

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



## LAB REPORT on

## Big Data Analytics

*Submitted by*

**Vineeth R Rao (1BM19CS183)**

*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” carried out by Vineeth R Rao (1BM19CS183), who is bonafide student of B. M. S. College of Engineering. It is in partial fulfillment for the award of Bachelor of Engineering in Computer Science and **Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Big Data Analytics - (20CS6PEBDA)** work prescribed for the said degree.

Dr. Shyamala G  
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	Analyze the Big Data and obtain insight using data analytics mechanisms.
CO3	Design and implement Big data applications by applying NoSQL, Hadoop or Spark

### DB operations using Cassandra (Employee):

```
cqlsh> create keyspace mployee_space WITH REPLICATION = {'class' :  
'SimpleStrategy','replication_factor':2};  
  
CREATE TABLE employee_space.employee_info (emp_id int PRIMARY  
KEY,emp_name text,designation text,date_of_joining timestamp,salary  
float,dept_name text);  
  
cqlsh> begin batch INSERT INTO  
employee_space.employee_info(emp_id,emp_name,designation,date_of_joini  
ng,salary,dept_name) VALUES(1,'Damodar','Manager','2022-01-  
24',100000,'Marketing');  
... apply batch;  
  
cqlsh> begin batch INSERT INTO  
employee_space.employee_info(emp_id,emp_name,designation,date_of_joini  
ng,salary,dept_name) VALUES(2,'George','Accountant','2021-01-  
24',200000,'Accounts');  
... INSERT INTO  
employee_space.employee_info(emp_id,emp_name,designation,date_of_joini  
ng,salary,dept_name) VALUES(3,'Mahesh','Manager','2021-03-
```

```
24',500000,'Marketing');
```

```
... INSERT INTO
```

```
employee_space.employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name) VALUES(4,'Vishal','Administrator','2021-05-24',500000,'Administration');
```

```
... INSERT INTO
```

```
employee_space.employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name) VALUES(5,'Rahul','Administrator','2009-05-24',2000000,'Administration');
```

```
... apply batch;
```

```
cqlsh> use employee_space;
```

```
cqlsh:employee_space> select * from employee_info;
```

```
emp_id | date_of_joining | dept_name | designation |  
emp_name | salary
```

```
-----+-----+-----+-----+-----+-----
```

```
5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |
```

```
Rahul | 2e+06
```

```
1 | 2022-01-23 18:30:00.000000+0000 | Marketing | Manager |
```

```
Damodar | 1e+05
```

```
2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |
```

```
George | 2e+05
```

```
4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |
```

```
Vishal | 5e+05
```

```
3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |
```

```
Mahesh | 5e+05
```

(5 rows)

```
cqlsh:employee_space> update employee_info set emp_name='Tushar' where  
emp_id=1;
```

```
cqlsh:employee_space> update employee_info set dept_name='Development'  
where emp_id=1;
```

```
cqlsh:employee_space> select * from employee_info;
```

```
emp_id | date_of_joining | dept_name | designation |  
emp_name | salary
```

```
-----+-----+-----+-----+-----+-----
```

```
5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |  
Rahul | 2e+06
```

```
1 | 2022-01-23 18:30:00.000000+0000 | Development | Manager |  
Tushar | 1e+05
```

```
2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |  
George | 2e+05
```

```
4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |  
Vishal | 5e+05
```

```
3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |  
Mahesh | 5e+05
```

(5 rows)

```
cqlsh:employee_space> alter table employee_info add projects set<text>;
```

```
cqlsh:employee_space> update employee_info set projects=projects+{'Web  
development','machine learning'} where emp_id=2;
```

```
cqlsh:employee_space> select * from employee_info;
```

```
emp_id | date_of_joining | dept_name | designation |
```

emp\_name | projects | salary

-----+-----+-----+-----+-----+-----  
-----+-----

5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |  
Rahul | null | 2e+06

1 | 2022-01-23 18:30:00.000000+0000 | Development | Manager |  
Tushar | null | 1e+05

2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |  
George | {'Web development', 'machine learning'} | 2e+05

4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |  
Vishal | null | 5e+05

3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |  
Mahesh | null | 5e+05

(5 rows)

cqlsh:employee\_space> update employee\_info set projects=projects+{'Web  
development','machine learning','cybersecurity'} where emp\_id=5;

cqlsh:employee\_space> select \* from employee\_info;

emp\_id | date\_of\_joining | dept\_name | designation |

emp\_name | projects | salary

-----+-----+-----+-----+-----+-----  
-----+-----

5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |  
Rahul | {'Web development', 'cybersecurity', 'machine learning'} | 2e+06

1 | 2022-01-23 18:30:00.000000+0000 | Development | Manager |  
Tushar | null | 1e+05

2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |

George | {'Web development', 'machine learning'} | 2e+05

4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |

Vishal | null | 5e+05

3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |

Mahesh | null | 5e+05

(5 rows)

cqlsh:employee\_space> INSERT INTO

employee\_space.employee\_info(emp\_id,emp\_name,designation,date\_of\_joining,salary,dept\_name) VALUES(6,'Harshitha','Manager','2022-01-24',100000,'Marketing') using ttl 15;

cqlsh:employee\_space> select \* from employee\_info;

emp\_id | date\_of\_joining | dept\_name | designation |

emp\_name | projects | salary

-----+-----+-----+-----+-----+-----  
-----+-----

5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |

Rahul | {'Web development', 'cybersecurity', 'machine learning'} | 2e+06

1 | 2022-01-23 18:30:00.000000+0000 | Development | Manager |

Tushar | null | 1e+05

2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |

George | {'Web development', 'machine learning'} | 2e+05

4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |

Nidhi | null | 5e+05

6 | 2022-01-23 18:30:00.000000+0000 | Marketing | Manager |



Harshitha | null | 1e+05

3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |

Mahesh | null | 5e+05

(6 rows)

cqlsh:employee\_space> select \* from employee\_info;

emp\_id | date\_of\_joining | dept\_name | designation |

emp\_name | projects | salary

-----+-----+-----+-----+-----+-----  
-----+-----

5 | 2009-05-23 18:30:00.000000+0000 | Administration | Administrator |

Rahul | {'Web development', 'cybersecurity', 'machine learning'} | 2e+06

1 | 2022-01-23 18:30:00.000000+0000 | Development | Manager |

Radha | null | 1e+05

2 | 2021-01-23 18:30:00.000000+0000 | Accounts | Accountant |

Mahalaxmi | {'Web development', 'machine learning'} | 2e+05

4 | 2021-05-23 18:30:00.000000+0000 | Administration | Administrator |

Nidhi | null | 5e+05

3 | 2021-03-23 18:30:00.000000+0000 | Marketing | Manager |

Mahesh | null | 5e+05

(5 rows)

## DB operations using Cassandra (Library)

```
cqlsh> create keyspace library_space WITH
REPLICATION={'class':'SimpleStrategy','replication_factor':2};

cqlsh> use library_space;

cqlsh:library_space> create table library_info(stud_id int,counter_value
counter,stud_name text,book_name text,book_id int,date_of_issue
timestamp,PRIMARY
KEY(stud_id,stud_name,book_name,book_id,date_of_issue));

cqlsh:library_space> update library_info set counter_value=counter_value+1
where stud_id=1 and stud_name='abc' and book_name='book1' and
book_id=11 and date_of_issue='2022-01-30';

cqlsh:library_space> update library_info set counter_value=counter_value+1
where stud_id=2 and stud_name='def' and book_name='book2' and
book_id=12 and date_of_issue='2022-03-30';

cqlsh:library_space> update library_info set counter_value=counter_value+1
where stud_id=3 and stud_name='ghi' and book_name='book3' and
book_id=13 and date_of_issue='2022-05-30';

cqlsh:library_space> update library_info set counter_value=counter_value+1
where stud_id=4 and stud_name='jkl' and book_name='book4' and
book_id=14 and date_of_issue='2022-07-30';

cqlsh:library_space> update library_info set counter_value=counter_value+1
where stud_id=5 and stud_name='mno' and book_name='book5' and
book_id=15 and date_of_issue='2022-09-30';
```

```
cqlsh:library_space> select * from library_info;
```

```
stud_id | stud_name | book_name | book_id | date_of_issue |
```

```
counter_value
```

```
-----+-----+-----+-----+-----+-----+-----
```

```
5 | mno | book5 | 15 | 2022-09-29 18:30:00.000000+0000 |
```

```
1
```

```
1 | abc | book1 | 11 | 2022-01-29 18:30:00.000000+0000 |
```

```
1
```

```
2 | def | book2 | 12 | 2022-03-29 18:30:00.000000+0000 |
```

```
1
```

```
4 | jkl | book4 | 14 | 2022-07-29 18:30:00.000000+0000 | 1
```

```
3 | ghi | book3 | 13 | 2022-05-29 18:30:00.000000+0000 |
```

```
1
```

```
(5 rows)
```

```
cqlsh:library_space> update library_info set counter_value=counter_value+1
```

```
where stud_id=5 and stud_name='mno' and book_name='book5' and
```

```
book_id=15 and date_of_issue='2022-09-30';
```

```
cqlsh:library_space> select * from library_info;
```

```
stud_id | stud_name | book_name | book_id | date_of_issue |
```

```
counter_value
```

```
-----+-----+-----+-----+-----+-----+-----
```

```
5 | mno | book5 | 15 | 2022-09-29 18:30:00.000000+0000 |
```

```
2
```

```
1 | abc | book1 | 11 | 2022-01-29 18:30:00.000000+0000 |
```

```
1
```

2 | def | book2 | 12 | 2022-03-29 18:30:00.000000+0000 |

1

4 | jkl | book4 | 14 | 2022-07-29 18:30:00.000000+0000 | 1

3 | ghi | book3 | 13 | 2022-05-29 18:30:00.000000+0000 |

1

(5 rows)

cqlsh:library\_space> copy

library\_info(stud\_id,stud\_name,book\_name,book\_id,date\_of\_issue,counter\_value) to '/home/bmscecse/Desktop/bda.csv';

Using 11 child processes

Starting copy of library\_space.library\_info with columns [stud\_id, stud\_name, book\_name, book\_id, date\_of\_issue, counter\_value].

Processed: 5 rows; Rate: 45 rows/s; Avg. rate: 45 rows/s

5 rows exported to 1 files in 0.121 seconds.

cqlsh:library\_space> create table library\_info\_copy(stud\_id int,counter\_value counter,stud\_name text,book\_name text,book\_id int,date\_of\_issue timestamp,PRIMARY

KEY(stud\_id,stud\_name,book\_name,book\_id,date\_of\_issue));

cqlsh:library\_space> copy

library\_info\_copy(stud\_id,stud\_name,book\_name,book\_id,date\_of\_issue,counter\_value) from '/home/bmscecse/Desktop/new.csv';

Using 11 child processes

Starting copy of library\_space.library\_info\_copy with columns [stud\_id, stud\_name, book\_name, book\_id, date\_of\_issue, counter\_value].

Processed: 5 rows; Rate: 8 rows/s; Avg. rate: 12 rows/s

5 rows imported from 1 files in 0.406 seconds (0 skipped).

```
cqlsh:library_space> select * from library_info where counter_value=2 allow  
filtering;
```

```
stud_id | stud_name | book_name | book_id | date_of_issue |  
counter_value
```

```
-----+-----+-----+-----+-----+-----+-----  
5 | mno | book5 | 15 | 2022-09-29 18:30:00.000000+0000 | 2
```

## MongoDB- CRUD Demonstration

```
use my_db
```

```
switched to db my_db
```

```
db.Student.insert({_id:1,name:"Michael",grade  
:"VII",hobbies:"reading"})
```

```
WriteResult({ "nInserted" : 1 })
```

```
db.Student.update({_id:1},{ $set:{hobbies:"crick  
et"}},{upsert:true})
```

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

```
db.Student.find()
```

```
{ "_id" : 1, "name" : "Michael", "grade" : "VII",  
"hobbies" : "cricket" }
```

```
db.Student.insert({id:1,name:"Latha",grade:"VII
```

```
l",hobbies:"Singing"})
WriteResult({ "nInserted" : 1 })
db.Student.find({name:"Latha"}).pretty()
{
  "_id" :
ObjectId("6253f120f7936
958d67f3c07"),
  "id" : 1,
  "name" : "Latha",
  "grade" : "VIII",
  "hobbies" : "Singing"
}
db.Student.find({}, {name:1,grade:1,_id:0})
{ "name" : "Michael", "grade" : "VII" }
{ "name" : "Latha", "grade" : "VIII" }
db.Student.find({grade:{$eq:"VII"}}).pretty()
{ "_id" : 1, "name" : "Michael", "grade" : "VII",
  "hobbies" : "cricket" }
db.Student.find({name:/^L/}).pretty()
{
  "_id" :
ObjectId("6253f120f7936
958d67f3c07"),
  "id" : 1,
  "name" : "Latha",
```

```
"grade" : "VIII",
"hobbies" : "Singing"
}
db.Student.find({name:/a/}).pretty()
{ "_id" : 1, "name" : "Michael", "grade" : "VII",
  "hobbies" : "cricket" }
{
  "_id" :
  ObjectId("6253f120f7936
  958d67f3c07"),
  "id" : 1,
  "name" : "Latha",
  "grade" : "VIII",
  "hobbies" : "Singing"
}
db.Student.count()
2
db.Student.find().sort({name:1}).pretty()
{
  "_id" :
  ObjectId("6253f120f7936
  958d67f3c07"),
  "id" : 1,
  "name" : "Latha",
  "grade" : "VIII",
```

```
"hobbies" : "Singing"
}
{ "_id" : 1, "name" : "Michael", "grade" : "VII",
"hobbies" : "cricket" }
db.Student.save({name:"Ratan",grade:"VII",_id:
1})
WriteResult({ "nMatched" : 1, "nUpserted" : 0,
"nModified" : 1 })
db.Student.find()
{ "_id" : 1, "name" : "Ratan", "grade" : "VII" }
{ "_id" :
ObjectId("6253f120f7936958d67f3c07"), "id" :
1, "name" : "Latha", "grade" : "VIII", "hobbies" :
"Singing" }
db.Student.update({_id:1},{ $set:{location:"net
work"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0,
"nModified" : 1 })
db.Student.update({_id:1},{ $unset:{location:"n
etwork"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0,
"nModified" : 1 })
db.Student.find({name:/n$/}).pretty()
{ "_id" : 1, "name" : "Ratan", "grade" : "VII" }
db.Student.find({grade:"VII"}).limit(3).pretty()
```



```
{ "_id" : 1, "name" : "Ratan", "grade" : "VII" }
```

```
db.Student.count({grade:"VIII"})
```

```
1
```

```
db.Student.find().sort({name:1}).pretty()
```

```
{
```

```
"_id" :
```

```
ObjectId("6253f120f7936
```

```
958d67f3c07"),
```

```
"id" : 1,
```

```
"name" : "Latha",
```

```
"grade" : "VIII",
```

```
"hobbies" : "Singing"
```

```
}
```

```
{ "_id" : 1, "name" : "Ratan", "grade" : "VII" }
```

```
db.Student.find().sort({name:-1}).pretty()
```

```
{ "_id" : 1, "name" : "Ratan", "grade" : "VII" }
```

```
{
```

```
"_id" :
```

```
ObjectId("6253f120f7936
```

```
958d67f3c07"),
```

```
"id" : 1,
```

```
"name" : "Latha",
```

```
"grade" : "VIII",
```

```
"hobbies" : "Singing"
```

```
}
```

```
db.Student.find().skip(1).pretty()
{
  "_id" :
  ObjectId("6253f120f7936
  958d67f3c07"),
  "id" : 1,
  "name" : "Latha",
  "grade" : "VIII",
  "hobbies" : "Singing"
}
db.createCollection("food")
{ "ok" : 1 }
db.food.insert({_id:1,fruits:['grapes','mango']})
WriteResult({ "nInserted" : 1 })
db.food.insert({_id:2,fruits:['grapes','mango','c
herry']})
WriteResult({ "nInserted" : 1 })
db.food.insert({_id:3,fruits:['banana','cherry']})
WriteResult({ "nInserted" : 1 })
db.food.find({fruits:['grapes','mango']})
{ "_id" : 1, "fruits" : [ "grapes", "mango" ] }
db.food.find({'fruits':{$size:2}})
{ "_id" : 1, "fruits" : [ "grapes", "mango" ] }
{ "_id" : 3, "fruits" : [ "banana", "cherry" ] }
db.food.find({_id:2},{'fruits':{$slice:2}})
```

```
{ "_id" : 2, "fruits" : [ "grapes", "mango" ] }  
db.food.find({fruits:{$all:['grapes','mango']}})  
{ "_id" : 1, "fruits" : [ "grapes", "mango" ] }  
{ "_id" : 2, "fruits" : [ "grapes", "mango",  
"cherry" ] }  
db.food.update({_id:3},{ $set: {'fruits.1': 'apple'}})  
WriteResult({ "nMatched" : 1, "nUpserted" : 0,  
"nModified" : 1 })  
db.food.find()  
{ "_id" : 1, "fruits" : [ "grapes", "mango" ] }  
{ "_id" : 2, "fruits" : [ "grapes", "mango",  
"cherry" ] }  
{ "_id" : 3, "fruits" : [ "banana", "apple" ] }  
db.food.update({_id:2},{ $push: {price: {grapes: 8  
0, mango: 200, cherry: 100}}})  
WriteResult({ "nMatched" : 1, "nUpserted" : 0,  
"nModified" : 1 })
```

## Screenshot of Hadoop installed

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.19044.1766]
(c) Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>hdfs namenode -format
2022-07-02 09:15:16,722 INFO namenode.NameNode: STARTUP_MSG:
/*****
STARTUP_MSG: Starting NameNode
STARTUP_MSG:   host = ADITHI/192.168.56.1
STARTUP_MSG:   args = [-format]
STARTUP_MSG:   version = 3.3.0
STARTUP_MSG:   classpath = C:\hadoop-3.3.0\etc\hadoop;C:\hadoop-3.3.0\share\hadoop\common;C:\hadoop-3.3.0\share\hadoop\com
mon\lib\accessors-smart-1.2.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\animal-sniffer-annotations-1.17.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\asm-5.0.4.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\audience-annotations-0.5.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\avro-1.7.7.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\checker-qual-2.5.2.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-beanutils-1.9.4.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-cli-1.2.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-codec-1.11.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-collections-3.2.2.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-compress-1.19.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-configuration2-2.1.1.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-daemon-1.0.13.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-io-2.5.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-lang3-3.7.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-logging-1.1.3.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-math3-3.1.1.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-net-3.6.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\commons-text-1.4.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\curator-client-4.2.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\curator-framework-4.2.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\curator-recipes-4.2.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\dnsjava-2.1.7.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\failureaccess-1.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\gson-2.2.4.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\guava-27.0-jre.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\hadoop-annotations-3.3.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\hadoop-auth-3.3.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\hadoop-protobuf_3_7-1.0.0.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\htrace-core4-4.1.0-incubating.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\httpclient-4.5.6.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\httpcore-4.4.10.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\j2objc-annotations-1.1.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\jackson-annotations-2.10.3.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\jackson-core-2.10.3.jar;C:\hadoop-3.3.0\share\hadoop\common\lib\jackson-core
```

## Execution of HDFS Commands for interaction with Hadoop Environment.

\$ start-all.sh

\$ jps

4193 ResourceManager

4691 Jps

3876 SecondaryNameNode

4566 NodeManager

3050 NameNode

3391 DataNode

```
$ hdfs dfs -mkdir /xyz
```

```
$ hadoop fs -ls /
```

```
Found 13 items
```

```
drwxr-xr-x - hduser supergroup      0 2022-06-04 09:48 /FFF
drwxr-xr-x - hduser supergroup      0 2022-06-04 10:10 /abc
drwxr-xr-x - hduser supergroup      0 2022-06-03 14:39 /folder1
drwxr-xr-x - hduser supergroup      0 2022-06-03 15:00 /folder2
drwxr-xr-x - hduser supergroup      0 2022-06-03 15:00 /folder3
drwxr-xr-x - hduser supergroup      0 2022-06-01 14:48 /lab1
drwxr-xr-x - hduser supergroup      0 2019-10-24 11:08 /output
drwxr-xr-x - hduser supergroup      0 2022-06-01 14:48 /pratibha
drwxr-xr-x - hduser supergroup      0 2019-10-24 10:47 /rgs
drwxr-xr-x - hduser supergroup      0 2022-06-03 12:05 /test
drwxrwxr-x - hduser supergroup      0 2019-08-01 16:19 /tmp
drwxr-xr-x - hduser supergroup      0 2019-08-01 16:03 /user
drwxr-xr-x - hduser supergroup      0 2022-06-06 11:33 /xyz
```

```
$ hdfs dfs -put /home/hduser/Desktop/welcome.txt /xyz/Wel.txt
```

```
$ hdfs dfs -cat /abc/WC.txt
```

```
Hadoop lab
```

```
$ hdfs dfs -copyFromLocal /home/hduser/Desktop/welcome.txt /xyz/Wel.txt
```

```
copyFromLocal: `/xyz/Wel.txt': File exists
```

```
$ hdfs dfs -get /abc/WC.txt /home/hduser/Downloads/wwc.txt
```

```
$ hdfs dfs -getmerge /abc/WC.txt /abc/WC2.txt  
/home/hduser/Desktop/Merge.txt
```

```
$ hadoop fs -getfacl /abc/
```

```
# file: /abc
```

```
# owner: hduser
```

```
# group: supergroup
```

```
user::rwx
```

```
group::r-x
```

```
other::r-x
```

```
$ hdfs dfs -copyToLocal /abc/WC2.txt /home/hduser/Desktop
```

```
$ hadoop fs -mv /abc /FFF
```

```
$ hdfs dfs -ls /FFF
```

```
Found 3 items
```

```
-rw-r--r--  1 hduser supergroup    11 2022-06-04 09:42 /FFF/WC.txt  
-rw-r--r--  1 hduser supergroup    20 2022-06-04 09:48 /FFF/WC2.txt  
drwxr-xr-x  - hduser supergroup     0 2022-06-04 10:10 /FFF/abc
```

```
$ hadoop fs -cp /FFF/ /xxx
```

```
$ hadoop fs -ls /xxx
```

Found 3 items

```
-rw-r--r--  1 hduser supergroup    11 2022-06-06 12:19 /xxx/WC.txt
-rw-r--r--  1 hduser supergroup    20 2022-06-06 12:19 /xxx/WC2.txt
drwxr-xr-x  - hduser supergroup     0 2022-06-06 12:19 /xxx/abc
```

**To use Hadoop to find the average temperature and mean max temperature for each year from NCDC data set.**

**Average temperature:**

AverageDriver:

```
package temp;

import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;

public class AverageDriver {

    public static void main(String[] args) throws Exception {

        if (args.length != 2) {

            System.err.println(""Please Enter the input and output parameters"");
            System.exit(-1);
        }

        Job job = new Job();
        job.setJarByClass(AverageDriver.class);
```

```
job.setJobName("&quot;Max temperature&quot;");
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) == '&#39;+&#39;') {
    temperature = Integer.parseInt(line.substring(88, 92));
} else {
    temperature = Integer.parseInt(line.substring(87, 92));
}
String quality = line.substring(92, 93);
if (temperature != 9999 &amp;&amp; quality.matches("&quot;[01459]&quot;"))
    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> {

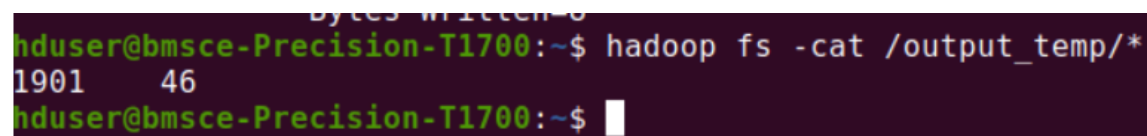
    public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text,
IntWritable,
Text, IntWritable>.Context context) throws IOException, InterruptedException
    {
        int max_temp = 0;

```

```

int count = 0;
for (IntWritable value : values) {
    max_temp += value.get();
    count++;
}
context.write(key, new IntWritable(max_temp / count));
}
}

```



A terminal window with a dark purple background. The prompt is 'hduser@bmsce-Precision-T1700:~\$'. The command 'hadoop fs -cat /output\_temp/\*' has been entered. The output shows '1901' and '46' on separate lines. The prompt is repeated at the bottom.

```

hduser@bmsce-Precision-T1700:~$ hadoop fs -cat /output_temp/*
1901      46
hduser@bmsce-Precision-T1700:~$

```

## Mean Max:

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("&quot;Please Enter the input and output parameters&quot;");
    System.exit(-1);
}

Job job = new Job();
job.setJarByClass(MeanMaxDriver.class);
job.setJobName("&quot;Max temperature&quot;");
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) == '#39;+#39;') {
        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));
}
```

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

**For a given Text file, create a Map Reduce program to sort the content in an alphabetic order listing only top 10 maximum occurrences of words.**

```
package samples.topn;

import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.GenericOptionsParser;

public class TopN {
```

```

public static void main(String[] args) throws Exception {
    Configuration conf = new Configuration();
    String[] otherArgs = (new GenericOptionsParser(conf, args)).getRemainingArgs();
    if (otherArgs.length != 2) {
        System.err.println("Usage: TopN <in> <out>");
        System.exit(2);
    }
    Job job = Job.getInstance(conf);
    job.setJobName("Top N");
    job.setJarByClass(TopN.class);
    job.setMapperClass(TopNMapper.class);
    job.setReducerClass(TopNReducer.class);
    job.setOutputKeyClass(Text.class);
    job.setOutputValueClass(IntWritable.class);
    FileInputFormat.addInputPath(job, new Path(otherArgs[0]));
    FileOutputFormat.setOutputPath(job, new Path(otherArgs[1]));
    System.exit(job.waitForCompletion(true) ? 0 : 1);
}

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

    private String tokens = "[_ $%&'\^=\[\]\\"/*^/\\.,;:~\n-
:()?!\"&#39;]&quot;;";

```

```

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, &quot;
&quot;);
StringTokenizer itr = new StringTokenizer(cleanLine);
while (itr.hasMoreTokens()) {
this.word.set(itr.nextToken().trim());
context.write(this.word, one);
}
}
}
}
}

```

TopNCombiner.class

```

package samples.topn;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class TopNCombiner extends Reducer<Text, IntWritable, Text,
IntWritable> {
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text,
IntWritable,

```



```

Text, IntWritable>.Context context) throws IOException, InterruptedException
{
    int sum = 0;
    for (IntWritable val : values)
        sum += val.get();
    context.write(key, new IntWritable(sum));
}
}

```

TopNMapper.class

```

package samples.topn;

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

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

    private String tokens = "&quot;[_|${&lt;&gt;\\^=\\[\\]\\\"/*^\\\\\\,;\\.\\\"-:()?!\\&quot;\\&#39;}&quot;;";

    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, "&quot;
        &quot;);

        StringTokenizer itr = new StringTokenizer(cleanLine);
    }
}

```

```

while (itr.hasMoreTokens()) {
    this.word.set(itr.next().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;

```

```

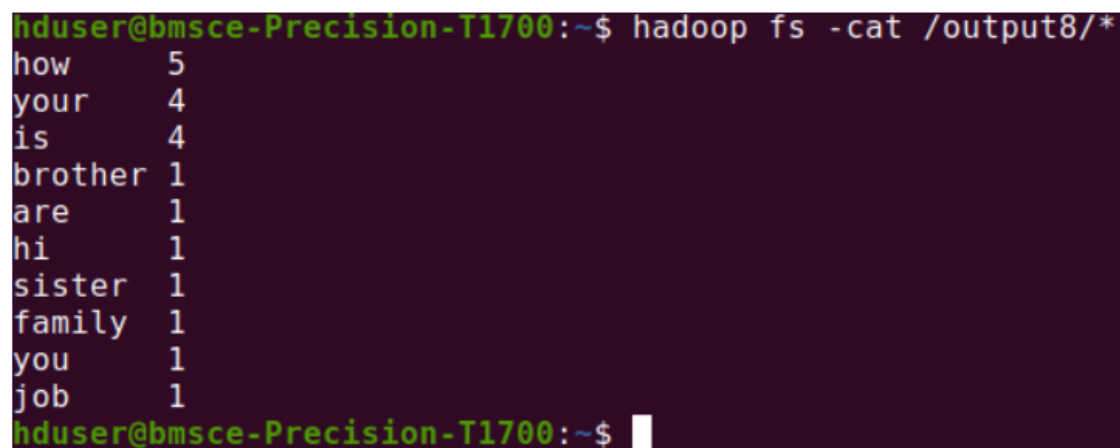
for (IntWritable val : values)
    sum += val.get();
this.countMap.put(new Text(key), new IntWritable(sum));
}

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));
    }
}
}

```



A terminal window screenshot showing the command `hadoop fs -cat /output8/*` being executed. The output displays a list of words and their corresponding counts, sorted in descending order of frequency. The words are: how (5), your (4), is (4), brother (1), are (1), hi (1), sister (1), family (1), you (1), and job (1). The terminal prompt is `hduser@bmsce-Precision-T1700:~$`.

```

hduser@bmsce-Precision-T1700:~$ hadoop fs -cat /output8/*
how      5
your     4
is       4
brother  1
are      1
hi       1
sister   1
family   1
you      1
job      1
hduser@bmsce-Precision-T1700:~$

```

## Create a Map Reduce program to demonstrating join operation

```
// 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 &#39;Department Emp Strength input&#39; with
&#39;Department Name
input&#39;&quot;");

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" + 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 + "&quot;\t&quot;" + 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);
}
}}

```

```

hduser@bmsce-Precision-T1700:~$ hadoop fs -cat /output_mapreduce/*
A11      50      Finance
B12      100     HR
C13      250     Manufacturing
Dept_ID  Total_Employee  Dept_Name
hduser@bmsce-Precision-T1700:~$

```

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

Word Count:

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

```
scala> reducedata.collect;
res8: Array[(String, Int)] = Array(("",1), (hello,5), (lab,3), (begin,3), (spark,5), (9,1))
```

Hello World:

```
object ExPrint {
    def main(args: Array[String]) {
        println("Hello World!");
    }
}
```

```
package word_count

object count {
  def main(args : Array[String]){
    println("Hello World!");
  }
}
```

Problems Tasks Console

<terminated> count\$ [Scala Application] /usr/lib/jvm/java-  
Hello World!

**Using RDD and FlatMap 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**

```
val textFile = sc.textFile("/home/bhoom/Desktop/wc.txt")
```

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

```
import scala.collection.immutable.ListMap
```

```
val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)// sort in descending order based
```

```
on values
```

```
println(sorted)
```

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

```
scala> println(sorted)
Map(hello -> 5, spark -> 5, lab -> 3, begin -> 3,  -> 1, 9 -> 1)

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