VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS
(20CS6PEBDA)

Submitted by

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

B.M.S. COLLEGE OF ENGINEERING
(Autonomous Institution under VTU)
BENGALURU-560019
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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**BIG DATA ANALYTICS**" carried out by **Mahantesh Gattina (1BM19CS219),** who is a bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Big Data Analytics - (20CS6PEBDA)**work prescribed for the said degree.

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Index Sheet

Course Outcome

CO1	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO2	Analyze the Big Data and obtain insight using data analytics mechanisms.
CO3	Design and implement Big data applications by applying NoSQL, Hadoop or Spark

Program 1: Employee Database using Cassandra

1. Create a keyspace by name Employee

CREATE KEYSPACE employee WITH REPLICATION={ 'class' : 'SimpleStrategy', 'replication_factor' : 1};

USE employee;

2. Create a column family by name Employee-Info with attributes Emp_Id Primary Key, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name

create table employee_info(emp_id int PRIMARY KEY, emp_name text, designation text, date_of_joining timestamp, salary double, dept_name text);

3. Insert the values into the table in batch

BEGIN BATCH

INSERT INTO employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name) VALUES(100,'TANYA','MANAGER','2020-09-11',30000,'TESTING')

... INSERT INTO employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name) VALUES(111,'SRIRAM','ASSOCIATE','2020-06-22',25000,'DEVELOPING')

... INSERT INTO employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name) VALUES(121,'SHIVA','MANAGER','2020-03-30',35000,'HR')

... APPLY BATCH;

SELECT * FROM employee_info;

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

UPDATE employee_info SET emp_name = 'SHAAN' WHERE emp_id = 121; SELECT * FROM employee_info;

5. Alter the schema of the table Employee_Info to add a column Projects which stores a set of Projects done by the corresponding Employee.

ALTER TABLE employee_info ADD projects text;

6. Update the altered table to add project names.

UPDATE employee_info SET projects = 'chat app' WHERE emp_id = 111;

UPDATE employee_info SET projects = 'campusx' WHERE emp_id = 121;

UPDATE employee_info SET projects = 'canteen app' WHERE emp_id = 100;

SELECT * FROM employee_info;

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

INSERT INTO
employee_info(emp_id,emp_name,designation,date_of_joining,salary,dept_name)
VALUES(110,'SAM','ASSOCIATE','2020-01-11',33000,'TESTING') USING TTL 15;

SELECT TTL(emp_name) from employee_info WHERE emp_id = 110; SELECT * FROM
employee_info;

Program 2:

Library Database using Cassandra

1.Create a keyspace by name Library

CREATE KEYSPACE library WITH REPLICATION={ 'class' : 'SimpleStrategy', 'replication_factor' : 1};

USE library;

2. 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

create table library_info(stud_id int, counter_value Counter, stud_name text,book_name text, date_of_issue timestamp, book_id int, PRIMARY KEY(stud_id,stud_name,book_name,date_of_issue,book_id));

3. Insert the values into the table in batch

UPDATE library_info SET counter_value = counter_value + 1 WHERE stud_id = 111 and stud_name = 'SAM' and book_name = 'ML' and date_of_issue = '2020-10-11'and book_id = 200;

UPDATE library_info SET counter_value = counter_value + 1 WHERE stud_id = 112 and stud_name = 'SHAAN' and book_name = 'BDA' and date_of_issue = '2020-09-21'and book_id = 300;

UPDATE library_info SET counter_value = counter_value + 1 WHERE stud_id = 113 and stud_name = 'AYMAN' and book_name = 'OOMD' and date_of_issue = '2020-04-01'and book_id = 400;

SELECT * FROM library_info;

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

UPDATE library_info SET counter_value = counter_value + 1 WHERE stud_id = 112 and stud_name = 'SHAAN' and book_name = 'BDA' and date_of_issue = '2020-09-21'and book_id = 300;

5. Write a query to show that a student with id 112 has taken a book “BDA” 2 times.

SELECT * FROM library_info WHERE stud_id = 112;

6. Export the created column to a csv file

COPY Library_Info(Stud_Id,Stud_Name,Book_Name,Book_Id,Date_Of_Issue,Counter_val ue) TO 'e:\libraryInfo.csv';

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

```
create table library_info2(stud_id int, counter_value Counter, stud_name text,book_name text,
date_of_issue timestamp, book_id int, PRIMARY
KEY(stud_id,stud_name,book_name,date_of_issue,book_id));

COPY library_info2(stud_id,stud_name,book_name,book_id,date_of_issue,counter _value)
FROM 'e:\libraryInfo.csv';
```

Program 3 :

Student MongoDB Program

```
> use mySTUD;

switched to db mySTUD

> db.getCollectionNames()

[ ]

> db.createCollection("Student");

{ "ok" : 1 }

> db.getCollectionNames()

[ "Student" ]

> db.Student.insert({_id: 1, Name:"John", USN: "1B22CS001",Semester: 6,Dept_name: "CSE", CGPA: 9.6, Hobbies : ["Reading","Gardening"]})

WriteResult({ "nInserted" : 1 })

> db.Student.insert({_id: 4, Name:"Arthur", USN: "1B22CS041",Semester: 6,Dept_name: "CSE", CGPA: 8.6, Hobbies : ["Novel Reading"]})

WriteResult({ "nInserted" : 1 })

> db.Student.insert({_id: 3, Name:"Horris", USN: "1B22EE021",Semester: 5,Dept_name: "EEE", CGPA: 9.3, Hobbies : ["eSports"]})

WriteResult({ "nInserted" : 1 })

> db.Student.insert({_id: 7, Name:"Hritik", USN: "1B22CS014",Semester: 5,Dept_name: "CSE", CGPA: 8.7, Hobbies : ["Reading"]})

WriteResult({ "nInserted" : 1 })

> db.Student.find().pretty()

{
        "_id" : 1,
        "Name" : "John",
        "USN" : "1B22CS001",
        "Semester" : 6,
```

```
        "Dept_name" : "CSE",
        "CGPA" : 9.6,
        "Hobbies" : [
                "Reading",
                "Gardening"
        ]
}
{
        "_id" : 4,
        "Name" : "Arthur",
        "USN" : "1B22CS041",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 8.6,
        "Hobbies" : [
                "Novel Reading"
        ]
}
{
        "_id" : 3,
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
        "Hobbies" : [
                "eSports"
        ]
```

```
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
        "Semester" : 5,
        "Dept_name" : "CSE",
        "CGPA" : 8.7,
        "Hobbies" : [
                "Reading"
        ]
}
```


```
> db.Student.update({_id: 3, Name:"Horris", USN: "1B22EE021",Semester: 5,Dept_name:
"EEE", CGPA: 9.3},{$set:{Hobbies:"Skating"}},{upset:true});
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.Student.find().pretty()
```


```
{
        "_id" : 1,
        "Name" : "John",
        "USN" : "1B22CS001",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 9.6,
        "Hobbies" : [
                "Reading",
                "Gardening"
        ]
}
```

```
{
        "_id" : 4,
        "Name" : "Arthur",
        "USN" : "1B22CS041",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 8.6,
        "Hobbies" : [
                "Novel Reading"
        ]
}
{
        "_id" : 3,
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
        "Hobbies" : "Skating"
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
        "Semester" : 5,
        "Dept_name" : "CSE",
        "CGPA" : 8.7,
        "Hobbies" : [
```

```
                "Reading"
        ]
}
> db.Student.find({},{StudName:1,Semester:1,_id:0});
{ "Semester" : 6 }
{ "Semester" : 6 }
{ "Semester" : 5 }
{ "Semester" : 5 }
> db.Student.find({},{Name:1,Semester:1,_id:0});
{ "Name" : "John", "Semester" : 6 }
{ "Name" : "Arthur", "Semester" : 6 }
{ "Name" : "Horris", "Semester" : 5 }
{ "Name" : "Hritik", "Semester" : 5 }

> db.Student.find({Semester:{$eq:5}}).pretty();
{
        "_id" : 3,
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
        "Hobbies" : "Skating"
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
```

```
        "Semester" : 5,
        "Dept_name" : "CSE",
        "CGPA" : 8.7,
        "Hobbies" : [
                "Reading"
        ]
}
> db.Student.count();
4
> db.Student.find().sort({Name:-1}).pretty();
{
        "_id" : 1,
        "Name" : "John",
        "USN" : "1B22CS001",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 9.6,
        "Hobbies" : [
                "Reading",
                "Gardening"
        ]
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
        "Semester" : 5,
        "Dept_name" : "CSE",
```

```
        "CGPA" : 8.7,
        "Hobbies" : [
                "Reading"
        ]
}
{
        "_id" : 3,
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
        "Hobbies" : "Skating"
}
{
        "_id" : 4,
        "Name" : "Arthur",
        "USN" : "1B22CS041",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 8.6,
        "Hobbies" : [
                "Novel Reading"
        ]
}
```


```
(base) bmsce@bmsce-Precision-T1700:~$ mongoexport --host localhost --db mySTUD
--collection Student --type=csv --fields="_id,Name,USN,Semester,Dept_name,CGPA,Hobbies"
--out /home/bmsce/Desktop/output.csv
```

2022-05-06T12:13:37.350+0530 connected to: localhost

2022-05-06T12:13:37.351+0530 exported 4 records

(base) bmsce@bmsce-Precision-T1700:~$ mongo

MongoDB shell version v3.6.8

connecting to: mongodb://127.0.0.1:27017

Implicit session: session { "id" : UUID("aabd8226-3ced-43d4-97fb-b0d55827849c") }

MongoDB server version: 3.6.8

Server has startup warnings:

2022-05-06T11:28:08.073+0530 I STORAGE [initandlisten]

2022-05-06T11:28:08.073+0530 I STORAGE [initandlisten] ** WARNING: Using the XFS filesystem is strongly recommended with the WiredTiger storage engine

2022-05-06T11:28:08.073+0530 I STORAGE [initandlisten] ** See http://dochub.mongodb.org/core/prodnotes-filesystem

2022-05-06T11:28:13.281+0530 I CONTROL [initandlisten]

2022-05-06T11:28:13.281+0530 I CONTROL [initandlisten] ** WARNING: Access control is not enabled for the database.

2022-05-06T11:28:13.281+0530 I CONTROL [initandlisten] ** Read and write access to data and configuration is unrestricted.

2022-05-06T11:28:13.281+0530 I CONTROL [initandlisten]

> use mySTUD;

switched to db mySTUD

> db.Student.update({_id:4},{$set:{Location:”Network”}})

2022-05-06T12:16:35.289+0530 E QUERY [thread1] SyntaxError: illegal character @(shell):1:42

> db.Student.update({_id:4},{$set:{Location:"Network"}})

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

> db.Student.find().pretty()

{

"_id" : 1,

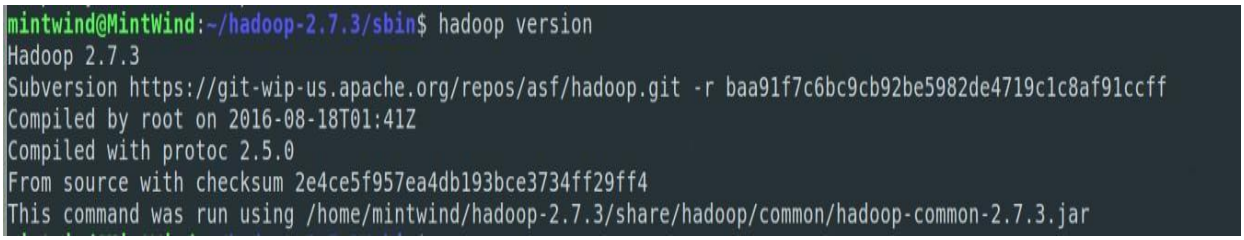
"Name" : "John",

```
        "USN" : "1B22CS001",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 9.6,
        "Hobbies" : [
                "Reading",
                "Gardening"
        ]
}
{
        "_id" : 4,
        "Name" : "Arthur",
        "USN" : "1B22CS041",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 8.6,
        "Hobbies" : [
                "Novel Reading"
        ],
        "Location" : "Network"
}
{
        "_id" : 3,
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
```

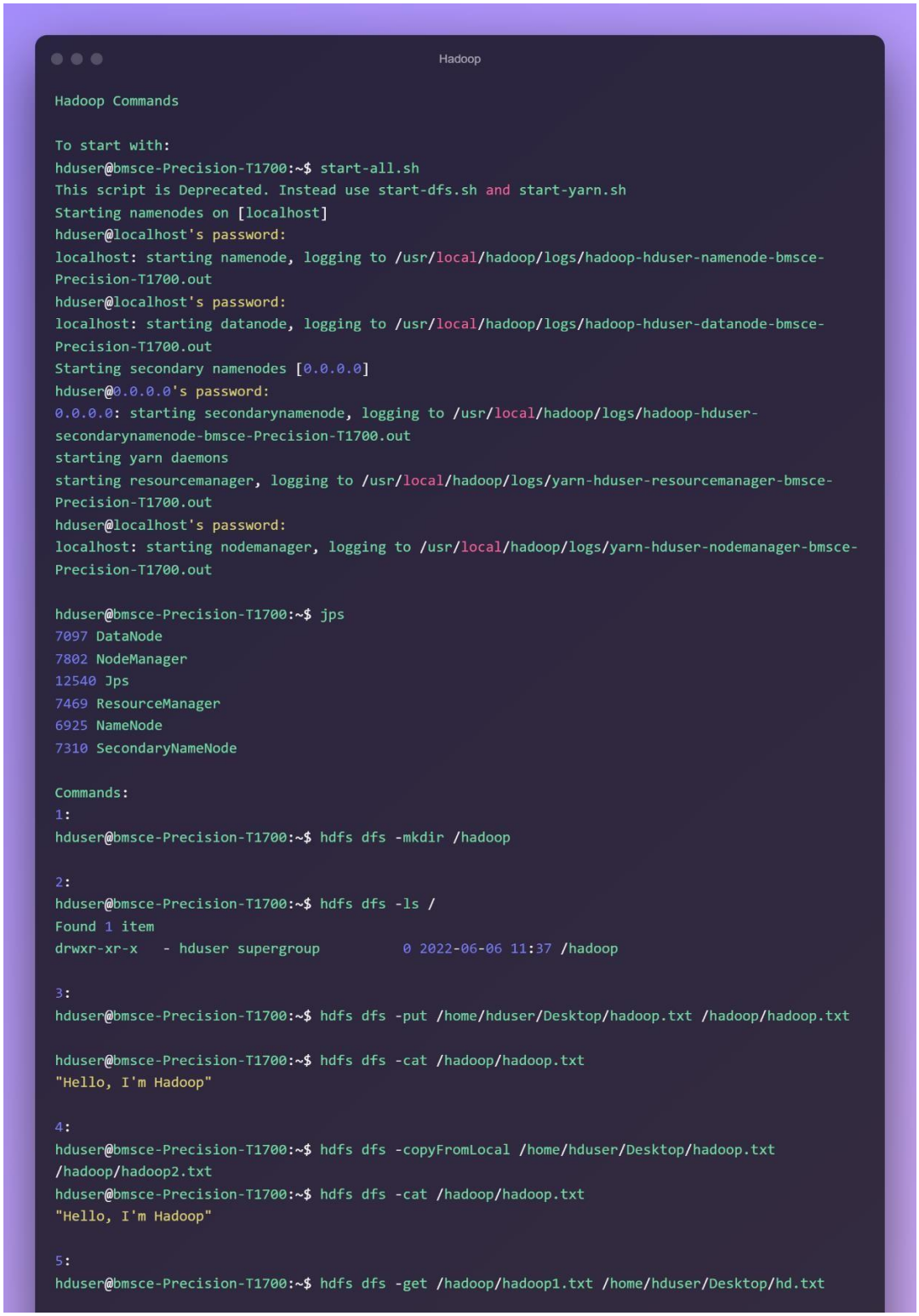
```
        "Hobbies" : "Skating"
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
        "Semester" : 5,
        "Dept_name" : "CSE",
        "CGPA" : 8.7,
        "Hobbies" : [
                "Reading"
        ]
}
> db.Student.find().sort({Name:1}).pretty();
{
        "_id" : 4,
        "Name" : "Arthur",
        "USN" : "1B22CS041",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 8.6,
        "Hobbies" : [
                "Novel Reading"
        ],
        "Location" : "Network"
}
{
        "_id" : 3,
```

```
        "Name" : "Horris",
        "USN" : "1B22EE021",
        "Semester" : 5,
        "Dept_name" : "EEE",
        "CGPA" : 9.3,
        "Hobbies" : "Skating"
}
{
        "_id" : 7,
        "Name" : "Hritik",
        "USN" : "1B22CS014",
        "Semester" : 5,
        "Dept_name" : "CSE",
        "CGPA" : 8.7,
        "Hobbies" : [
                "Reading"
        ]
}
{
        "_id" : 1,
        "Name" : "John",
        "USN" : "1B22CS001",
        "Semester" : 6,
        "Dept_name" : "CSE",
        "CGPA" : 9.6,
        "Hobbies" : [
                "Reading",
                "Gardening" }
```

Screenshot of Hadoop installed:



Execution of HDFS Commands for interaction with Hadoop Environment:



```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -getmerge /hadoop/hadoop.txt /hadoop/hadoop2.txt
/home/hduser/Desktop/hd_merge.txt
hduser@bmsce-Precision-T1700:~$ ls Desktop/hd_merge.txt
Desktop/hd_merge.txt

hduser@bmsce-Precision-T1700:~$ hdfs dfs -getfacl /hadoop
# file: /hadoop
# owner: hduser
# group: supergroup
user::rwx
group::r-x
other::r-x


6:
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyToLocal /hadoop/hadoop.txt
/home/hduser/Desktop/hd2.txt

hduser@bmsce-Precision-T1700:~$ ls Desktop/hd2.txt
Desktop/hd2.txt

7:
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /hadoop/hadoop.txt
"Hello, I'm Hadoop"

8:
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mkdir /hadoop/AA
hduser@bmsce-Precision-T1700:~$ hdfs dfs -mv /hadoop/hadoop.txt /hadoop/AA/hadoop.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /hadoop/AA
Found 1 items
-rw-r--r--   1 hduser supergroup         18 2022-06-06 11:41 /hadoop/AA/hadoop.txt

9:
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cp /hadoop/AA/hadoop.txt /hadoop/hadoop2.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /hadoop/hadoop2.txt
Hello, I'm Hadoop

To stop Hadoop:
hduser@bmsce-Precision-T1700:~$ stop-all.sh
This script is Deprecated. Instead use stop-dfs.sh and stop-yarn.sh
Stopping namenodes on [localhost]
hduser@localhost's password:
localhost: stopping namenode
hduser@localhost's password:
localhost: stopping datanode
Stopping secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: stopping secondarynamenode
stopping yarn daemons
stopping resourcemanager
hduser@localhost's password:
localhost: stopping nodemanager
no proxyserver to stop
```

Map Reduce program for weather data:

(a) Average temperature for each year:

mapper.py

```
#!/usr/bin/python
import sys

for line in sys.stdin:
    line = line.strip()
    year = line[15:19]

    if line[87] == '+':
        temperature = int(line[88:92])
    else:
        temperature = int(line[87:92])

    quality = line[92:93]

    if temperature != 9999 and quality in "[01459]":
        print(year+"\t"+str(temperature))
```

reducer.py

```
#!/usr/bin/python
import sys
cur_year = None
average_temp = 0
count = 0

for line in sys.stdin:
    line = line.strip()
    year, temperature = line.split("\t",1)
    if cur_year == None:
        cur_year = year
    elif cur_year != year:
        print(cur_year+"\t"+str(average_temp // count))
        average_temp = 0
        count = 0
    average_temp += int(temperature)
    count += 1

if cur_year == year:
    print(cur_year+"\t"+str(average_temp // count))
```

Output:

```
mintwind@MintWind:~$ hdfs dfs -ls /prog3
Found 2 items
-rw-r--r--   1 mintwind supergroup          0 2022-07-10 16:00 /prog3/_SUCCESS
-rw-r--r--   1 mintwind supergroup          8 2022-07-10 16:00 /prog3/part-00000
mintwind@MintWind:~$ hdfs dfs -cat /prog3/part-00000
1901    46
```

(a) Mean max temperature for every month:

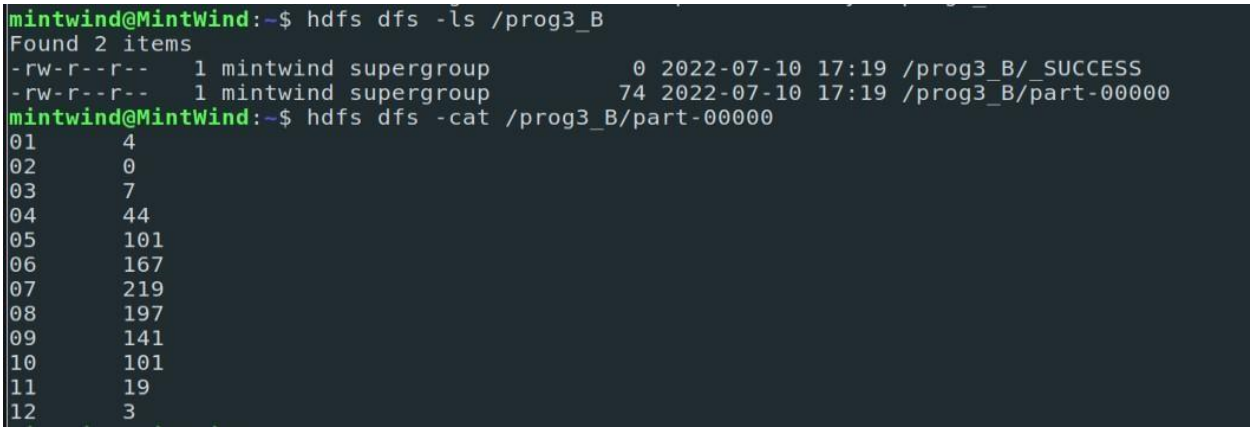
mapper.py

```
#!/usr/bin/python
import sys

for line in sys.stdin:
    line = line.strip()
    month = line[19:21]

    if line[87] == '+':
        temperature = int(line[88:92])
    else:
        temperature = int(line[87:92])

    quality = line[92]

    if temperature != 9999 and quality in "[01459]":
        print(month+"\t"+str(temperature))
```

reducer.py

```
#!/usr/bin/python
import sys

cur_month = None
max_temp = 0
temp_sum = 0
count = 0
days = 0

for line in sys.stdin:
    line = line.strip()
    month, temperature = line.split("\t", 1)
    if cur_month == None:
        cur_month = month
    elif cur_month != month:
        print(cur_month+"\t"+str(temp_sum//days))
        cur_month = month
        max_temp = 0
        temp_sum = 0
        count= 0
        days = 0
    if int(temperature) > max_temp:
        max_temp = int(temperature)
    count += 1

    if count == 3:
        temp_sum += max_temp
        max_temp = 0
        count=0
        days += 1

if cur_month == month:
        print(cur_month+"\t"+str(temp_sum//days))
```

Output:


mintwind@MintWind:~$ hdfs dfs -ls /prog3_B
Found 2 items
-rw-r--r--   1 mintwind supergroup   0 2022-07-10 17:19 /prog3_B/_SUCCESS
-rw-r--r--   1 mintwind supergroup   74 2022-07-10 17:19 /prog3_B/part-00000
mintwind@MintWind:~$ hdfs dfs -cat /prog3_B/part-00000
01	4
02	0
03	7
04	44
05	101
06	167
07	219
08	197
09	141
10	101
11	19
12	3

Map Reduce program - Top N:

mapper.py

```python
#!/usr/bin/python
import sys

for line in sys.stdin:
    line = line.strip()
    words = line.split()
    for word in words:
        print(word+"\t"+str(1))
```

reducer.py

```python
#!/usr/bin/python
import sys

current_word = None
current_count = 0
word = None
word_map = []
N = 20

for line in sys.stdin:
    line = line.strip()
    word, count = line.split("\t", 1)
    try:
        count = int(count)
    except ValueError:
        continue

    if current_word == word:
        current_count += 1
    else:
        if current_word:
            word_map.append([(current_count), current_word])
        current_count = count
        current_word = word

if current_word == word:
    word_map.append([(current_count), current_word])

word_map.sort(reverse=True)
for v, k in word_map:
    print("%s\t%d" % (k, v))
```

Output:

```
mintwind@MintWind:~$ hdfs dfs -ls /prog2
Found 2 items
-rw-r--r--   1 mintwind supergroup          0 2022-07-10 15:13 /prog2/_SUCCESS
-rw-r--r--   1 mintwind supergroup         31 2022-07-10 15:13 /prog2/part-00000
mintwind@MintWind:~$ hdfs dfs -cat /prog2/part-00000
hello   2
world   1
hadoop  1
bye     1
```

Map Reduce program to demonstrating join operation:

mapper.py

```python
#!/usr/bin/python

import sys

for line in sys.stdin:
    dept_ID = "-1"  # default sorted as first
    dept_Name = "-1"  # default sorted as first
    no_Emp = "-1"  # default sorted as first

    line = line.strip()

    splits = line.split("\t")

    if splits[-1].isdigit():  # dept strength data
        dept_ID = splits[0]
        no_Emp = str(splits[1])
    else:
        dept_ID = splits[0]
        dept_Name = str(splits[1])

    print('%s^%s^%s' % (dept_ID, dept_Name, no_Emp))
```

reducer.py

```python
#!/usr/bin/python

import sys

new_list = {}

for line in sys.stdin:
    line = line.strip()
    dept_ID, dept_Name, no_Emp = line.split("^")
    if dept_ID not in new_list.keys():
        new_list[dept_ID] = [dept_Name, int(no_Emp)]
    else:
        if dept_Name != -1:
            new_list[dept_ID][0] = dept_Name
        if no_Emp != -1:
            if new_list[dept_ID][1] != -1:
                new_list[dept_ID][1] += int(no_Emp)
            else:
                new_list[dept_ID][1] = int(no_Emp)


for i in new_list:
    print(i+"\t"+new_list[i][0]+"\t"+str(new_list[i][1]))
```

Output:

```
mintwind@MintWind:~$ hdfs dfs -ls /prog4
Found 2 items
-rw-r--r--   1 mintwind supergroup          0 2022-07-10 18:40 /prog4/_SUCCESS
-rw-r--r--   1 mintwind supergroup         47 2022-07-10 18:40 /prog4/part-00000
mintwind@MintWind:~$ hdfs dfs -cat /prog4/part-00000
C13     Manufacturing   249
B12     HR      99
A11     Finance 49
```

Word count on Scala shell:

Scala-Shell

```
val data=sc.textFile("D:\\sparkdata.txt")

data.collect;

val splitdata = data.flatMap(line => line.split(" "));

splitdata.collect;

val mapdata = splitdata.map(word => (word,1));

mapdata.collect;

val reducedata = mapdata.reduceByKey(_+_);

reducedata.collect;
```

Output:

```
scala> val data=sc.textFile("D:\\sparkdata.txt")
data: org.apache.spark.rdd.RDD[String] = D:\sparkdata.txt MapPartitionsRDD[6] at textFile at <console>:23

scala> data.collect
res5: Array[String] = Array(Hello World BMSCE Lion Tiger Fish)

scala> val splitdata = data.flatMap(line => line.split(" "))
splitdata: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[7] at flatMap at <console>:23

scala> splitdata.collect
res6: Array[String] = Array(Hello, World, BMSCE, Lion, Tiger, Fish)

scala> val mapdata = splitdata.map(word => (word,1))
mapdata: org.apache.spark.rdd.RDD[(String, Int)] = MapPartitionsRDD[8] at map at <console>:23

scala> mapdata.collect
res7: Array[(String, Int)] = Array((Hello,1), (World,1), (BMSCE,1), (Lion,1), (Tiger,1), (Fish,1))

scala> val reducedata = mapdata.reduceByKey(_+_)
reducedata: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[9] at reduceByKey at <console>:23

scala> reducedata.collect
res8: Array[(String, Int)] = Array((Fish,1), (Hello,1), (Lion,1), (BMSCE,1), (World,1), (Tiger,1))
```

RDD and Flat Map count how many times each word appears strictly greater than 4 times:

Scala-Shell

```
val textFile = sc.textFile("D:\\sparkdata2.txt")

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

import scala.collection.immutable.ListMap

val sorted=ListMap(counts.collect.sortWith(_._2  _._2)_*)

println(sorted)

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

Output:

```
scala> val textFile = sc.textFile("D:\\sparkdata2.txt")
textFile: org.apache.spark.rdd.RDD[String] = D:\sparkdata2.txt MapPartitionsRDD[21] at textFile at <console>:24

scala> val counts = textFile.flatMap(line => line.split(" ")).map(word => (word, 1)).reduceByKey(_ + _)
counts: org.apache.spark.rdd.RDD[(String, Int)] = ShuffledRDD[24] at reduceByKey at <console>:24

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

scala> val sorted=ListMap(counts.collect.sortWith(_._2 > _._2):_*)
sorted: scala.collection.immutable.ListMap[String,Int] = ListMap(Spark -> 6, data -> 4, computations -> 4, shells -> 4, "" -> 3, memory -> 3, on -> 3, is -> 2, can -> 2, with -> 2, Shells -> 2, you -> 2, that ->
 2, a -> 2, many -> 2, disk -> 2, in -> 2, distributed -> 2, and -> 2, the -> 2, however, -> 1, hoc -> 1, this -> 1, analysis. -> 1, distributing -> 1, Python -> 1, provides -> 1, interact -> 1, few -> 1, Becaus
e -> 1, load -> 1, takes -> 1, into -> 1, interactive -> 1, using -> 1, machines -> 1, Scala -> 1, manipulate -> 1, Unlike -> 1, other -> 1, single -> 1, worker -> 1, shells, -> 1, processing. -> 1, enable -> 1,
 run -> 1, allow -> 1, most -> 1, let -> 1, across -> 1, or -> 1, to -> 1, automatically -> 1, ad -> 1, which -> 1, of -> 1, care -> 1, comes -> 1, both -> 1, Spark...

scala> println(sorted)
ListMap(Spark -> 6, data -> 4, computations -> 4, shells -> 4,  -> 3, memory -> 3, on -> 3, is -> 2, can -> 2, with -> 2, Shells -> 2, you -> 2, that -> 2, a -> 2, many -> 2, disk -> 2, in -> 2, distributed -> 2
, and -> 2, the -> 2, however, -> 1, hoc -> 1, this -> 1, analysis. -> 1, distributing -> 1, Python -> 1, provides -> 1, interact -> 1, few -> 1, Because -> 1, load -> 1, takes -> 1, into -> 1, interactive -> 1,
 using -> 1, machines -> 1, Scala -> 1, manipulate -> 1, Unlike -> 1, other -> 1, single -> 1, worker -> 1, shells, -> 1, processing. -> 1, enable -> 1, run -> 1, allow -> 1, most -> 1, let -> 1, across -> 1, or
 -> 1, to -> 1, automatically -> 1, ad -> 1, which -> 1, of -> 1, care -> 1, comes -> 1, both -> 1, Spark?s -> 1, seconds -> 1, nodes, -> 1, machine, -> 1)

scala> for((k,v)<-sorted)
     | {
     | if(v>4)
     | {
     | print(k+",")
     | print(v)
     | println()
     | }
     | }
Spark,6
```