is in the process of committing
23/06/10 10:03:53 INFO mapred.LocalJobRunner: map
23/06/10 10:03:53 INFO mapred.Task: Task 'attempt_local86685270_0001_m_000000_0' done.
23/06/10 10:03:53 INFO mapred.LocalJobRunner: Finishing task: attempt_local86685270_0001_m_000000_0

```

```

Bytes Written=72
hduser@bmsce-Precision-T1700:~$ hadoop fs -ls outputtempmax1
Found 2 items
-rw-r--r-- 1 hduser supergroup 0 2023-06-10 10:07 outputtempmax1/_SUCCESS
-rw-r--r-- 1 hduser supergroup 72 2023-06-10 10:07 outputtempmax1/part-r-00000
hduser@bmsce-Precision-T1700:~$ hadoop fs -cat outputtempmax1/part-r-00000
01      4
02      1
03      4
04     24
05     78
06    119
07    145
08    146
09    104
10     45
11     23
12      4

```

```

hduser@bmsce-Precision-T1700:~$ hadoop fs -ls outputtempmax
Found 2 items
-rw-r--r-- 1 hduser supergroup 0 2023-06-10 10:03 outputtempmax/_SUCCESS
-rw-r--r-- 1 hduser supergroup 74 2023-06-10 10:03 outputtempmax/part-r-00000

```

```

hduser@bmsce-Precision-T1700:~$ hadoop fs -cat outputtempmax/part-r-00000
01      4
02      0
03      7
04     44
05    100
06    168
07    219
08    198
09    141
10    100
11     19
12      3

```

**Program 7:** Create a Map Reduce program to sort the content in an alphabetic order listing only top 10 maximum occurrences of words.

TopNMapper:

```
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;

public class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
    private static final IntWritable one = new IntWritable(1);

    private Text word = new Text();

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

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

TopNReducer:

```
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));
    }
}
}

```

#### TopnNDriver:

```

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.getInstance(conf);
        job.setJobName("Top N");
        job.setJarByClass(TopN.class);
        job.setMapperClass(TopNMapper.class);
        job.setReducerClass(TopNReducer.class);
        job.setOutputKeyClass(Text.class);
    }
}

```

```
job.setOutputValueClass(IntWritable.class);
FileInputFormat.addInputPath(job, new Path(otherArgs[0]));
FileOutputFormat.setOutputPath(job, new Path(otherArgs[1]));
System.exit(job.waitForCompletion(true) ? 0 : 1);
}

public static class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
    private static final IntWritable one = new IntWritable(1);

    private Text word = new Text();

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

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

### TopNCombiner:

```
import java.io.IOException;  
import org.apache.hadoop.io.IntWritable;  
import org.apache.hadoop.io.Text;  
import org.apache.hadoop.mapreduce.Reducer;
```

```
public class TopNCombiner extends Reducer<Text, IntWritable, Text, IntWritable> {  
    public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text, IntWritable>.Context context) throws IOException, InterruptedException {  
        int sum = 0;  
        for (IntWritable val : values)  
            sum += val.get();  
        context.write(key, new IntWritable(sum));  
    }  
}
```

## Package util:

package utils;

```
import java.util.*;
public class MiscUtils {
    /**
     * sorts the map by values. Taken from:
     * http://javarevisited.blogspot.it/2012/12/how-to-sort-hashmap-java-by-key-and-value.html
     */
    public static <K extends Comparable, V extends Comparable> Map<K, V>
    sortByValues(Map<K, V> map) {
        List<Map.Entry<K, V>> entries = new LinkedList<Map.Entry<K, V>>(map.entrySet());
        Collections.sort(entries, new Comparator<Map.Entry<K, V>>() {
            @Override
            public int compare(Map.Entry<K, V> o1, Map.Entry<K, V> o2) {
                return o2.getValue().compareTo(o1.getValue());
            }
        });
        Map<K, V> sortedMap = new LinkedHashMap<K, V>();
        for (Map.Entry<K, V> entry : entries) {
            sortedMap.put(entry.getKey(), entry.getValue());
        }
        return sortedMap;
    }
}
```

### Test.txt:

hi how are you  
how is your job  
how is your family  
how is your brother  
how is your sister

```

hduser@ubuntu:~/hadoop-3.2.1/sbin$ hadoop jar /home/hduser/TopNRecords.jar /rgs/test.txt /output_6/
2021-05-13 03:43:26,785 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
2021-05-13 03:43:27,393 INFO client.RMProxy: Connecting to ResourceManager at /127.0.0.1:8032
2021-05-13 03:43:27,849 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/hduser/.staging/job_1620900977604_0001
2021-05-13 03:43:27,989 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
2021-05-13 03:43:28,661 INFO input.FileInputFormat: Total input files to process : 1
2021-05-13 03:43:28,718 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
2021-05-13 03:43:29,146 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
2021-05-13 03:43:29,559 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-13 03:43:29,746 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
2021-05-13 03:43:29,791 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1620900977604_0001
2021-05-13 03:43:29,792 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-13 03:43:30,022 INFO conf.Configuration: resource-types.xml not found
2021-05-13 03:43:30,022 INFO ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-13 03:43:30,417 INFO impl.YarnClientImpl: Submitted application application_1620900977604_0001
2021-05-13 03:43:30,499 INFO mapreduce.Job: The url to track the job: http://ubuntu:8088/proxy/application_1620900977604_0001/
2021-05-13 03:43:30,500 INFO mapreduce.Job: Running job: job_1620900977604_0001
2021-05-13 03:43:39,700 INFO mapreduce.Job: Job job_1620900977604_0001 running in uber mode : false
2021-05-13 03:43:39,702 INFO mapreduce.Job: map 0% reduce 0%
2021-05-13 03:43:45,786 INFO mapreduce.Job: map 100% reduce 0%
2021-05-13 03:43:50,823 INFO mapreduce.Job: map 100% reduce 100%
2021-05-13 03:43:50,850 INFO mapreduce.Job: Job job_1620900977604_0001 completed successfully
2021-05-13 03:43:50,978 INFO mapreduce.Job: Counters: 54
    File System Counters
        FILE: Number of bytes read=215
        FILE: Number of bytes written=451185
        FILE: Number of read operations=0
        FILE: Number of large read operations=0
        FILE: Number of write operations=0
        HDFS: Number of bytes read=188
        HDFS: Number of bytes written=69
        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)=3255
        Total time spent by all reduces in occupied slots (ms)=2836
        Total time spent by all map tasks (ms)=3255
        Total time spent by all reduce tasks (ms)=2836
        Total vcore-milliseconds taken by all map tasks=3255
        Total vcore-milliseconds taken by all reduce tasks=2836
        Total megabyte-milliseconds taken by all map tasks=3333120
        Total megabyte-milliseconds taken by all reduce tasks=2904064

```

```

Bytes Written=69
hduser@ubuntu:~/hadoop-3.2.1/sbin$ hdfs dfs -cat /output_6/part-r-00000
2021-05-13 03:44:48,892 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform...
2021-05-13 03:44:49,577 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false
how      5
your     4
is       4
brother  1
are      1
hi       1
sister   1
family   1
you      1
job      1

```

**Program 8:** Create a Map Reduce program to combine information from the users file along with Information from the posts file by using the concept of join and display user\_id, Reputation and Score.

JoinDriver.java:

```
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
import org.apache.hadoop.mapred.lib.MultipleInputs;
import org.apache.hadoop.util.*;
public class JoinDriver extends Configured implements Tool {
    public static class KeyPartitioner implements Partitioner<TextPair, Text> {
        @Override
        public void configure(JobConf job) {}
        @Override
        public int getPartition(TextPair key, Text value, int numPartitions) {
            return (key.getFirst().hashCode() & Integer.MAX_VALUE) %
                numPartitions;
        }
    }
    @Override
    public int run(String[] args) throws Exception {
        if (args.length != 3) {
            System.out.println("Usage: <Department Emp Strength input>
<Department Name input> <output>");
            return -1;
        }
        JobConf conf = new JobConf(getConf(), getClass());
        conf.setJobName("Join 'Department Emp Strength input' with 'Department Name input'");
    }
}
```

```

Path AInputPath = new Path(args[0]);
Path BInputPath = new Path(args[1]);
Path outputPath = new Path(args[2]);
MultipleInputs.addInputPath(conf, AInputPath, TextInputFormat.class, Posts.class);
MultipleInputs.addInputPath(conf, BInputPath, TextInputFormat.class, User.class);
FileOutputFormat.setOutputPath(conf, outputPath);
conf.setPartitionerClass(KeyPartitioner.class);
conf.setOutputValueGroupingComparator(TextPair.FirstComparator.class);
conf.setMapOutputKeyClass(TextPair.class);
conf.setReducerClass(JoinReducer.class);
conf.setOutputKeyClass(Text.class);
JobClient.runJob(conf);
return 0;
}

public static void main(String[] args) throws Exception {
int exitCode = ToolRunner.run(new JoinDriver(), args);
System.exit(exitCode);
}
}

```

### JoinReducer.java:

```

import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
public class JoinReducer extends MapReduceBase implements Reducer<TextPair, Text, Text, Text> {
@Override
public void reduce (TextPair key, Iterator<Text> values, OutputCollector<Text, Text>
output, Reporter reporter) throws IOException

```

```

{
Text nodeId = new Text(values.next());
while (values.hasNext()) {
Text node = values.next();
Text outValue = new Text(nodeId.toString() + "\t\t" + node.toString());
output.collect(key.getFirst(), outValue);
}
}
}
}

```

User.java:

```

import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.FSDataInputStream;
import org.apache.hadoop.fs.FSDataOutputStream;
import org.apache.hadoop.fs.FileSystem;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.*;
import org.apache.hadoop.io.IntWritable;
public class User extends MapReduceBase implements Mapper<LongWritable, Text, TextPair,
Text> {
@Override
public void map(LongWritable key, Text value, OutputCollector<TextPair, Text> output,
Reporter reporter)
throws IOException
{

```

```
String valueString = value.toString();
String[] SingleNodeData = valueString.split("\t");
output.collect(new TextPair(SingleNodeData[0], "1"), new Text(SingleNodeData[1]));
}
}
```

### Posts.java:

```
import java.io.IOException;
import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;
public class Posts extends MapReduceBase implements Mapper<LongWritable, Text, TextPair,
Text> {
@Override
public void map(LongWritable key, Text value, OutputCollector<TextPair, Text> output,
Reporter reporter) throws IOException
{
String valueString = value.toString();
String[] SingleNodeData = valueString.split("\t");
output.collect(new TextPair(SingleNodeData[3], "0"), new Text(SingleNodeData[9]));
}
}
```

### TextPair.java:

```
import java.io.*;
import org.apache.hadoop.io.*;
public class TextPair implements WritableComparable<TextPair> {
private Text first;
private Text second;
public TextPair() {
set(new Text(), new Text());
```

```
}

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

public TextPair(Text first, Text second) {

set(first, second);

}

public void set(Text first, Text second) {

this.first = first;

this.second = second;

}

public Text getFirst() {

return first;

}

public Text getSecond() {

return second;

}

@Override

public void write(DataOutput out) throws IOException {

first.write(out);

second.write(out);

}

@Override

public void readFields(DataInput in) throws IOException {

first.readFields(in);

second.readFields(in);

}

@Override

public int hashCode() {

return first.hashCode() * 163 + second.hashCode();

}
```

```
}

@Override
public boolean equals(Object o) {
    if (o instanceof TextPair) {
        TextPair tp = (TextPair) o;
        return first.equals(tp.first) && second.equals(tp.second);
    }
    return false;
}
@Override
public String toString() {
    return first + "\t" + second;
}
@Override
public int compareTo(TextPair tp) {
    int cmp = first.compareTo(tp.first);
    if (cmp != 0) {
        return cmp;
    }
    return second.compareTo(tp.second);
}
// ^^ TextPair

// vv TextPairComparator
public static class Comparator extends WritableComparator {

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

```

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

@Override
public int compare(byte[] b1, int s1, int l1,
    byte[] b2, int s2, int l2) {
    try {
        int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
        int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
        int cmp = TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
        if (cmp != 0) {
            return cmp;
        }
        return TEXT_COMPARATOR.compare(b1, s1 + firstL1, l1 - firstL1,
            b2, s2 + firstL2, l2 - firstL2);
    } catch (IOException e) {
        throw new IllegalArgumentException(e);
    }
}
}

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

public static class FirstComparator extends WritableComparator {
    private static final Text.Comparator TEXT_COMPARATOR = new Text.Comparator();
    public FirstComparator() {
        super(TextPair.class);
    }
}

```

```

@Override
public int compare(byte[] b1, int s1, int l1,
byte[] b2, int s2, int l2) {
try {
int firstL1 = WritableUtils.decodeVIntSize(b1[s1]) + readVInt(b1, s1);
int firstL2 = WritableUtils.decodeVIntSize(b2[s2]) + readVInt(b2, s2);
return TEXT_COMPARATOR.compare(b1, s1, firstL1, b2, s2, firstL2);
} catch (IOException e) {
throw new IllegalArgumentException(e);
}
}

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

```

### DeptName.txt:

Dept_ID	Dept_Name
A11	Finance
B12	HR
C13	Manufacturing

### DeptStrength:

Dept_ID	Total_Employee
A11	50
B12	100
C13	250

```
hduser@ubuntu:~/hadoop-3.2.1/sbin$ hdfs dfs -cat /output_join/part-00000
2021-06-13 09:01:24,785 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
2021-06-13 09:01:26,736 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
A11      50          Finance
B12     100          HR
C13     250          Manufacturing
Dept_ID Total_Employee      Dept_Name
hduser@ubuntu:~/hadoop-3.2.1/sbin$
```

```
Bytes Written=69
hduser@ubuntu:~/hadoop-3.2.1/sbin$ hdfs dfs -cat /output_6/part-r-00000
2021-05-13 03:44:48,892 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform...
2021-05-13 03:44:49,577 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false
how      5
your      4
is        4
brother   1
are        1
hi         1
sister    1
family    1
you        1
job        1
```

## Program 9: Program to print word count on scala shell and print “Hello world” on scala IDE

```
Command Prompt - spark-shell

scala> val data=sc.textFile("C:\\Spark\\spark-2.4.8-bin-hadoop2.7\\bin\\testdata\\sparkdata.txt")
data: org.apache.spark.rdd.RDD[String] = C:\\Spark\\spark-2.4.8-bin-hadoop2.7\\bin\\testdata\\sparkdata.txt MapPartitionsRDD[61] at textFile at <console>:24

scala> data.collect;
res31: Array[String] = Array(hi how are you?, how is your sister?, how is your jib?, how have you been?, "", "", "", "")

scala> val splitdata = data.flatMap(line => line.split(" "));
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[62] at flatMap at <console>:25

scala> splitdata.collect;
res32: Array[String] = Array(hi, how, are, you?, how, is, your, sister?, how, is, your, jib?, how, have, you, been?, "", "", "", "")
```

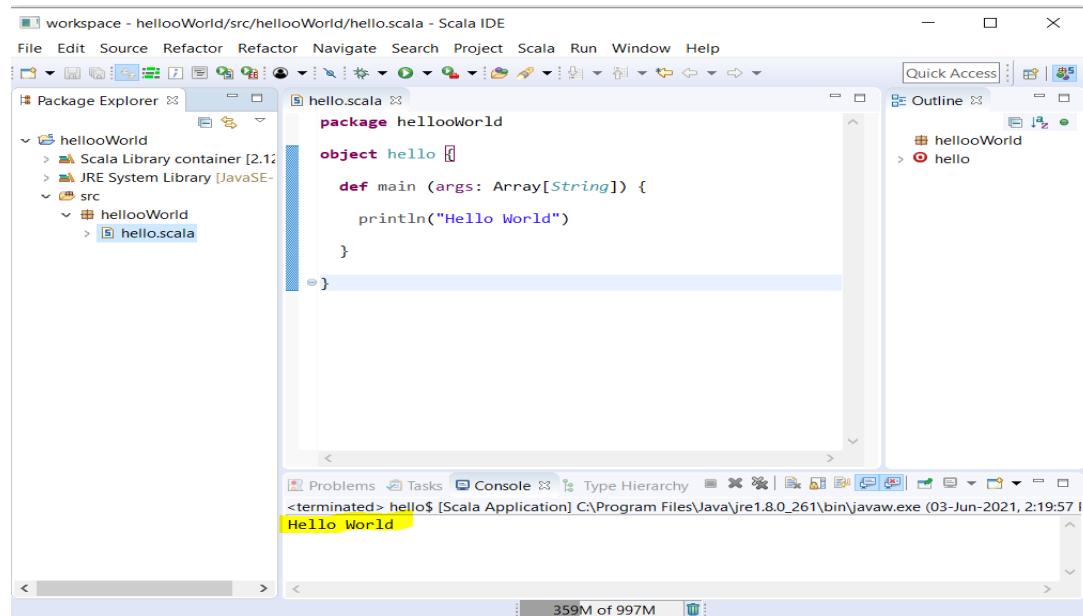
```
scala> val mapdata = splitdata.map(word => (word,1));
mapdata: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[63] at map at <console>:25

scala> mapdata.collect;
res33: Array[(String, Int)] = Array((hi,1), (how,1), (are,1), (you?,1), (how,1), (is,1), (your,1), (sister?,1), (how,1), (is,1), (your,1), (jib?,1), (how,1), (have,1), (you,1), (been?,1), ("",1), ("",1), ("",1), ("",1))

scala> val reducedata = mapdata.reduceByKey(_+_);
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[64] at reduceByKey at <console>:25

scala> reducedata.collect;
res34: Array[(String, Int)] = Array((are,1), (is,2), (jib?,1), (have,1), (how,4), (you?,1), ("",4), (sister?,1), (you,1), (hi,1), (been?,1), (your,2))

scala>
```



**Program 10:** Using RDD and FlaMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark.

```
Command Prompt - spark-shell
scala> val textFile = sc.textFile("C:\\\\Spark\\\\spark-2.4.8-bin-hadoop2.7\\\\bin\\\\testdata\\\\sparkdata.txt")
textFile: org.apache.spark.rdd.RDD[String] = C:\\\\Spark\\\\spark-2.4.8-bin-hadoop2.7\\\\bin\\\\testdata\\\\sparkdata.txt MapPartitionsRDD[75] at textFile at <console>:31

scala> val counts = textFile.flatMap(line => line.split(" ")).map(word => (word, 1)).reduceByKey(_ + _)
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[78] at reduceByKey at <console>:32

scala> import scala.collection.immutable.ListMap
import scala.collection.immutable.ListMap

scala> val sorted=ListMap(counts.collect.sortWith(_.2 > _.2):_*)// sort in descending order based on values
sorted: scala.collection.immutable.ListMap[String,Int] = Map(how -> 5, "" -> 4, is -> 2, your -> 2, are -> 1, can -> 1, have -> 1, you? -> 1, job? -> 1, help? -> 1, sister? -> 1, you -> 1, hi -> 1, i -> 1, been? -> 1)

scala> println(sorted)
Map(how -> 5, "" -> 4, is -> 2, your -> 2, are -> 1, can -> 1, have -> 1, you? -> 1, job? -> 1, help? -> 1, sister? -> 1, you -> 1, hi -> 1, i -> 1, been? -> 1)

scala> for((k,v)<-sorted)
| {
|   if(v>4)
|   {
|     print(k+",")
|     print(v)
|     println()
|   }
| }
how,5

scala>
```