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
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Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**Big Data Analytics**" carried out by **Rachana N (1BM23CS416),** 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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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.

1. Experiments

Experiment - 1

Question:

Perform the following DB operations using Cassandra.

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

1/4/25 CQlsh

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Working with Cassandra

> Create KeySpace:

```
CREATE KEYSPACE Students WITH REPLICATION:
{'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 (column family) by name Student_Info:

```
CREATE TABLE Students_info (Roll_No int PRIMARY KEY,
StudName text, Date Of Joining timestamp, Last_exam_Percent
double);
```

> Lookup the names of all the tables in the current Keyspace

```
DESCRIBE TABLES;
```

> Describe the table information

```
DESCRIBE TABLE Students_info;
```

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> CRUD INSert :-

BEGIN BATCH
INSERT INTO Students_info (Roll_No, StudName, DateOfJoining, last_exam_Percent) VALUES (1, 'Asha', '2018-03-12', 79.9)
INSERT INTO . . .
. . .
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 or 2 or 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);

"Now execute the above command";

> To specify the number of rows returned in the output

~~select * from~~ st
select Roll_No, StudName from Students_info LIMIT 2;

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> Alias for column:

select Roll_No as USN from Students_info;

> update

UPDATE Students_info SET StudName = 'David Shreen' where Roll_no = 2;

"on primary key you cannot perform update operation"

> Delete

DELETE Last_Exam_Percent FROM students_info WHERE Roll_No = 2;

> Delete a Row

DELETE FROM studit_info WHERE ROLLNo = 2;

Set collection :

ALTER TABLE Students_info ADD hobbies set (text)

List collection:

ALTER TABLE students_info ADD languages list (text);

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```
UPDATE student_info
    SET hobbies = hobbies + {'chess', Table Tennis'}
        where RollNo = 1;

select * from students_info where RollNo = 1;

UPDATE Student_info
    SET langige = language + ['Hindi, English']
            where Roll_No = 1;
```

"can remove an element from a set using the Subtraction (-) operator.

> USING A counter :-

```
CREATE TABLE library.book (counter value counter,
book_name varchar, stud_name = 'Big data Analytics' AND
stud_name = 'jeet';
```

> TIME TO live :-

```
CREATE TABLE userlogin(userid int PRIMARY KEY,
                       passwold text);

INSERT INTO userlogin(userid, passwold) VALUES (1,
'injy') USING TTL 30;

SELECT TTL(passwold) FROM userlogin WHERE userid=1;
```

1.1.2 Code with Output:

```
bmscecse@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC: $ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.4 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> create keyspace Employee with replication = {'class':'SimpleStrategy;,;replicationfactor':1};
SyntaxException: line 1:89 mismatched input ':' expecting '}' (...with replication = {'class':'SimpleStrategy;,;replicationfactor'[:]1...)
cqlsh> create keyspace Employee WITH replication={'class':'SimpleStrategy','replicationfactor':1};
ConfigurationException: Unrecognized strategy option {replicationfactor} passed to SimpleStrategy for keyspace employee
cqlsh> create keyspace Employee WITH replication={'class':'SimpleStrategy','replication_factor':1};
cqlsh> DESCRIBE KEYSPACES

employee  system_auth         system_schema  system_views
system    system_distributed  system_traces  system_virtual_schema

cqlsh> CREATE TABLE IF NOT EXISTS Employee_Info(
   ... Emp_Id INT PRIMARY KEY,
   ... Emp_name TEXT,
   ... designation TEXT,
   ... date_of_joining DATE,
   ... Salary FLOAT,
   ... Dep_name TEXT,
   ... Projects SET<TEXT>);
InvalidRequest: Error from server: code=2200 [Invalid query] message="No keyspace has been specified. USE a keyspace, or explicitly specify keyspace.tablename"
cqlsh> USE eMPLOYEE
   ...
cqlsh> USE Employee
   ...
cqlsh> USE Employee;
cqlsh:employee> CREATE TABLE IF NOT EXISTS Employee_Info( Emp_Id INT PRIMARY KEY, Emp_name TEXT, designation TEXT, date_of_joining DATE, Salary FLOAT, Dep_name TEXT, Projects SET<TEXT>);
cqlsh:employee> describe keyspace Employee

CREATE KEYSPACE employee WITH replication = {'class': 'SimpleStrategy', 'replication_factor': '1'}  AND durable_writes = true;

CREATE TABLE employee.employee_info (
    emp_id int PRIMARY KEY,
    date_of_joining date,
    dep_name text,
    designation text,
    emp_name text,
    salary float,
    projects set<text>
) 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_threshold': '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
```

```
cqlsh:employee> update employee_info using ttl 15 set salary = 0 where emp_id = 121;
cqlsh:employee> select * from employee_info;

 emp_id | bonus | date_of_joining | dep_name    | designation | emp_name    | projects                    | salary
--------+-------+-----------------+-------------+-------------+-------------+-----------------------------+---------
    120 | 12000 |      2024-05-06 | Engineering |   Developer | Priyanka GH |  {'Project B', 'ProjectA'} |   1e+06
    123 |  null |      2024-05-07 | Engineering |    Engineer |     Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |  null |      2024-05-06 |  Management |          HR |     Rachana | {'Project C', 'Project M'} |   9e+05
    121 | 11000 |      2024-05-06 |  Management |   Developer |      Shreya |  {'Project C', 'ProjectA'} |       0

(4 rows)
cqlsh:employee> select * from employee_info;

 emp_id | bonus | date_of_joining | dep_name    | designation | emp_name    | projects                    | salary
--------+-------+-----------------+-------------+-------------+-------------+-----------------------------+---------
    120 | 12000 |      2024-05-06 | Engineering |   Developer | Priyanka GH |  {'Project B', 'ProjectA'} |   1e+06
    123 |  null |      2024-05-07 | Engineering |    Engineer |     Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |  null |      2024-05-06 |  Management |          HR |     Rachana | {'Project C', 'Project M'} |   9e+05
    121 | 11000 |      2024-05-06 |  Management |   Developer |      Shreya |  {'Project C', 'ProjectA'} |    null

(4 rows)
cqlsh:employee>
```

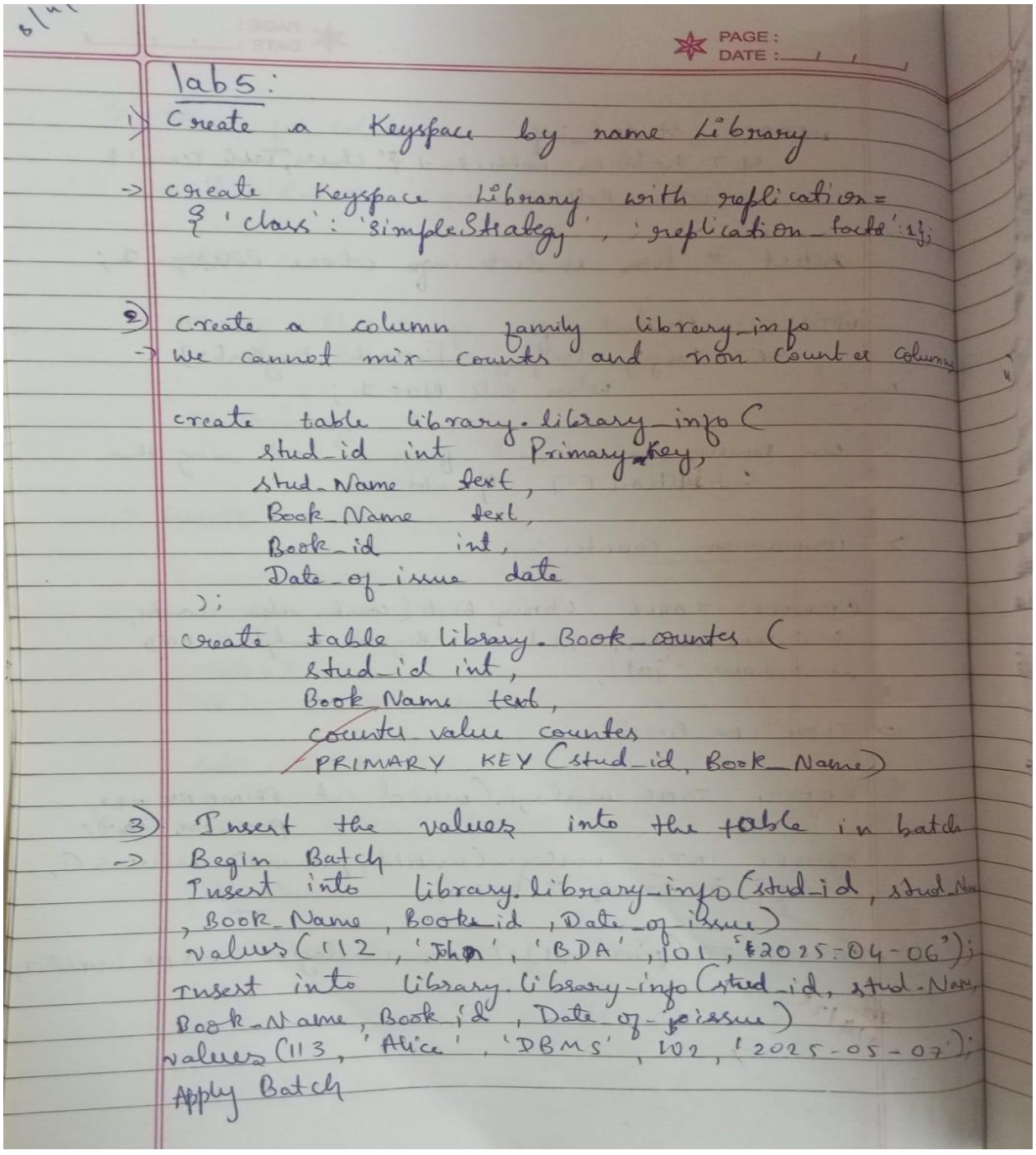
```
    AND speculative_retry = '99p';
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining | dep_name    | designation | emp_name | projects                    | salary
--------+-----------------+-------------+-------------+----------+-----------------------------+---------
    120 |      2024-05-06 | Engineering |   Developer | Priyanka |  {'Project B', 'ProjectA'} |   1e+06
    123 |      2024-05-07 | Engineering |    Engineer |  Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |      2024-05-06 |  Management |          HR |  Rachana | {'Project C', 'Project M'} |   9e+05
    121 |      2024-05-06 |  Management |   Developer |   Shreya |  {'Project C', 'ProjectA'} |   9e+05

(4 rows)
cqlsh:employee> update employee_info set emp_name = 'Priyanka GH' Where emp_id = '120';
InvalidRequest: Error from server: code=2200 [Invalid query] message="Invalid STRING constant (120) for "emp_id" of type int"
cqlsh:employee> update employee_info set emp_name = 'Priyanka GH' Where emp_id=120;
cqlsh:employee> select * from employee_info;

 emp_id | date_of_joining | dep_name    | designation | emp_name    | projects                    | salary
--------+-----------------+-------------+-------------+-------------+-----------------------------+---------
    120 |      2024-05-06 | Engineering |   Developer | Priyanka GH |  {'Project B', 'ProjectA'} |   1e+06
    123 |      2024-05-07 | Engineering |    Engineer |     Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |      2024-05-06 |  Management |          HR |     Rachana | {'Project C', 'Project M'} |   9e+05
    121 |      2024-05-06 |  Management |   Developer |      Shreya |  {'Project C', 'ProjectA'} |   9e+05

(4 rows)
cqlsh:employee> select * from employee_info order by salary;
InvalidRequest: Error from server: code=2200 [invalid query] message="ORDER BY is only supported when the partition key is restricted by an EQ or an IN."
cqlsh:employee> alter table employee_info add bonus INT;
cqlsh:employee> select * from employee_info;

 emp_id | bonus | date_of_joining | dep_name    | designation | emp_name    | projects                    | salary
--------+-------+-----------------+-------------+-------------+-------------+-----------------------------+---------
    120 |  null |      2024-05-06 | Engineering |   Developer | Priyanka GH |  {'Project B', 'ProjectA'} |   1e+06
    123 |  null |      2024-05-07 | Engineering |    Engineer |     Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |  null |      2024-05-06 |  Management |          HR |     Rachana | {'Project C', 'Project M'} |   9e+05
    121 |  null |      2024-05-06 |  Management |   Developer |      Shreya |  {'Project C', 'ProjectA'} |   9e+05

(4 rows)
cqlsh:employee> update employee_info set bonus = 12000 where emp_id = 120;
cqlsh:employee> select * from employee_info;

 emp_id | bonus | date_of_joining | dep_name    | designation | emp_name    | projects                    | salary
--------+-------+-----------------+-------------+-------------+-------------+-----------------------------+---------
    120 | 12000 |      2024-05-06 | Engineering |   Developer | Priyanka GH |  {'Project B', 'ProjectA'} |   1e+06
    123 |  null |      2024-05-07 | Engineering |    Engineer |     Sadhana | {'Project M', 'Project P'} | 1.2e+06
    122 |  null |      2024-05-06 |  Management |          HR |     Rachana | {'Project C', 'Project M'} |   9e+05
    121 |  null |      2024-05-06 |  Management |   Developer |      Shreya |  {'Project C', 'ProjectA'} |   9e+05

(4 rows)
cqlsh:employee> update employee_info set bonus = 11000 where emp_id = 121;
cqlsh:employee> select * from employee_info using ttl 15 where emp_id = 123;
SyntaxException: line 1:28 mismatched input 'using' expecting EOF (select * from employee_info [using] ttl...)
cqlsh:employee> select * from employee_info where emp_id = 121 using ttl 15;
SyntaxException: line 1:47 no viable alternative at input 'using' (...employee_info where emp_id = 121 [using]...)
cqlsh:employee> update employee_info using ttl 15 set salary = 0 where emp_id = 121;
cqlsh:employee> select * from employee_info;
```

1.2 Experiment - 2

1.2.1 Question:

Perform the following DB operations using Cassandra:

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



lab 5:

1) Create a Keyspace by name Library.

-> create Keyspace Library with replication = { 'class': 'SimpleStrategy', 'replication_factor': 1};

2) Create a column family library_info
-> We cannot mix counter and non counter column

```
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_Na
, BOOK_Name, Book_id, Date_of_issue)
values(112, 'John', 'BDA', 101, '2025-04-06');
Insert into library.library-info(stud_id, stud-Nam
Book_Name, Book_id, Date_of_issue)
values(113, 'Alice', 'DBMS', 102, '2025-05-07');
Apply Batch
```

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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 = counter_value + 1
where stud_id = 112 and Book_Name = 'BDA'
Apply Batch.

4) Display details and increase Counter

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

update library.Book_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'
with header = TRUE;

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7 Import csv into column family

→ copy library.library_info FROM 'Library_info.csv' with header = TRUE;

(01)

Import csv file to cassandra

copy library.library_info (stud_id, stud_Name, Book_Name, Book_id, Date_of_issue) from 'library_info.csv' with header = TRUE

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1.2.2 Code with Output:

```
bmscecse@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042
[cqlsh 6.1.0 | Cassandra 4.1.4 | CQL spec 3.4.6 | Native protocol v5]
Use HELP for help.
cqlsh> CREATE KEYSPACE Students WITH REPLICATION={
   ... 'class':'SimpleStrategy','replication_factor':1};
cqlsh> DESCRIBE KEYSPACES

students  system_auth         system_schema  system_views
system    system_distributed  system_traces  system_virtual_schema

cqlsh> SELECT * FROM system.schema_keyspaces;
InvalidRequest: Error from server: code=2200 [Invalid query] message="table schema_keyspaces does not exist"
cqlsh> use Students;
cqlsh:students> create table Students_info(Roll_No int Primary key,StudName text,DateOfJoining timestamp,last_exam_Percent double);
cqlsh:students> describe tables;

students_info

cqlsh:students> describe table students;
Table 'students' not found in keyspace 'students'
cqlsh:students> describe table students_info;

CREATE TABLE students.students_info (
    roll_no int PRIMARY KEY,
    dateofjoining timestamp,
    last_exam_percent double,
    studname text
) 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_threshold': '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';
```

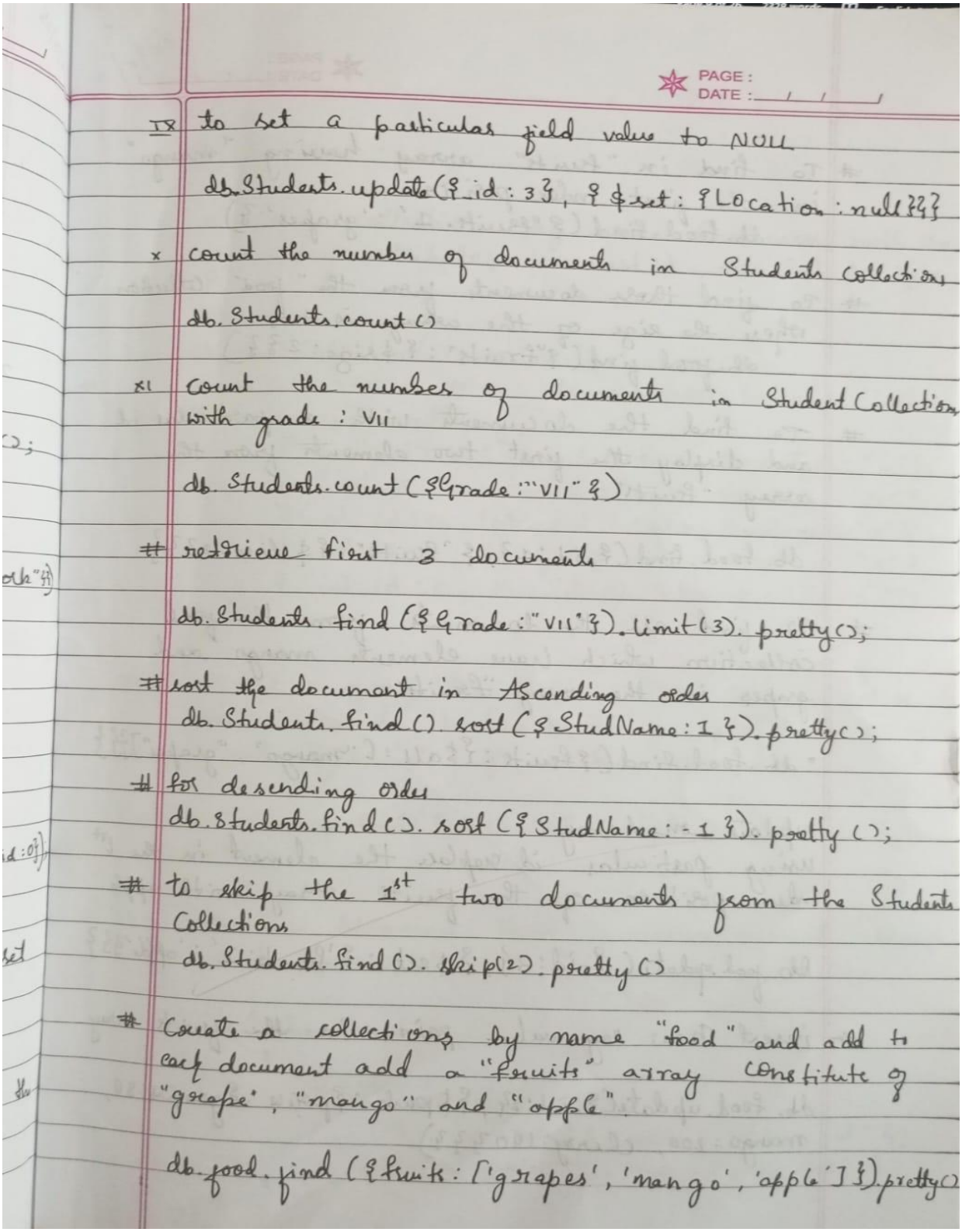
```
cqlsh:students> Begin batch insert into Students_info(Roll_no, StudName,DateOfJoining, last_exam_Percent) values(1,'Sadhana','2023-10-09', 98) insert into Students_info(Roll_no, StudName,DateOfJoining, last_exam
_Percent) values(2,'Rutu','2023-10-10', 97) insert into Students_info(Roll_no, StudName,DateOfJoining, last_exam_Percent) values(3,'Rachana','2023-10-10', 97.5) insert into Students_info(Roll_no, StudName,DateOf
Joining, last_exam_Percent) values(4,'Charu','2023-10-06', 96.5) apply batch;
cqlsh:students> select * from students_info;

 roll_no | dateofjoining                   | last_exam_percent | studname
---------+---------------------------------+-------------------+----------
       1 | 2023-10-08 18:30:00.000000+0000 |                98 |  Sadhana
       2 | 2023-10-09 18:30:00.000000+0000 |                97 |     Rutu
       4 | 2023-10-05 18:30:00.000000+0000 |              96.5 |    Charu
       3 | 2023-10-09 18:30:00.000000+0000 |              97.5 |  Rachana

(4 rows)
cqlsh:students> select * from students_info where roll_no in (1,2,3);

 roll_no | dateofjoining                   | last_exam_percent | studname
---------+---------------------------------+-------------------+----------
       1 | 2023-10-08 18:30:00.000000+0000 |                98 |  Sadhana
       2 | 2023-10-09 18:30:00.000000+0000 |                97 |     Rutu
       3 | 2023-10-09 18:30:00.000000+0000 |              97.5 |  Rachana

(3 rows)
cqlsh:students> select * from students_info where Studname='Charu';
InvalidRequest: Error from server: code=2200 [Invalid query] message="Cannot execute this query as it might involve data filtering and thus may have unpredictable performance. If you want to execute this query d
espite the performance unpredictability, use ALLOW FILTERING"
cqlsh:students> create index on Students_info(StudName);
cqlsh:students> select * from students_info where Studname='Charu';

 roll_no | dateofjoining                   | last_exam_percent | studname
---------+---------------------------------+-------------------+----------
       4 | 2023-10-05 18:30:00.000000+0000 |              96.5 |    Charu

(1 rows)
cqlsh:students> select Roll_no,StudName from students_info LIMIT 2;
```

```
(4 rows)
cqlsh:students> select * from students_info where roll_no in (1,2,3);

 roll_no | dateofjoining                   | last_exam_percent | studname
---------+---------------------------------+-------------------+----------
       1 | 2023-10-08 18:30:00.000000+0000 |                98 |  Sadhana
       2 | 2023-10-09 18:30:00.000000+0000 |                97 |     Rutu
       3 | 2023-10-09 18:30:00.000000+0000 |              97.5 |  Rachana

(3 rows)
cqlsh:students> select * from students_info where Studname='Charu';
InvalidRequest: Error from server: code=2200 [invalid query] message="Cannot execute this query as it might involve data filtering and thus may have unpredictable performance. If you want to execute this query d
espite the performance unpredictability, use ALLOW FILTERING"
cqlsh:students> create index on Students_info(StudName);
cqlsh:students> select * from students_info where Studname='Charu';

 roll_no | dateofjoining                   | last_exam_percent | studname
---------+---------------------------------+-------------------+----------
       4 | 2023-10-05 18:30:00.000000+0000 |              96.5 |    Charu

(1 rows)
cqlsh:students> select Roll_no,StudName from students_info LIMIT 2;

 roll_no | studname
---------+----------
       1 |  Sadhana
       2 |     Rutu

(2 rows)
cqlsh:students> SELECT Roll_no as "USN" from Students_info;

 USN
-----
   1
   2
   4
   3
```

1.3 Experiment - 3

1.3.1 Question:

MongoDB - CRUD Demonstration.



IX to set a particular field value to NULL

```
db.Students.update({_id:3}, {$set:{Location:null}})
```

x count the number of documents in Students collection

```
db.Students.count()
```

xi count the number of documents in Student Collection with grade : VII

```
db.Students.count({Grade:"VII"})
```

retrieve first 3 documents

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

sort the document in Ascending order

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

for descending order

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

to skip the 1st two documents from the Students Collections

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

Create a collections by name "food" and add to each document add a "fruits" array constitute of "grape", "mango" and "apple".

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

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Student Names begins with M

db.Student.find({StudName:/^M/}).pretty();

Student Names contains 'h' in any position

db.Student.find({StudName:/h/}).pretty();

db.Student.count();

descending order:

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

Add new field in an existing Document

db.Student.update({_id:2},{$set:{Location:"Network"}})

Remove field

db.Students.update({_id:2},{$unset:{Location:"Network"}})

VIII Finding Document based on search criteria Suppressing few fields

db.Student.find({_id:1},{StudName:1,Grade:1,_id:0})

To find those documents where the Grade is not set to 'VII'

db.Student.find({Grade:{$ne:'VII'}}).pretty();

To find documents from the Students collection where the StudName ends with s.

db.Student.find({StudName:/s$/}).pretty();

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BDA

Lab 1

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Working with mongoDB

1. Create Database in mongoDB

use myDB;
db;
show dbs;

2 CRUD (Create, Read, Update, delete) operations

i) db.createCollection("Student");

db.Student.drop();

→ db.Student.insert({_id:1, StudName:"Rach", Grade:"6th", Hobbies:"Nothing"});

→ db.Student.update({_id:1, StudName:"Rach", Grade:"6th"}, {$set:{Hobbies:"Playing"}}, {upsert:true});

db.Student.find({StudName:"Rach"});

db.Student.find({}, {StudName:1, Grade:1, _id:0});

db.Student.find({Grade:{$eq:'6th'}}).pretty();

→ db.Student.insert({_id:2, StudName:"Monisha", Grade:"6th", Hobbies:"Nothing"});

db.Student.find({Hobbies:{$in:['Nothing','playing']}}).pretty();

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To find in "fruits" array having "mango" in the first index position

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

To find those documents from the "food" collection where the size of the array is two

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

To find the documents with a particular id and display the first two elements from the array "fruits"

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

To find all the documents from the food collection which have elements mango and grapes in the array "fruits"

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

update on Array:
using particular id replace the element in the 1st index position of the fruits array with apple

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

insert new key value pairs in the fruits array

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

1.3.2 Code with Output:

1. Create a database "Student" with the following attributes Rollno, Name , Age, ContactNo, Email-Id, grade, hobby:

use Students

2. Insert 5 appropriate values according to the below queries.

db.students.insertMany([
{ "Rollno": 10, "Name": "John", "Age": 20, "ContactNo": "1234567890", "Email-Id": "john@example.com", "grade": "A", "hobby": "Reading" },
{ "Rollno": 11, "Name": "Alice", "Age": 21, "ContactNo": "9876543210", "Email-Id": "alice@example.com", "grade": "B", "hobby": "Painting" },
{ "Rollno": 12, "Name": "Bob", "Age": 22, "ContactNo": "2345678901", "Email-Id": "bob@example.com", "grade": "C", "hobby": "Cooking" },
{ "Rollno": 13, "Name": "Eve", "Age": 23, "ContactNo": "3456789012", "Email-Id": "eve@example.com", "grade": "A" },
{ "Rollno": 14, "Name": "Charlie", "Age": 24, "ContactNo": "4567890123", "Email-Id": "charlie@example.com", "hobby": "Gardening" }
])

```
Atlas atlas-wanmtx-shard-0 [primary] Student> use Students
switched to db Students
Atlas atlas-wanmtx-shard-0 [primary] Students> show collections

Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.insertMany([
...     { "Rollno": 10, "Name": "John", "Age": 20, "ContactNo": "1234567890", "Email-Id":
"john@example.com", "grade": "A", "hobby": "Reading" },
...     { "Rollno": 11, "Name": "Alice", "Age": 21, "ContactNo": "9876543210", "Email-Id":
 "alice@example.com", "grade":
 "B", "hobby": "Painting" },
...     { "Rollno": 12, "Name": "Bob", "Age": 22, "ContactNo": "2345678901", "Email-Id": "
bob@example.com", "grade": "C", "hobby": "Cooking" },
...     { "Rollno": 13, "Name": "Eve", "Age": 23, "ContactNo": "3456789012", "Email-Id": "
eve@example.com", "grade": "A"
 },
...     { "Rollno": 14, "Name": "Charlie", "Age": 24, "ContactNo": "4567890123", "Email-Id
": "charlie@example.com", "hobby": "Gardening" }
... ])
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId("661ce9dc76a00ff8cc51dae1"),
    '1': ObjectId("661ce9dc76a00ff8cc51dae2"),
    '2': ObjectId("661ce9dc76a00ff8cc51dae3"),
    '3': ObjectId("661ce9dc76a00ff8cc51dae4"),
    '4': ObjectId("661ce9dc76a00ff8cc51dae5")
  }
}
```

3. Write query to update Email-Id of a student with rollno 10.

db.students.updateOne(
{ "Rollno": 10 },
{ $set: { "Email-Id": "john.doe@example.com" } }
)

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.updateOne(
...     { "Rollno": 10 },
...     { $set: { "Email-Id": "john.doe@example.com" } }
... )
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

4. Replace the student name from “Alice” to “Alicee” of rollno 11

```
db.students.updateOne(
   { "Rollno": 11 },
   { $set: { "Name": "Alicee" } }
)
```

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.updateOne(
...     { "Rollno": 11 },
...     { $set: { "Name": "Alicee" } }
... )
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

5. Display Student Name and grade(Add if grade is not present)where the _id column is 1.

```
db.students.find({}, { "Name": 1, "grade": { $ifNull: ["$grade", "Not available"] }, "_id": 0 })
```

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.find({}, { "Name": 1, "grade":
{ $ifNull: ["$grade", "Not available"] }, "_id": 0 })
[
  { Name: 'John', grade: 'A' },
  { Name: 'Alicee', grade: 'B' },
  { Name: 'Bob', grade: 'C' },
  { Name: 'Eve', grade: 'A' },
  { Name: 'Charlie', grade: 'Not available' }
]
```

6. Update to add hobbies

```
db.students.updateMany(
   { "Name": "Eve" },
   { $set: { "hobby": "Dancing" } }
)
```

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.updateMany(
...     { "Name": "Eve" },
...     { $set: { "hobby": "Dancing" } }
... )
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

7. Find documents where hobbies is set neither to Chess nor to Skating

db.students.find({ "hobby": { $nin: ["Chess", "Skating"] } })

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.find({ "hobby": { $nin: ["Chess
", "Skating"] } })
[
  {
    _id: ObjectId("661ce9dc76a00ff8cc51dae1"),
    Rollno: 10,
    Name: 'John',
    Age: 20,
    ContactNo: '1234567890',
    'Email-Id': 'john.doe@example.com',
    grade: 'A',
    hobby: 'Reading'
  },
  {
    _id: ObjectId("661ce9dc76a00ff8cc51dae2"),
    Rollno: 11,
    Name: 'Alicee',
    Age: 21,
    ContactNo: '9876543210',
    'Email-Id': 'alice@example.com',
    grade: 'B',
    hobby: 'Painting'
  },
  {
    _id: ObjectId("661ce9dc76a00ff8cc51dae3"),
    Rollno: 12,
    Name: 'Bob',
    Age: 22,
    ContactNo: '2345678901',
    'Email-Id': 'bob@example.com',
    grade: 'C',
    hobby: 'Cooking'
  },
```

8. Find documents whose name begins with A

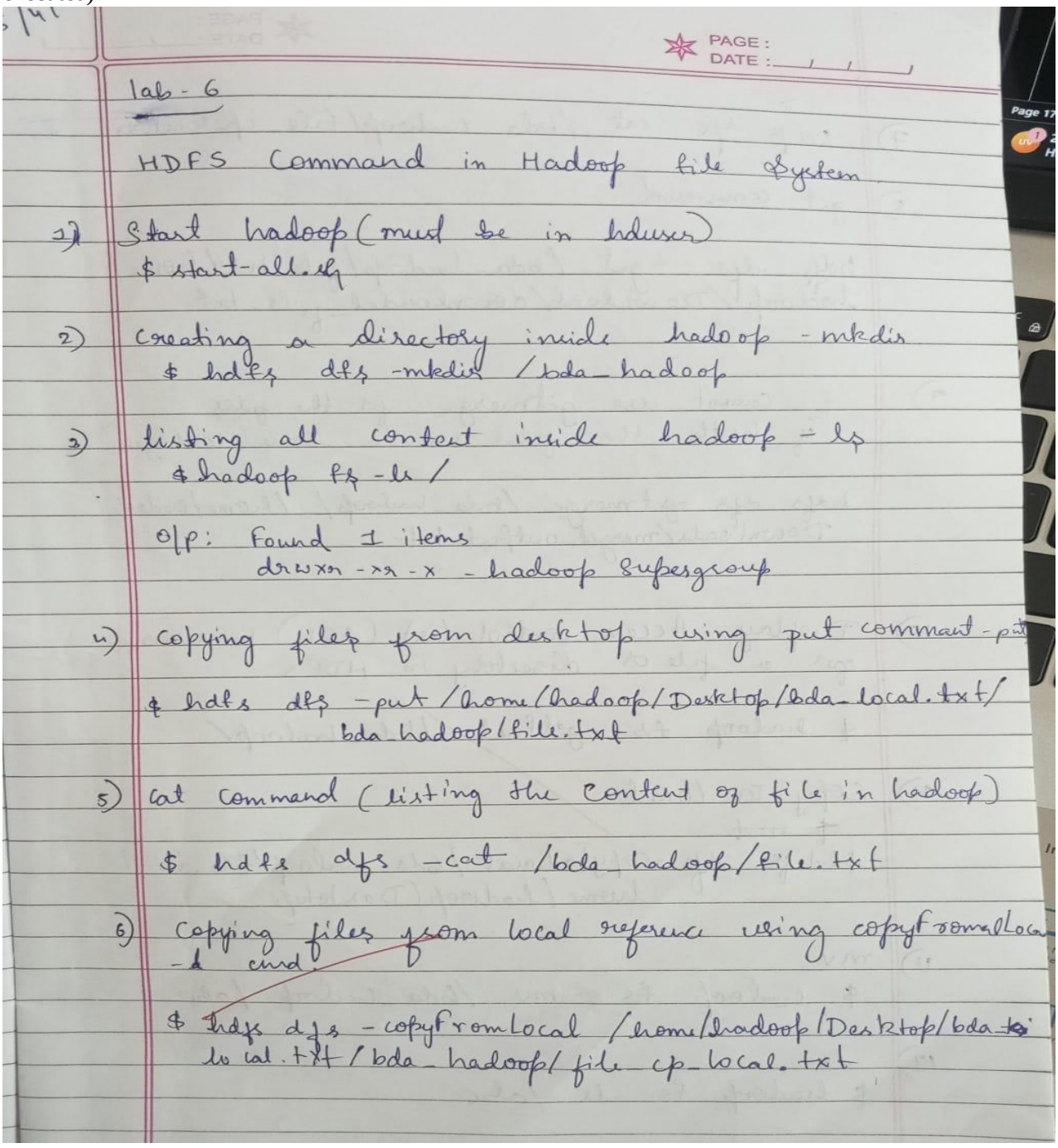
db.students.find({ "Name": /^A/ })

```
Atlas atlas-wanmtx-shard-0 [primary] Students> db.students.find({ "Name": /^A/ })
[
  {
    _id: ObjectId("661ce9dc76a00ff8cc51dae2"),
    Rollno: 11,
    Name: 'Alicee',
    Age: 21,
    ContactNo: '9876543210',
    'Email-Id': 'alice@example.com',
    grade: 'B',
    hobby: 'Painting'
  }
]
```

Experiment - 5

1.3.3 Question:

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



lab - 6

HDFS Command in Hadoop file System

1) Start hadoop (must be in hduser)
$ start-all.sh

2) Creating a directory inside hadoop - mkdir
$ hdfs dfs -mkdir /bda_hadoop

3) listing all content inside hadoop - ls
$ hadoop fs -ls /

o/p: Found 1 items
drwxr-xr-x - hadoop supergroup

4) copying files from desktop using put command - put
$ hdfs dfs -put /home/hadoop/Desktop/bda_local.txt/
bda_hadoop/file.txt

5) cat command (listing the content of file in hadoop)
$ hdfs dfs -cat /bda_hadoop/file.txt

6) copying files from local reference using copyfromLocal
-d cmd.
$ hdfs dfs -copyfromLocal /home/hadoop/Desktop/bda_local.txt /bda_hadoop/file_cp_local.txt

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7) hdfs dfs -cat /bda_hadoop/file_cp_local.txt

8) get command

hdfs dfs -get /bda_hadoop/file.txt /home/hadoop/Downloads/downloaded_file.txt

9) Cannot use getmerge for the files if both the files are in same (local system)

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

10) Display Access control list (ACL) permissions for a file or directory in HDFS

$ hadoop fs -getfacl /bda_hadoop/

11) Copy To Local

~~$ hadoop~~

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

12) mv

$ hadoop fs -mv /bda_hadoop /abc

13) ls

$ hadoop fs -ls /abc

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13 - copy

$ hadoop fs -cp /hello/ /hadoop_lab

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1.3.4 Code with Output:

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~$ cd ./Desktop/
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ 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-800-G9-Desktop-PC]
Starting resourcemanager
Starting nodemanagers
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -mkdir /Lab05
```

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hadoop fs -ls /Hadoop
ls: `/Hadoop': No such file or directory
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hadoop fs -ls /Lab05
```

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ touch test.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ nano text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -put ./text.txt /Lab05/text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hadoop fs -ls /Lab05
Found 1 items
-rw-r--r--   1 hadoop supergroup         19 2024-05-13 14:33 /Lab05/text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -cat /Lab05/text.txt
Hello
How are you?
```

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hadoop fs -ls /Lab05
Found 2 items
-rw-r--r--   1 hadoop supergroup         15 2024-05-13 14:40 /Lab05/test.txt
-rw-r--r--   1 hadoop supergroup         19 2024-05-13 14:33 /Lab05/text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -getmerge /Lab05 /text.txt /Lab05 /test.txt ../
Downloads/Merged.txt
getmerge: `/text.txt': No such file or directory
getmerge: `/test.txt': No such file or directory
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -getmerge /Lab05/text.txt /Lab05/test.txt ../Do
wnloads/Merged.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hadoop fs -getfacl /Lab05
# file: /Lab05
# owner: hadoop
# group: supergroup
user::rwx
group::r-x
other::r-x
```

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -copyToLocal /Lab05/text.txt ../Documents
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -copyToLocal /Lab05/test.txt ../Documents
```

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -cat /Lab05/text.txt
Hello
How are you?
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -mv /Lab05 /test_Lab05
```

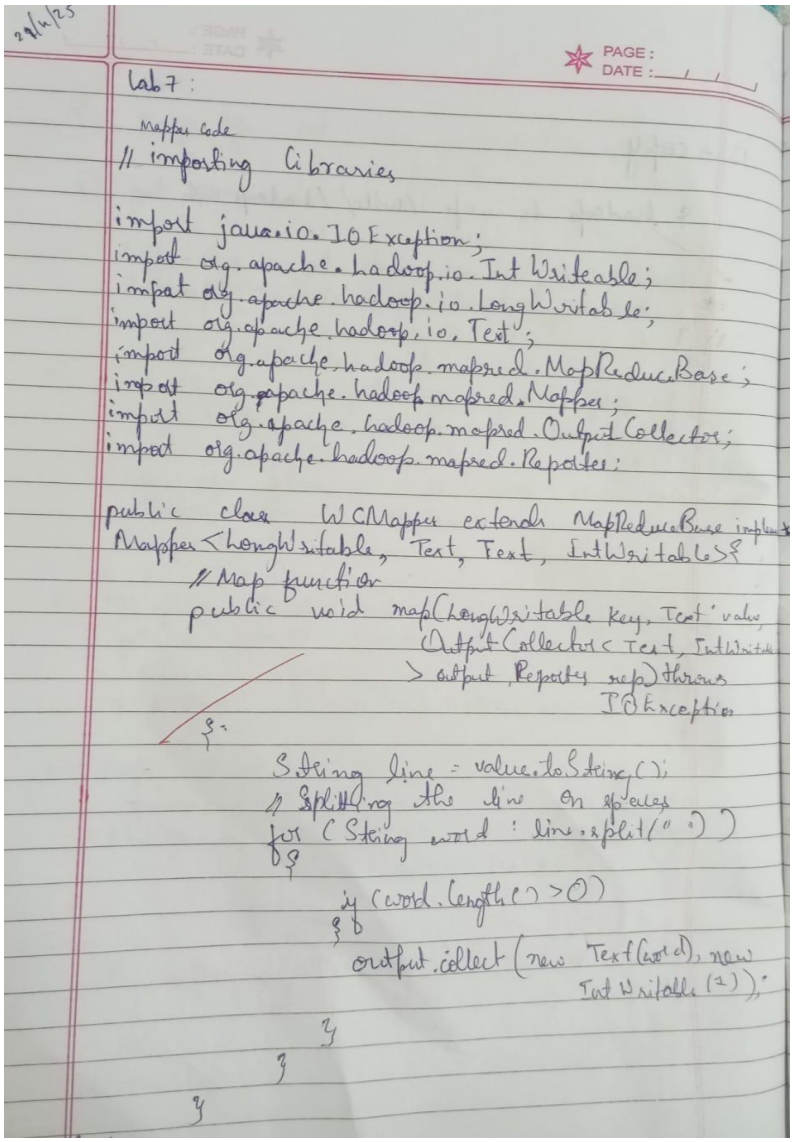
`

```
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -ls /test_Lab05
Found 2 items
-rw-r--r--   1 hadoop supergroup         15 2024-05-13 14:40 /test_Lab05/test.txt
-rw-r--r--   1 hadoop supergroup         19 2024-05-13 14:33 /test_Lab05/text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -cp /test_Lab05/ /Lab05
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -ls /Lab05
Found 2 items
-rw-r--r--   1 hadoop supergroup         15 2024-05-13 14:51 /Lab05/test.txt
-rw-r--r--   1 hadoop supergroup         19 2024-05-13 14:51 /Lab05/text.txt
hadoop@bmscecse-HP-Elite-Tower-800-G9-Desktop-PC:~/Desktop$ hdfs dfs -ls /test_Lab05
Found 2 items
-rw-r--r--   1 hadoop supergroup         15 2024-05-13 14:40 /test_Lab05/test.txt
-rw-r--r--   1 hadoop supergroup         19 2024-05-13 14:33 /test_Lab05/text.txt
```

Experiment - 6

1.3.5 Question:

Implement WordCount Program on Hadoop framework.



```
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lab 7 :

Mapper code
// importing libraries

import java.io.IOException;
import org.apache.hadoop.io.IntWriteable;
impat org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
impod org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.Mapper;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reporter;

public class WCMapper extends MapReduceBase implements
Mapper<LongWritable, Text, Text, IntWritable>{
    // Map function
    public void map(LongWritable key, Text value,
                    OutputCollector< Text, IntWritable
                    > output, Reporter rep) throws
                    IOException
    {
        String line = value.toString();
        // Splitting the line on spaces
        for (String word : line.split(" "))
        {
            if (word.length() > 0)
            {
                output.collect(new Text(word), new
                               IntWritable(1));
            }
        }
    }
}
```

```
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;

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

Driver code :

```
import java.io.IOException;
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.FileInputFormat;
import org.apache.hadoop.mapred.FileOutput
import org.apache.hadoop.JobClient;
import org.apache.hadoop.mapred.JobConf;
import org.apache.hadoop.util.Tool;
import org.apache.hadoop.util.ToolRunner;

public class WCDrivers 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(WCDrivers.class);
    FileInputFormat.setInputPaths(conf, new Path(args[0]));
    FileOutputFormat.setOutputPath(conf, new Path(args[1]));
    conf.setReducer
    conf.setMapperClass(WCMappers.class);
    conf.setReducerClass(WCReducers.class);
    conf.setMapOutputKeyClass(Text.class);
    conf.setMapOutputValueClass(IntWritable.class);
    JobClient.runJob(conf);
    return 0;
  }
```

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

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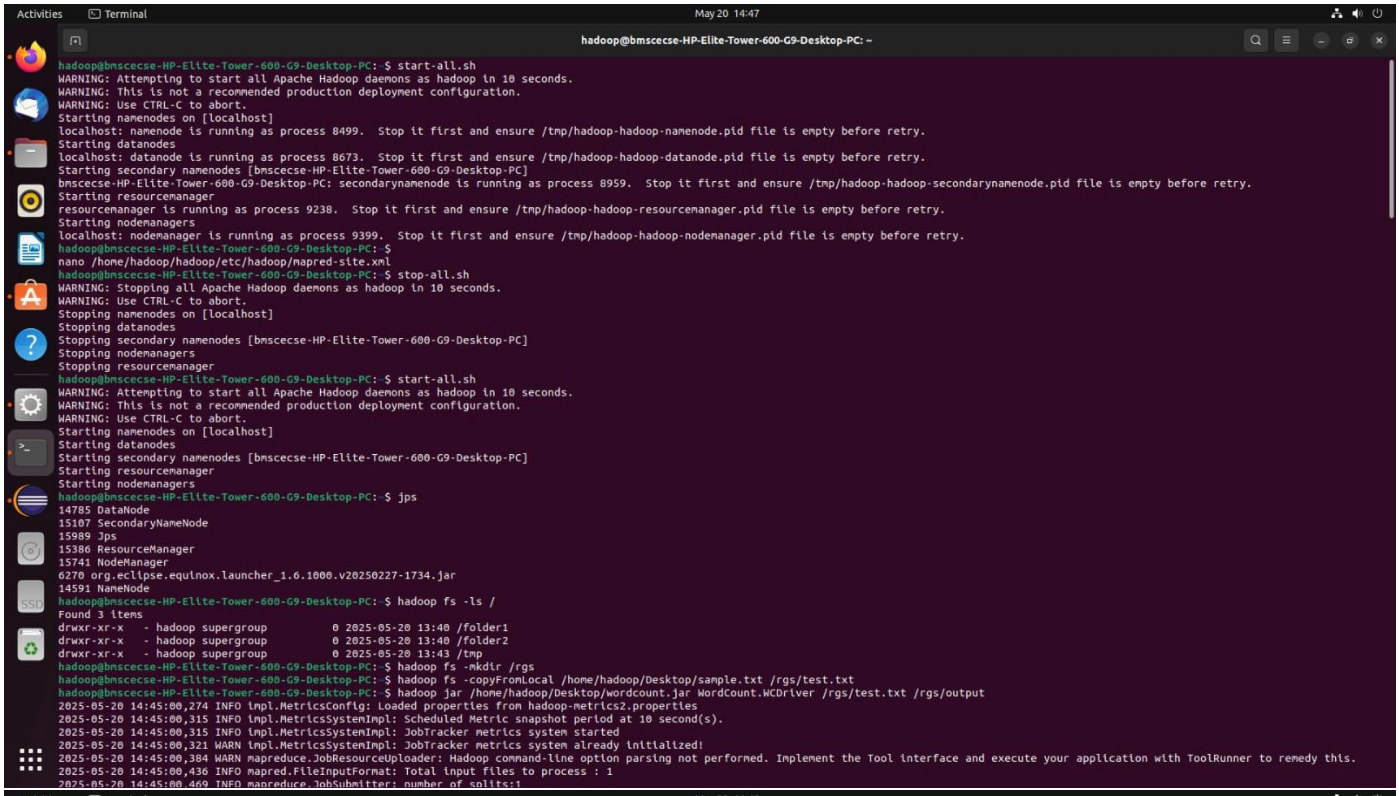
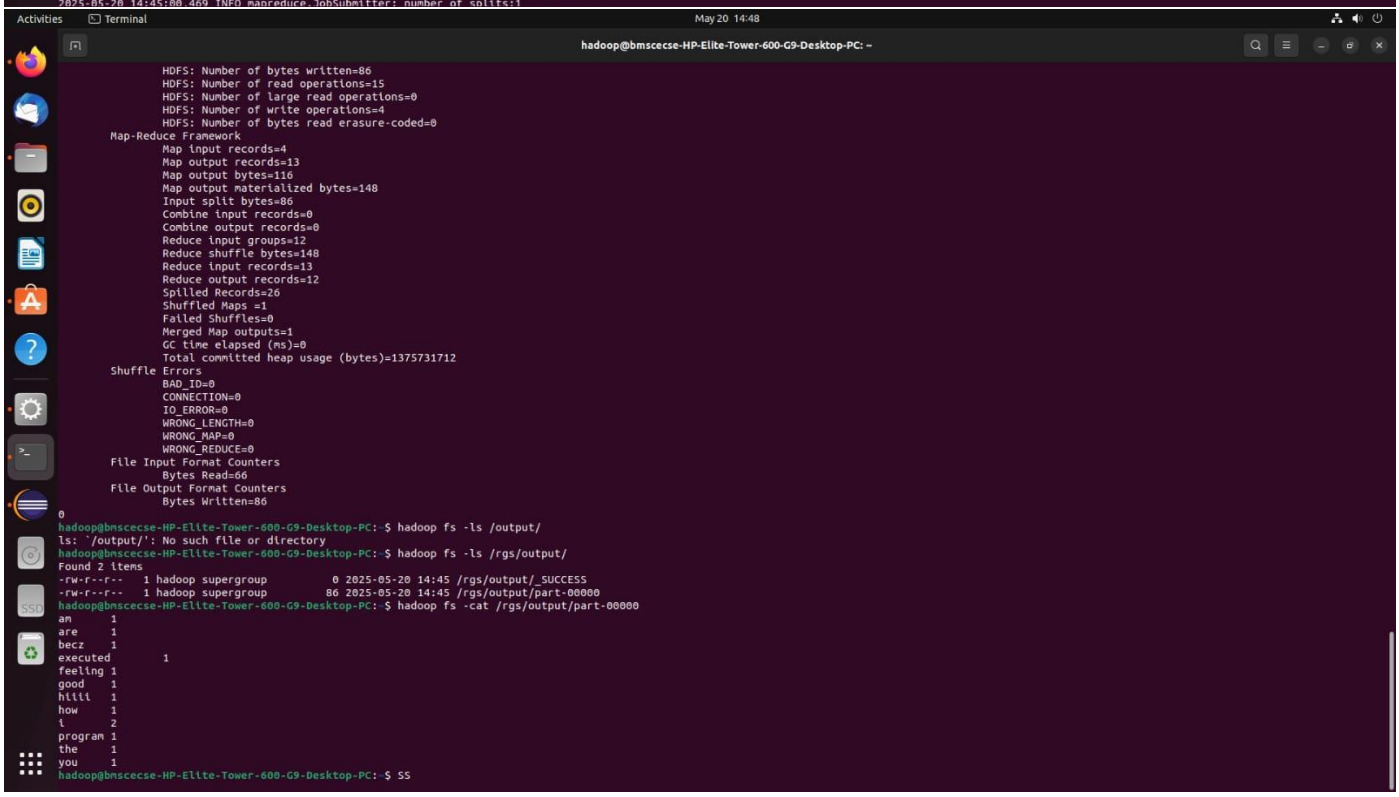




1.3.6 Code with Output:

Mapper Code:

```
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));
} } } }
```

Reducer Code:

```
// Importing libraries
import java.io.IOException;
import java.util.Iterator;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;
public class WCReducer extends MapReduceBase implements Reducer<Text,IntWritable, Text,
IntWritable> {
// Reduce function
public void reduce(Text key, Iterator<IntWritable> value,
OutputCollector<Text, IntWritable> output,
Reporter rep) throws IOException
{
int count = 0;
// Counting the frequency of each words
while (value.hasNext())
{
IntWritable i = value.next();
count += i.get();
}
output.collect(key, new IntWritable(count));
```

```
} }
```

Driver Code: WCDriver Java Class file.

```
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);
}
}
```

1.4 Experiment - 7

1.4.1 Question:

From the following link extract the weather data:
https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all

Create a Map Reduce program to:

c) Find average temperature for each year from NCDC data set.
d) Find the mean max temperature for every month.

1.4.2 Code with Output:

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

AverageDriver:

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

AverageMapper:

```
package temp;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class AverageMapper extends Mapper<LongWritable, Text, Text, IntWritable> {
public static final int MISSING = 9999;
public void map(LongWritable key, Text value, Mapper<LongWritable, Text, Text,
IntWritable>.Context context) throws IOException, InterruptedException {
int temperature;
String line = value.toString();
String year = line.substring(15, 19);
if (line.charAt(87) == '+') {
```

```
temperature = Integer.parseInt(line.substring(88, 92));
} else {
temperature = Integer.parseInt(line.substring(87, 92));
}
String quality = line.substring(92, 93);
if (temperature != 9999 && quality.matches("[01459]"))
context.write(new Text(year), new IntWritable(temperature));
}
}
```

AverageReducer:

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

```
C:\hadoop-3.3.0\sbin>hadoop jar C:\avgtemp.jar temp.AverageDriver /input_dir/temp.txt /avgtemp_outputdir
2021-05-15 14:52:50,635 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-15 14:52:51,005 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2021-05-15 14:52:51,111 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1621060230696_0005
2021-05-15 14:52:51,735 INFO input.FileInputFormat: Total input files to process : 1
2021-05-15 14:52:52,751 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-15 14:52:53,073 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1621060230696_0005
2021-05-15 14:52:53,073 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-15 14:52:53,237 INFO conf.Configuration: resource-types.xml not found
2021-05-15 14:52:53,238 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-15 14:52:53,312 INFO impl.YarnClientImpl: Submitted application application_1621060230696_0005
2021-05-15 14:52:53,352 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1621060230696_0005/
2021-05-15 14:52:53,353 INFO mapreduce.Job: Running job: job_1621060230696_0005
2021-05-15 14:53:06,640 INFO mapreduce.Job: Job job_1621060230696_0005 running in uber mode : false
2021-05-15 14:53:06,643 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-15 14:53:12,758 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-15 14:53:19,860 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-15 14:53:25,967 INFO mapreduce.Job: Job job_1621060230696_0005 completed successfully
2021-05-15 14:53:26,096 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=72210
                FILE: Number of bytes written=674341
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=894860
                HDFS: Number of bytes written=8
                HDFS: Number of read operations=8
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
                HDFS: Number of bytes read erasure-coded=0
        Job Counters
                Launched map tasks=1
                Launched reduce tasks=1
                Data-local map tasks=1
                Total time spent by all maps in occupied slots (ms)=3782
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -ls /avgtemp_outputdir
Found 2 items
-rw-r--r--   1 Anusree supergroup          0 2021-05-15 14:53 /avgtemp_outputdir/_SUCCESS
-rw-r--r--   1 Anusree supergroup          8 2021-05-15 14:53 /avgtemp_outputdir/part-r-00000

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /avgtemp_outputdir/part-r-00000
1901    46

C:\hadoop-3.3.0\sbin>
```

b) find the mean max temperature for every month

MeanMaxDriver.class

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

MeanMaxMapper.class

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

```
}
String quality = line.substring(92, 93);
if (temperature != 9999 && quality.matches("[01459]"))
context.write(new Text(month), new IntWritable(temperature));
}
}
```

MeanMaxReducer.class

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

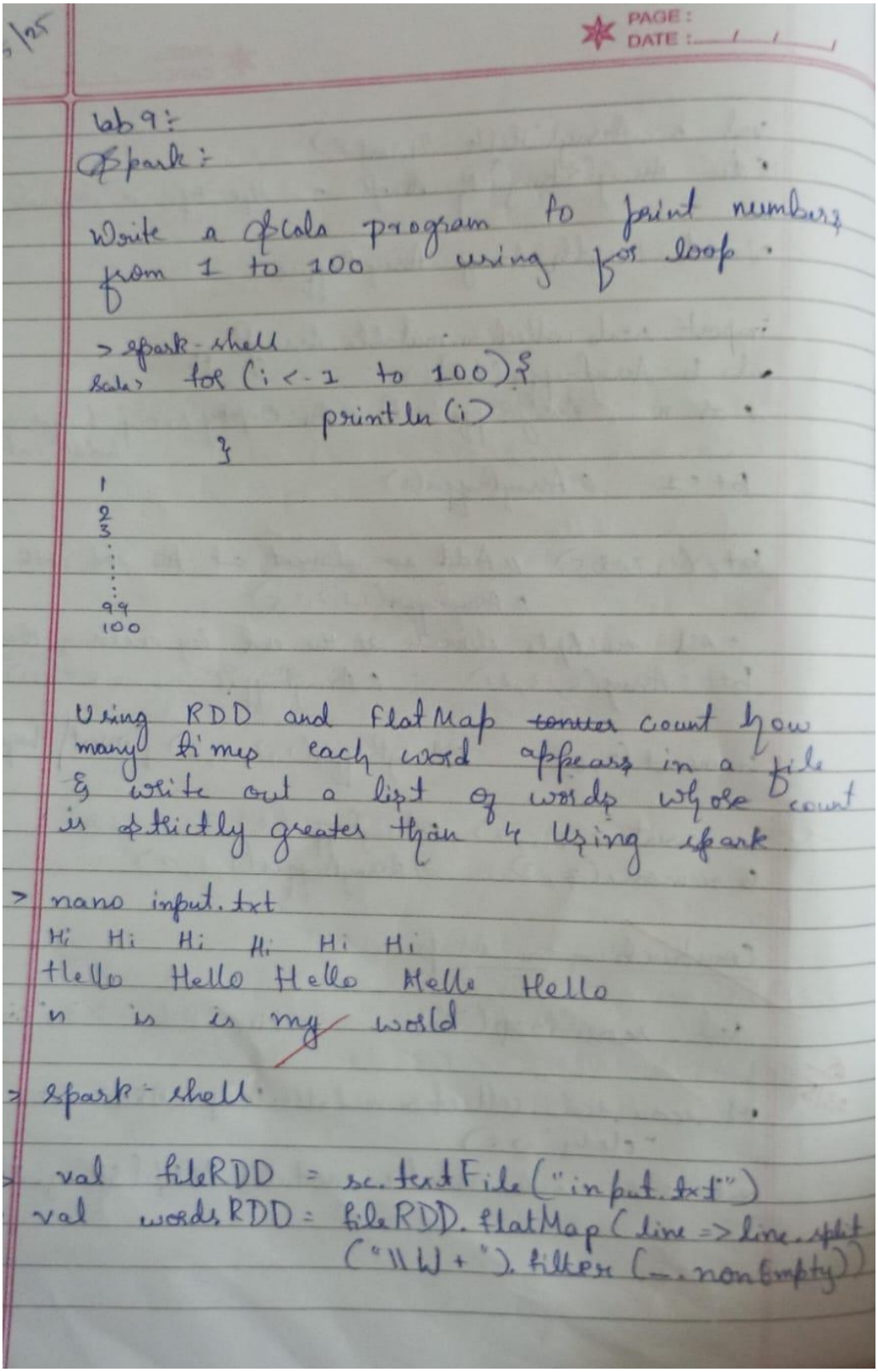
```
C:\hadoop-3.3.0\sbin>hadoop jar C:\meanmax.jar meanmax.MeanMaxDriver /input_dir/temp.txt /meanmax_output
2021-05-21 20:28:05,250 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-21 20:28:06,662 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2021-05-21 20:28:06,916 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1621608943095_0001
2021-05-21 20:28:08,426 INFO input.FileInputFormat: Total input files to process : 1
2021-05-21 20:28:09,107 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-21 20:28:09,741 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1621608943095_0001
2021-05-21 20:28:09,741 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-21 20:28:10,029 INFO conf.Configuration: resource-types.xml not found
2021-05-21 20:28:10,030 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-21 20:28:10,676 INFO impl.YarnClientImpl: Submitted application application_1621608943095_0001
2021-05-21 20:28:11,005 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1621608943095_0001/
2021-05-21 20:28:11,006 INFO mapreduce.Job: Running job: job_1621608943095_0001
2021-05-21 20:28:29,385 INFO mapreduce.Job: Job job_1621608943095_0001 running in uber mode : false
2021-05-21 20:28:29,389 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-21 20:28:40,664 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-21 20:28:50,832 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-21 20:28:58,965 INFO mapreduce.Job: Job job_1621608943095_0001 completed successfully
2021-05-21 20:28:59,178 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=59082
                FILE: Number of bytes written=648091
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=894860
                HDFS: Number of bytes written=74
                HDFS: Number of read operations=8
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
                HDFS: Number of bytes read erasure-coded=0
        Job Counters
                Launched map tasks=1
                Launched reduce tasks=1
                Data-local map tasks=1
                Total time spent by all maps in occupied slots (ms)=8077
                Total time spent by all reduces in occupied slots (ms)=7511
                Total time spent by all map tasks (ms)=8077
                Total time spent by all reduce tasks (ms)=7511
                Total vcore-milliseconds taken by all map tasks=8077
                Total vcore-milliseconds taken by all reduce tasks=7511
                Total megabyte-milliseconds taken by all map tasks=8270848
                Total megabyte-milliseconds taken by all reduce tasks=7691264
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /meanmax_output/*
01      4
02      0
03      7
04      44
05      100
06      168
07      219
08      198
09      141
10      100
11      19
12      3

C:\hadoop-3.3.0\sbin>
```

Experiment – 8

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



lab 9:

Spark:

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

```
> spark-shell
scala> for (i <- 1 to 100){
          println(i)
       }
1
2
3
.
.
.
99
100
```

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

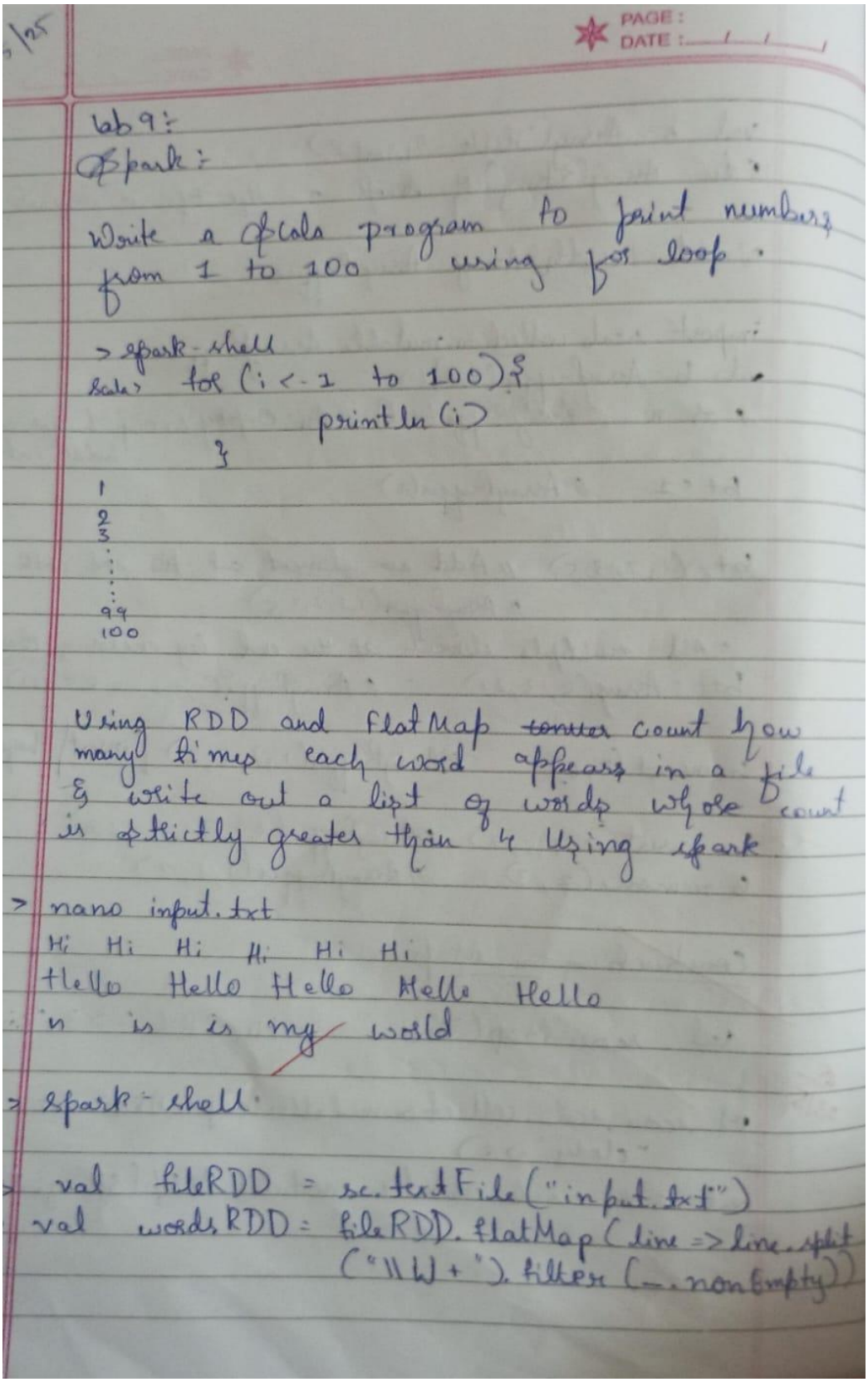
```
> nano input.txt
Hi Hi Hi Hi Hi Hi
Hello Hello Hello Hello Hello
is is is my world

> spark-shell

> val fileRDD = sc.textFile("input.txt")
val wordsRDD = fileRDD.flatMap(line => line.split("\\W+")).filter(_.nonEmpty))
```

Experiment – 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.



lab 9:

Spark:

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

> spark-shell

Scala> for (i <- 1 to 100) {
println (i)
}

1
2
3
.
.
.
99
100

Using RDD and FlatMap ~~counter~~ count how many times each word appears in a file & 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("\\W+")).filter(_.nonEmpty))

PAGE :
DATE : / /

> 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}

> val result = filteredWordsRDD.collect()

> result.foreach(println)
(Hi, 6)
(Hello, 5)

Q For a given text file, create a map reduce program to sort the content in an alphabetical order listing only top 10 maximum occurences of words

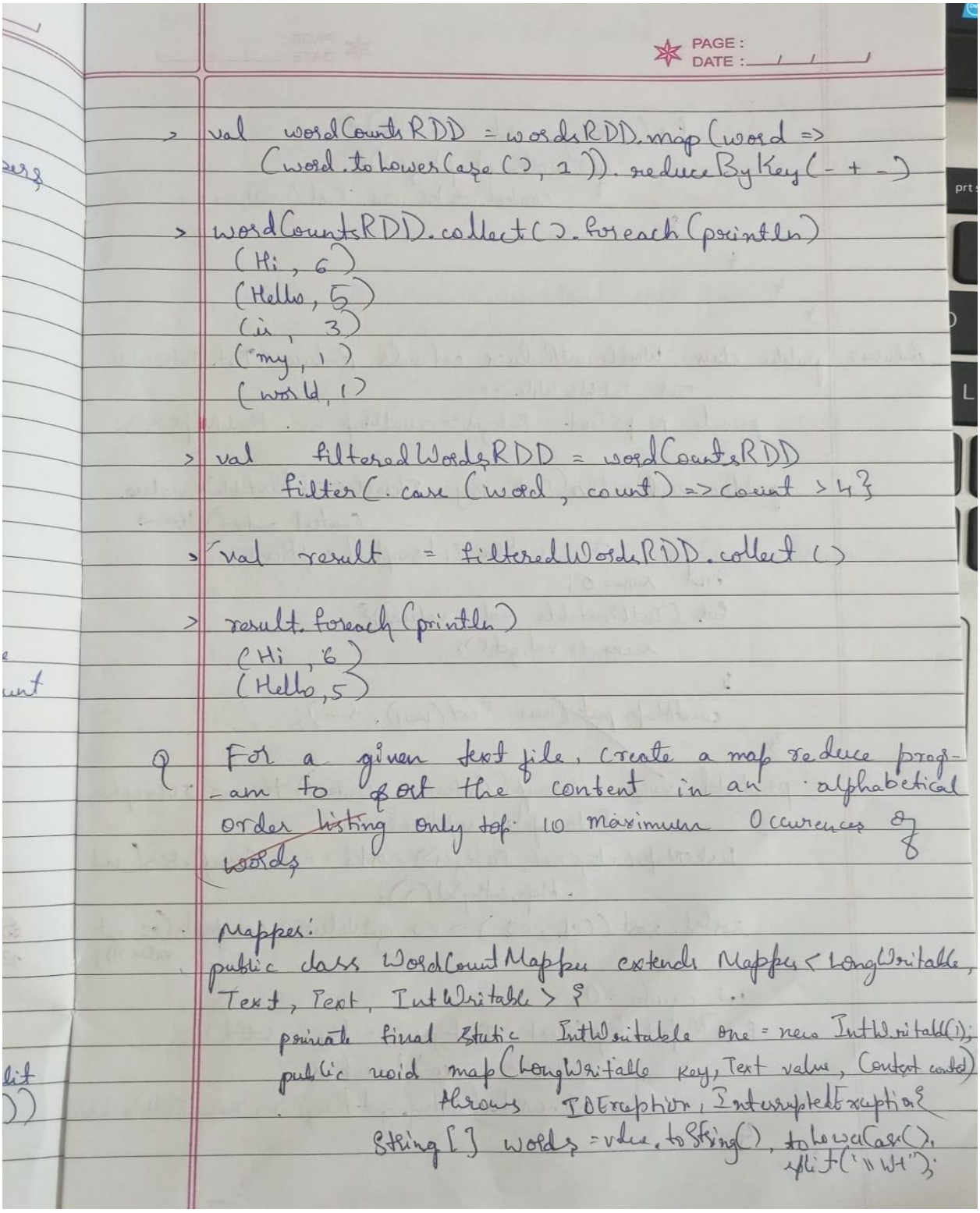
Mapper:
public class WordCountMapper extends Mapper<LongWritable, Text, Text, IntWritable> {
private final static IntWritable one = new IntWritable(1);
public void map(LongWritable key, Text value, Context context)
throws IOException, InterruptedException {
String[] words = value.toString().toLowerCase().
split("\\W+");

}

Experiment - 10

1.4.3 Question:

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.



```
> 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}

> val result = filteredWordsRDD.collect()

> result.foreach(println)
(Hi, 6)
(Hello, 5)
```

Q For a given text file, create a map reduce program to sort the content in an alphabetical order ~~listing~~ only top 10 maximum occurences of words

Mapper:

```
public class WordCountMapper extends Mapper<LongWritable,
Text, Text, IntWritable> {
    private final static IntWritable one = new IntWritable(1);
    public void map(LongWritable key, Text value, Context context)
            throws IOException, InterruptedException{
        String[] words = value.toString().toLowerCase().
                split("\\W+");
```

```
        for(String word : words){
            if(!word.isEmpty()){
                context.write(new Text(word), one);
            }
        }
    }
}
```

Reducer:

```
public class WordCountReducer extends Reducer<Text, IntWritable,
        Text, IntWritable>{
    private Map<Text, Integer> countMap = new HashMap<>();

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

    protected void cleanup(Context context) throws IOException,
            InterruptedException{
        List<Map.Entry<Text, Integer>> sorted = new ArrayList<>(cont
                .Map.entrySet());
        sorted.sort((e1, e2) -> e2.getValue().compareTo(e1.get
                Value()));

        int counter = 0;
        for(Map.Entry<Text, Integer> entry : sorted){
            if(counter++ == 10) break;
            context.write(entry.getKey(), new IntWritable(en
        }
    }
}
```

1.4.4 Code with Output:

Driver-TopN.class

```
package samples.topn;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.GenericOptionsParser;
public class TopN {
public static void main(String[] args) throws Exception {
Configuration conf = new Configuration();
String[] otherArgs = (new GenericOptionsParser(conf, args)).getRemainingArgs();
if (otherArgs.length != 2) {
System.err.println("Usage: TopN <in> <out>");
System.exit(2);
}
Job job = Job.getInstance(conf);
job.setJobName("Top N");
job.setJarByClass(TopN.class);
job.setMapperClass(TopNMapper.class);
job.setReducerClass(TopNReducer.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
FileInputFormat.addInputPath(job, new Path(otherArgs[0]));
FileOutputFormat.setOutputPath(job, new Path(otherArgs[1]));
System.exit(job.waitForCompletion(true) ? 0 : 1);
}
public static class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
private static final IntWritable one = new IntWritable(1);
private Text word = new Text();
private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']";
public void map(Object key, Text value, Mapper<Object, Text, Text, IntWritable>.Context
context) throws IOException, InterruptedException {
String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, " ");
StringTokenizer itr = new StringTokenizer(cleanLine);
while (itr.hasMoreTokens()) {
this.word.set(itr.nextToken().trim());
context.write(this.word, one);
}
}
}
}
```

TopNCombiner.class

```
package samples.topn;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class TopNCombiner extends Reducer<Text, IntWritable, Text, IntWritable> {
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable,
Text, IntWritable>.Context context) throws IOException, InterruptedException {
int sum = 0;
for (IntWritable val : values)
sum += val.get();
context.write(key, new IntWritable(sum));
}
}
```

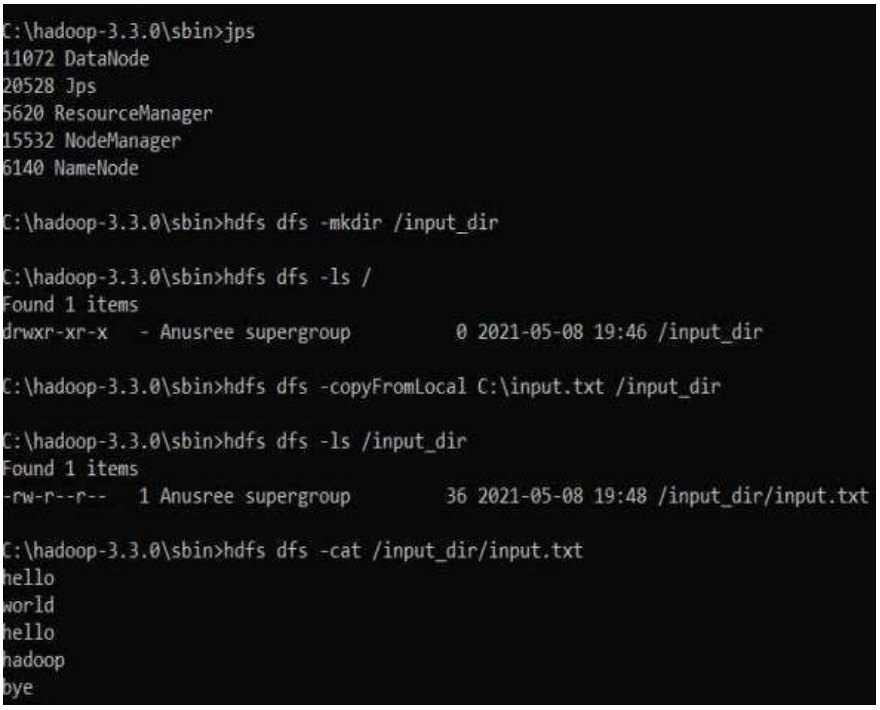
TopNMapper.class

```
package samples.topn;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class TopNMapper extends Mapper<Object, Text, Text, IntWritable> {
private static final IntWritable one = new IntWritable(1);
private Text word = new Text();
private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']";
public void map(Object key, Text value, Mapper<Object, Text, Text, IntWritable>.Context
context) throws IOException, InterruptedException {
String cleanLine = value.toString().toLowerCase().replaceAll(this.tokens, " ");
StringTokenizer itr = new StringTokenizer(cleanLine);
while (itr.hasMoreTokens()) {
this.word.set(itr.nextToken().trim());
context.write(this.word, one);
}
}
}
```

TopNReducer.class

```
package samples.topn;
import java.io.IOException;
import java.util.HashMap;
import java.util.Map;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
import utils.MiscUtils;
public class TopNReducer extends Reducer<Text, IntWritable, Text, IntWritable> {
private Map<Text, IntWritable> countMap = new HashMap<>();
public void reduce(Text key, Iterable<IntWritable> values, Reducer<Text, IntWritable,
Text, IntWritable>.Context context) throws IOException, InterruptedException {
int sum = 0;
for (IntWritable val : values)
```

```
sum += val.get();
this.countMap.put(new Text(key), new IntWritable(sum));
}
protected void cleanup(Reducer<Text, IntWritable, Text, IntWritable>.Context context)
throws IOException, InterruptedException {
Map<Text, IntWritable> sortedMap = MiscUtils.sortByValues(this.countMap);
int counter = 0;
for (Text key : sortedMap.keySet()) {
if (counter++ == 20)
break;
context.write(key, sortedMap.get(key));
}
}
}
```

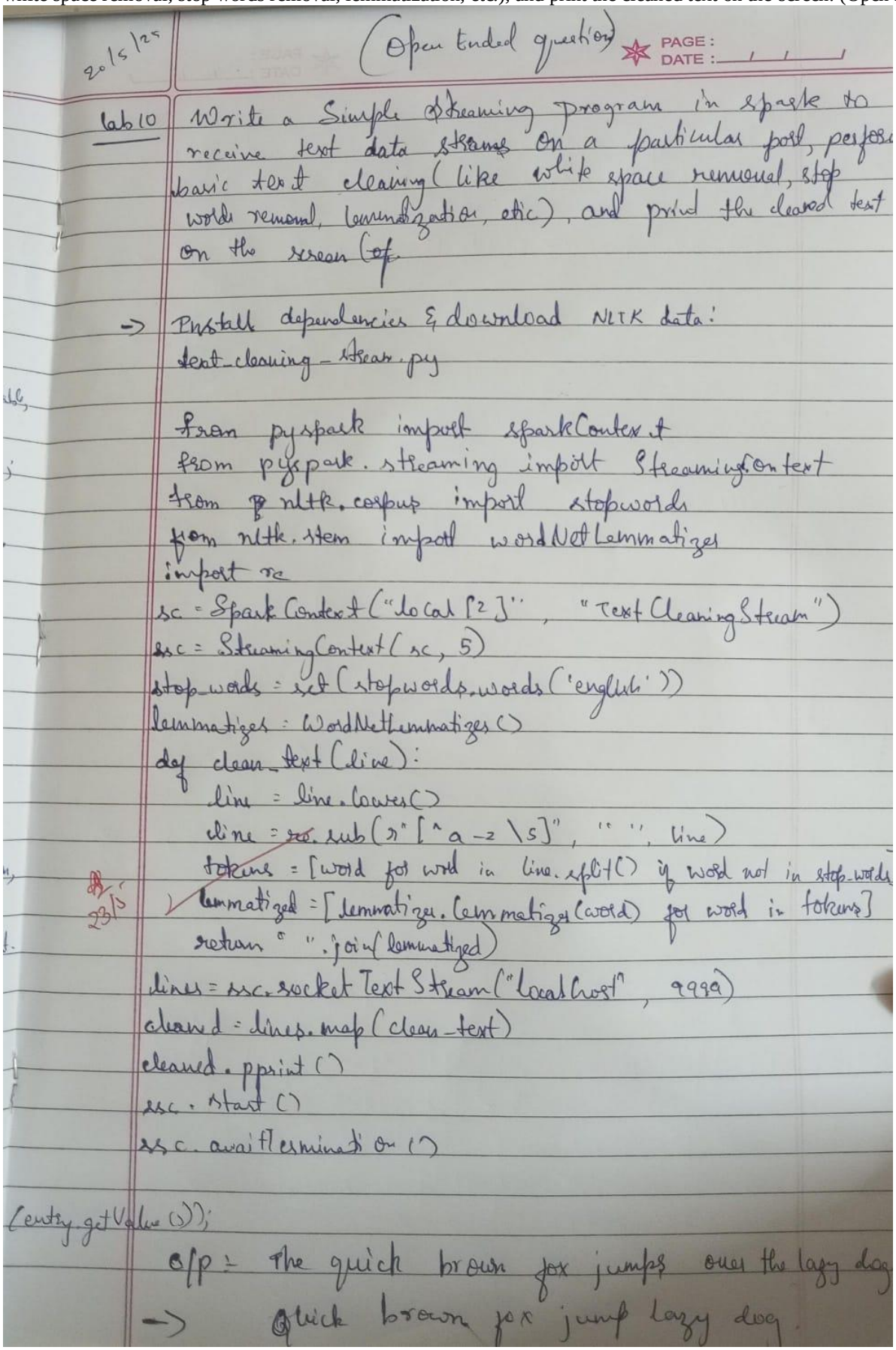


```
C:\hadoop-3.3.0\sbin>hadoop jar C:\sort.jar samples.topn.TopN /input_dir/input.txt /output_dir
2021-05-08 19:54:54,582 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-08 19:54:55,291 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1620483374279_0001
2021-05-08 19:54:55,821 INFO input.FileInputFormat: Total input files to process : 1
2021-05-08 19:54:56,261 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1620483374279_0001
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-08 19:54:56,843 INFO conf.Configuration: resource-types.xml not found
2021-05-08 19:54:56,843 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-08 19:54:57,387 INFO impl.YarnClientImpl: Submitted application application_1620483374279_0001
2021-05-08 19:54:57,507 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1620483374279_0001/
2021-05-08 19:54:57,508 INFO mapreduce.Job: Running job: job_1620483374279_0001
2021-05-08 19:55:13,792 INFO mapreduce.Job: Job job_1620483374279_0001 running in uber mode : false
2021-05-08 19:55:13,794 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-08 19:55:20,020 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-08 19:55:27,116 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-08 19:55:33,199 INFO mapreduce.Job: Job job_1620483374279_0001 completed successfully
2021-05-08 19:55:33,334 INFO mapreduce.Job: Counters: 54
       File System Counters
              FILE: Number of bytes read=65
              FILE: Number of bytes written=530397
              FILE: Number of read operations=0
              FILE: Number of large read operations=0
              FILE: Number of write operations=0
              HDFS: Number of bytes read=142
              HDFS: Number of bytes written=31
              HDFS: Number of read operations=8
              HDFS: Number of large read operations=0
              HDFS: Number of write operations=2
              HDFS: Number of bytes read erasure-coded=0
```

```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /output_dir/*
hello   2
hadoop  1
world   1
bye     1

C:\hadoop-3.3.0\sbin>
```

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).



Lab 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 (o/p

-> Install dependencies & download NLTK data:

text_cleaning_stream.py

```
from pyspark import SparkContext
from pyspark.streaming import StreamingContext
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer
import re
sc = SparkContext("local[2]", "TextCleaningStream")
ssc = StreamingContext(sc, 5)
stop_words = set(stopwords.words('english'))
lemmatizer = WordNetLemmatizer()
def clean_text(line):
    line = line.lower()
    line = re.sub(r"[^a-z\s]", "", line)
    tokens = [word for word in line.split() if word not in stop_words]
    lemmatized = [lemmatizer.lemmatize(word) for word in tokens]
    return " ".join(lemmatized)
lines = ssc.socketTextStream("localhost", 9999)
cleaned = lines.map(clean_text)
cleaned.pprint()
ssc.start()
ssc.awaitTermination()
```

(entry.getValue());

o/p : The quick brown fox jumps over the lazy dog

-> quick brown fox jump lazy dog.