VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

Big Data Analytics (23CS6PCBDA)

Submitted by:

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Under the Guidance of
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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
(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 **Shraddha (1BM22CS357),** 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 2025. The Lab report has been approved as it satisfies the academic requirements in respect of **Big Data Analytics –(23CS6PCBDA)** work prescribed for the said degree.

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Table Of Contents

Github Link: https://github.com/Shraddha-357/BDA

Course Outcomes

CO1: Apply the concepts of NoSQL, Hadoop, Spark for a given task

CO2: Analyse data analytic techniques for a given problem.

CO3: Conduct experiments using data analytics mechanisms for a given problem.

Program 1

MongoDB- CRUD Operations Demonstration (Practice and Self Study)

- Created a database named **myDB** and verified its existence.
- Created and dropped collections like **Student** and **Students**.
- Inserted student data into collections.
- Performed **upsert** to insert or update a student record.
- Used to find queries with various filters: by name, grade, hobbies, regex, etc.
- Retrieved specific fields while suppressing _id.
- Counted total documents and documents with specific criteria.
- Sorted records in ascending and descending order.
- Imported data from a CSV file and exported data to a CSV file.
- Used save() to insert or replace documents.
- Added, removed, and set fields to null in documents.
- Retrieved limited records and skipped initial entries.
- Created a **food** collection with arrays and queried arrays by value, index, size, etc.
- Updated specific elements in an array.
- Practiced query optimizations using $in, $all, $ne, $regex, $slice, and more.

Observation:

Date
Page 1

LAB-1

Working with mongoDB

I. Create database in mongoDB

```
use myDB;
db;
show dbs;
```

II. CRUD Operations.

```
db.create(ollection("Student")
db.Student.drop().
db.Student.insert({_id:1, StudName:"Michelle Jachintha",
    Grade:"VII", Hobbies:"Internet Surfing"})
db.Student.update({_id:3, StudName:"Aryan David",
    Grade:"VII"}, {$set:{Hobbies:"Skating"}}, {upset:true})
```

FIND method.

```
db.Student.find({StudName:"Aryan David"})
db.Student.find({},{StudName:1, Grade:1, _id:0})
db.Student.find({Grade:{$eq:'VII'}}).pretty()
db.Student.find({Hobbies:{$in:['Chess','Skating']}}).pretty()
db.Student.find({StudName:/^M/}).pretty()
db.Student.find({StudName:/e/}).pretty()
db.Student.count()
db.Student.find().sort({StudName:-1}).pretty()
```

III. Import data from a csv file

```
mongoimport --db Student --collection airlines --type csv
--headerline --file /home/hduser/Desktop/airline.csv
```

IV Export data to a csv file

```
mongoexport --host localhost --db student --collecton airlines
--csv --out/home/hduser/Desktop/output.txt --fields "Year","Quar
```

V Save method.

```
db.Student.save({StudName:"Vamsi", Grade:"VI"})
```

VI Some more methods.

```
db.Students.update({_id:4},{$set:{location:"Network"}});
db.Students.update({id:4},{$unset:{Location:"Network"}})
db.Student.find({_id:1},{StudName:1, Grade:1, _id:0})
db.Student.find({Grade:{$ne:'VII'}}).pretty()
db.Students.find({Grade:"VII"}).limit(3).pretty()
```

VII Sort the daoments in ascending order

```
db.Students.find().sort({StudName:1}).pretty();
```

for desc order:

```
db.Students.find().sort({StudName:-1}).pretty();
```

VIII To skip 1st two documents from student collection

```
db.Students.find().skip(2).pretty()
```

IX To find those documents from the "food" collection which has the 'fuits array' constitute of 'grapes', 'mango' and 'apple'.

```
db.Food.find({fruits:['grapes','mango','apple']}).pretty().
```

To find in 'fruits' array having mango in 1st inder pos.

```
db.Food.find({'fruits.1':'grapes'})
```

find from food where size of array is two.

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

find doc with particular id and display the 1st 2 elements from array "fruits".

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

11/3/25.

Date
Page 3

LAB-2
MongoDB Exercise

Customer

① Create a collection by name Customers with attributes cust_id, Acc_Bal, Acc_Type

```
> db.createCollection("Customer");
{ok:1};
> db.Customers.insertMany([
 {cust_id:1, acc_bal:1500, actype:'X'},
 {cust_id:2, acc_bal:900, acc_type:"X"},
 {cust_id:3, acc_bal:2000, acc_type:"Z"},
 {cust_id:4, acc_bal:1100, acc_type:"Y"},
 {cust_id:5, acc_bal:1800, acc_type:"Z"},
])
{acknowledged:true}
```

② Write a query to display those records whose total account balance is greater than 1200 of acc_type 'Z' for each customer id.

```
> db.Customers.find({acc_bal:{$gt:1200},acc_type:"Z"})
```

③ Determine min and max account balance for each customer.

```
> db.Customers.aggregate([{ $group:{_id:"$cust_id",
  min_balance:{$min:"$acc_bal"}, max_balance:{
  $max:"$acc_bal"}}}])
```

E-commerce Platform

```
> db.createCollection("Products")
> db.createCollection("Users")
> db.createCollection("Orders")
```

```
> db.Products.insertMany([
{_id:1, name:"Laptop", category:"Electronics", price:800, quantity:10},
{_id:2, name:"Phone", category:"Electronics", price:500, quantity:15},
{_id:3, name:"Headphone", category:"Accessories", price:50, quantity:25},
{_id:4, name:"Shoes", category:"Fashion", price:90, quantity:30},
{_id:5, name:"Washing machine", category:"Appliance", price:300, quantity:5}])

> db.Users.insertMany([
{_id:"123abc", name:"Alice", cart:[{prod_id, quantity:1}, {prod_id:3, quant:1}]},
{_id:"789ghi", name:"Bob", cart:[{prod_id:2, quant:1}, {prod_id:4, quant:1}]}
])
```

- Retrieve all products.

```
> db.Product.find()
```

- Retrieve products in specific category.

```
> db.Products.find({category:"Electronics"})
```

- Retrieve products with quantity greater than 0.

```
> db.Products.find({quantity:{$gt:0}})
```

- Retrieve products sorted by Price in asc order.

```
> db.Products.find().sort({price:1})
```

- Retrieve products with price less than or equal to $100.

```
> db.Products.find({price:{$lte:100}})
```

- Retrieve orders placed by a user.

```
> db.Orders.aggregate([{$match:{user_id:"123abc"}},
                       {$group:{_id:"$user_id", total_spent:
                        {$sum:"$total_price"}}}])
```

- Retrieve total price of orders placed by a user.

> db.Products.aggregate([{$group:{_id:"$category", total_products:{$sum:1}}}])

Additional Queries:-

① Calculate total no. of products in each category.

> db.Products.aggregate([{$group:{_id:"$category", total_products:{sum:1}}}])

② Calculate total price of products in each category.

> db.Products.aggregate([{$group:{_id:"$category", total_price:{$sum:"$price"}}}])

③ Find average price of products.

> db.Products.aggregate([{$group:{_id:null, avg_price:{$avg:"$price"}}}])

④ Find products with quantity less than 10.

> db.Products.find({quantity:{$lt:10}})

⑤ Sort products by price in descending order.

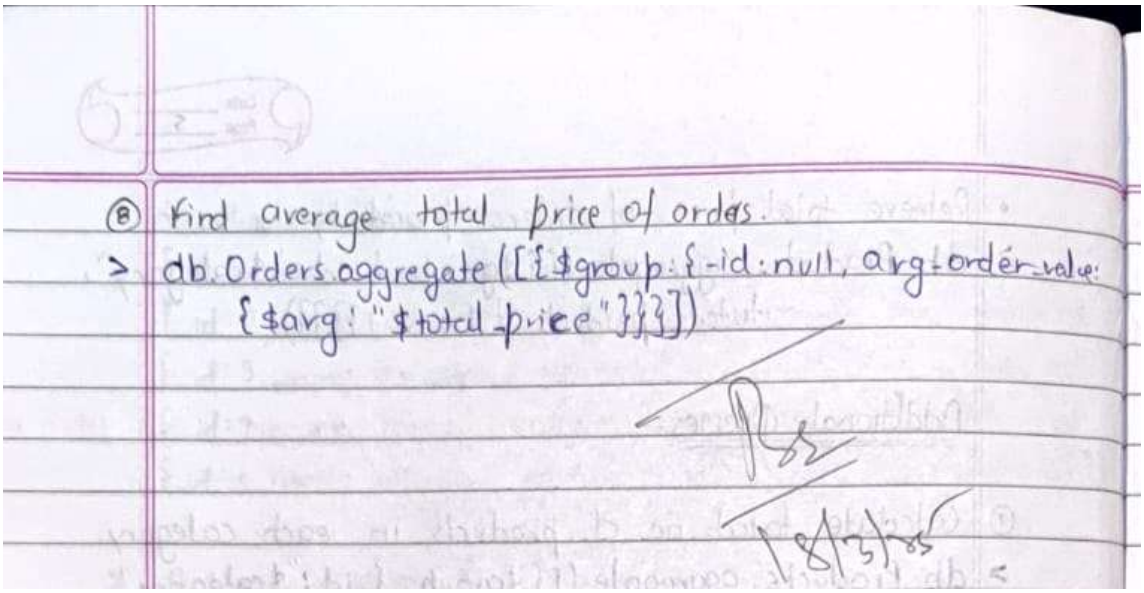
> db.Products.find().sort({price:-1})

⑥ Calculate total price of orders placed by each user.

> dbOrders.agg([{$group:{_id:"$user_id", total_sent:{$sum:1}}}])

⑦ Find users with highest total price of orders

> db.Users.aggregate([{$group:{_id:"$user_id", totalspent:{$sum:"$total_price"}}}, {$sort:{total_spent:-1}}, {$limit:1}])



Code with Output:

```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ mongosh
Current Mongosh Log ID: 6833f9c9126af1945c47586f
Connecting to:          mongodb://127.0.0.1:27017/?directConnection=true&serverSelectionTimeoutMS=2000&appName=mongosh+2.0.1
Using MongoDB:          7.0.2
Using Mongosh:          2.0.1
mongosh 2.5.1 is available for download: https://www.mongodb.com/try/download/shell

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

------
   The server generated these startup warnings when booting
   2025-05-26T10:46:48.806+05:30: Using the XFS filesystem is strongly recommended with the WiredTiger storage engine. See http://dochub.mongo
db.org/core/prodnotes-filesystem
   2025-05-26T10:46:50.937+05:30: Access control is not enabled for the database. Read and write access to data and configuration is unrestric
ted
------

test> use MyDB
switched to db MyDB
MyDB> db
MyDB
MyDB> show dbs
admin          40.00 KiB
config         72.00 KiB
local          80.00 KiB
myNewDatabase  72.00 KiB
MyDB> db.createCollection("Student");
{ ok: 1 }
MyDB> db.Student.insert({_id:1,Name:"Preeti",Grade:"V",Hobbies:"Dancing"},{_id:2,Name:"Prajwal",Grade:"V",Hobbies:"Drawing"});
DeprecationWarning: Collection.insert() is deprecated. Use insertOne, insertMany, or bulkWrite.
{ acknowledged: true, insertedIds: { '0': 1 } }
MyDB> db.find();
TypeError: db.find is not a function
MyDB> db.Student.find();
[ { _id: 1, Name: 'Preeti', Grade: 'V', Hobbies: 'Dancing' } ]
MyDB> db.Student.insertMany({_id:2,Name:"Rachana",Grade:"V",Hobbies:"Painting"},{_id:3,Name:"Prajwal",Grade:"V",Hobbies:"Drawing"});
MongoInvalidArgumentError: Argument "docs" must be an array of documents
MyDB> db.Student.insertMany([{_id:2,Name:"Rachana",Grade:"V",Hobbies:"Painting"},{_id:3,Name:"Prajwal",Grade:"V",Hobbies:"Drawing"}]);
{ acknowledged: true, insertedIds: { '0': 2, '1': 3 } }
MyDB> db.Student.update({_id:2,Name:"Rachana",Grade:"V"},{$set:{Hobbies:"Singing"}},{upsert:true});
DeprecationWarning: Collection.update() is deprecated. Use updateOne, updateMany, or bulkWrite.
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
MyDB> db.Student.find();
[
  { _id: 1, Name: 'Preeti', Grade: 'V', Hobbies: 'Dancing' },
  { _id: 2, Name: 'Rachana', Grade: 'V', Hobbies: 'Singing' },
  { _id: 3, Name: 'Prajwal', Grade: 'V', Hobbies: 'Drawing' }
]
```

```
  { _id: 1, fruits: [ 'grapes', 'banana', 'apple' ] },
  {
    _id: 2,
    fruits: [ 'grapes', 'mango', 'cherry' ],
    price: [ { grapes: 80, mango: 100, cherry: 200 } ]
  },
  { _id: 3, fruits: [ 'banana', 'mango' ] }
]
MyDB> db.food.find().pretty();
[
  { _id: 1, fruits: [ 'grapes', 'banana', 'apple' ] },
  {
    _id: 2,
    fruits: [ 'grapes', 'mango', 'cherry' ],
    price: [ { grapes: 80, mango: 100, cherry: 200 } ]
  },
  { _id: 3, fruits: [ 'banana', 'mango' ] }
]
MyDB> db.createCollection("customer");
{ ok: 1 }
MyDB> var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"});
Uncaught:
SyntaxError: Unexpected token, expected "," (1:144)

> 1 | var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"});
    |
      ^
  2 |

MyDB> var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"}];

MyDB> db.customer.insert(val);
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId("683405cb126af1945c475870"),
    '1': ObjectId("683405cb126af1945c475871"),
    '2': ObjectId("683405cb126af1945c475872"),
    '3': ObjectId("683405cb126af1945c475873")
  }
}
MyDB> db.customer.aggregate({$group:{_id:'$custid',totalbal:{$sum:'$accbal'}}});
[ { _id: 1, totalbal: 200 }, { _id: 2, totalbal: 400 } ]
MyDB> db.Customers.aggregate ( {$match:{AcctType:"S"}},{$group : { _id : "$custID",TotAccBal :
Uncaught:
SyntaxError: Unexpected character '"'. (1:43)

> 1 | db.Customers.aggregate ( {$match:{AcctType:"S"}},{$group : { _id : "$custID",TotAccBal :
```

```
  { _id: 1, fruits: [ 'grapes', 'banana', 'apple' ] },
  {
    _id: 2,
    fruits: [ 'grapes', 'mango', 'cherry' ],
    price: [ { grapes: 80, mango: 100, cherry: 200 } ]
  },
  { _id: 3, fruits: [ 'banana', 'mango' ] }
]
MyDB> db.food.find().pretty();
[
  { _id: 1, fruits: [ 'grapes', 'banana', 'apple' ] },
  {
    _id: 2,
    fruits: [ 'grapes', 'mango', 'cherry' ],
    price: [ { grapes: 80, mango: 100, cherry: 200 } ]
  },
  { _id: 3, fruits: [ 'banana', 'mango' ] }
]
MyDB> db.createCollection("customer");
{ ok: 1 }
MyDB> var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"});
Uncaught:
SyntaxError: Unexpected token, expected "," (1:144)

> 1 | var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"});
    |
      ^
  2 |

MyDB> var val=[{custid:1,accbal:100,acctype:"A"},{custid:1,accbal:100,acctype:"B"},{custid:2,accbal:200,accty
ype:"B"}];

MyDB> db.customer.insert(val);
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId("683405cb126af1945c475870"),
    '1': ObjectId("683405cb126af1945c475871"),
    '2': ObjectId("683405cb126af1945c475872"),
    '3': ObjectId("683405cb126af1945c475873")
  }
}
MyDB> db.customer.aggregate({$group:{_id:'$custid',totalbal:{$sum:'$accbal'}}});
[ { _id: 1, totalbal: 200 }, { _id: 2, totalbal: 400 } ]
MyDB> db.Customers.aggregate ( {$match:{AcctType:"S"}},{$group : { _id : "$custID",TotAccBal :
Uncaught:
SyntaxError: Unexpected character '"'. (1:43)

> 1 | db.Customers.aggregate ( {$match:{AcctType:"S"}},{$group : { _id : "$custID",TotAccBal :
```

```
MyDB> db.customer.aggregate({$match:{acctype:"A"}},{$group:{_id:"$custid",totalbal:{$sum:'$accbal'}}});
[ { _id: 1, totalbal: 100 }, { _id: 2, totalbal: 200 } ]
MyDB> db.customer.aggregate({$match:{acctype:"A"}},{$group:{_id:"$custid",totalbal:{$sum:'$accbal'}}},{$mat$m

MyDB> db.customer.aggregate({$match:{acctype:"A"}},{$group:{_id:"$custid",totalbal:{$sum:'$accbal'}}},{$match

MyDB> db.customer.aggregate({$match:{acctype:"A"}},{$group:{_id:"$custid",totalbal:{$sum:'$accbal'}}},{$match
[ { _id: 2, totalbal: 200 } ]
MyDB> S
```

Program 2

Perform the following DB operations using Cassandra.

a) Create a keyspace by name Employee
b) Create a column family by name
Employee-Info with attributes Emp_Id Primary Key, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name
c) Insert the values into the table in batch
d) Update Employee name and Department of Emp-Id 121
e) Sort the details of Employee records based on salary
f) Alter the schema of the table Employee_Info to add a column Projects which stores a set of Projects done by the corresponding Employee.
g) Update the altered table to add project names.
h) Create a TTL of 15 seconds to display the values ofEmployees.

Observation:

LAB-4

Working with Cassandra

- Create Keyspace:
  CREATE KEYSPACE Students WITH REPLICATON = {'class': 'SimpleStrategy', 'replication_factor': 1};

- Describe the existing Keyspaces:
  DESCRIBE KEYSPACES;

- For more details on existing keyspaces:
  SELECT * FROM system_schema_keyspaces;

- Use the keyspace "Students":
  USE Students;

- To create table by name Student_Info:
  CREATE TABLE Students_info(Roll_No int PRIMARY KEY, StudName text, DateOfJoining timestamp, Last_exam_Percent double);

- Lookup the names of all the tables in the current keyspaces

  DESCRIBE TABLES;

- Describe the table information
  DESCRIBE TABLE Students_info;

- CRUD INSERT:-

BEGIN BATCH
INSERT INTO Students_info (Roll_No, StudName, DateOfJoining, last_exam_Percent) VALUES (1, 'Asha', '2012-03-12', 79.9)
....
....
APPLY BATCH;

- View data from the table "Students_info"
  SELECT * FROM Students_info;

- view data from the "Students_info" where Roll no Column either have 1 & 2 & 3
  SELECT * FROM Students_info WHERE ROLL_NO IN (1,2,3);

- To execute a non primary key - will throw an error
  SELECT * FROM Students_info where StudName = 'Asha';

->So Create an INDEX on the Column as below:
To create an INDEX on StudName Column of the Students_info column family
CREATE INDEX ON students_info(StudName);
SELECT * FROM Students_info where StudName = 'Asha';

- To specify numbers of rows returned in the output
  SELECT ROLL_NO, StudName from Students_info LIMIT 2;

- Alias for Column:
  SELECT Roll_No as USN from Students_info

- update
  UPDATE Students_info SET StudName = 'David Sheen' where Roll_no = 2;
  "On Primary key you cannot perform update operation"

- delete
DELETE last_exam_Percent FROM student_info
WHERE Roll_No = 2;

- delete Row
DELETE FROM Student_Info WHERE Roll NO = 2;

SET Collection:-
ALTER TABLE Student_info ADD hobbies set <text>

LIST Collection:-
ALTER TABLE student_info ADD languages list<text>

- UPDATE Student_Info
SET hobbies = hobbies + {'Chess', 'Table Tennis'}
WHERE Roll no = 1;

- SELECT * FROM students_info WHERE Roll no = 1;

UPDATE Student_Info
SET language = language + ['Hindi', 'English']
WHERE Roll No = 1;

- Counter
CREATE TABLE library book(counter value Counter, book_nam
varchar, std_name = 'jeet' and std value = 'Big Data Ads'

Code with Output:

```
cqlsh> CREATE KEYSPACE Student WITH REPLICATION= {'class':'SimpleStrategy','replication_factor':1};
cqlsh> describe keysapces;
'keysapces' not found in keyspaces
cqlsh> describe keyspaces;

student   system       system_distributed  system_traces  system_virtual_schema
students  system_auth  system_schema       system_views

cqlsh> use students;
cqlsh:students> create table st_info(rollno int primary key,name text,doj timestamp,percent double);
cqlsh:students> describe tables;

library_book  st_info  students_info  userlogin

cqlsh:students> describe table<st_info>;
Improper describe command.
cqlsh:students> describe table st_info;

CREATE TABLE students.st_info (
    rollno int PRIMARY KEY,
    doj timestamp,
    name text,
    percent double
) WITH additional_write_policy = '99p'
    AND bloom_filter_fp_chance = 0.01
    AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
    AND cdc = false
    AND comment = ''
    AND compaction = {'class': 'org.apache.cassandra.db.compaction.SizeTieredCompactionStrategy', 'max_threshold': '32', 'min_thr
eshold': '4'}
    AND compression = {'chunk_length_in_kb': '16', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
    AND memtable = 'default'
    AND crc_check_chance = 1.0
    AND default_time_to_live = 0
    AND extensions = {}
    AND gc_grace_seconds = 864000
    AND max_index_interval = 2048
    AND memtable_flush_period_in_ms = 0
    AND min_index_interval = 128
    AND read_repair = 'BLOCKING'
    AND speculative_retry = '99p';
cqlsh:students> begin batch
           ... insert into st_info(rollno,name,doj,percent)
```

```
cqlsh:students> select * from st_info;

 rollno | doj                             | name    | percent
--------+---------------------------------+---------+---------
      1 | 2010-02-28 18:30:00.000000+0000 |  preeti |      90
      2 | 2010-03-19 18:30:00.000000+0000 | prajwal |      89
      4 | 2010-04-22 18:30:00.000000+0000 | rachana |      90

(3 rows)
cqlsh:students> select * from st_info where rollno in(1,2);

 rollno | doj                             | name    | percent
--------+---------------------------------+---------+---------
      1 | 2010-02-28 18:30:00.000000+0000 |  preeti |      90
      2 | 2010-03-19 18:30:00.000000+0000 | prajwal |      89

(2 rows)
cqlsh:students> select  * from st_info where name="preeti";
SyntaxException: line 1:42 no viable alternative at input ';' (...* from st_info where name=["preet]i";)
cqlsh:students> create index on st_info(name);
cqlsh:students> select  * from st_info where name="preeti";
SyntaxException: line 1:42 no viable alternative at input ';' (...* from st_info where name=["preet]i";)
cqlsh:students> select * from st_info where name='preeti';

 rollno | doj                             | name   | percent
--------+---------------------------------+--------+---------
      1 | 2010-02-28 18:30:00.000000+0000 | preeti |      90

(1 rows)
cqlsh:students> select rollno,name,percent from st_info limit 2;

 rollno | name    | percent
--------+---------+---------
      1 |  preeti |      90
      2 | prajwal |      89

(2 rows)
cqlsh:students> slect rollno as usn from st_info;
SyntaxException: line 1:0 no viable alternative at input 'slect' ([slect]...)
cqlsh:students> select rollno as usn from st_info;

 usn
-----
   1
```

```
 usn
-----
   1
   2
   4

(3 rows)
cqlsh:students> create table library(c_val counter,book_name varchar,stud_name varchar,primary key(book_name,stud_name)
cqlsh:students> update library set c_val=c_val+1 where book_name='BDA' and stud_name='preeti';
cqlsh:students> create table userlogin(id int primary key,pass text);
AlreadyExists: Table 'students.userlogin' already exists
cqlsh:students> create table login(id int primary key,pass text);
cqlsh:students> insert into login(id,pass) values(1,'infy')using ttl 30;
cqlsh:students> select ttl(pass) from login where id=1;

 ttl(pass)
-----------
         3
```

Program 3

Perform the following DB operations using Cassandra.

a) Create a keyspace by name Library
b) 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
c) Insert the values into the table in batch
d) Display the details of the table created and increase the value of the counter
e) Write a query to show that a student with id 112 has taken a book “BDA” 2 times.
f) Export the created column to a csv file
g) Import a given csv dataset from local file system into Cassandra column family

Observation:

Lab-5

1. Create a keyspace by name Library.

- Create KeySpace Library with Replication = {'class': 'Simple Strategy', 'replication_factor': 1};

2. Create a column family Library_Info.

- Create table library.library_info(
  Stud_id int Primary Key;
  Stud_Name text,
  Book_name text,
  Book_id int,
  Date_of_issue date
  );

  create table library.Book_Counter(
  stud_id int,
  Book_name text,
  counter_value counter
  PRIMARY KEY(stud_id, Book_Name)

3. Insert the values into the table in batch.

- Begin Batch;
  Insert into library.library_info (Stud_id, stud_name, book_name, Book_id, Date_of_issue) values (112, 'John', 'BDA', 101, 2025-04-06);
  Insert into library.library_info(Stud_id, Stud_name, book_name, Book_id, Date_of_issue) values. (113, 'Alice', 'DBMS', 102, 2025-05-07);
  Apply Batch;

Begin Batch
update library.Book_counter
set counter_value = counter_value +1
where stud_id=112 and Book_name = 'BDA'
update library.Book_counter
set counter_value = countervalue +1
where stud_id=112 and Book_name: 'BDA'
Apply Batch.

4. Display details and increase counter

select * from library.library_info
slect * from library.book_counter

Update library.Bobk_Counter
set counter_value = counter_value +1
where stud_id =112 and Book Name = 'BDA'

5. Write a query to show that a student with ID 112 has taken a book 'BDA' 2 times

select counter_value from library.Book_counter
where stud_id =112 and Book_name ='BDA';

6. Export the created column to a .csv file

copy library.library_info to 'library_info.csv'
~~whe~~ with header = TRUE;

7. Import csv into column family

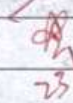
copy library.library_info FROM 'library_info.csv'

with Header= TRUE;

(or)

import csv to cassandra.

copy library.library-info(stud-id, stud-name, book-name, Book-id, Date-of-issue)
from library_info.csv with Header = TRUE.



Code with Output:

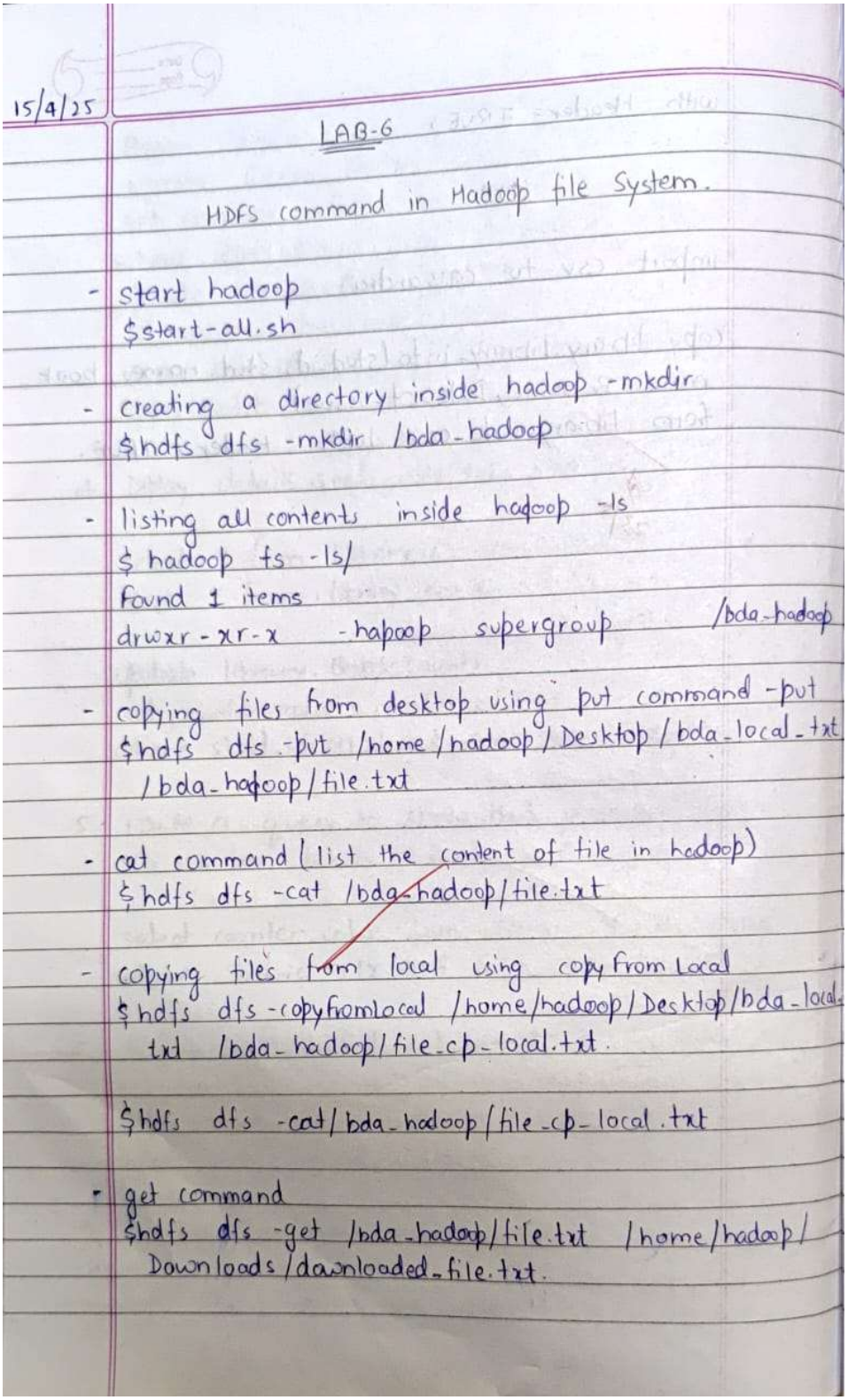
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.8 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace library with replication={'class':'Simplestrategy','replication_factor':1};
ConfigurationException: Unable to find replication strategy class 'org.apache.cassandra.locator.Simplestrategy'
cqlsh> create keyspace library with replication={'class':'Simplestrategy','replication_factor':1};exit
ConfigurationException: Unable to find replication strategy class 'org.apache.cassandra.locator.Simplestrategy'
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.8 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace library with replication={'class':'SimpleStrategy','replication_factor':1};exit
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.8 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace library with replication={'class':'SimpleStrategy','replication_factor':1};
AlreadyExists: Keyspace 'library' already exists
cqlsh> exit
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.8 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace libraries with replication={'class':'SimpleStrategy','replication_factor':1};
cqlsh> keyspaces
   ...
cqlsh> describe keyspaces;

libraries  students     system_distributed  system_views
library    system       system_schema       system_virtual_schema
student    system_auth  system_traces

cqlsh> use libraries;
cqlsh:libraries> create table l_info(sid int primary key, c_val counter, sname varchar,bname varchar,bid int,doi timestamp);
InvalidRequest: Error from server: code=2200 [Invalid query] message="Cannot mix counter and non counter columns in the same tabl
e"
cqlsh:libraries> create table l_info(sid int primary key, sname varchar,bname varchar,bid int,doi timestamp);
cqlsh:libraries> create table count(sid int primary key,c_val counter);
cqlsh:libraries> begin batch
            ... insert into l_info(sid,sname,bname,bid,doi)
            ... values(112,'alice','bda',1,'2020-03-03')
            ... insert into l_info(sid,sname,bname,bid,doi)
            ... values(113,'preeti','cn',2,'2020-03-04')
            ... apply batch;
cqlsh:libraries> update l_info
```

```
cqlsh:libraries> select * from l_info;

 sid | bid | bname | doi                                 | sname
-----+-----+-------+-------------------------------------+--------
 113 |   2 |    cn | 2020-03-03 18:30:00.000000+0000 | preeti
 112 |   1 |   bda | 2020-03-02 18:30:00.000000+0000 |  alice

(2 rows)
cqlsh:libraries> select * from count;

 sid | c_val
-----+-------
 112 |     1

(1 rows)
cqlsh:libraries>
```

Program 4

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

Observation:



15/4/25

LAB-6

HDFS command in Hadoop file System.

- start hadoop
  $start-all.sh
- creating a directory inside hadoop -mkdir
  $hdfs dfs -mkdir /bda_hadoop
- listing all contents inside hadoop -ls
  $ hadoop fs -ls/
  Found 1 items
  drwxr-xr-x - hapoop supergroup /bda_hadoop
- copying files from desktop using put command -put
  $hdfs dfs -put /home/hadoop/Desktop/bda_local_txt /bda_hadoop/file.txt
- cat command (list the content of file in hadoop)
  $hdfs dfs -cat /bda_hadoop/file.txt
- copying files from local using copy from Local
  $hdfs dfs -copyfromlocal /home/hadoop/Desktop/bda_local.txt /bda_hadoop/file_cp_local.txt.

  $hdfs dfs -cat/bda_hadoop/file_cp_local.txt
- get command
  $hdfs dfs -get /bda_hadoop/file.txt /home/hadoop/Downloads/downloaded_file.txt.

$ hdfs dfs -getmerge /bda_hadoop/ /home/hadoop/Downloads/merged_output.txt.

- display Access Control List (ACL) permission of file or directory in HDFS.
$ hadoop fs -getfacl /bda_hadoop/

- copyToLocal
$ hdfs dfs -copyToLocal /bda_hadoop/file.txt /home/hadoop/Desktop

- mv
$ hadoop fs -mv /bda_hadoop /abc
$ hadoop fs -ls /abc

- copy
$ hadoop fs -cp /hello/ /hadoop_lab

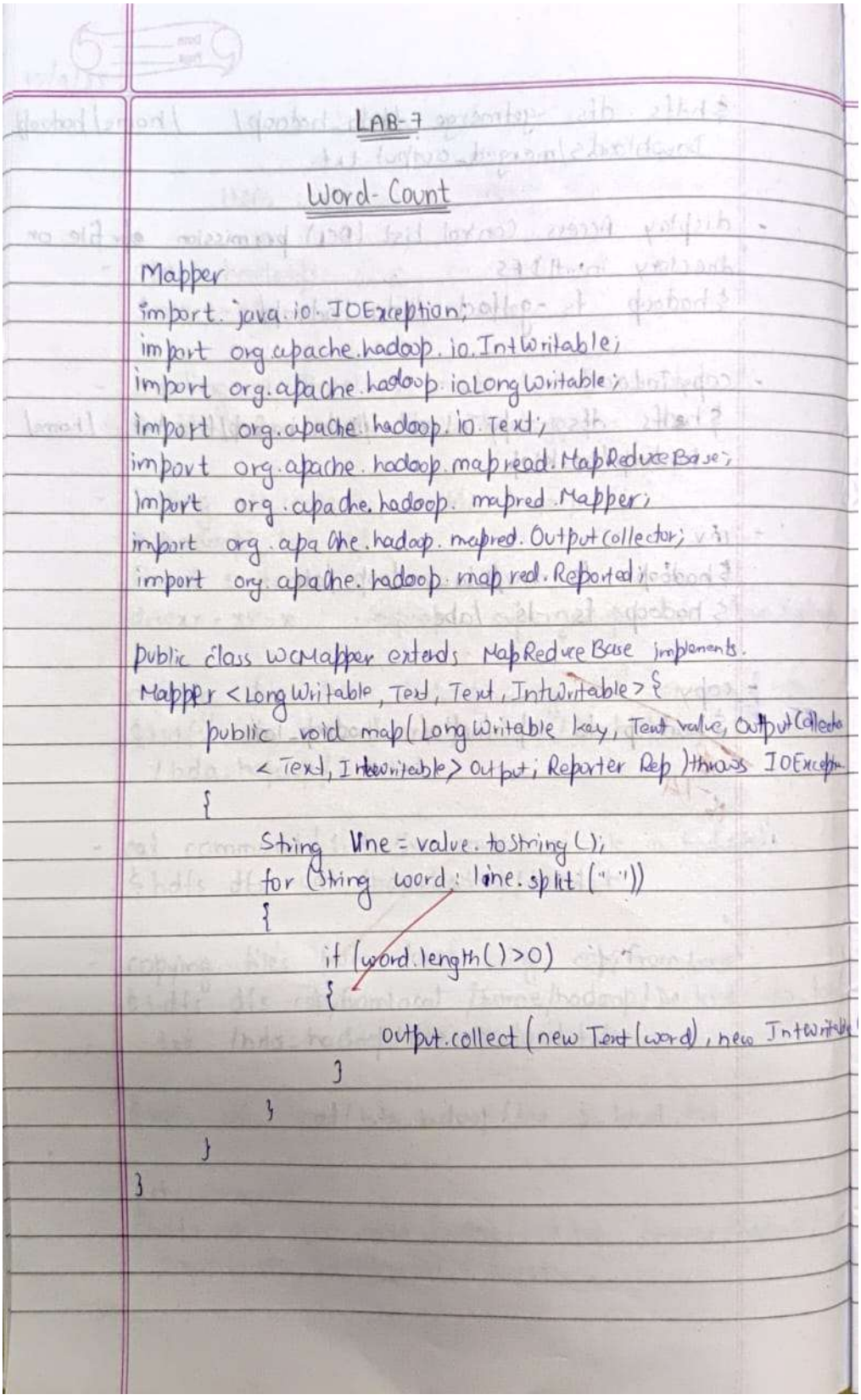
Code with Output:

```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [bmscecse-HP-Elite-Tower-600-G9-Desktop-PC]
Starting resourcemanager
Starting nodemanagers
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -mkdir /bda_hadoop
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -ls /
Found 4 items
drwxr-xr-x   - hadoop supergroup          0 2025-04-15 15:07 /abc
drwxr-xr-x   - hadoop supergroup          0 2025-05-26 14:13 /bda_hadoop
drwxr-xr-x   - hadoop supergroup          0 2025-05-22 16:32 /pqr
drwxr-xr-x   - hadoop supergroup          0 2025-05-20 16:36 /rgs
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -put /home/hadoop/sample.txt /bda_hadoop/file.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/sample.txt /bda_hadoop/local.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/file.txt
hi how are you
how is your job
how is your family
how is your brother
how is your sister
eof
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -get /bda_hadoop/file.txt /home/hadoop/sample.txt
get: `/home/hadoop/sample.txt': File exists
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -get /bda_hadoop/file.txt /home/hadoop/get.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -getfacl /bda_hadoop/
# file: /bda_hadoop
# owner: hadoop
# group: supergroup
user::rwx
group::r-x
other::r-x

hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyToLocal /bda_hadoop/file.txt /home/hadoop/tolocal.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -cp /bda_hadoop /abc
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop fs -ls /abc
Found 3 items
drwxr-xr-x   - hadoop supergroup          0 2025-05-26 14:28 /abc/bda_hadoop
-rw-r--r--   1 hadoop supergroup         55 2025-04-15 15:05 /abc/file.txt
-rw-r--r--   1 hadoop supergroup         55 2025-04-15 15:07 /abc/file_cp_.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$
```

Program 5

Implement Wordcount program on Hadoop framework

Observation:



LAB-7

Word-Count

Mapper

```
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.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>{
    public void map(LongWritable key, Text value, OutputCollecto
        <Text, IntWritable> output, Reporter Rep) throws IOExcepti
    {
        String line = value.toString();
        for (String word : line.split(" "))
        {
            if (word.length()>0)
            {
                output.collect(new Text(word), new IntWritable
            }
        }
    }
}
```

WC Reducer.

```
import java.io.IOExcepher;
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 implement
Reducer<Text, IntWritable, Text, IntWritable>{
    public void reduce(Text key, Iterator<IntWritable>
      value, OutputCollector<Text, IntWritable>outpt,
       Reporter rep) throws IOException
    {
        int count=0;
        while(value.hasNext())
        {
            intWritable i=value.next();
            count+=i.get();
        }
        output.collect(key, new IntWritable(count));
    }
}
```

WCDriver

```
import java.io.IOException;
import org.apache.hadoop.conf.configure;
                    fs.path;
                    io.IntWritable;
                    io.Text;
                    mapred.FileInputFormat;
                    mapred.FileOutputFormat;
                    mapred.JobClient;
                    mapred.JobConf;
                    util.Tool;
                    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;
    }
```

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

23/5

Code with Output:

```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
localhost: namenode is running as process 12082.  Stop it first and ensure /tmp/hadoop-hadoop-namenode.pid file is empty before retry.
Starting datanodes
localhost: datanode is running as process 12255.  Stop it first and ensure /tmp/hadoop-hadoop-datanode.pid file is empty before retry.
Starting secondary namenodes [bmscecse-HP-Elite-Tower-600-G9-Desktop-PC]
bmscecse-HP-Elite-Tower-600-G9-Desktop-PC: secondarynamenode is running as process 12557.  Stop it first and ensure /tmp/hadoop-hadoop-secondarynamenode.pid file is empty before retry.
Starting resourcemanager
resourcemanager is running as process 12845.  Stop it first and ensure /tmp/hadoop-hadoop-resourcemanager.pid file is empty before retry.
Starting nodemanagers
localhost: nodemanager is running as process 13014.  Stop it first and ensure /tmp/hadoop-hadoop-nodemanager.pid file is empty before retry.
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
12082 NameNode
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
17036 Jps
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/sample.txt /bda_hadoop/input.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Desktop/hdpwordcount.jar WCDriver /bda_hadoop/input.txt /bda_hadoop/output
Exception in thread "main" java.lang.ClassNotFoundException: WCDriver
        at java.base/java.net.URLClassLoader.findClass(URLClassLoader.java:476)
        at java.base/java.lang.ClassLoader.loadClass(ClassLoader.java:594)
        at java.base/java.lang.ClassLoader.loadClass(ClassLoader.java:527)
        at java.base/java.lang.Class.forName0(Native Method)
        at java.base/java.lang.Class.forName(Class.java:398)
        at org.apache.hadoop.util.RunJar.run(RunJar.java:321)
        at org.apache.hadoop.util.RunJar.main(RunJar.java:241)
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Desktop/hdpwordcount.jar hdpwordcount.WCDriver /bda_hadoop/input.txt /bda_hadoop/output
2025-05-26 14:40:01,404 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2025-05-26 14:40:01,440 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2025-05-26 14:40:01,440 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2025-05-26 14:40:01,446 WARN impl.MetricsSystemImpl: JobTracker metrics system already initialized!
2025-05-26 14:40:01,501 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2025-05-26 14:40:01,545 INFO mapred.FileInputFormat: Total input files to process : 1
2025-05-26 14:40:01,567 INFO mapreduce.JobSubmitter: number of splits:1
2025-05-26 14:40:01,624 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local276129153_0001
2025-05-26 14:40:01,624 INFO mapreduce.JobSubmitter: Executing with tokens: []
2025-05-26 14:40:01,677 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2025-05-26 14:40:01,679 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2025-05-26 14:40:01,679 INFO mapreduce.Job: Running job: job_local276129153_0001
2025-05-26 14:40:01,680 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapred.FileOutputCommitter
2025-05-26 14:40:01,682 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:40:01,682 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:false, ign
```

```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -ls /bda_hadoop/output
Found 2 items
-rw-r--r--   1 hadoop supergroup          0 2025-05-26 14:40 /bda_hadoop/output/_SUCCESS
-rw-r--r--   1 hadoop supergroup         75 2025-05-26 14:40 /bda_hadoop/output/part-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/output/part-00000
are     1
brother 1
eof     1
family  1
hi      1
how     5
is      4
job     1
sister  1
you     1
your    4
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$
```

Program 6

From the following link extract the weather data

https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all

a) Create a MapReduce program to find average temperature for each year from the NCDC data set.

b) find the mean max temperature for every month

Observation:

Code with Output:

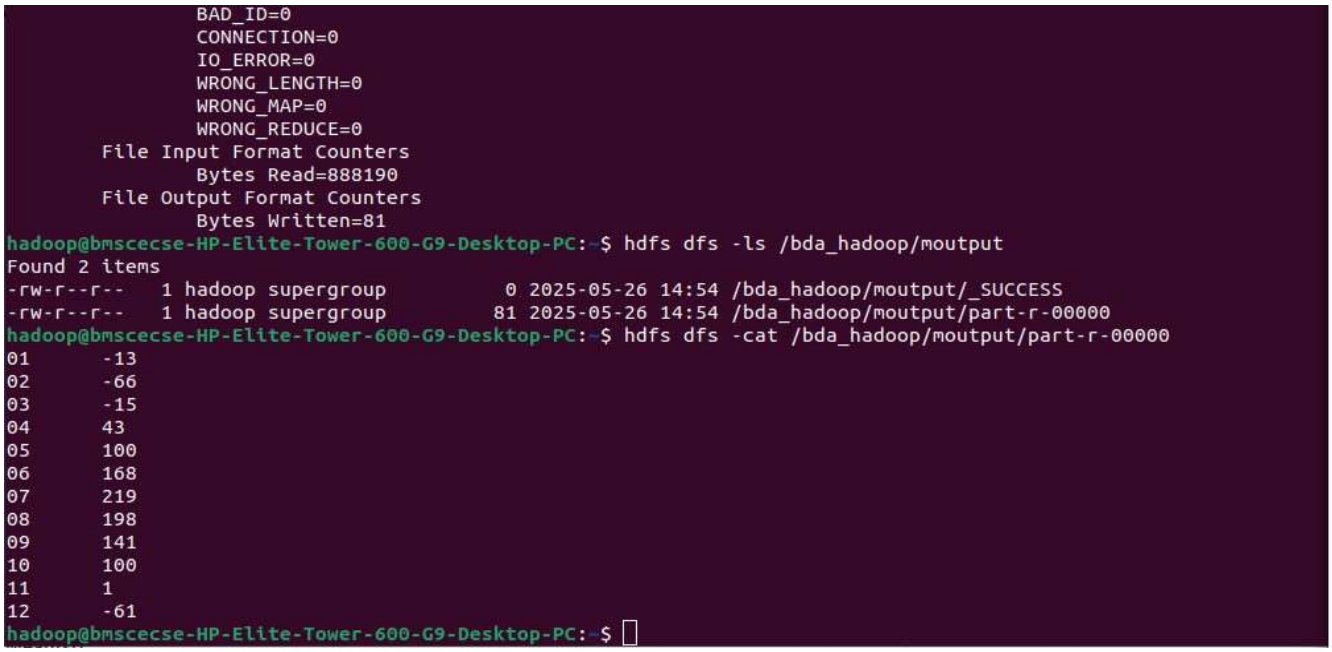
a) Average temperature

```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
12082 NameNode
17908 Jps
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/Downloads/1901 /bda_hadoop/avinput.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Desktop/WeatherAverage.jar WeatherAverage.AVDriver /bda_h
adoop/avinput.txt /bda_hadoop/avoutput
2025-05-26 14:49:09,290 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2025-05-26 14:49:09,327 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2025-05-26 14:49:09,327 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2025-05-26 14:49:09,380 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool inte
rface and execute your application with ToolRunner to remedy this.
2025-05-26 14:49:09,427 INFO input.FileInputFormat: Total input files to process : 1
2025-05-26 14:49:09,452 INFO mapreduce.JobSubmitter: number of splits:1
2025-05-26 14:49:09,510 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1313646497_0001
2025-05-26 14:49:09,510 INFO mapreduce.JobSubmitter: Executing with tokens: []
2025-05-26 14:49:09,566 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2025-05-26 14:49:09,566 INFO mapreduce.Job: Running job: job_local1313646497_0001
2025-05-26 14:49:09,567 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2025-05-26 14:49:09,570 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting to FileOutputCommitte
rFactory
2025-05-26 14:49:09,571 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:49:09,571 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:f
alse, ignore cleanup failures: false
2025-05-26 14:49:09,571 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.FileOutputCommitter
2025-05-26 14:49:09,620 INFO mapred.LocalJobRunner: Waiting for map tasks
2025-05-26 14:49:09,620 INFO mapred.LocalJobRunner: Starting task: attempt_local1313646497_0001_m_000000_0
2025-05-26 14:49:09,629 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting to FileOutputCommitte
rFactory
2025-05-26 14:49:09,629 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:49:09,629 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders under output directory:f
alse, ignore cleanup failures: false
2025-05-26 14:49:09,635 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
2025-05-26 14:49:09,637 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/bda_hadoop/avinput.txt:0+888190
2025-05-26 14:49:09,666 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
2025-05-26 14:49:09,666 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2025-05-26 14:49:09,666 INFO mapred.MapTask: soft limit at 83886080
2025-05-26 14:49:09,666 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2025-05-26 14:49:09,666 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2025-05-26 14:49:09,668 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapOutputBuffer
2025-05-26 14:49:09,730 INFO mapred.LocalJobRunner:
2025-05-26 14:49:09,731 INFO mapred.MapTask: Starting flush of map output
2025-05-26 14:49:09,731 INFO mapred.MapTask: Spilling map output
2025-05-26 14:49:09,731 INFO mapred.MapTask: bufstart = 0; bufend = 59076; bufvoid = 104857600
2025-05-26 14:49:09,731 INFO mapred.MapTask: kvstart = 26214396(104857584); kvend = 26188144(104752576); length = 26253/6553600
2025-05-26 14:49:09,739 INFO mapred.MapTask: Finished spill 0
2025-05-26 14:49:09,743 INFO mapred.Task: Task:attempt_local1313646497_0001_m_000000_0 is done. And is in the process of committing
2025-05-26 14:49:09,745 INFO mapred.LocalJobRunner: map
```

```
                Merged Map outputs=1
                GC time elapsed (ms)=0
                Total committed heap usage (bytes)=1052770304
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=888190
        File Output Format Counters
                Bytes Written=8
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -ls /bda_hadoop/avoutput
Found 2 items
-rw-r--r--   1 hadoop supergroup          0 2025-05-26 14:49 /bda_hadoop/avoutput/_SUCCESS
-rw-r--r--   1 hadoop supergroup          8 2025-05-26 14:49 /bda_hadoop/avoutput/part-r-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/avoutput/part-r-00000
1901    46
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$
```

b) Maximum temperature

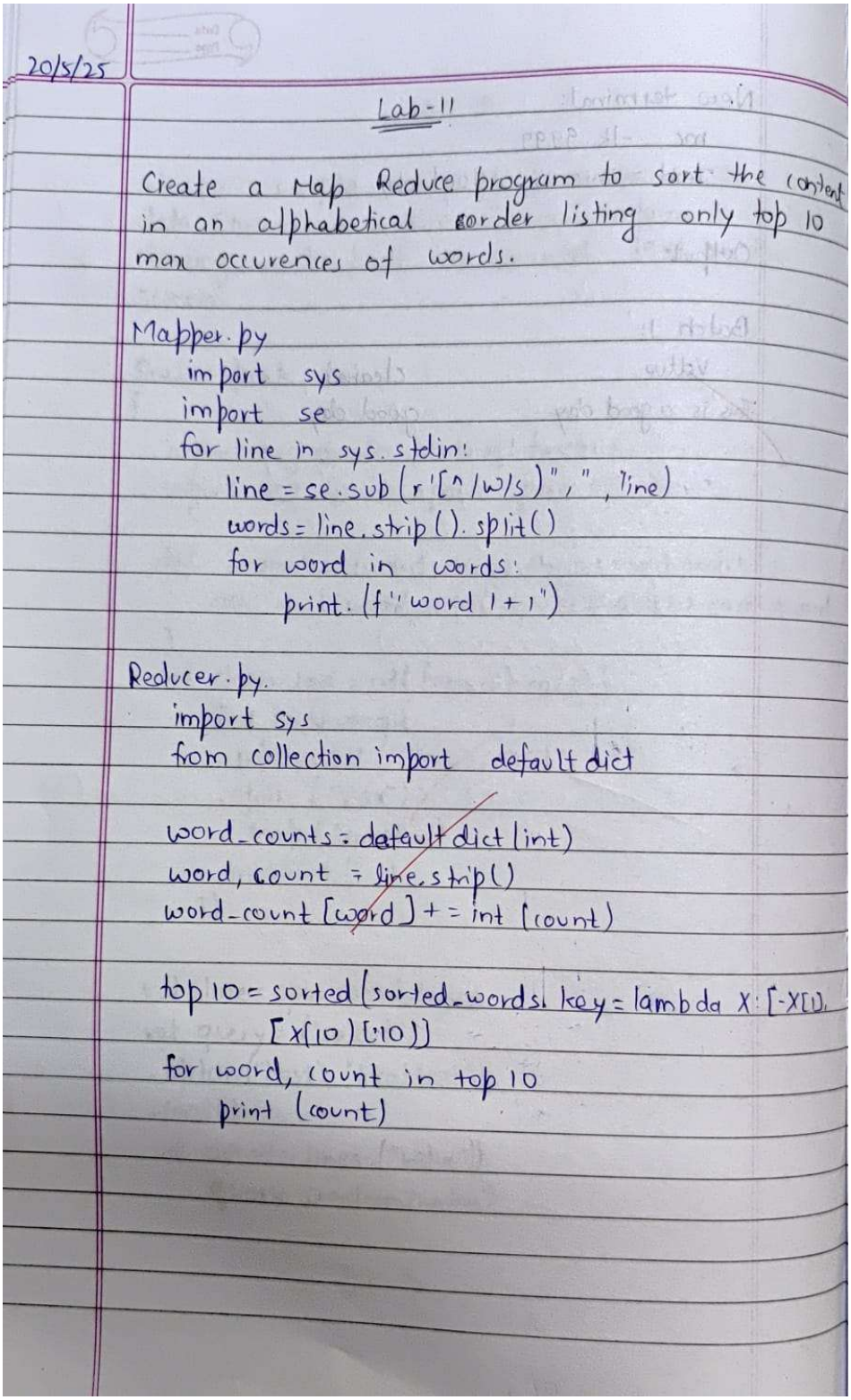
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
18721 Jps
12082 NameNode
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/Downloads/1901 /bda_ha
doop/minput.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Desktop/meanTemp.jar Mean.MNDriver
/bda_hadoop/minput.txt /bda_hadoop/moutput
2025-05-26 14:54:41,993 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2025-05-26 14:54:42,029 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2025-05-26 14:54:42,029 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2025-05-26 14:54:42,083 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. I
mplement the Tool interface and execute your application with ToolRunner to remedy this.
2025-05-26 14:54:42,131 INFO input.FileInputFormat: Total input files to process : 1
2025-05-26 14:54:42,158 INFO mapreduce.JobSubmitter: number of splits:1
2025-05-26 14:54:42,216 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local862196817_0001
2025-05-26 14:54:42,216 INFO mapreduce.JobSubmitter: Executing with tokens: []
2025-05-26 14:54:42,272 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2025-05-26 14:54:42,273 INFO mapreduce.Job: Running job: job_local862196817_0001
2025-05-26 14:54:42,273 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2025-05-26 14:54:42,276 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting
 to FileOutputCommitterFactory
2025-05-26 14:54:42,277 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:54:42,277 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders un
der output directory:false, ignore cleanup failures: false
2025-05-26 14:54:42,277 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.F
ileOutputCommitter
2025-05-26 14:54:42,319 INFO mapred.LocalJobRunner: Waiting for map tasks
2025-05-26 14:54:42,319 INFO mapred.LocalJobRunner: Starting task: attempt_local862196817_0001_m_000000_0
2025-05-26 14:54:42,328 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting
 to FileOutputCommitterFactory
2025-05-26 14:54:42,329 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:54:42,329 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders un
der output directory:false, ignore cleanup failures: false
2025-05-26 14:54:42,335 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
2025-05-26 14:54:42,336 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/bda_hadoop/minput.txt:0+88
8190
2025-05-26 14:54:42,366 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
2025-05-26 14:54:42,366 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2025-05-26 14:54:42,366 INFO mapred.MapTask: soft limit at 83886080
2025-05-26 14:54:42,366 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2025-05-26 14:54:42,366 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2025-05-26 14:54:42,368 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapO
utputBuffer
2025-05-26 14:54:42,428 INFO mapred.LocalJobRunner:
2025-05-26 14:54:42,428 INFO mapred.MapTask: Starting flush of map output
2025-05-26 14:54:42,429 INFO mapred.MapTask: Spilling map output
2025-05-26 14:54:42,429 INFO mapred.MapTask: bufstart = 0; bufend = 45948; bufvoid = 104857600
```


BAD_ID=0
CONNECTION=0
IO_ERROR=0
WRONG_LENGTH=0
WRONG_MAP=0
WRONG_REDUCE=0
File Input Format Counters
Bytes Read=888190
File Output Format Counters
Bytes Written=81
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -ls /bda_hadoop/moutput
Found 2 items
-rw-r--r-- 1 hadoop supergroup 0 2025-05-26 14:54 /bda_hadoop/moutput/_SUCCESS
-rw-r--r-- 1 hadoop supergroup 81 2025-05-26 14:54 /bda_hadoop/moutput/part-r-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/moutput/part-r-00000
01 -13
02 -66
03 -15
04 43
05 100
06 168
07 219
08 198
09 141
10 100
11 1
12 -61
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$

Program 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.

Observation:



20/5/25

Lab-11

Create a Map Reduce program to sort the content in an alphabetical order listing only top 10 max occurences of words.

Mapper.py

```
import sys
import re
for line in sys.stdin:
    line = re.sub(r'[^\w\s]', '', line)
    words = line.strip().split()
    for word in words:
        print(f"{word}\t1")
```

Reducer.py

```
import sys
from collection import defaultdict

word_counts = defaultdict(int)
word, count = line.strip()
word_count[word] += int(count)

top10 = sorted(sorted_words, key = lambda x: [-x[1],
        [x[10][:10]])
for word, count in top10
    print(count)
```

Output:
apple : 34
code : 25
dots : 23
file : 21
hadoop: 20
text : 17
zebra : 25

23/5/25

Code with Output:

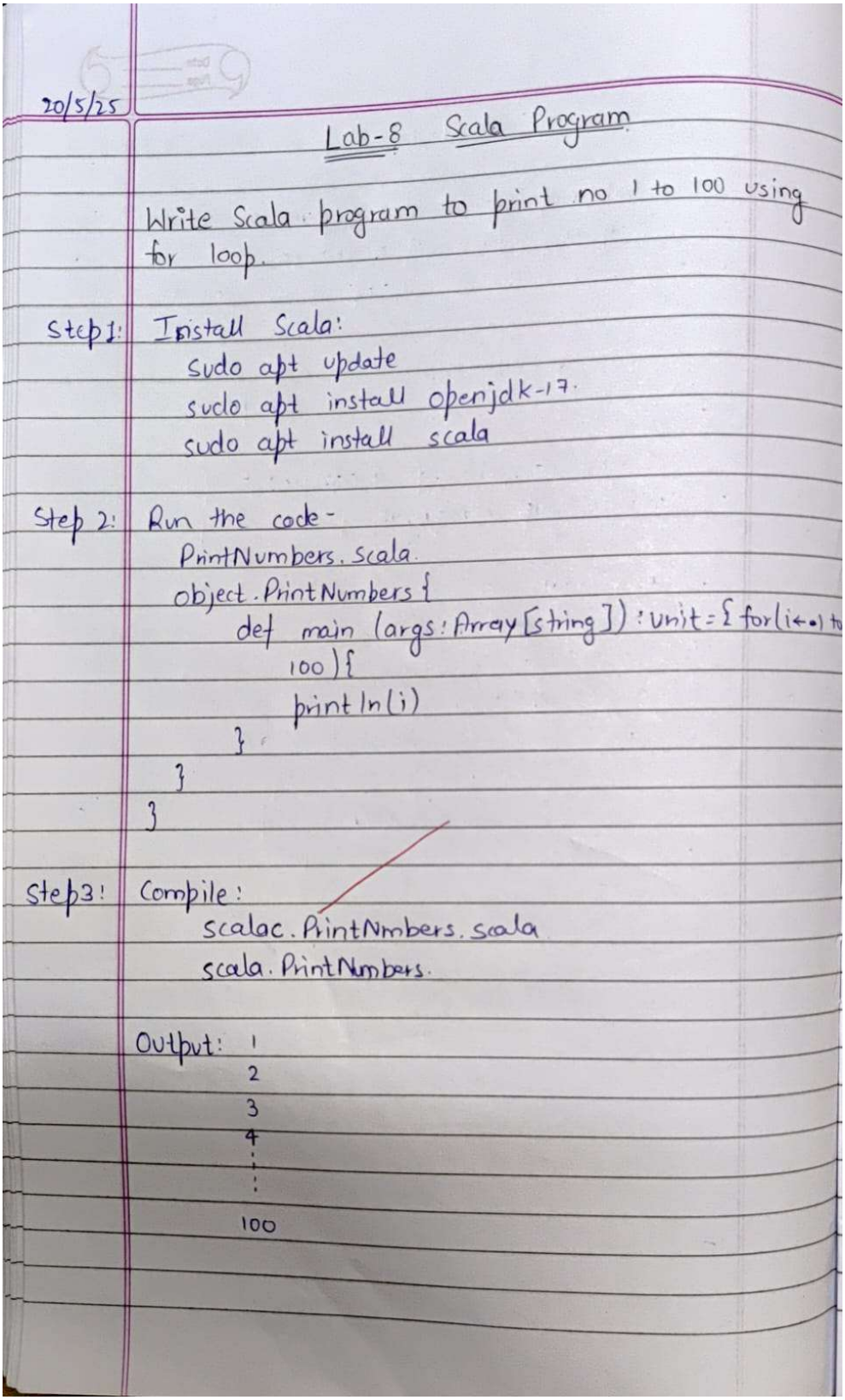
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
12082 NameNode
19238 Jps
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/Desktop/TopN.txt /bda_
haoop/tinput.txt
copyFromLocal: `/bda_haoop/tinput.txt': No such file or directory: `hdfs://localhost:9000/bda_haoop/tinput.txt'
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /home/hadoop/Desktop/TopN.txt /bda_
hadoop/tinput.txt
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hadoop jar /home/hadoop/Desktop/TopN.jar TopN.TNDriver /bda
_hadoop/tinput.txt /bda_hadoop/toutput
2025-05-26 14:59:03,334 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2025-05-26 14:59:03,372 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2025-05-26 14:59:03,372 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2025-05-26 14:59:03,426 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. I
mplement the Tool interface and execute your application with ToolRunner to remedy this.
2025-05-26 14:59:03,472 INFO input.FileInputFormat: Total input files to process : 1
2025-05-26 14:59:03,497 INFO mapreduce.JobSubmitter: number of splits:1
2025-05-26 14:59:03,554 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_local1824101299_0001
2025-05-26 14:59:03,554 INFO mapreduce.JobSubmitter: Executing with tokens: []
2025-05-26 14:59:03,609 INFO mapreduce.Job: The url to track the job: http://localhost:8080/
2025-05-26 14:59:03,610 INFO mapreduce.Job: Running job: job_local1824101299_0001
2025-05-26 14:59:03,610 INFO mapred.LocalJobRunner: OutputCommitter set in config null
2025-05-26 14:59:03,614 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting
 to FileOutputCommitterFactory
2025-05-26 14:59:03,614 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:59:03,614 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders un
der output directory:false, ignore cleanup failures: false
2025-05-26 14:59:03,614 INFO mapred.LocalJobRunner: OutputCommitter is org.apache.hadoop.mapreduce.lib.output.F
ileOutputCommitter
2025-05-26 14:59:03,654 INFO mapred.LocalJobRunner: Waiting for map tasks
2025-05-26 14:59:03,655 INFO mapred.LocalJobRunner: Starting task: attempt_local1824101299_0001_m_000000_0
2025-05-26 14:59:03,664 INFO output.PathOutputCommitterFactory: No output committer factory defined, defaulting
 to FileOutputCommitterFactory
2025-05-26 14:59:03,664 INFO output.FileOutputCommitter: File Output Committer Algorithm version is 2
2025-05-26 14:59:03,664 INFO output.FileOutputCommitter: FileOutputCommitter skip cleanup _temporary folders un
der output directory:false, ignore cleanup failures: false
2025-05-26 14:59:03,670 INFO mapred.Task:  Using ResourceCalculatorProcessTree : [ ]
2025-05-26 14:59:03,672 INFO mapred.MapTask: Processing split: hdfs://localhost:9000/bda_hadoop/tinput.txt:0+95
2025-05-26 14:59:03,701 INFO mapred.MapTask: (EQUATOR) 0 kvi 26214396(104857584)
2025-05-26 14:59:03,701 INFO mapred.MapTask: mapreduce.task.io.sort.mb: 100
2025-05-26 14:59:03,701 INFO mapred.MapTask: soft limit at 83886080
2025-05-26 14:59:03,701 INFO mapred.MapTask: bufstart = 0; bufvoid = 104857600
2025-05-26 14:59:03,701 INFO mapred.MapTask: kvstart = 26214396; length = 6553600
2025-05-26 14:59:03,702 INFO mapred.MapTask: Map output collector class = org.apache.hadoop.mapred.MapTask$MapO
utputBuffer
2025-05-26 14:59:03,738 INFO mapred.LocalJobRunner:
2025-05-26 14:59:03,739 INFO mapred.MapTask: Starting flush of map output
```

```
        File System Counters
                FILE: Number of bytes read=10682
                FILE: Number of bytes written=1291808
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=190
                HDFS: Number of bytes written=40
                HDFS: Number of read operations=15
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=4
                HDFS: Number of bytes read erasure-coded=0
        Map-Reduce Framework
                Map input records=3
                Map output records=15
                Map output bytes=154
                Map output materialized bytes=190
                Input split bytes=108
                Combine input records=0
                Combine output records=0
                Reduce input groups=5
                Reduce shuffle bytes=190
                Reduce input records=15
                Reduce output records=5
                Spilled Records=30
                Shuffled Maps =1
                Failed Shuffles=0
                Merged Map outputs=1
                GC time elapsed (ms)=0
                Total committed heap usage (bytes)=1052770304
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=95
        File Output Format Counters
                Bytes Written=40
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -ls /bda_hadoop/toutput
Found 2 items
-rw-r--r--   1 hadoop supergroup          0 2025-05-26 14:59 /bda_hadoop/toutput/_SUCCESS
-rw-r--r--   1 hadoop supergroup         40 2025-05-26 14:59 /bda_hadoop/toutput/part-r-00000
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -cat /bda_hadoop/toutput/part-r-00000
banana  5
apple   4
fruit   3
mango   2
kiwi    1
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$
```

Program 8

Write a Scala program to print numbers from 1 to 100 using for loop.

Observation:



20/5/25

Lab-8 Scala Program

Write Scala program to print no 1 to 100 using for loop.

Step 1: Install Scala:

```
sudo apt update
sudo apt install openjdk-17.
sudo apt install scala
```

Step 2: Run the code -

PrintNumbers.scala

```
object PrintNumbers {
    def main (args: Array[String]): Unit = { for(i<-1 to
        100){
        println(i)
    }
  }
}
```

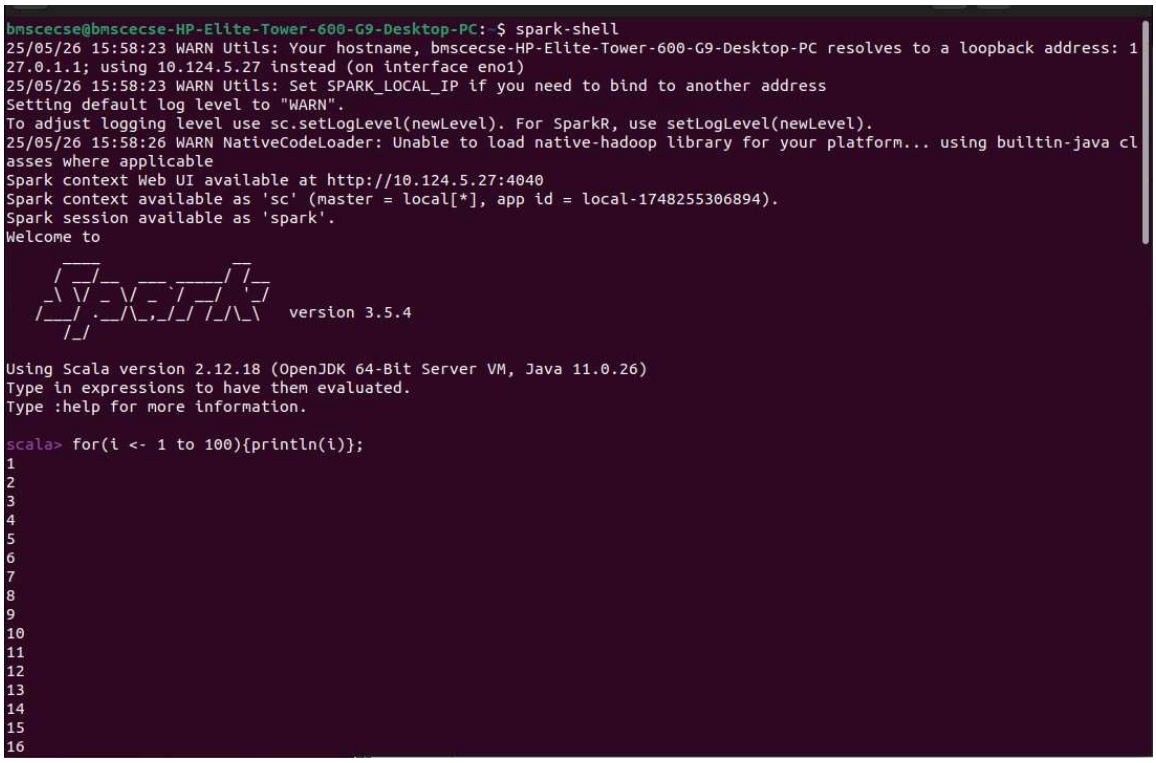
Step 3: Compile:

```
scalac PrintNmbers.scala
scala PrintNumbers
```

Output:

```
1
2
3
4
:
:
100
```

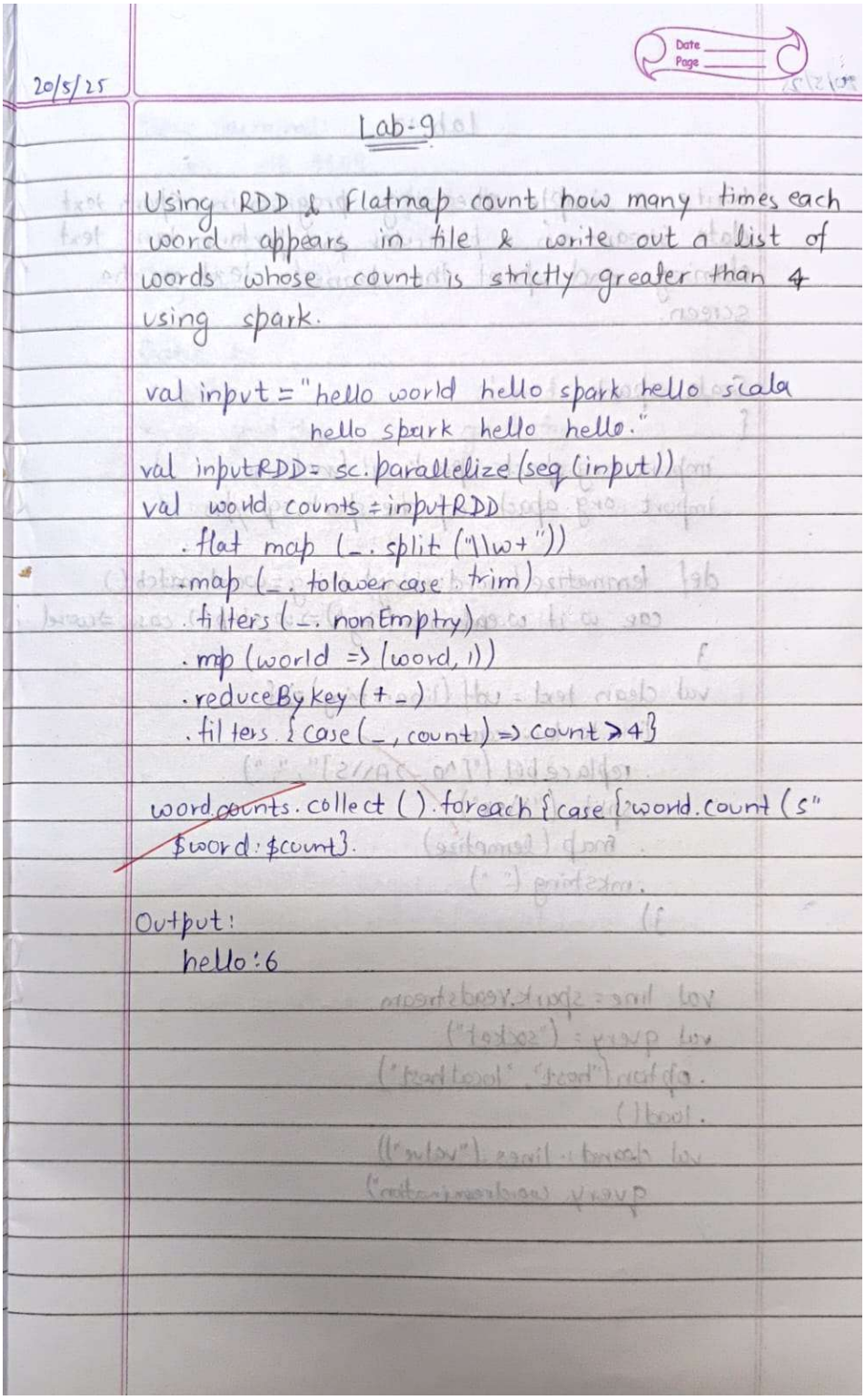
Code with Output:



Program 9

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

Observation:



20/5/25

Lab-9

Using RDD & flatmap count how many times each word appears in file & write out a list of words whose count is strictly greater than 4 using spark.

```
val input = "hello world hello spark hello scala
             hello spark hello hello."
val inputRDD = sc.parallelize(seq(input))
val word counts = inputRDD
  .flat map (_.split("\\w+"))
  .map(_.tolowercase.trim)
  .filters(_.nonEmptry)
  .mp(world => (word, 1))
  .reduceByKey(+_)
  .filters.{case(_, count) => count > 4}

word counts.collect().foreach{case{(word.count(s"
$word: $count}.
```

Output:

hello: 6

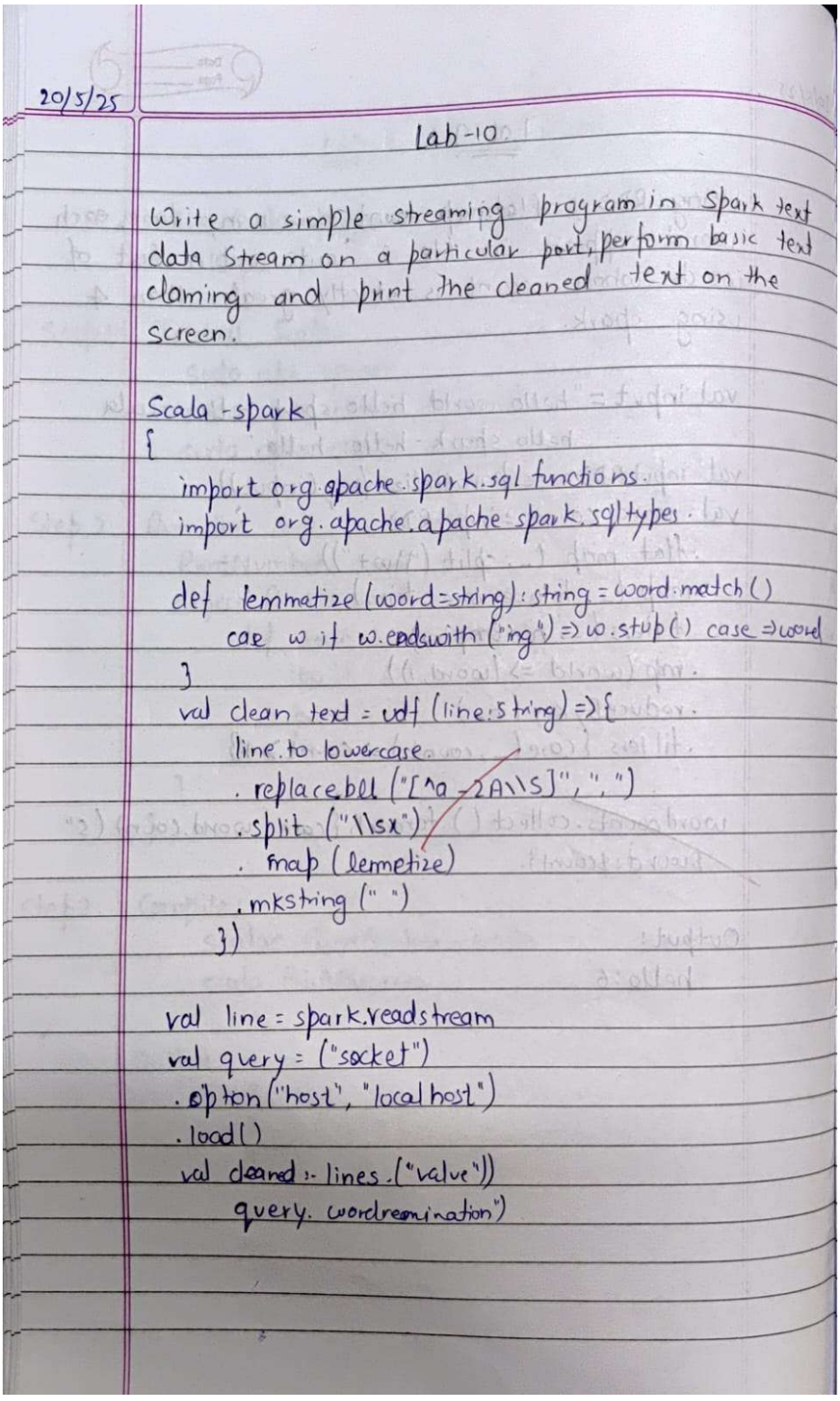
Code with Output:

```
bmscecse@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ echo "code code code code code spark spark spark spark spark hell
o hello hi hi joe ken">input.txt
bmscecse@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ spark-shell
25/05/26 16:01:15 WARN Utils: Your hostname, bmscecse-HP-Elite-Tower-600-G9-Desktop-PC resolves to a loopback address:
127.0.1.1; using 10.124.5.27 instead (on interface eno1)
25/05/26 16:01:15 WARN Utils: Set SPARK_LOCAL_IP if you need to bind to another address
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
25/05/26 16:01:17 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java c
lasses where applicable
Spark context Web UI available at http://10.124.5.27:4040
Spark context available as 'sc' (master = local[*], app id = local-1748255477930).
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 3.5.4
      /_/

Using Scala version 2.12.18 (OpenJDK 64-Bit Server VM, Java 11.0.26)
Type in expressions to have them evaluated.
Type :help for more information.

scala> val lines=sc.textFile("input.txt")
lines: org.apache.spark.rdd.RDD[String] = input.txt MapPartitionsRDD[1] at textFile at <console>:23

scala> val words=lines.flatmap(line => line.split(" "))
<console>:23: error: value flatmap is not a member of org.apache.spark.rdd.RDD[String]
       val words=lines.flatmap(line => line.split(" "))
                       ^

scala> val words=lines.flatMap(line => line.split(" "))
words: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[2] at flatMap at <console>:23

scala> val wordParts = words.map(word => (word,1))
wordParts: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[3] at map at <console>:23

scala> val wordcount = wordParts.reduceByKey(_+_)
wordcount: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[4] at reduceByKey at <console>:23

scala> val freq = wordcount.filter {case (word,count) => count > 4}
freq: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[5] at filter at <console>:23

scala> freq.collect().foreach(println)
(spark,5)
(code,5)

scala>
```

Program 10

Write a simple streaming program in Spark to receive text data streams on a particular port, perform basic text cleaning (like white space removal, stop words removal, lemmatization, etc.), and print the cleaned text on the screen. (Open Ended Question).

Observation:



20/5/25

Lab-10

Write a simple streaming program in Spark text data stream on a particular port, perform basic text claming and print the cleaned text on the screen.

```
Scala -spark
{
  import org.apache.spark.sql functions.
  import org.apache.apache spark.sql types.

  def lemmatize (word=string): string = word.match()
     case w if w.endswith ("ing") => w.stup() case => word
  }
  val clean text = udf (line:string) => {
     line.to lowercase
     . replaceAll ("[^a-zA\\s]", "")
     .split ("\\sx")
     . map (lemetize)
     .mkstring (" ")
    })

  val line = spark.readstream
  val query = ("socket")
  .option("host", "localhost")
  .load()
  val cleaned :- lines.("value"))
     query. wordreamination")
```

New terminal:

mc -lk.9999

Text = This is a good day.

Output:

Batch 1:

Value	cleaned
This is a good day	good day.