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)
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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 **Ranjan Devi (1BM22CS219),** who is bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2024. The Lab report has been approved as it satisfies the academic requirements in respect of **Big Data Analytics –(23CS6PCBDA)** work prescribed for the said degree.

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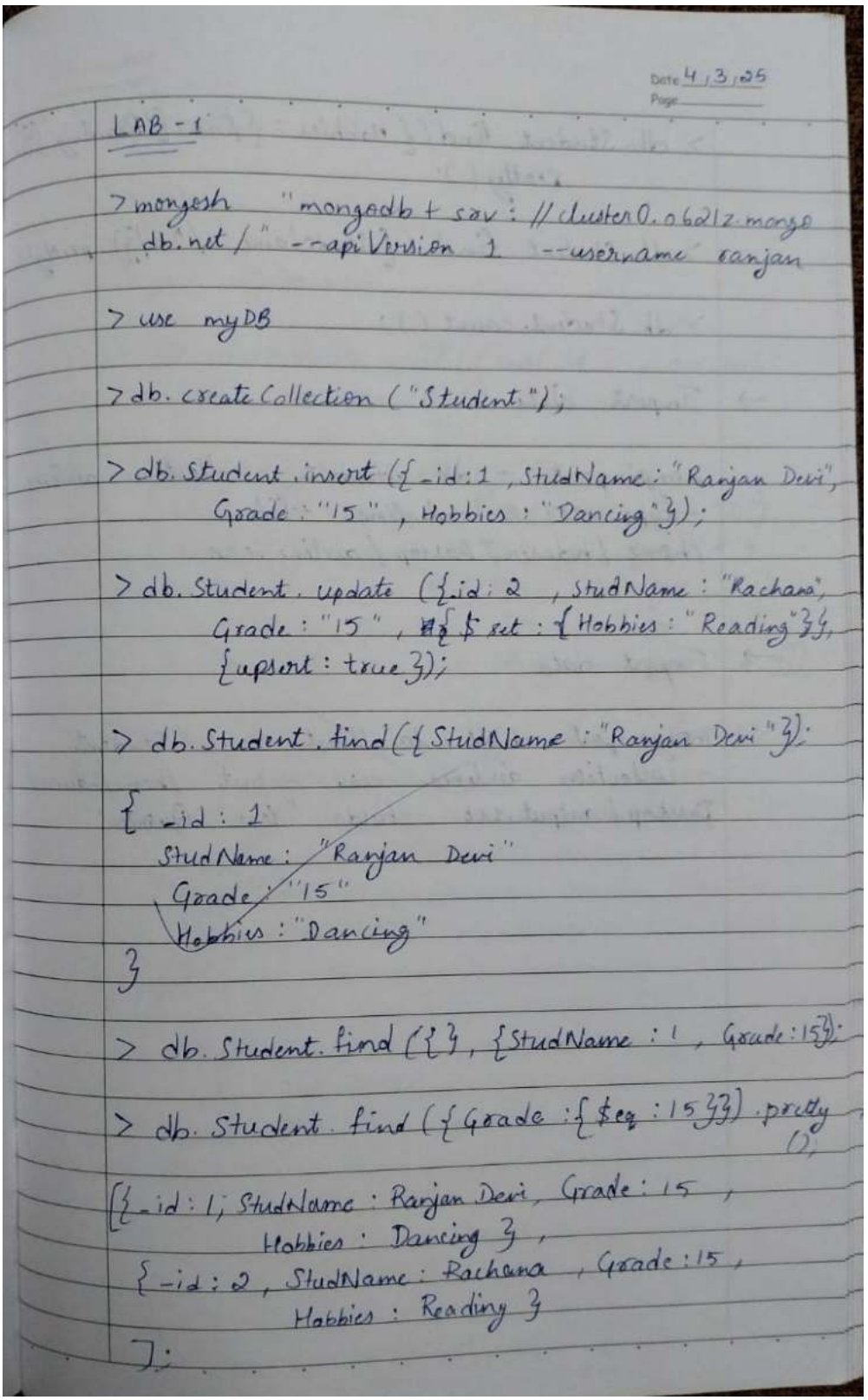
Github Link: https://github.com/ranjandevi219/BDA.git

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:



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LAB - 1

> mongosh "mongodb+srv://cluster0.o62lz.mongodb.net/" --apiVersion 1 --username ranjan

> use myDB

> db.createCollection("Student");

> db.Student.insert({_id:1, StudName: "Ranjan Devi", Grade: "15", Hobbies: "Dancing"});

> db.Student.update({_id: 2, StudName: "Rachana", Grade: "15", $set: {Hobbies: "Reading"}}, {upsert: true});

> db.Student.find({StudName: "Ranjan Devi"});

{
_id: 1
StudName: "Ranjan Devi"
Grade: "15"
Hobbies: "Dancing"
}

> db.Student.find({}, {StudName: 1, Grade: 15});

> db.Student.find({Grade: {$eq: 15}}).pretty();

[{_id: 1, StudName: Ranjan Devi, Grade: 15, Hobbies: Dancing},
{_id: 2, StudName: Rachana, Grade: 15, Hobbies: Reading}
];

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

(2) E-commerce platform.

```
> db.createCollection("Products");

> db.Products.insertMany([
  {product_id:"12345", name:"Smartphone",
  category:"Electronics", price:299.99, quantity:50,
  "  "  "  "
  "  "  "  "
]);

> db.createCollection("Users");

> db.Users.insertMany([
  {user_id:"789gh", name:"John",
  email:"john.doe@email.com", cart:[
  {product_id:"12345", quantity:2},
  {product_id:"23456", quantity:1}
  ], orders:[{order_id:"order123",
  order_date:ISODate("  "),
  "  "  "
  "  "  "
  "  "  "
},
]);
```

> db.createCollection("Orders");

```
>db.Orders.insertMany([
  { order_id: "order123",
    user_id: "789ghi",
    order_date: ISODate(" ");
    products: [{
      product_id: "12345", quantity: 1,
          price: 299.99},
    {product_id: "23456", quantity: 2,
          price: 49.99}],
    total_price: 399.97
}]);
```

→ Retrieve all products
```
>db.Products.find();
```

→ Retrieve products in specific category
```
>db.Products.find({category: "Electronics"});
```

→ Retrive products quantity greater than 0.
```
>db.Products.find({quantity: {$gt: 0}});
```

→ Retrieve sorted by price
```
>db.Products.find({}).sort({price:1});
```

→ Retrive price less than or equal to 100.
```
>db.Products.find({price: {$lte: 100}});
```

→
```
>db.Users.find({user_id: "123abc"},
          {orders:1});
```

→ Retrieve total price of orders placed by User.

```
db.Users.aggregate([{
  $match: { user_id: "123abc" }},
  { $unwind: "$orders" },
  { $group: { _id: "$user_id",
    totalprice: { $sum: "$orders.total_price" }
  }}]);
```

→ Calculate total number of products in each category.

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

OUTPUT:

```
[{ _id: 'Footwear', total: 1},
  { _id: 'Electronics', total: 3},
  { _id: 'Clothing', total: 1}
];
```

→ Calculate total price of products in each category

```
db.Products.aggregate([{$group: { _id:
"$category", total_price: { $sum: { $multiply:
["$price", "$quantity"] }}}
```

→ Find average price of products

```
db.Products.aggregate([{$group:{_id:null,
  average_price:{$avg:"$price"}}}]);
```

→ Find products with quantity less than 10.

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

→ Sort products by Price in Descending Order

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

→ Calculate Total Price of Orders Placed by each user.

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

→ Find average total price of orders

```
db.Orders.aggregate([{$group:{_id:null,
  average_order_price:{$avg:"total_price"}}}]);
```

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'}}},{$mat$

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:

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CASANDRA :

```
create keyspace ;

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

Describe keyspaces ;

select * from system_schema.keyspaces ;

Use students ;

create table students_info (Roll_No int
  primary key , studname text , dob timestamp,
  last_exam_perc double);

describe tables ;

describe tables student_info ;
```

CRUD

```
Begin Batch
insert into students_info (Rollno , studname ,
    dob , last_exam_perc)
  values (1, 'Asha', '2012-03-12', 79.9)

insert into students_info (Rollno , studname , dob,
    last_exam_perc)
  values (2, 'Kiran', '2012-03-12', 89.9)
insert into students_info (Rollno , studname , dob,
    last_exam_perc)
```

values (3, 'Tarun', '2012-03-12', 78.9)

Apply Batch;

select * from students-info;

→

Roll_no	dob	last_exam_perc	studname
1	2012-03-12	79.9	Asha
2	2012-03-12	89.9	Kiran
3	2012-03-12	78.9	Tarun

select * from students-info where Rollno in (1, 2);

select * from students-info where studname = 'Asha';

create index on students-info (studname);

select Rollno, studname from students-info limit 2;

select Rollno as "USN" from students-info;

→

USN
1
2
3

update students-info set studname = 'David' where Rollno = 2;

delete last_exam-perc from students-info where Rollno = 2;

alter table students_info add hobby set <text>;

update students_info
set hobby = hobby + {"chess", "tennis"}
where RollNo = 1;

create table library (counter_value = counter_value + 1 where book_name = 'BDA' and studname = 'Jeet';

2); create table user login (id int primary key, pss text);

'); insert into userlogin (id, pss) values (1, 'infy') using TTL 30;

2; select TTL (pss) from userlogin where id = 1;

→ TTL (pss)
28

→ RollNo dob hobby language last_exam_perc
1 2012-03-11 {chess, tennis} null 79.9

→ studname
Asha

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:

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CASSANDRA 2

:$ cqlsh

```
> create table Library_Info (
      Stud_Id INT, Stud_Name TEXT,
    Book_Name TEXT, Book_Id INT,
    Date_of_Issue DATE,
    PRIMARY KEY (Stud_ID, Book_Id));

>create table Library_Counter (
        Stud_Id INT PRIMARY KEY,
        Counter_value COUNTER
    );

> Begin UNLOGGED BATCH
    UPDATE Library_Counter
    SET Counter_value = Counter_value + 1
    WHERE Stud_Id = 101;

    UPDATE Library_Counter
    SET counter_value = Counter_value + 1
    WHERE Stud_Id = 102;
    APPLY BATCH;

> Begin UNLOGGED BATCH
    INSERT into Library_Info (Stud_Id, Stud_Name
      Book_Name, Book_Id, Date_of_Issue)
    VALUES (101, 'Alice', 'The Great Gatsby',
        501, '2025-04-10');

    INSERT into Library_Info (Stud_Id, Stud_Name
      Book_Name, Book_Id, Date_of_Issue)
```

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```
VALUES (102, 'Bob', '1984', 502,
        '2025-04-11');
APPLY BATCH;
```

> SELECT * FROM Library_Info;

Stud_id	book_id	Stud_name	book_name	date
101	501	Alice	The Great Gatsby	2025-04-10
102	502	Bob	1984	2025-04-11

> select * FROM Library_Counter;

Stud_id	counter_value
101	1
102	1

> COPY Library_Info TO 'library_info.csv'
WITH HEADER = true;

Using 16 CHILD Processes
4 rows exported to 1 files in 0.100 seconds.

S. Pradeep
11/4/25

Code with Output:

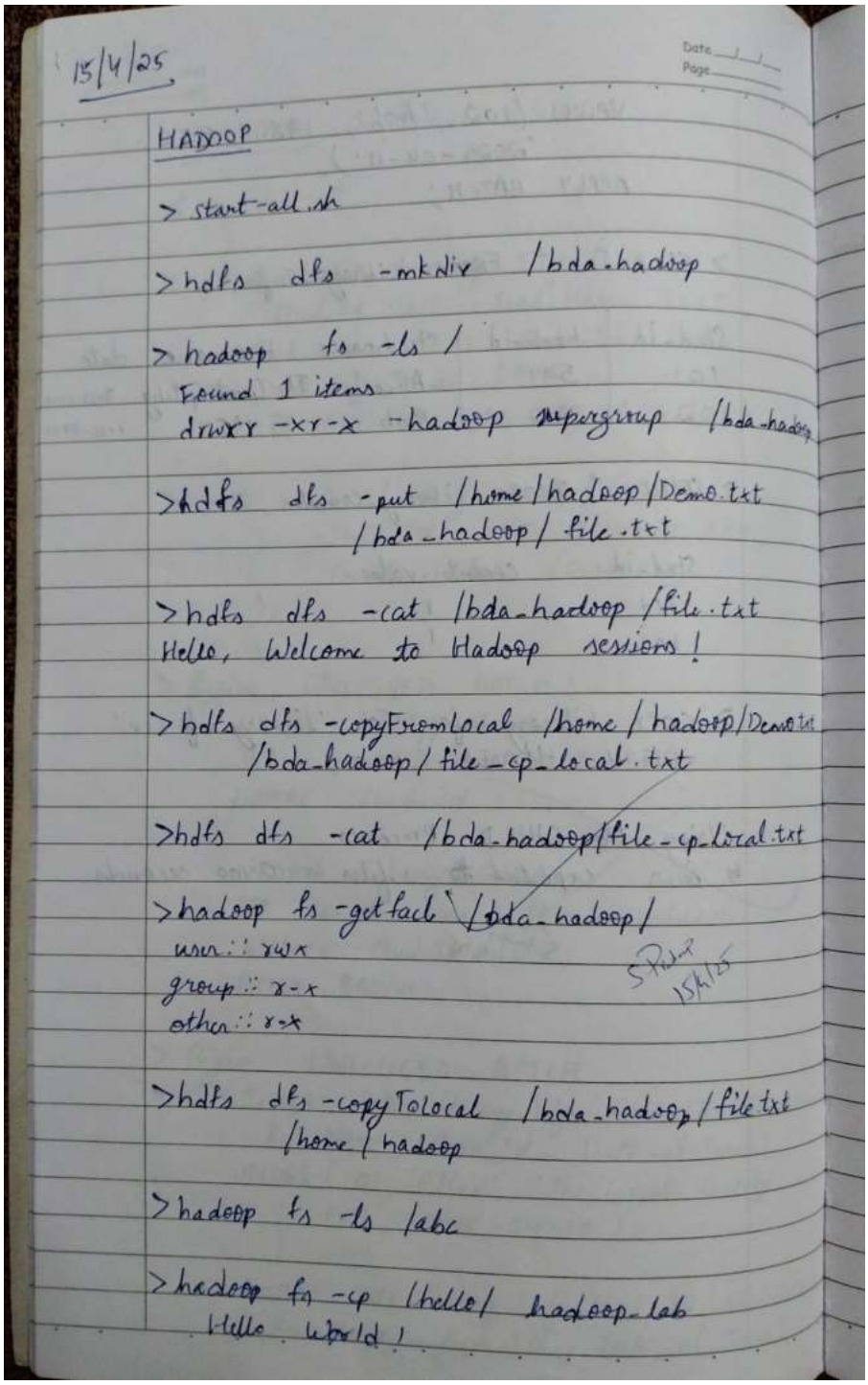
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.8 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace library with replication={'class':'Simplestrategy','replication_factor':1};
ConfigurationException: 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:



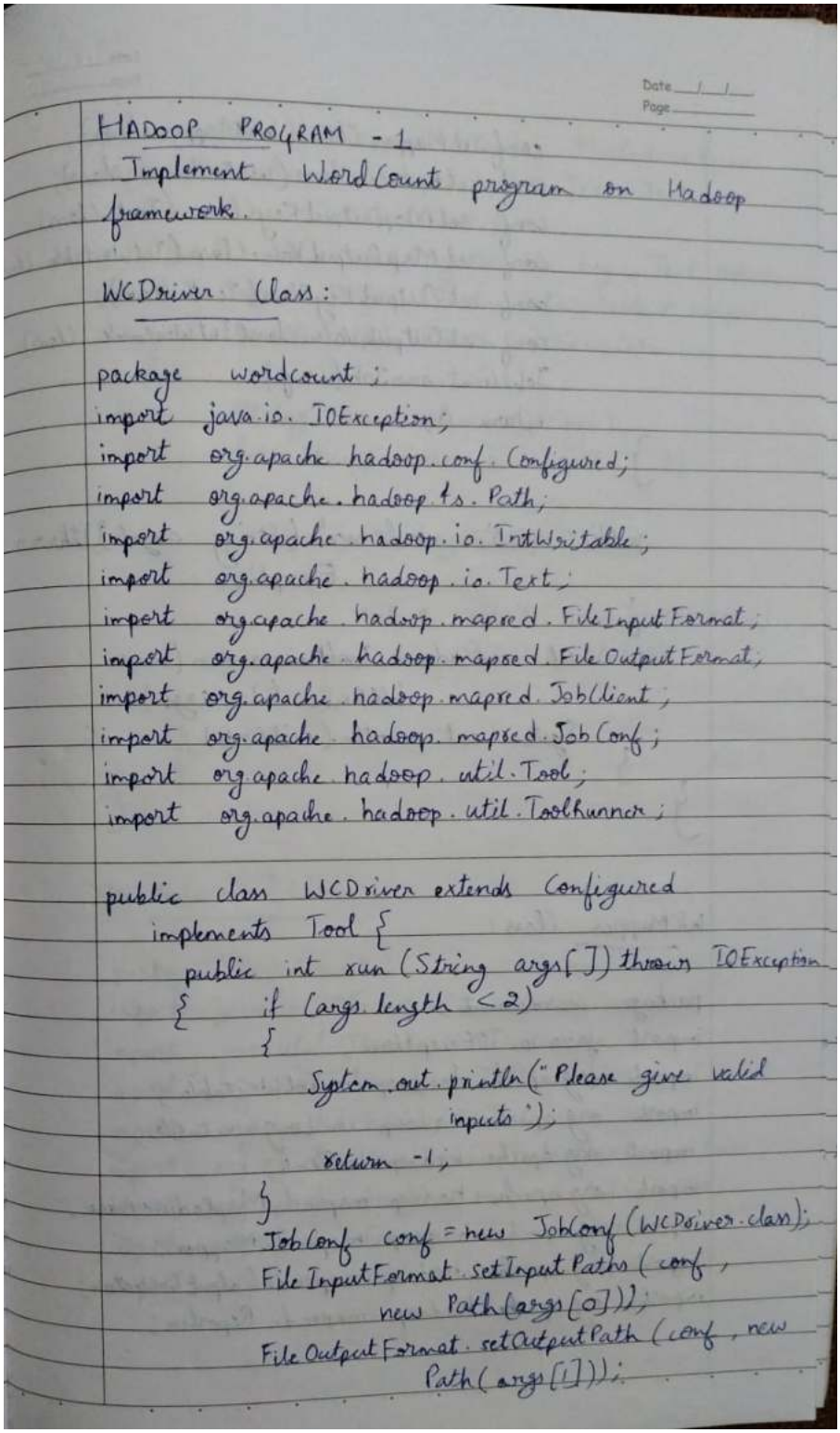
Code with Output:

```
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:



HADOOP PROGRAM - 1

Implement WordCount program on Hadoop framework.

WCDriver Class:

```
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;
    }

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

WCMapper Class:

```
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> {
    public void map (LongWritable key, Text value,
        OutputCollector <Text, IntWritable> output,
        Reporter rep) throws IOException
    {
        String line = value.toString();
        for (String word: line.split(" "))
        {
            if (word.length() > 0)
            {
                output.collect (new Text(word),
                    new IntWritable(1));
            }
        }
    }
}
```

WCReducer Class:

```
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.OutCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;
```

```
public class WCReducer extends MapReduceBase
implements Reducer <Text, IntWritable, Text,
        IntWritable> {
    public void reduce (Text key, Iterator
        <IntWritable> value, OutputCollector
        <Text, IntWritable> output,
            Reporter rep) throws IOException
    {
        int count = 0;
        while (value.hasNext())
        {
            IntWritable i = value.next();
            count += i.get();
        }
        output.collect (key, new IntWritable(count
    }
}
```

Input.txt
Hello World
Hello World
This is BDA Lab

Output:
Hello - 2
World - 2
This - 1
is - 1
BDA - 1
Lab - 1

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

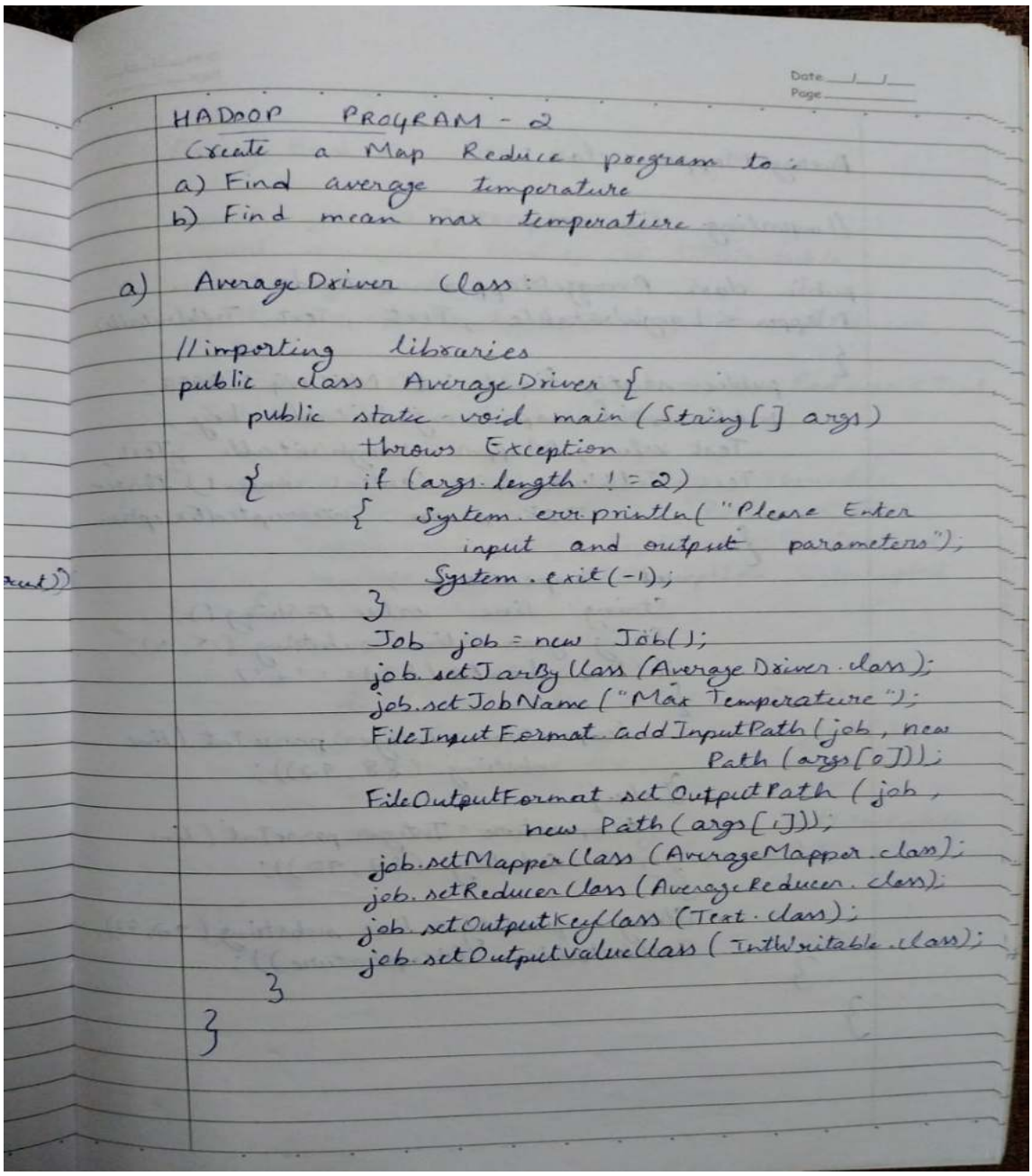
From the following link extract the weather data

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:



HADOOP PROGRAM - 2

Create a Map Reduce program to:

a) Find average temperature

b) Find mean max temperature

a) AverageDriver Class:

```
//importing libraries
public class AverageDriver {
    public static void main(String[] args)
            throws Exception
    {       if (args.length != 2)
            { System.err.println("Please Enter
                    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);
    }
}
```

Date
Page

AverageMapper class:

```
//importing libraries

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);
          IntWritable (temperature));
      }
}
```

Date __/__/__
Page

Average Reducer class:

```
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 , Reduce <Text,
      IntWritable, Text, IntWritable>.Context
      context) throws IOException, Interrupted
   {
      int max_temp = 0;
      int count = 0;
      for (IntWritable value: values)
      {      max_temp += value.get();
             count ++;
      }
      context.write (key, new IntWritable
             (max_temp / count));
   }
}
```

b) MeanMaxDriver class :

```
//importing libraries

public class MeanMaxDriver
{
    public static void main (String [] args)
        throws Exception
    { if (args.length != 2)
        { System.err.println ("Please Enter");
          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);
    }
}
```

MeanMaxMapper class :

```
// importing libraries

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));
        }
}
```

MeanMax Reducer class:

```
//importing libraries

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++;
            }
        }
    }
}
```

Code with Output:

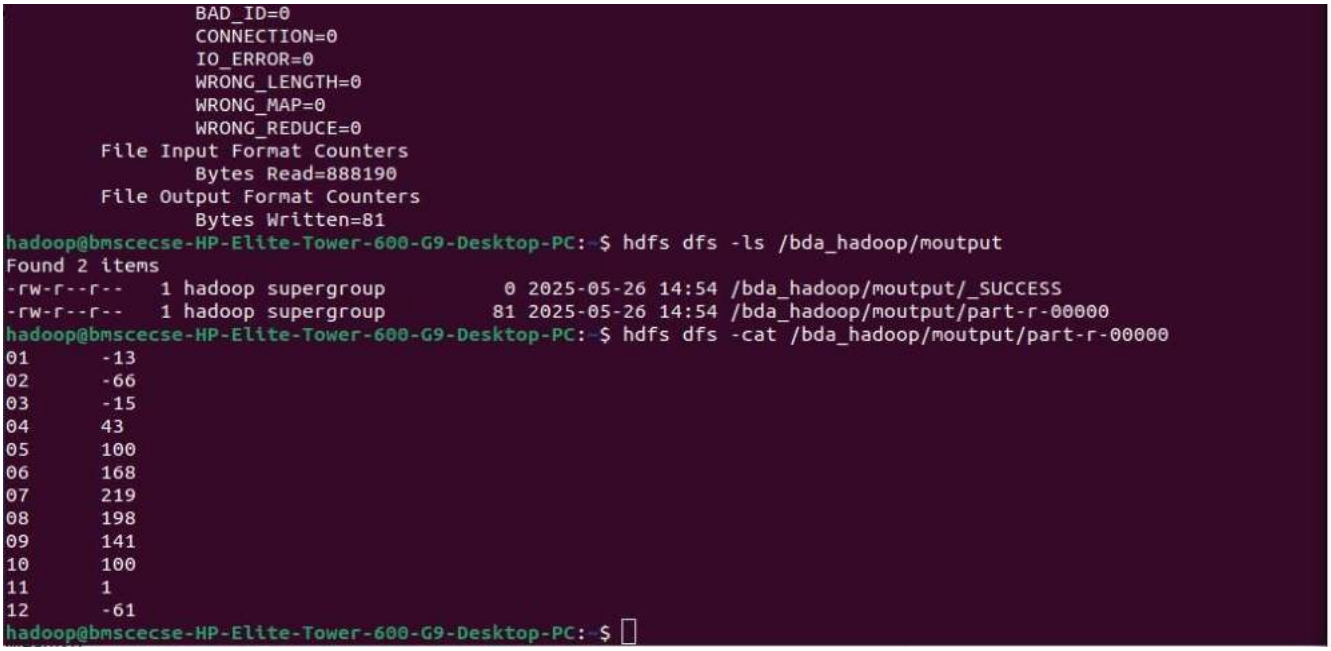
a) Average temperature

```
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

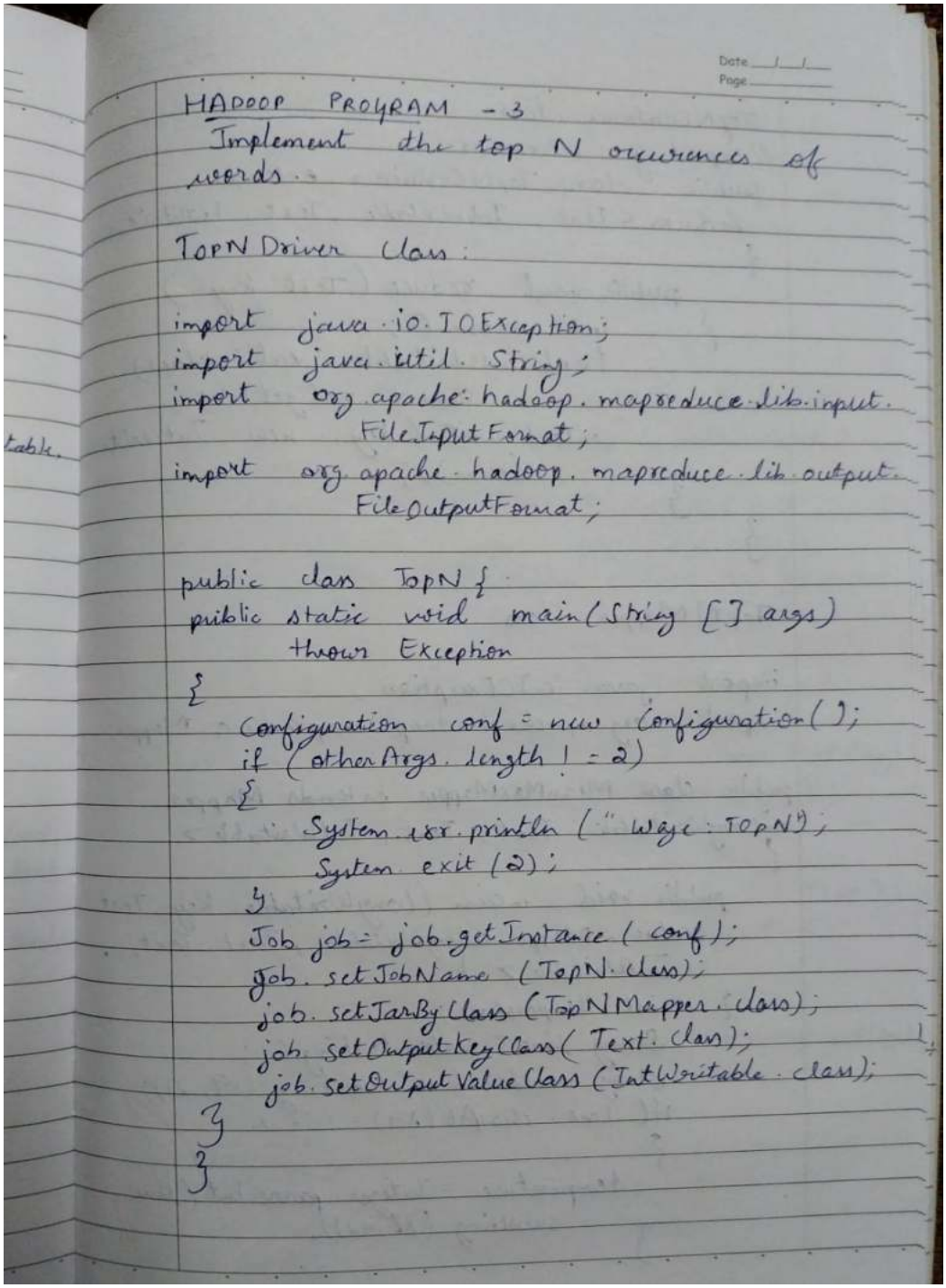
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
18721 Jps
12082 NameNode
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /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:



HADOOP PROGRAM - 3
Implement the top N occurrences of words.

TopN Driver Class:

```
import java.io.IOException;
import java.util.String;
import org.apache.hadoop.mapreduce.lib.input.
        FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.
        FileOutputFormat;

public class TopN {
public static void main(String [] args)
      throws Exception
{
   Configuration conf = new Configuration();
   if (otherArgs.length != 2)
   {
      System.err.println("Usage: TopN");
      System.exit(2);
   }
   Job job = job.getInstance(conf);
   Job.setJobName(TopN.class);
   job.setJarByClass(TopNMapper.class);
   job.setOutputKeyClass(Text.class);
   job.setOutputValueClass(IntWritable.class);
}
}
```

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

```
TopNMapper.class

import java.io.IOException;
import org.apache.hadoop.mapreduce.Mapper;

public class MeanMaxMapper extends Mapper
<LongWritable Text, Text, IntWritable>
{
    public void main(LongWritable key, Text
      value, Mapper<LongWritable, Text, Text,
       IntWritable>)
    {   int temperature;
        String line = value.toString();
        string month = line.substring(19,21);
        if(line.charAt(87)=='+')
        {
            temperature = Integer.parseInt(line.
                substring(88,92));
        }
```

```
        String quality = line.substring(92,93);
        context.write(new Text(month), new
            IntWritable);
    }
}
```

TopNReducer.class

```
public class TopNReducer extends Reducer
<Text, IntWritable, Text, IntWritable>
{
    private Map<Text, IntWritable>
    countMap = new HashMap<>();
    public void reduce (Text key)
    {
        int sum = 0;
        for (IntWritable val: values)
            sum += val.get();
        this.countMap.put(new Text(key),
            new IntWritable(sum));
    }

    protected void cleanup (Reducer<Text>)
    {   for( Text key . SortedMap keyset <>)
        {   if(counter ++ == 20)
                break;
            context.write(key, sootedMap.get(key));
    } } }
```

OUTPUT:

Hello
world
hadoop.

Code with Output:

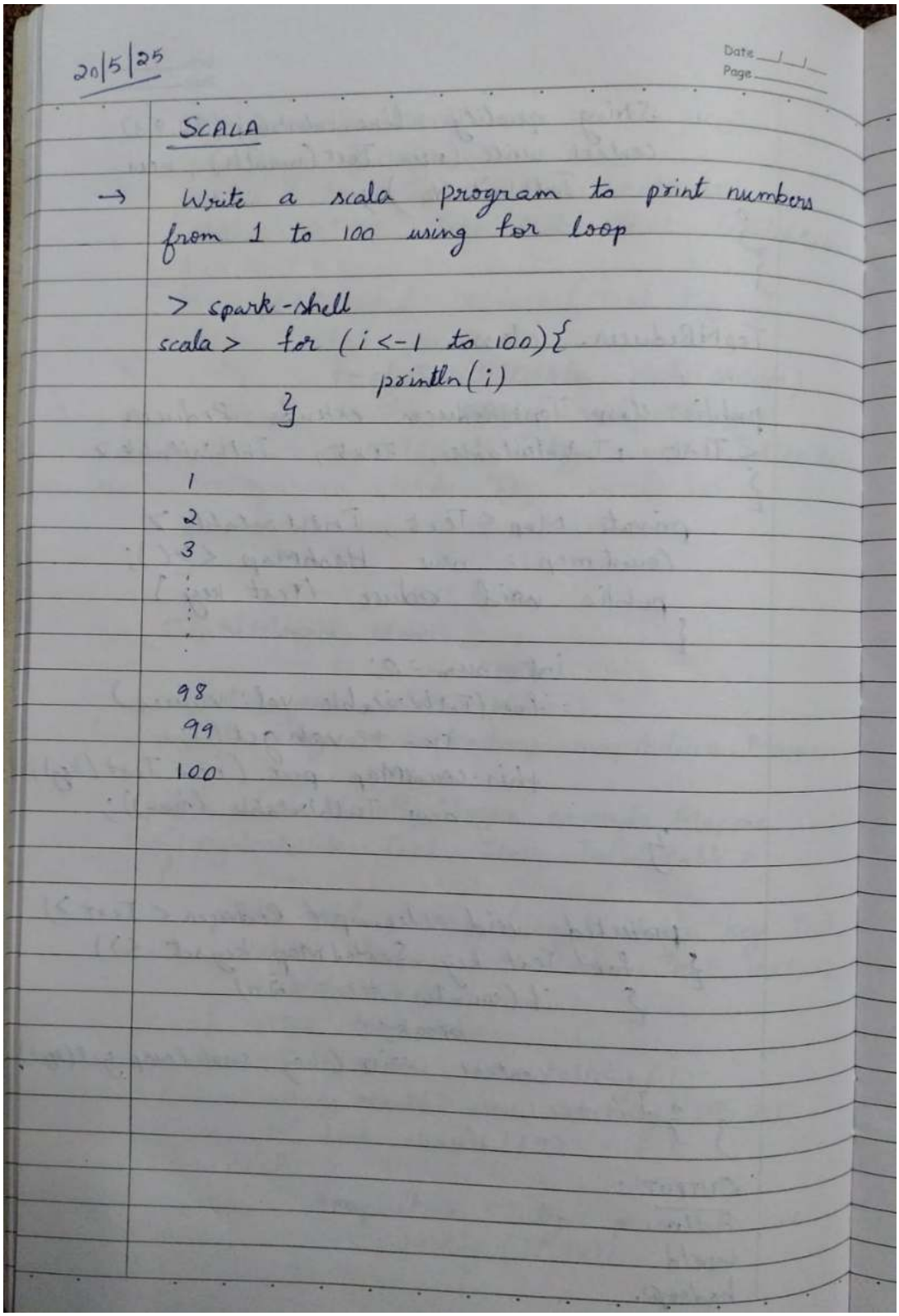
```
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ jps
12082 NameNode
19238 Jps
13014 NodeManager
15100 org.eclipse.equinox.launcher_1.6.1000.v20250227-1734.jar
12845 ResourceManager
12557 SecondaryNameNode
12255 DataNode
hadoop@bmscecse-HP-Elite-Tower-600-G9-Desktop-PC:~$ hdfs dfs -copyFromLocal /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:~$
```

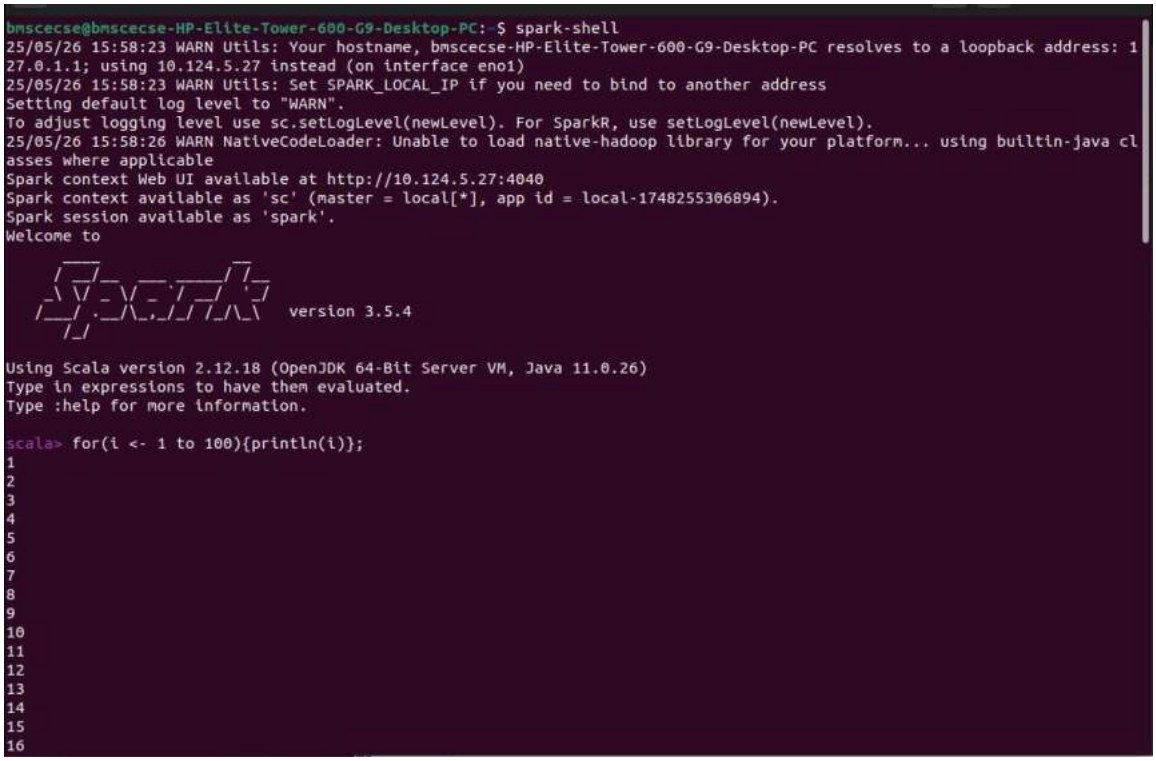
Program 8

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

Observation:



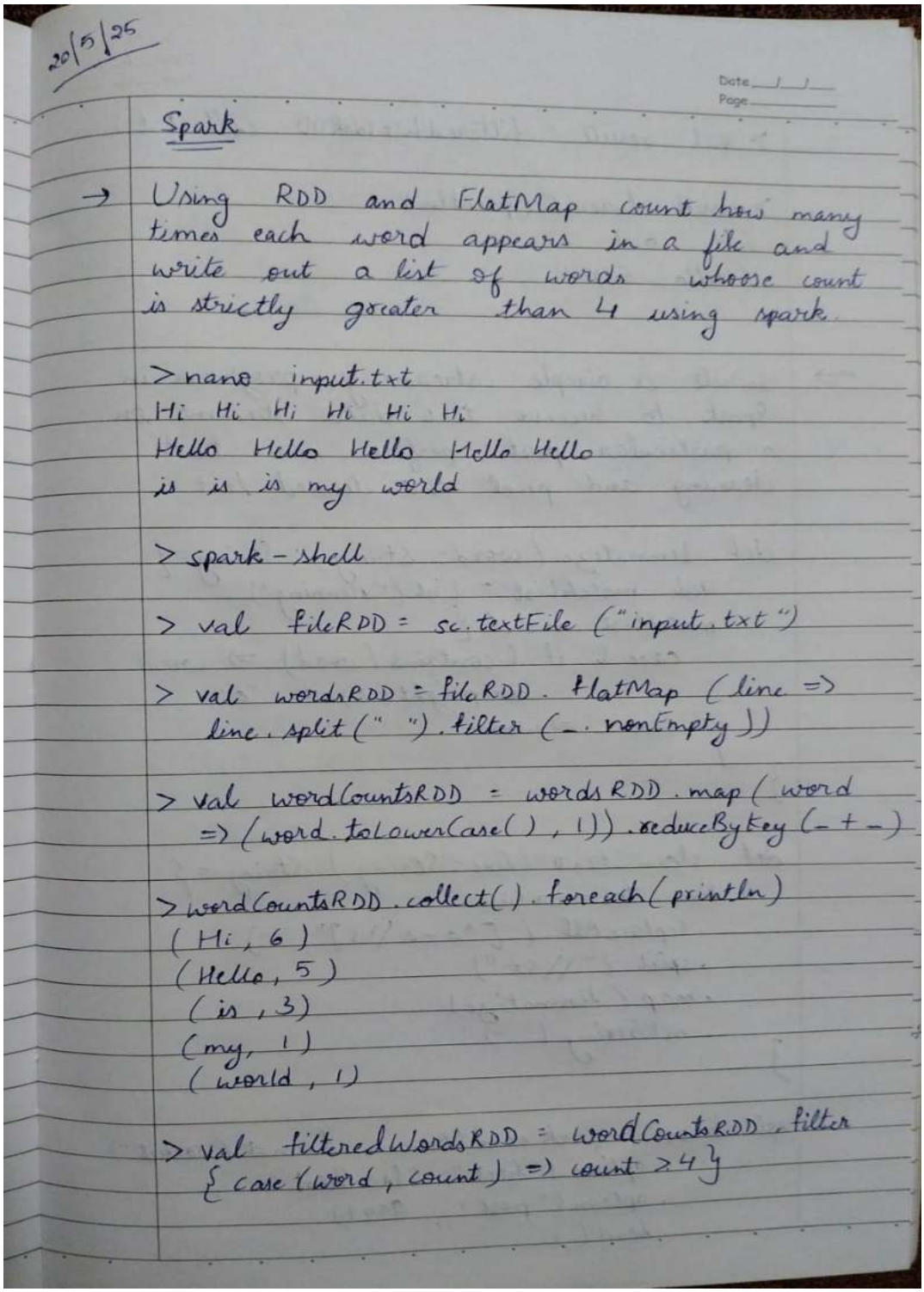
Code with Output:



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:



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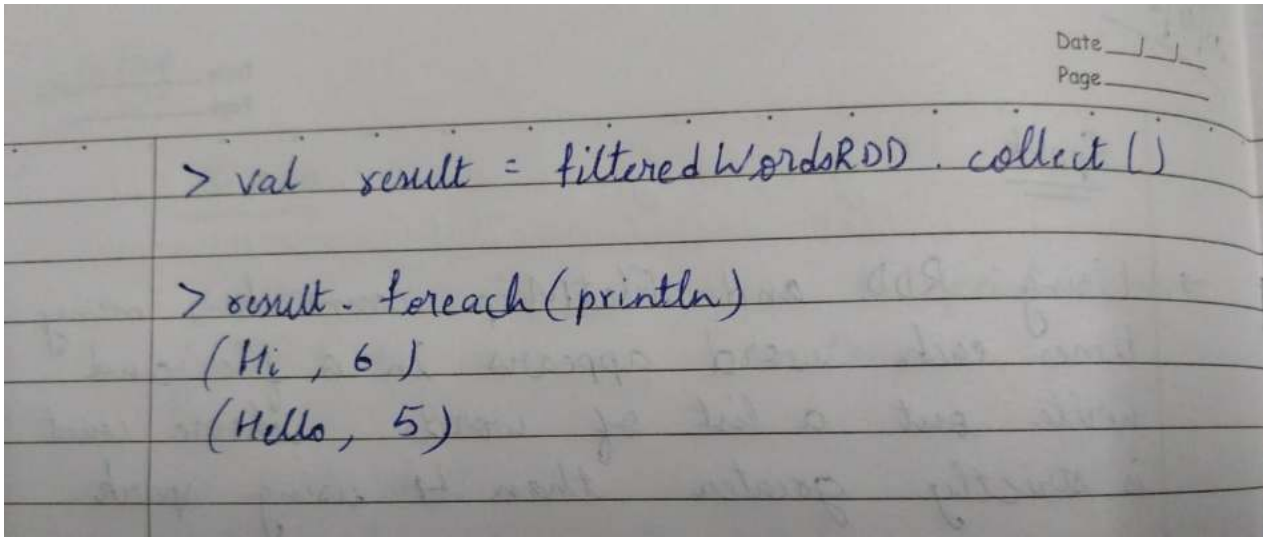
Date / /
Page

Spark

→ 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.

```
> nano input.txt
Hi Hi Hi Hi Hi Hi
Hello Hello Hello Hello Hello
is is is my world

> spark-shell

> val fileRDD = sc.textFile("input.txt")

> val wordsRDD = fileRDD.flatMap(line =>
  line.split(" ").filter(_.nonEmpty))

> val wordCountsRDD = wordsRDD.map(word
  => (word.toLowerCase(), 1)).reduceByKey(_+_)

> wordCountsRDD.collect().foreach(println)
(Hi, 6)
(Hello, 5)
(is, 3)
(my, 1)
(world, 1)

> val filteredWordsRDD = wordCountsRDD.filter
  {case (word, count) => count > 4}
```



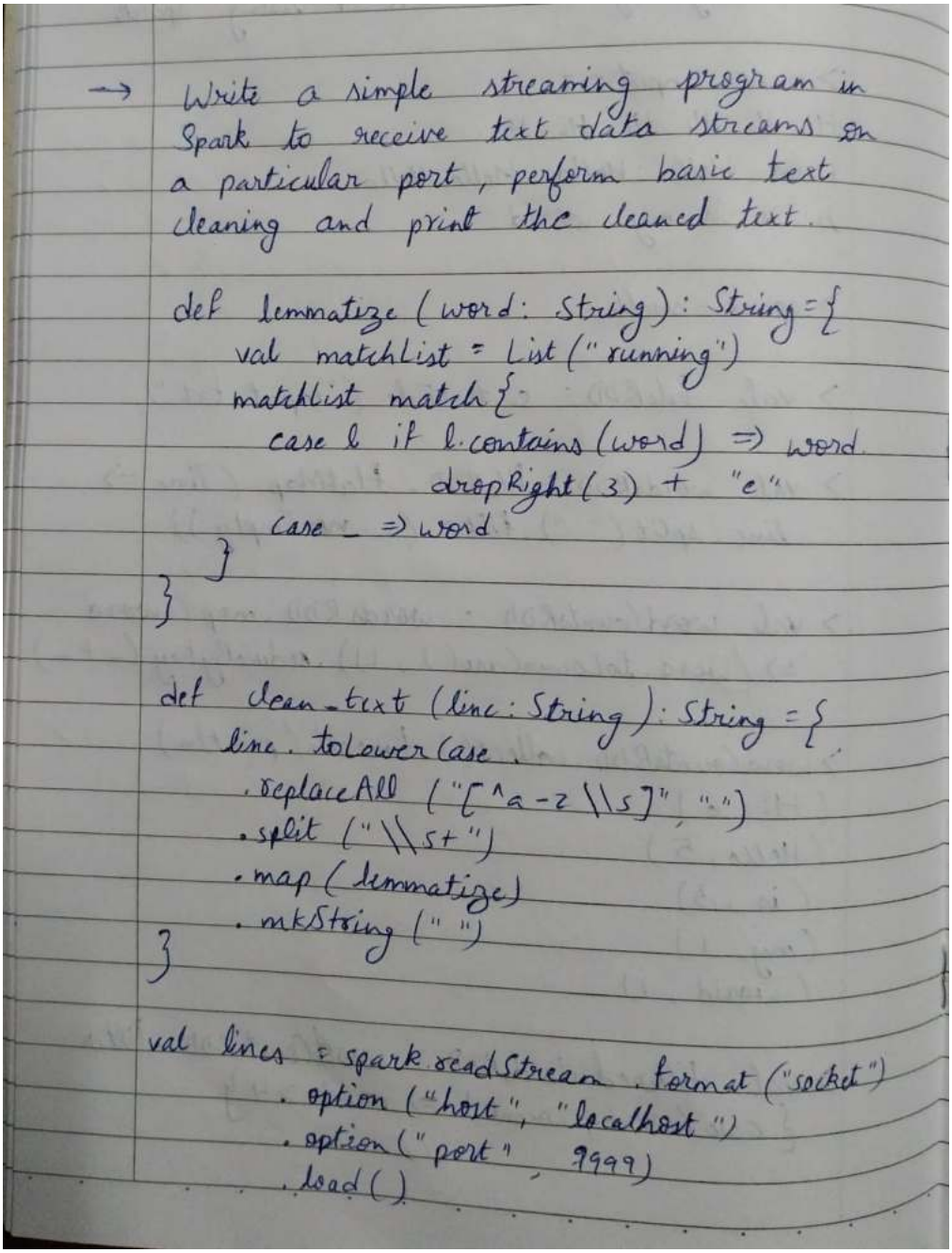
Code with Output:

```
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:



→ Write a simple streaming program in Spark to receive text data streams on a particular port, perform basic text cleaning and print the cleaned text.

```
def lemmatize (word: String): String = {
    val matchList = List ("running")
    matchlist match {
      case l if l.contains (word) => word.
          dropRight (3) + "e"
      case _ => word
    }
}

def clean_text (line: String): String = {
    line. toLowerCase .
      .replaceAll ("[^a-z\\s]", "")
      .split ("\\s+")
      .map (lemmatize)
      .mkString (" ")
}

val lines = spark.readStream .format ("socket")
      . option ("host", "localhost")
      . option ("port", 9999)
      .load ()
```

Date __/__/__
Page _____

```
import org.apache.spark.sql.functions.udf

val cleanUDF = udf(clean_text _)

val cleaned = lines.withColumn("cleaned",
      cleanUDF("value")))

val query = cleaned.select("cleaned").
    .writeStream
    .outputMode("append")
    .format("console")
    .start()

query.awaitTermination()
```

- New Terminal

```
nc -lk 9999
Text = Hello! Spark Shell!
```

Output :

value : Hello! Spark Shell!
cleaned: Spark Shell