VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS (20CS6PEBDA)

Submitted by

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

B.M.S. COLLEGE OF ENGINEERING
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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 "LAB COURSE **BIG DATA ANALYTICS (20CS6PEBDA)**" carried out by **JOEL NINAN JOHNSON (1BM19CS199),** 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.

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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

LAB 1: Cassandra Lab Program 1: - Employee Database

1) Perform the following DB operations using Cassandra.

I. Create a keyspace by name Employee

II. Create a column family by name

Employee-Info with attributes

Emp_Id Primary Key, Emp_Name,

Designation, Date_of_Joining, Salary, Dept_Name

III. Insert the values into the table in batch

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

V. Sort the details of Employee records based on salary

VI. Alter the schema of the table Employee_Info to add a column Projects which stores a set of

Projects done by the corresponding Employee.

VII. Update the altered table to add project names.

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

```
create keyspace employee_199 with replication =
{'class':'SimpleStrategy','replication_factor':1};

cqlsh> describe keyspaces;


stud1        system_auth  employ          employee      drivers

harshita      newstudents  students1         system_traces

employee_199   library     student          lib1

system_schema  system       system_distributed  bigcassandra


cqlsh> select * from system_schema.keyspaces;
```

```
 keyspace_name      | durable_writes | replication
--------------------+----------------+-----------------------------------------------------------------------------------
            student |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
        system_auth |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
      system_schema |           True |                         {'class':
'org.apache.cassandra.locator.LocalStrategy'}
            library |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
       bigcassandra |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '3'}
               lib1 |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
       employee_199 |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
              stud1 |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
          students1 |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
        newstudents |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
 system_distributed |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '3'}
             system |           True |                         {'class':
'org.apache.cassandra.locator.LocalStrategy'}
            drivers |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}
      system_traces |           True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '2'}
```

```
         harshita |          True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '3'}

         employee |          True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}

           employ |          True | {'class': 'org.apache.cassandra.locator.SimpleStrategy',
'replication_factor': '1'}


(17 rows)

cqlsh> use employee_199;

cqlsh:employee_199> create table emp_info ( emp_id int, emp_name text, designation text,
DOJ timestamp, salary double, dept_name text, PRIMARY KEY(emp_id, salary));

cqlsh:employee_199> describe tables;


emp_info


cqlsh:employee_199> describe table emp_info;


CREATE TABLE employee_199.emp_info (

    emp_id int,

    salary double,

    dept_name text,

    designation text,

    doj timestamp,

    emp_name text,

    PRIMARY KEY (emp_id, salary)

) ;


cqlsh:employee_199> begin batch
```

```
        ... insert into emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name)
values(1,'Jack','manager','2021-02-12',5000,'webdev')
        ... insert into emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name)
values(2,'Mohan','clerk','2022-03-22',10000,'datacenter')
        ... insert into emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name)
values(3,'Sumesh','COE','2019-04-10',100000,'marketing')
        ... apply batch;


cqlsh:employee_199> select * from emp_info;

 emp_id | salary | dept_name  | designation | doj                             | emp_name
--------+--------+------------+-------------+---------------------------------+----------
      1 |   5000 |     webdev |     manager | 2021-02-11 18:30:00.000000+0000 |   Jack
      2 |  10000 | datacenter |       clerk | 2022-03-21 18:30:00.000000+0000 |   Mohan
      3 |  1e+05 |  marketing |         COE | 2019-04-09 18:30:00.000000+0000 |   Sumesh

(3 rows)
cqlsh:employee_199> update emp_info set emp_name='Rohit', dept_name='advertising' where
emp_id=3;
cqlsh:employee_199> select * from emp_info;

 emp_id | salary | dept_name   | designation | doj                             | emp_name
--------+--------+-------------+-------------+---------------------------------+----------
      1 |   5000 |      webdev |     manager | 2021-02-11 18:30:00.000000+0000 |   Jack
      2 |  10000 |  datacenter |       clerk | 2022-03-21 18:30:00.000000+0000 |   Mohan
      3 |  1e+05 | advertising |         COE | 2019-04-09 18:30:00.000000+0000 |   Rohit

(3 rows)
```

```
cqlsh:employee_199> select * from emp_info order by salary desc;

InvalidRequest: Error from server: code=2200 [Invalid query] message="ORDER BY is only
supported when the partition key is restricted by an EQ or an IN."


cqlsh:employee_199> alter table emp_info add projects set <text>;


cqlsh:employee_199> select * from emp_info;


 emp_id | salary | dept_name   | designation | doj                             | emp_name | projects

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

      1 |   5000 |      webdev |     manager | 2021-02-11 18:30:00.000000+0000 |   Jack   |    null

      2 |  10000 |  datacenter |       clerk | 2022-03-21 18:30:00.000000+0000 |   Mohan  |    null

      3 |  1e+05 | advertising |         COE | 2019-04-09 18:30:00.000000+0000 |   Rohit  |    null


(3 rows)

cqlsh:employee_199> update emp_info set projects={'data science'} where emp_id=1;

cqlsh:employee_199> update emp_info set projects={'security','crypto'} where emp_id=2;

cqlsh:employee_199> update emp_info set projects={'mobile app'} where emp_id=3;

cqlsh:employee_199> select * from emp_info;


 emp_id | salary | dept_name   | designation | doj                             | emp_name | projects

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

      1 |   5000 |      webdev |     manager | 2021-02-11 18:30:00.000000+0000 |     Jack |
{'data science'}

      2 |  10000 |  datacenter |       clerk | 2022-03-21 18:30:00.000000+0000 |    Mohan |
{'crypto', 'security'}

      3 |  1e+05 | advertising |         COE | 2019-04-09 18:30:00.000000+0000 |    Rohit |
{'mobile app'}
```

```
(3 rows)

cqlsh:employee_199> insert into
emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name)
values(4,'rakesh','intern','2022-04-19',1000,'marketing',{'data science'}) using TTL 18;

InvalidRequest: Error from server: code=2200 [Invalid query] message="Unmatched column
names/values"

cqlsh:employee_199> insert into
emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name,projects)
values(4,'rakesh','intern','2022-04-19',1000,'marketing',{'data science'}) using TTL 18;

cqlsh:employee_199> select ttl(dept_name) from emp_info where emp_id=4;


 ttl(dept_name)
----------------


(0 rows)

cqlsh:employee_199> insert into
emp_info(emp_id,emp_name,designation,DOJ,salary,dept_name,projects)
values(4,'rakesh','intern','2022-04-19',1000,'marketing',{'data science'}) using TTL 50;

cqlsh:employee_199> select ttl(dept_name) from emp_info where emp_id=4;


 ttl(dept_name)
----------------
             46


(1 rows)
```

LAB 2: Cassandra Lab Program 2: - Library Database

2) Perform the following DB operations using Cassandra.

I. Create a keyspace by name Library

II. Create a column family by name Library-Info with attributes

Stud_Id Primary Key, Counter_value of type Counter,

Stud_Name, Book-Name, Book-Id, Date_of_issue

III. Insert the values into the table in batch

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

V. Write a query to show that a student with id 112 has taken a book "BDA" 2 times.

VI. Export the created column to a csv file

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

```
bmsce@bmsce-Precision-T1700:~$ cqlsh

Connected to Test Cluster at 127.0.0.1:9042.

[cqlsh 5.0.1 | Cassandra 3.11.4 | CQL spec 3.4.4 | Native protocol v4]

Use HELP for help.

cqlsh> create keyspace library with replication={'class':'SimpleStrategy', 'replication_factor':1};

AlreadyExists: Keyspace 'library' already exists

cqlsh> create keyspace library_199 with replication={'class':'SimpleStrategy',
'replication_factor':1};

cqlsh> describe keyspaces;


stud1        system_auth  employ           employee      drivers

harshita      newstudents  students1        system_traces  library_199

bigcassandra   library     student          lib1

system_schema  system      system_distributed  employee_199


cqlsh:library> use library_199;
```

```
cqlsh:library_199> create table lib_info(stud_id int PRIMARY KEY, counter_val  counter,
stud_name text, book_name text, book_id int, issue_date date);

InvalidRequest: Error from server: code=2200 [Invalid query] message="Cannot mix counter
and non counter columns in the same table"

cqlsh:library_199> create table lib_info(stud_id int , counter_val  counter, stud_name text,
book_name text, book_id int, issue_date date, PRIMARY KEY
(stud_id,stud_name,book_name,book_id,issue_date);

SyntaxException: line 1:180 mismatched input ';' expecting ')'
(...stud_id,stud_name,book_name,book_id,issue_date)[;])

cqlsh:library_199> create table lib_info(stud_id int , counter_val  counter, stud_name text,
book_name text, book_id int, issue_date date, PRIMARY KEY
(stud_id,stud_name,book_name,book_id,issue_date));

cqlsh:library_199> begin batch

            ... insert into lib_info(stud_id,stud_name,book_name,book_id,issue_date) values
(121,'sumit','java',1140,'2022-05-07')

            ... apply batch;

InvalidRequest: Error from server: code=2200 [Invalid query] message="INSERT statements are
not allowed on counter tables, use UPDATE instead"

cqlsh:library_199> update lib_info set counter_val=counter_val+1 where stud_id=1 and
stud_name='sumit' and book_name='oomd' and book_id=121 and issue_date='2022-05-06';

cqlsh:library_199> select * from lib_info;


 stud_id | stud_name | book_name | book_id | issue_date | counter_val

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

       1 |    sumit  |      oomd |     121 | 2022-05-06 |          1


(1 rows)

cqlsh:library_199> update lib_info set counter_val=counter_val+1 where stud_id=2 and
stud_name='sukesh' and book_name='bda' and book_id=122 and issue_date='2022-04-06';

cqlsh:library_199> update lib_info set counter_val=counter_val+1 where stud_id=3 and
stud_name='reddy' and book_name='java' and book_id=123 and issue_date='2022-04-10';
```

```
cqlsh:library_199> update lib_info set counter_val=counter_val+1 where stud_id=4 and
stud_name='nikhil' and book_name='ml' and book_id=124 and issue_date='2022-03-10';

cqlsh:library_199> select * from lib_info;


 stud_id | stud_name | book_name | book_id | issue_date | counter_val
---------+-----------+-----------+---------+------------+-------------
       1 |     sumit |      oomd |     121 | 2022-05-06 |           1
       2 |    sukesh |       bda |     122 | 2022-04-06 |           1
       4 |    nikhil |        ml |     124 | 2022-03-10 |           1
       3 |     reddy |      java |     123 | 2022-04-10 |           1


(4 rows)

cqlsh:library_199> update lib_info set counter_val=counter_val+1 where stud_id=2 and
stud_name='sukesh' and book_name='bda' and book_id=122 and issue_date='2022-04-06';

cqlsh:library_199> select * from lib_info;


 stud_id | stud_name | book_name | book_id | issue_date | counter_val
---------+-----------+-----------+---------+------------+-------------
       1 |     sumit |      oomd |     121 | 2022-05-06 |           1
       2 |    sukesh |       bda |     122 | 2022-04-06 |           2
       4 |    nikhil |        ml |     124 | 2022-03-10 |           1
       3 |     reddy |      java |     123 | 2022-04-10 |           1


(4 rows)

cqlsh:library_199> select * from lib_info where counter_val=2;

InvalidRequest: Error from server: code=2200 [Invalid query] message="Cannot execute this
query as it might involve data filtering and thus may have unpredictable performance. If you
want to execute this query despite the performance unpredictability, use ALLOW FILTERING"

cqlsh:library_214> select * from lib_info where counter_val=2 allow filtering;
```

```
 stud_id | stud_name | book_name | book_id | issue_date | counter_val
---------+-----------+-----------+---------+------------+-------------
       2 |    sukesh |       bda |     122 | 2022-04-06 |           2

(1 rows)

cqlsh:library_199> copy
lib_info(stud_id,counter_val,stud_name,book_name,book_id,issue_date) to
'/home/bmsce/desktop/lib_data.csv';

Using 11 child processes

Can't open '/home/bmsce/desktop/lib_data.csv' for writing: [Errno 2] No such file or directory:
'/home/bmsce/desktop/lib_data.csv'

cqlsh:library_199> copy
lib_info(stud_id,counter_val,stud_name,book_name,book_id,issue_date) to
'/home/bmsce/Desktop/lib_data';

Using 11 child processes


Starting copy of library_199.lib_info with columns [stud_id, counter_val, stud_name,
book_name, book_id, issue_date].

Processed: 4 rows; Rate:      24 rows/s; Avg. rate:      24 rows/s

4 rows exported to 1 files in 0.177 seconds.

cqlsh:library_199> create table lib_info1(stud_id int , counter_val  counter, stud_name text,
book_name text, book_id int, issue_date date, PRIMARY KEY
(stud_id,stud_name,book_name,book_id,issue_date));

cqlsh:library_199> copy
lib_info(stud_id,counter_val,stud_name,book_name,book_id,issue_date) from 'lib_data.csv';

Using 11 child processes


Starting copy of library_199.lib_info with columns [stud_id, counter_val, stud_name,
book_name, book_id, issue_date].
```

```
Failed to import 0 rows: IOError - Can't open 'lib_data.csv' for reading: no matching file found,
given up after 1 attempts

Processed: 0 rows; Rate:      0 rows/s; Avg. rate:      0 rows/s

0 rows imported from 0 files in 0.149 seconds (0 skipped).

cqlsh:library_199> copy
lib_info1(stud_id,counter_val,stud_name,book_name,book_id,issue_date) from
'/home/bmsce/Desktop/lib_data.csv';

Using 11 child processes


Starting copy of library_199.lib_info1 with columns [stud_id, counter_val, stud_name,
book_name, book_id, issue_date].

Failed to import 0 rows: IOError - Can't open '/home/bmsce/Desktop/lib_data.csv' for reading:
no matching file found,  given up after 1 attempts

Processed: 0 rows; Rate:      0 rows/s; Avg. rate:      0 rows/s

0 rows imported from 0 files in 0.156 seconds (0 skipped).

cqlsh:library_199> copy
lib_info1(stud_id,counter_val,stud_name,book_name,book_id,issue_date) from
'/home/bmsce/Desktop/lib_data';

Using 11 child processes


Starting copy of library_199.lib_info1 with columns [stud_id, counter_val, stud_name,
book_name, book_id, issue_date].

Processed: 4 rows; Rate:      7 rows/s; Avg. rate:     11 rows/s

4 rows imported from 1 files in 0.375 seconds (0 skipped).

cqlsh:library_199> select * from lib_info1;


 stud_id | stud_name | book_name | book_id | issue_date | counter_val
---------+-----------+-----------+---------+------------+-------------
       1 |     sumit |      oomd |     121 | 2022-05-06 |           1
       2 |    sukesh |       bda |     122 | 2022-04-06 |           2
```

```
      4 |    nikhil |       ml |     124 | 2022-03-10 |          1
      3 |     reddy |      java |     123 | 2022-04-10 |          1

(4 rows)
```

LAB 3: MongoDB- CRUD Demonstration

```
bmsce@bmsce-Precision-T1700:~$ mongo

MongoDB shell version v3.6.8

connecting to: mongodb://127.0.0.1:27017

Implicit session: session { "id" : UUID("d66acdb3-8482-417d-8b75-d65dae4b53ee") }

MongoDB server version: 3.6.8

Server has startup warnings:

2022-04-11T18:49:15.627+0530 I STORAGE  [initandlisten]

2022-04-11T18:49:15.627+0530 I STORAGE  [initandlisten] ** WARNING: Using the XFS
filesystem is strongly recommended with the WiredTiger storage engine

2022-04-11T18:49:15.627+0530 I STORAGE  [initandlisten] **          See
http://dochub.mongodb.org/core/prodnotes-filesystem

2022-04-11T18:49:18.771+0530 I CONTROL  [initandlisten]

2022-04-11T18:49:18.771+0530 I CONTROL  [initandlisten] ** WARNING: Access control is not
enabled for the database.

2022-04-11T18:49:18.771+0530 I CONTROL  [initandlisten] **          Read and write access to
data and configuration is unrestricted.

2022-04-11T18:49:18.771+0530 I CONTROL  [initandlisten]

> use Student

switched to db Student

> db.createCollection("student");

{ "ok" : 1 }

> db.Student.insert({_id:1,StudName:"Megha",Grade:"vii",Hobbies:"InternetSurfing"});

WriteResult({ "nInserted" : 1 })

>
db.Student.update({_id:3,StudName:"Ayan",Grade:"vii"},{$set:{Hobbies:"skating"}},{upsert:true
});

WriteResult({ "nMatched" : 0, "nUpserted" : 1, "nModified" : 0, "_id" : 3 })
```

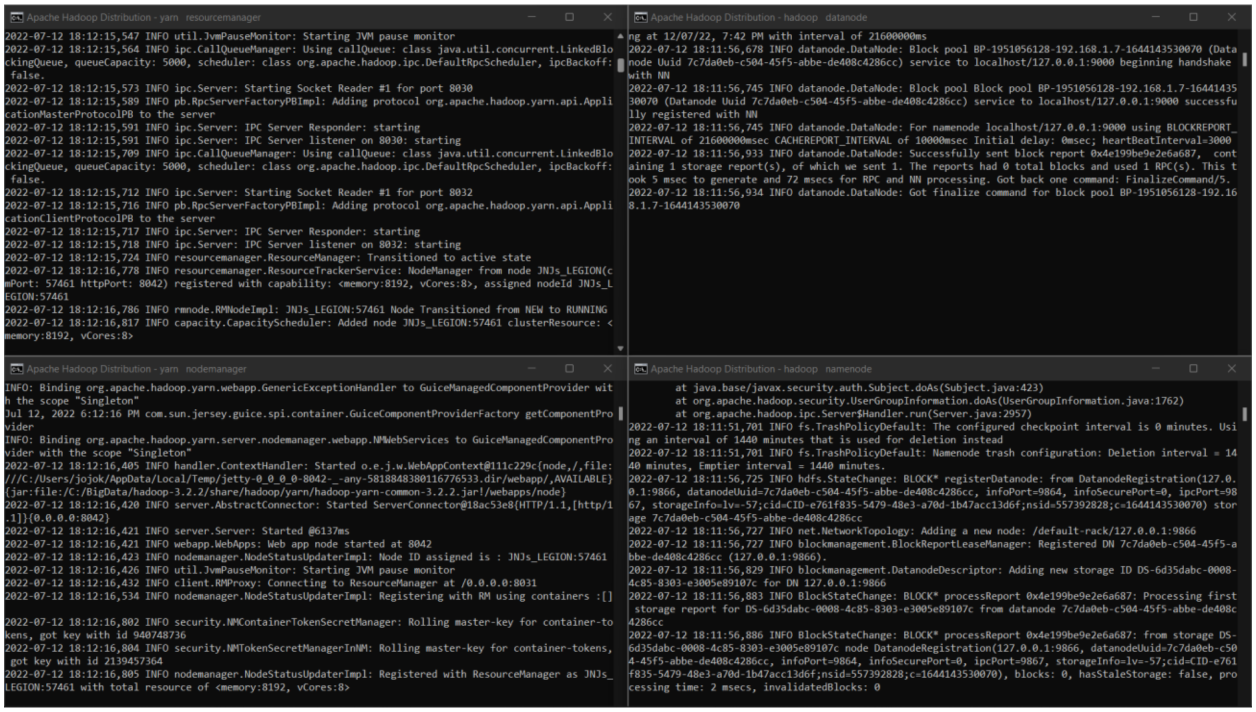
```
> db.Student.find({StudName:"Ayan"});
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.find({},{StudName:1,Grade:1,_id:0});
{ "StudName" : "Megha", "Grade" : "vii" }
{ "Grade" : "vii", "StudName" : "Ayan" }

> db.Student.find({Grade:{$eq:'vii'}}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.find({Grade:{$eq:'vii'}});
{ "_id" : 1, "StudName" : "Megha", "Grade" : "vii", "Hobbies" : "InternetSurfing" }
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.find({Grade:{$eq:'vii'}}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.find({Hobbies:{$in:['Chess','Skating']}}).pretty();
> db.Student.find({Hobbies:{$in:['Skating']}}).pretty();
> db.Student.find({Hobbies:{$in:['skating']}}).pretty();
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.find({StudName:/^M/}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
> db.Student.find({StudName:/e/}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
> db.Student.count();
2
> db.Student.find().sort({StudName:-1}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
> db.Student.save({StudName:"Vamsi",Greade:"vi"})
```

```
WriteResult({ "nInserted" : 1 })
> db.Students.update({_id:4},{$set:{Location:"Network"}})
WriteResult({ "nMatched" : 0, "nUpserted" : 0, "nModified" : 0 })
> db.Students.update({_id:4},{$unset:{Location:"Network"}})
WriteResult({ "nMatched" : 0, "nUpserted" : 0, "nModified" : 0 })
> db.Student.find({_id:1},{StudName:1,Grade:1,_id:0});
{ "StudName" : "Megha", "Grade" : "vii" }
> db.Student.find({Grade:{$ne:'VII'}}).pretty();
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
{ "_id" : 3, "Grade" : "vii", "StudName" : "Ayan", "Hobbies" : "skating" }
{
        "_id" : ObjectId("6253f413e88b8c9e787b194e"),
        "StudName" : "Vamsi",
        "Greade" : "vi"
}
> db.Student.find({StudName:/s$/}).pretty();
> db.Students.update({_id:3},{$set:{Location:null}})
WriteResult({ "nMatched" : 0, "nUpserted" : 0, "nModified" : 0 })
> db.Students.count()
0
> db.Students.count({Grade:"VII"})
0
```

```
> db.Student.find({Grade:"VII"}).limit(3).pretty();

> db.Student.update({_id:3},{$set:{Location:null}})

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

> db.Student.count({Grade:"VII"})

0

> db.Students.count({Grade:"vii"})

0

> db.Student.count()

3

> db.Student.count({Grade:"vii"})

2

> db.Student.find({Grade:"vii"}).limit(3).pretty();

{

        "_id" : 1,

        "StudName" : "Megha",

        "Grade" : "vii",

        "Hobbies" : "InternetSurfing"

}

{

        "_id" : 3,

        "Grade" : "vii",

        "StudName" : "Ayan",

        "Hobbies" : "skating",

        "Location" : null

}

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

{
        "_id" : 3,
        "Grade" : "vii",
        "StudName" : "Ayan",
        "Hobbies" : "skating",
        "Location" : null
}
{
        "_id" : 1,
        "StudName" : "Megha",
        "Grade" : "vii",
        "Hobbies" : "InternetSurfing"
}
{
        "_id" : ObjectId("6253f413e88b8c9e787b194e"),
        "StudName" : "Vamsi",
        "Greade" : "vi"
}
> db.Student.find().skip(2).pretty()
{
        "_id" : ObjectId("6253f413e88b8c9e787b194e"),
        "StudName" : "Vamsi",
        "Greade" : "vi"
}
> db.food.insert( { _id:1, fruits:['grapes','mango','apple';] } )
2022-04-11T15:05:51.894+0530 E QUERY    [thread1] SyntaxError: missing ] after element list
@(shell):1:57
> db.food.insert({_id:1,fruits:['grapes','mango','apple']})
WriteResult({ "nInserted" : 1 })
```

```
> db.food.insert({_id:2,fruits:['grapes','mango','cherry']})

WriteResult({ "nInserted" : 1 })

> db.food.insert({_id:3,fruits:['banana','mango']})

WriteResult({ "nInserted" : 1 })

> db.food.find({fruits:['grapes','mango','apple']}).pretty();

{ "_id" : 1, "fruits" : [ "grapes", "mango", "apple" ] }

> db.food.find({'fruits.1':'grapes'})

> db.food.find({"fruits":{$size:2}})

{ "_id" : 3, "fruits" : [ "banana", "mango" ] }

> db.food.find({_id:1},{"fruits":{$slice:2}})

{ "_id" : 1, "fruits" : [ "grapes", "mango" ] }

> db.food.find({fruits:{$all:["mango","grapes"]}})

{ "_id" : 1, "fruits" : [ "grapes", "mango", "apple" ] }

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

> db.food.update({_id:3},{$set:{"fruits.1":"apple"}})

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

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

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


>db.Customers.insert({_custID:1,AcctBal:'100000',AcctType:"saving"});

WriteResult({ "nInserted" : 1 })

> db.Customers.aggregate({$group:{_id:"$custID",TotAccBal:{$sum:"$AccBal"}}});

{ "_id" : null, "TotAccBal" : 0 }

db.Customers.aggregate({$match:{AcctType:"saving"}},{$group:{_id:"$custID",TotAccBal:{$sum:
"$AccBal"}}});

{ "_id" : null, "TotAccBal" : 0 }

db.Customers.aggregate({$match:{AcctType:"saving"}},{$group:{_id:"$custID",TotAccBal:{$sum:
"$AccBal"}}},{$match:{TotAccBal:{$gt:1200}}});
```

<span style="color:blue">**LAB 4:**</span> **Hadoop Installation**



Apache Hadoop Distribution - yarn resourcemanager

```
2022-07-12 18:12:15,547 INFO util.JvmPauseMonitor: Starting JVM pause monitor
2022-07-12 18:12:15,564 INFO ipc.CallQueueManager: Using callQueue: class java.util.concurrent.LinkedBlo
ckingQueue, queueCapacity: 5000, scheduler: class org.apache.hadoop.ipc.DefaultRpcScheduler, ipcBackoff:
 false.
2022-07-12 18:12:15,573 INFO ipc.Server: Starting Socket Reader #1 for port 8030
2022-07-12 18:12:15,589 INFO pb.RpcServerFactoryPBImpl: Adding protocol org.apache.hadoop.yarn.api.Appli
cationMasterProtocolPB to the server
2022-07-12 18:12:15,591 INFO ipc.Server: IPC Server Responder: starting
2022-07-12 18:12:15,591 INFO ipc.Server: IPC Server listener on 8030: starting
2022-07-12 18:12:15,709 INFO ipc.CallQueueManager: Using callQueue: class java.util.concurrent.LinkedBlo
ckingQueue, queueCapacity: 5000, scheduler: class org.apache.hadoop.ipc.DefaultRpcScheduler, ipcBackoff:
 false.
2022-07-12 18:12:15,712 INFO ipc.Server: Starting Socket Reader #1 for port 8032
2022-07-12 18:12:15,716 INFO pb.RpcServerFactoryPBImpl: Adding protocol org.apache.hadoop.yarn.api.Appli
cationClientProtocolPB to the server
2022-07-12 18:12:15,717 INFO ipc.Server: IPC Server Responder: starting
2022-07-12 18:12:15,718 INFO ipc.Server: IPC Server listener on 8032: starting
2022-07-12 18:12:15,724 INFO resourcemanager.ResourceManager: Transitioned to active state
2022-07-12 18:12:16,778 INFO resourcemanager.ResourceTrackerService: NodeManager from node JNJs_LEGION(c
mPort: 57461 httpPort: 8042) registered with capability: <memory:8192, vCores:8>, assigned nodeId JNJs_L
EGION:57461
2022-07-12 18:12:16,786 INFO rmnode.RMNodeImpl: JNJs_LEGION:57461 Node Transitioned from NEW to RUNNING
2022-07-12 18:12:16,817 INFO capacity.CapacityScheduler: Added node JNJs_LEGION:57461 clusterResource: <
memory:8192, vCores:8>
```

Apache Hadoop Distribution - hadoop datanode

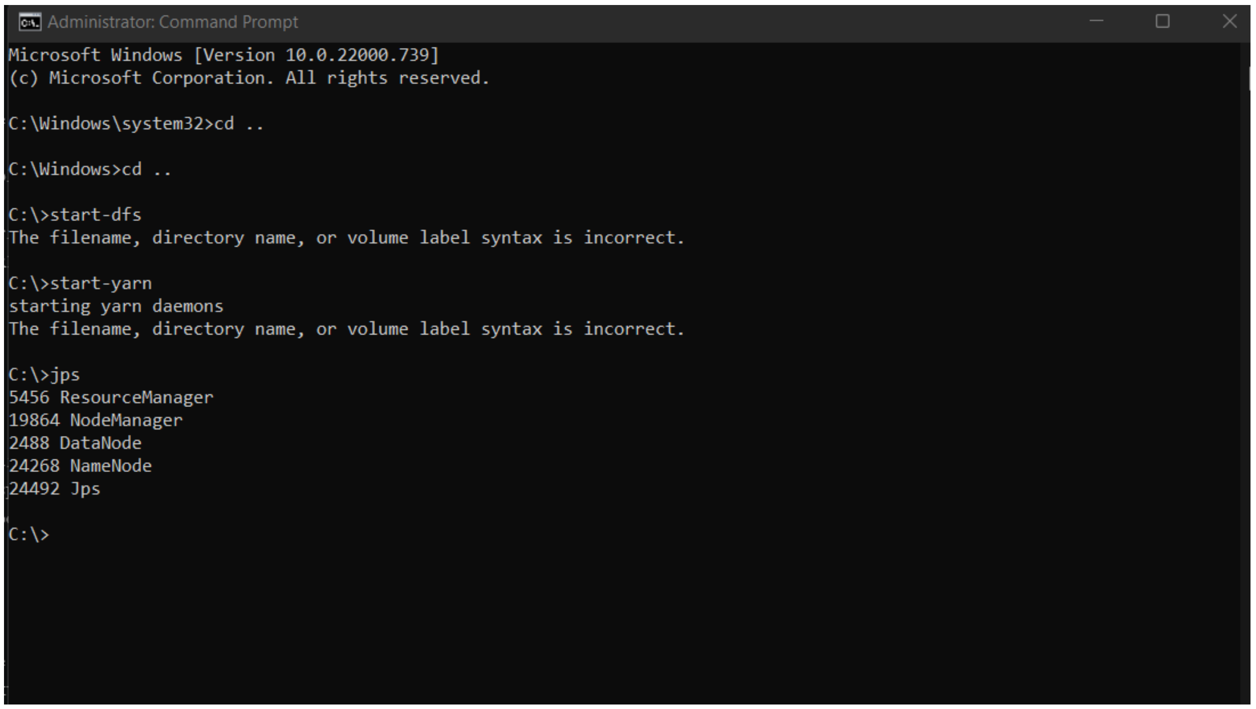
```
ng at 12/07/22, 7:42 PM with interval of 21600000ms
2022-07-12 18:11:56,678 INFO datanode.DataNode: Block pool BP-1951056128-192.168.1.7-1644143530070 (Data
node Uuid 7c7da0eb-c504-45f5-abbe-de408c4286cc) service to localhost/127.0.0.1:9000 beginning handshake
with NN
2022-07-12 18:11:56,745 INFO datanode.DataNode: Block pool Block pool BP-1951056128-192.168.1.7-16441435
30070 (Datanode Uuid 7c7da0eb-c504-45f5-abbe-de408c4286cc) service to localhost/127.0.0.1:9000 successfu
lly registered with NN
2022-07-12 18:11:56,745 INFO datanode.DataNode: For namenode localhost/127.0.0.1:9000 using BLOCKREPORT_
INTERVAL of 21600000msec CACHEREPORT_INTERVAL of 10000msec Initial delay: 0msec; heartBeatInterval=3000
2022-07-12 18:11:56,933 INFO datanode.DataNode: Successfully sent block report 0x4e199be9e2e6a687,  cont
aining 1 storage report(s), of which we sent 1. The reports had 0 total blocks and used 1 RPC(s). This t
ook 5 msec to generate and 72 msecs for RPC and NN processing. Got back one command: FinalizeCommand/5.
2022-07-12 18:11:56,934 INFO datanode.DataNode: Got finalize command for block pool BP-1951056128-192.16
8.1.7-1644143530070
```

Apache Hadoop Distribution - yarn nodemanager

```
INFO: Binding org.apache.hadoop.yarn.webapp.GenericExceptionHandler to GuiceManagedComponentProvider wit
h the scope "Singleton"
Jul 12, 2022 6:12:16 PM com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory getComponentPro
vider
INFO: Binding org.apache.hadoop.yarn.server.nodemanager.webapp.NMWebServices to GuiceManagedComponentPro
vider with the scope "Singleton"
2022-07-12 18:12:16,405 INFO handler.ContextHandler: Started o.e.j.w.WebAppContext@111c229c{node,/,file:
///C:/Users/jojok/AppData/Local/Temp/jetty-0_0_0_0-8042-_-any-5818848380116776533.dir/webapp/,AVAILABLE}
{jar:file:/C:/BigData/hadoop-3.2.2/share/hadoop/yarn/hadoop-yarn-common-3.2.2.jar!/webapps/node}
2022-07-12 18:12:16,420 INFO server.AbstractConnector: Started ServerConnector@18ac53e8{HTTP/1.1,[http/1
.1]}{0.0.0.0:8042}
2022-07-12 18:12:16,421 INFO server.Server: Started @6137ms
2022-07-12 18:12:16,421 INFO webapp.WebApps: Web app node started at 8042
2022-07-12 18:12:16,423 INFO nodemanager.NodeStatusUpdaterImpl: Node ID assigned is : JNJs_LEGION:57461
2022-07-12 18:12:16,426 INFO util.JvmPauseMonitor: Starting JVM pause monitor
2022-07-12 18:12:16,432 INFO client.RMProxy: Connecting to ResourceManager at /0.0.0.0:8031
2022-07-12 18:12:16,534 INFO nodemanager.NodeStatusUpdaterImpl: Registering with RM using containers :[]

2022-07-12 18:12:16,802 INFO security.NMContainerTokenSecretManager: Rolling master-key for container-to
kens, got key with id 940748736
2022-07-12 18:12:16,804 INFO security.NMTokenSecretManagerInNM: Rolling master-key for container-tokens,
 got key with id 2139457364
2022-07-12 18:12:16,805 INFO nodemanager.NodeStatusUpdaterImpl: Registered with ResourceManager as JNJs_
LEGION:57461 with total resource of <memory:8192, vCores:8>
```

Apache Hadoop Distribution - hadoop namenode

```
        at java.base/javax.security.auth.Subject.doAs(Subject.java:423)
        at org.apache.hadoop.security.UserGroupInformation.doAs(UserGroupInformation.java:1762)
        at org.apache.hadoop.ipc.Server$Handler.run(Server.java:2957)
2022-07-12 18:11:51,701 INFO fs.TrashPolicyDefault: The configured checkpoint interval is 0 minutes. Usi
ng an interval of 1440 minutes that is used for deletion instead
2022-07-12 18:11:51,701 INFO fs.TrashPolicyDefault: Namenode trash configuration: Deletion interval = 14
40 minutes, Emptier interval = 1440 minutes.
2022-07-12 18:11:56,725 INFO hdfs.StateChange: BLOCK* registerDatanode: from DatanodeRegistration(127.0.
0.1:9866, datanodeUuid=7c7da0eb-c504-45f5-abbe-de408c4286cc, infoPort=9864, infoSecurePort=0, ipcPort=98
67, storageInfo=lv=-57;cid=CID-e761f835-5479-48e3-a70d-1b47acc13d6f;nsid=557392828;c=1644143530070) stor
age 7c7da0eb-c504-45f5-abbe-de408c4286cc
2022-07-12 18:11:56,727 INFO net.NetworkTopology: Adding a new node: /default-rack/127.0.0.1:9866
2022-07-12 18:11:56,727 INFO blockmanagement.BlockReportLeaseManager: Registered DN 7c7da0eb-c504-45f5-a
bbe-de408c4286cc (127.0.0.1:9866).
2022-07-12 18:11:56,829 INFO blockmanagement.DatanodeDescriptor: Adding new storage ID DS-6d35dabc-0008-
4c85-8303-e3005e89107c for DN 127.0.0.1:9866
2022-07-12 18:11:56,883 INFO BlockStateChange: BLOCK* processReport 0x4e199be9e2e6a687: Processing first
 storage report for DS-6d35dabc-0008-4c85-8303-e3005e89107c from datanode 7c7da0eb-c504-45f5-abbe-de408c
4286cc
2022-07-12 18:11:56,886 INFO BlockStateChange: BLOCK* processReport 0x4e199be9e2e6a687: from storage DS-
6d35dabc-0008-4c85-8303-e3005e89107c node DatanodeRegistration(127.0.0.1:9866, datanodeUuid=7c7da0eb-c50
4-45f5-abbe-de408c4286cc, infoPort=9864, infoSecurePort=0, ipcPort=9867, storageInfo=lv=-57;cid=CID-e761
f835-5479-48e3-a70d-1b47acc13d6f;nsid=557392828;c=1644143530070), blocks: 0, hasStaleStorage: false, pro
cessing time: 2 msecs, invalidatedBlocks: 0
```



Administrator: Command Prompt

```
Microsoft Windows [Version 10.0.22000.739]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>cd ..

C:\Windows>cd ..

C:\>start-dfs
The filename, directory name, or volume label syntax is incorrect.

C:\>start-yarn
starting yarn daemons
The filename, directory name, or volume label syntax is incorrect.

C:\>jps
5456 ResourceManager
19864 NodeManager
2488 DataNode
24268 NameNode
24492 Jps

C:\>
```

LAB 5: Hadoop Commands

```
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

5072 SecondaryNameNode

4674 NameNode

4856 DataNode

5563 NodeManager

6507 Jps

5231 ResourceManager

hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /abc
```

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 7 items
drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:52 /SharmaJi
drwxr-xr-x   - hduser supergroup          0 2022-06-04 09:34 /abc
drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:44 /bhavana
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:22 /lochan
drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:45 /u1
-rw-r--r--   1 hduser supergroup         19 2022-05-31 11:01 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-01 10:08 /vallisha
hduser@bmsce-Precision-T1700:~$ cat newfile.txt
SharmaJi
KhanwaJi
PaiJI
Kasturba
pandeyji
patilwa
Nairwa
hduser@bmsce-Precision-T1700:~$ hdfs dfs -put /home/hduser/newfile.txt /abc/joel.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /abc/joel.txt
SharmaJi
KhanwaJi
PaiJI
Kasturba
pandeyji
patilwa
Nairwa
hduser@bmsce-Precision-T1700:~$ cat > sample.txt
```

```
Hello
This is a new text file
^C
hduser@bmsce-Precision-T1700:~$ cat sample.txt
Hello
This is a new text file
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyFromLocal /home/hduser/sample.txt
/abc/joel2.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /abc/joel2.txt
Hello
This is a new text file
hduser@bmsce-Precision-T1700:~$ hdfs dfs -get /abc/joel2.txt /home/hduser/joel2_copy.txt
hduser@bmsce-Precision-T1700:~$ ls
 derby.log          'Packet Tracer 7.2.1 for Linux 64 bit.tar.gz'
 Desktop             Pictures
 Documents           pig_1564816082257.log
 Downloads           pig_1599215374374.log
 examples.desktop    pt
 first.text          PT72Installer
 hadoop-2.6.0.tar.gz Public
 hive                R
 joel2_copy.txt      TCPclient.py
 sample.txt          TCPserver.py
 lol                 Templates
 metastore_db        toinstalledlist
 Music               UDPclient.py
 newfile.txt         UDPserver.py
```

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -getmerge /abc/joel.txt /abc/joel2.txt
/home/hduser/joel_merge.txt

hduser@bmsce-Precision-T1700:~$ ls

 derby.log           'Packet Tracer 7.2.1 for Linux 64 bit.tar.gz'

 Desktop              Pictures

 Documents            pig_1564816082257.log

 Downloads            pig_1599215374374.log

 examples.desktop     pt

 first.text           PT72Installer

 hadoop-2.6.0.tar.gz  Public

 hive                 R

 joel2_copy.txt       TCPclient.py

 joel_merge.txt       TCPserver.py

 sample.txt           Templates

 lol                  toinstalledlist

 metastore_db         UDPclient.py

 Music                UDPserver.py

 newfile.txt          Videos

hduser@bmsce-Precision-T1700:~$ cat joel_merge.txt

SharmaJi

KhanwaJi

PaiJI

Kasturba

pandeyji

patilwa

Nairwa

Hello

This is a new text file
```

```
hduser@bmsce-Precision-T1700:~$ hadoop fs -getfacl /abc/

# file: /abc

# owner: hduser

# group: supergroup

user::rwx

group::r-x

other::r-x


hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyToLocal /abc/joel.txt /home/hduser/Desktop

hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /

Found 7 items

drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:52 /SharmaJi

drwxr-xr-x   - hduser supergroup          0 2022-06-04 09:40 /abc

drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:44 /bhavana

drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:22 /lochan

drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:45 /u1

-rw-r--r--   1 hduser supergroup         19 2022-05-31 11:01 /user

drwxr-xr-x   - hduser supergroup          0 2022-06-01 10:08 /vallisha

hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /joel

hduser@bmsce-Precision-T1700:~$ hadoop fs -mv /abc /joel

hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /joel

Found 1 items

drwxr-xr-x   - hduser supergroup          0 2022-06-04 09:40 /joel/abc

hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /

Found 7 items

drwxr-xr-x   - hduser supergroup          0 2022-06-03 12:52 /SharmaJi

drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:44 /bhavana
```

```
drwxr-xr-x   - hduser supergroup          0 2022-06-04 09:59 /joel
drwxr-xr-x   - hduser supergroup          0 2022-06-01 15:22 /lochan
drwxr-xr-x   - hduser supergroup          0 2022-06-03 15:45 /u1
-rw-r--r--   1 hduser supergroup         19 2022-05-31 11:01 /user
drwxr-xr-x   - hduser supergroup          0 2022-06-01 10:08 /vallisha
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /vallisha
Found 1 items
-rw-r--r--   1 hduser supergroup         13 2022-06-01 09:52 /vallisha/sample1.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /joel/abc
Found 2 items
-rw-r--r--   1 hduser supergroup         57 2022-06-04 09:37 /joel/abc/joel.txt
-rw-r--r--   1 hduser supergroup         30 2022-06-04 09:40 /joel/abc/joel2.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /joel/abc/joel.txt
SharmaJi
KhanwaJi
PaiJI
Kasturba
pandeyji
patilwa
Nairwa
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cp /vallisha/sample1.txt /joel
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /joel
Found 2 items
drwxr-xr-x   - hduser supergroup          0 2022-06-04 09:40 /joel/abc
-rw-r--r--   1 hduser supergroup         13 2022-06-04 10:07 /joel/sample1.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /joel/sample1.txt
sample1 text
```

LAB 6: Hadoop Program: Average Temperature

6. Create a Map Reduce program to

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

AverageDriver

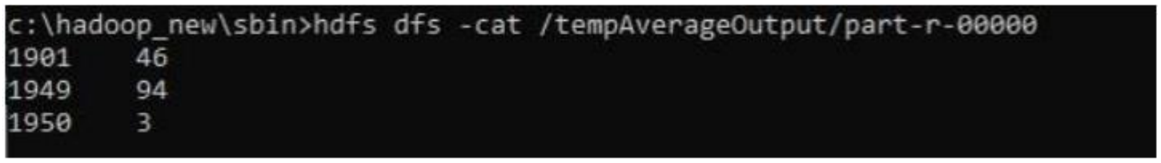
```
package temp;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
public class AverageDriver {
public static void main(String[] args) throws Exception {
if (args.length != 2) {
System.err.println("Please Enter the input and output parameters");
System.exit(-1);
}
Job job = new Job();
job.setJarByClass(AverageDriver.class);
job.setJobName("Max temperature");
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
job.setMapperClass(AverageMapper.class);
job.setReducerClass(AverageReducer.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
}
```

AverageMapper

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class AverageMapper extends Mapper<LongWritable, Text, Text, IntWritable> {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value, Mapper<LongWritable, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
int temperature;
String line = value.toString();
String year = line.substring(15, 19);
if (line.charAt(87) == '+') {
temperature = Integer.parseInt(line.substring(88, 92));
} else {
temperature = Integer.parseInt(line.substring(87, 92));
}
String quality = line.substring(92, 93);
if (temperature != 9999 && quality.matches("[01459]"))
context.write(new Text(year), new IntWritable(temperature));
}
}
```

AverageReducer

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class AverageReducer extends Reducer<Text, IntWritable, Text, IntWritable> {
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
int max_temp = 0;
int count = 0;
for (IntWritable value : values) {
max_temp += value.get();
count++;
}
context.write(key, new IntWritable(max_temp / count));
}
}
```



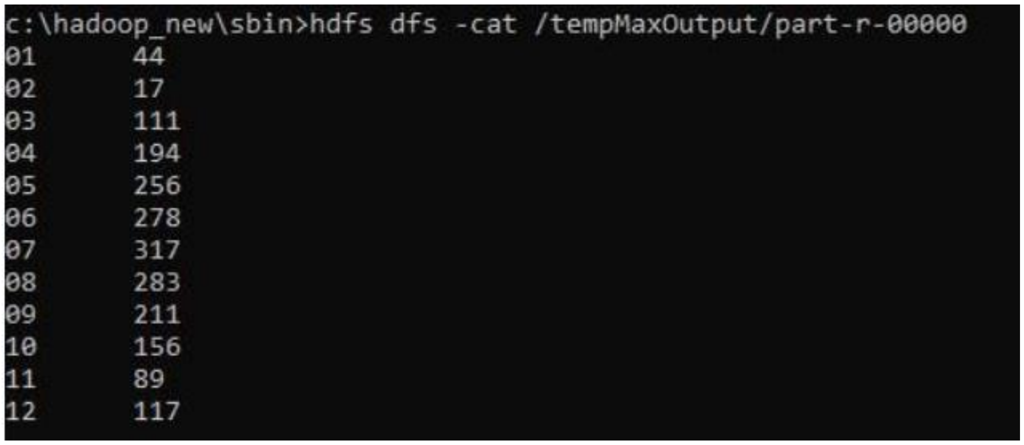
```
c:\hadoop_new\sbin>hdfs dfs -cat /tempAverageOutput/part-r-00000
1901    46
1949    94
1950    3
```

b) Create a Map Reduce program to find the mean max temperature for every month

MeanMaxDriver.class

```
package meanmax;

import org.apache.hadoop.fs.Path;

import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.io.Text;

import org.apache.hadoop.mapreduce.Job;

import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;

import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;

public class MeanMaxDriver {

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

if (args.length != 2) {

System.err.println("Please Enter the input and output parameters");

System.exit(-1);

}

Job job = new Job();

job.setJarByClass(MeanMaxDriver.class);

job.setJobName("Max temperature");

FileInputFormat.addInputPath(job, new Path(args[0]));

FileOutputFormat.setOutputPath(job, new Path(args[1]));

job.setMapperClass(MeanMaxMapper.class);

job.setReducerClass(MeanMaxReducer.class);

job.setOutputKeyClass(Text.class);

job.setOutputValueClass(IntWritable.class);

System.exit(job.waitForCompletion(true) ? 0 : 1);

}
}
MeanMaxMapper.class
package meanmax;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class MeanMaxMapper extends Mapper<LongWritable, Text, Text, IntWritable> {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value, Mapper<LongWritable, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
int temperature;
String line = value.toString();
String month = line.substring(19, 21);
if (line.charAt(87) == '+') {
temperature = Integer.parseInt(line.substring(88, 92));
} else {
temperature = Integer.parseInt(line.substring(87, 92));
}
String quality = line.substring(92, 93);
if (temperature != 9999 && quality.matches("[01459]"))
context.write(new Text(month), new IntWritable(temperature));
}
}
MeanMaxReducer.class
package meanmax;
```

```
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class MeanMaxReducer extends Reducer<Text, IntWritable, Text, IntWritable> {
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
int max_temp = 0;
int total_temp = 0;
int count = 0;
int days = 0;
for (IntWritable value : values) {
int temp = value.get();
if (temp > max_temp)
max_temp = temp;
count++;
if (count == 3) {
total_temp += max_temp;
max_temp = 0;
count = 0;
days++;
}
}
context.write(key, new IntWritable(total_temp / days));
}
}
```



```
c:\hadoop_new\sbin>hdfs dfs -cat /tempMaxOutput/part-r-00000
01      44
02      17
03      111
04      194
05      256
06      278
07      317
08      283
09      211
10      156
11      89
12      117
```

LAB 7: Hadoop Program: Word Count (TopN)

7) 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.

```
//Driver Code

package wordCount;

import java.io.IOException;

import org.apache.hadoop.conf.Configured;

import org.apache.hadoop.fs.Path;

import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.io.Text;

import org.apache.hadoop.mapred.FileInputFormat;

import org.apache.hadoop.mapred.FileOutputFormat;

import org.apache.hadoop.mapred.JobClient;

import org.apache.hadoop.mapred.JobConf;

import org.apache.hadoop.util.Tool;

import org.apache.hadoop.util.ToolRunner;

public class WCDriver extends Configured implements Tool {

public int run(String args[]) throws IOException

{

if (args.length < 2)

{

System.out.println("Please give valid inputs");

return -1;

}

JobConf conf = new JobConf(WCDriver.class);

FileInputFormat.setInputPaths(conf, new Path(args[0]));

FileOutputFormat.setOutputPath(conf, new Path(args[1]));
conf.setMapperClass(WCMapper.class);

conf.setReducerClass(WCReducer.class);

conf.setMapOutputKeyClass(Text.class);

conf.setMapOutputValueClass(IntWritable.class);

conf.setOutputKeyClass(Text.class);

conf.setOutputValueClass(IntWritable.class);

JobClient.runJob(conf);

return 0;

}

// Main Method

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

{

int exitCode = ToolRunner.run(new WCDriver(), args);

System.out.println(exitCode);

}

}

//Mapper Code

package wordCount;

import java.io.IOException;

import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.io.LongWritable;

import org.apache.hadoop.io.Text;

import org.apache.hadoop.mapred.MapReduceBase;

import org.apache.hadoop.mapred.Mapper;

import org.apache.hadoop.mapred.OutputCollector;

import org.apache.hadoop.mapred.Reporter;

public class WCMapper extends MapReduceBase implements Mapper<LongWritable,Text, Text,
IntWritable> {
```

```
// Map function
public void map(LongWritable key, Text value, OutputCollector<Text, IntWritable> output,
Reporter
rep) throws IOException
{
String line = value.toString();
// Splitting the line on spaces
for (String word : line.split(" "))
{
if (word.length() > 0)
{
output.collect(new Text(word), new IntWritable(1));
}
}
}
}
//Reducer Code
package wordCount;
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;
public class WCReducer extends MapReduceBase implements Reducer<Text,IntWritable, Text,
IntWritable> {
```

```
// Reduce function
public void reduce(Text key, Iterator<IntWritable> value, OutputCollector<Text, IntWritable>
output,Reporter rep) throws IOException
{
int count = 0;
// Counting the frequency of each words
while (value.hasNext())
{
IntWritable i = value.next();
count += i.get();
}
output.collect(key, new IntWritable(count));
}
}
```

//Hadoop Commands

```
hduser@bmsce-Precision-T1700:~$ hadoop fs -mkdir /joel
hduser@bmsce-Precision-T1700:~$ hadoop fs -copyFromLocal
/home/hduser/Desktop/sample.txt
/joel/test.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /joel/test.txt
hi how are you
how is your job
how is your family
how is your brother
how is your sister
hduser@bmsce-Precision-T1700:~$ hadoop jar /home/hduser/Documents/wordCount.jar
```

```
wordCount.WCDriver /joel/test.txt /joel/output
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /joel/output/part-00000
are 1
brother 1
family 1
hi 1
how 5
is 4
job 1
sister 1
you 1
your 4
```

LAB 8: Hadoop Program: Join Operation

8) 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 'Department Emp Strength input' with 'Department Nameinput'");
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.*;
```

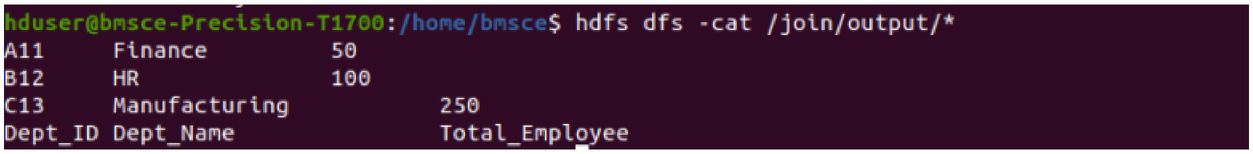
```
public class JoinReducer extends MapReduceBase implements Reducer<TextPair, Text,

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);

}

} }
```

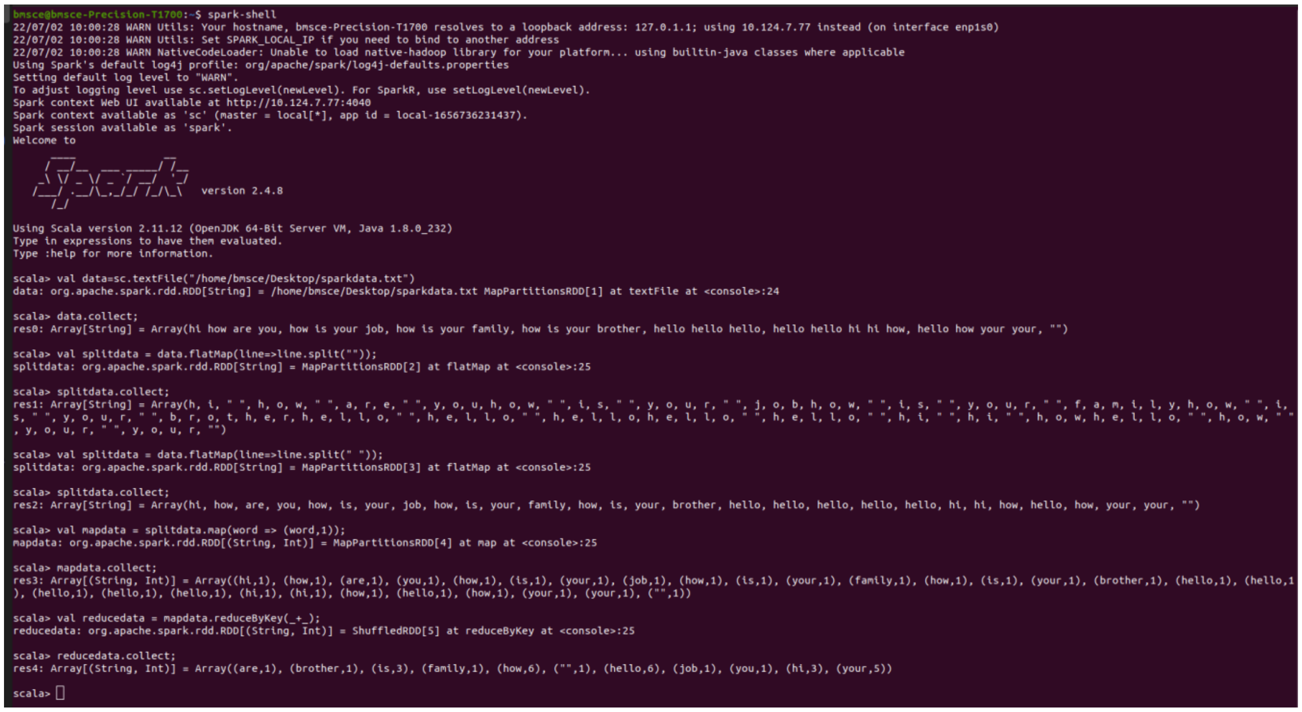


```
hduser@bmsce-Precision-T1700:/home/bmsce$ hdfs dfs -cat /join/output/*
A11     Finance         50
B12     HR              100
C13     Manufacturing           250
Dept_ID Dept_Name               Total_Employee
```

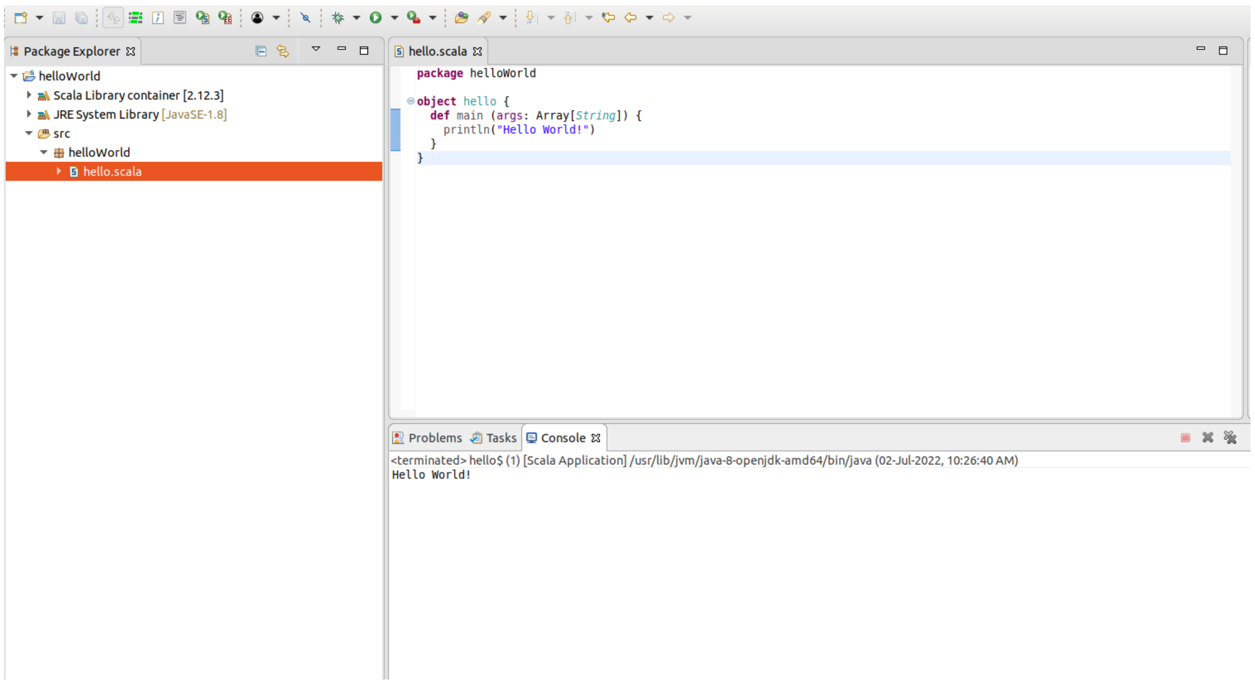
LAB 9: Scala Program

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

```
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;
```



```
bmsce@bmsce-Precision-T1700:~$ spark-shell
22/07/02 10:00:28 WARN Utils: Your hostname, bmsce-Precision-T1700 resolves to a loopback address: 127.0.1.1; using 10.124.7.77 instead (on interface enp1s0)
22/07/02 10:00:28 WARN Utils: Set SPARK_LOCAL_IP if you need to bind to another address
22/07/02 10:00:28 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
Spark context Web UI available at http://10.124.7.77:4040
Spark context available as 'sc' (master = local[*], app id = local-1656736231437).
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 2.4.8
      /_/

Using Scala version 2.11.12 (OpenJDK 64-Bit Server VM, Java 1.8.0_232)
Type in expressions to have them evaluated.
Type :help for more information.

scala> val data=sc.textFile("/home/bmsce/Desktop/sparkdata.txt")
data: org.apache.spark.rdd.RDD[String] = /home/bmsce/Desktop/sparkdata.txt MapPartitionsRDD[1] at textFile at <console>:24

scala> data.collect;
res0: Array[String] = Array(hi how are you, how is your job, how is your family, how is your brother, hello hello hello, hello hello hi hi how, hello how your your, "")

scala> val splitdata = data.flatMap(line=>line.split(""));
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[2] at flatMap at <console>:25

scala> splitdata.collect;
res1: Array[String] = Array(h, i, " ", h, o, w, " ", a, r, e, " ", y, o, u, h, o, w, " ", i, s, " ", y, o, u, r, " ", j, o, b, h, o, w, " ", i, s, " ", y, o, u, r, " ", f, a, m, i, l, y, h, o, w, " ", i,
s, " ", y, o, u, r, " ", b, r, o, t, h, e, r, h, e, l, l, o, " ", h, e, l, l, o, " ", h, e, l, l, o, h, e, l, l, o, " ", h, e, l, l, o, " ", h, i, " ", h, i, " ", h, o, w, h, e, l, l, o, " ", h, o, w, " "
, y, o, u, r, " ", y, o, u, r, "")

scala> val splitdata = data.flatMap(line=>line.split(" "));
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[3] at flatMap at <console>:25

scala> splitdata.collect;
res2: Array[String] = Array(hi, how, are, you, how, is, your, job, how, is, your, family, how, is, your, brother, hello, hello, hello, hello, hello, hi, hi, how, hello, how, your, your, "")

scala> val mapdata = splitdata.map(word => (word,1));
mapdata: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[4] at map at <console>:25

scala> mapdata.collect;
res3: Array[(String, Int)] = Array((hi,1), (how,1), (are,1), (you,1), (how,1), (is,1), (your,1), (job,1), (how,1), (is,1), (your,1), (family,1), (how,1), (is,1), (your,1), (brother,1), (hello,1), (hello,1
), (hello,1), (hello,1), (hello,1), (hi,1), (hi,1), (how,1), (hello,1), (how,1), (your,1), (your,1), ("",1))

scala> val reducedata = mapdata.reduceByKey(_+_);
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[5] at reduceByKey at <console>:25

scala> reducedata.collect;
res4: Array[(String, Int)] = Array((are,1), (brother,1), (is,3), (family,1), (how,6), ("",1), (hello,6), (job,1), (you,1), (hi,3), (your,5))

scala> 
```



```
package helloWorld

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

```
<terminated> hello$ (1) [Scala Application] /usr/lib/jvm/java-8-openjdk-amd64/bin/java (02-Jul-2022, 10:26:40 AM)
Hello World!
```

LAB 10: Scala Program: Word Count

10) 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/bmsce/Desktop/sparkdata.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)

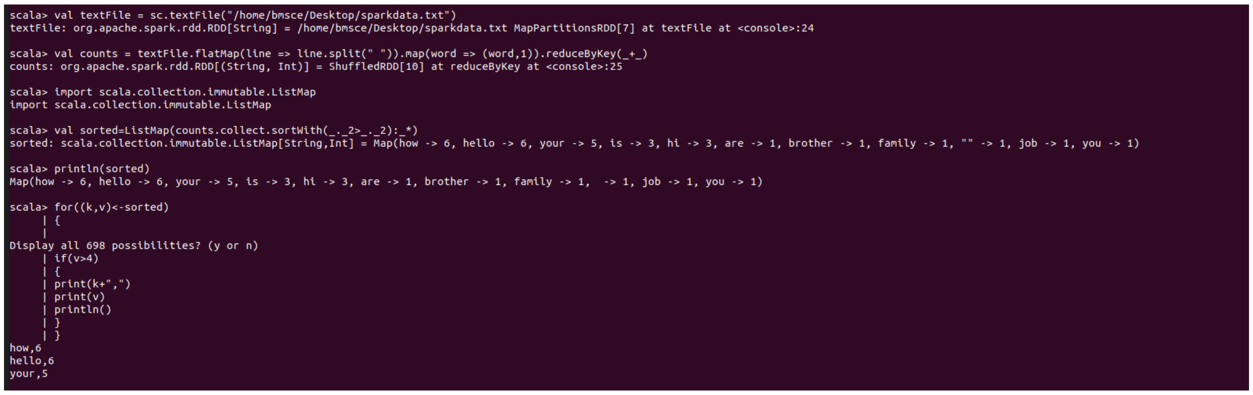
{

print(k+",")

print(v)

println()

}}



```
scala> val textFile = sc.textFile("/home/bmsce/Desktop/sparkdata.txt")
textFile: org.apache.spark.rdd.RDD[String] = /home/bmsce/Desktop/sparkdata.txt MapPartitionsRDD[7] at textFile at <console>:24

scala> val counts = textFile.flatMap(line => line.split(" ")).map(word => (word,1)).reduceByKey(_+_)
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[10] at reduceByKey at <console>:25

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

scala> val sorted=ListMap(counts.collect.sortWith(_._2>_._2):_*)
sorted: scala.collection.immutable.ListMap[String,Int] = Map(how -> 6, hello -> 6, your -> 5, is -> 3, hi -> 3, are -> 1, brother -> 1, family -> 1, "" -> 1, job -> 1, you -> 1)

scala> println(sorted)
Map(how -> 6, hello -> 6, your -> 5, is -> 3, hi -> 3, are -> 1, brother -> 1, family -> 1,  -> 1, job -> 1, you -> 1)

scala> for((k,v)<-sorted)
     | {
     |
Display all 698 possibilities? (y or n)
     | if(v>4)
     | {
     | print(k+",")
     | print(v)
     | println()
     | }
     | }
how,6
hello,6
your,5
```