VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

BIG DATA ANALYTICS

Submitted by

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

B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "BIG DATA ANALYTICS" carried out by **Shreshtha Aggarwal (1BM19CS155),** who is bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a BIG DATA ANALYTICS - (20CS6PEBDA) work prescribed for the said degree.

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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

1. DB operations using Cassandra – Employee:

LAB 1 - Cassandra Commands

```sql

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> use students;

cqlsh:students> create table student_info( rollNo int primary key, name text, joinDate timestamp,
lastExamPerc double );

cqlsh:students> describe tables

student_info

cqlsh:students> describe table student

student_info  students.

cqlsh:students> describe table student_info

CREATE TABLE students.student_info (

   rollno int PRIMARY KEY,

   joindate timestamp,

   lastexamperc double,

   name 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 crc_check_chance = 1.0

   AND default_time_to_live = 0

   AND extensions = {}

   AND gc_grace_seconds = 864000
```

```
   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 student_info(rollno, joindate, lastexamperc, name) values (1,
'2021-05-23', 90.0, 'Adam') insert into student_info(rollno, joindate, lastexamperc, name) values (2,
'2021-05-22', 97.7, 'Eve') apply batch;
cqlsh:students> select * from student_info;
 rollno | joindate                       | lastexamperc | name
--------+---------------------------------+--------------+------
      1 | 2021-05-22 18:30:00.000000+0000 |         90 | Adam
      2 | 2021-05-21 18:30:00.000000+0000 |       97.7 |  Eve
(2 rows)
cqlsh:students> update student_info set name = 'Micheal' where rollno = 1;
cqlsh:students> select * from student_info where rollno in (1,2);
 rollno | joindate                       | lastexamperc | name
--------+---------------------------------+--------------+---------
      1 | 2021-05-22 18:30:00.000000+0000 |         90 | Micheal
      2 | 2021-05-21 18:30:00.000000+0000 |       97.7 |     Eve
(2 rows)
cqlsh:students> create index on student_info(lastexamperc);
cqlsh:students> select rollno, name from student_info limit 2;
 rollno | name
--------+---------
      1 | Micheal
      2 |     Eve
(2 rows)
cqlsh:students> create index on student_info(name);
cqlsh:students> update student_info set name='Eve2', lastexamperc=100.0 where rollno=2;
cqlsh:students> select * from student_info;
```

```
(2 rows)
cqlsh:students> create index on student_info(lastexamperc);
cqlsh:students> select rollno, name from student_info limit 2;
 rollno | name
--------+---------
      1 | Micheal
      2 |     Eve
(2 rows)
cqlsh:students> create index on student_info(name);
cqlsh:students> update student_info set name='Eve2', lastexamperc=100.0 where rollno=2;
cqlsh:students> select * from student_info;
 rollno | joindate                       | lastexamperc | name
--------+---------------------------------+--------------+---------
      1 | 2021-05-22 18:30:00.000000+0000 |         90 | Micheal
      2 | 2021-05-21 18:30:00.000000+0000 |        100 |    Eve2
(2 rows)
cqlsh:students> delete lastexamperc from student_info where rollno=2;
cqlsh:students> select * from student_info;
 rollno | joindate                       | lastexamperc | name
--------+---------------------------------+--------------+---------
      1 | 2021-05-22 18:30:00.000000+0000 |         90 | Micheal
      2 | 2021-05-21 18:30:00.000000+0000 |       null |    Eve2
(2 rows)
cqlsh:students> delete from student_info where rollno=2;
cqlsh:students> select * from student_info;
 rollno | joindate                       | lastexamperc | name
--------+---------------------------------+--------------+---------
      1 | 2021-05-22 18:30:00.000000+0000 |         90 | Micheal
(1 rows)
```

2. DB operations using Cassandra – Library:

```sql
cqlsh> create keyspace employee_info with
replication={'class':'SimpleStrategy','replication_factor':1};
cqlsh> use employee_info;
cqlsh:employee_info> create table employee_details(emp_id int, emp_name text, designation text,
doj timestamp, salary double, dept_name text, primary key(emp_id,salary));
cqlsh:employee_info> describe table employee_details;
CREATE TABLE employee_info.employee_details (
    emp_id int,
    salary double,
    dept_name text,
    designation text,
    doj timestamp,
    emp_name text,
    PRIMARY KEY (emp_id, salary)
) WITH CLUSTERING ORDER BY (salary ASC)
    AND 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 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:employee_info> begin batch insert into
employee_details(emp_id,emp_name,designation,doj,salary,dept_name) values
(100,'tanya','manager','2020-09-11',30000,'testing') insert into
employee_details(emp_id,emp_name,designation,doj,salary,dept_name) values
(111,'sriram','associate','2020-06-11',25000,'development') insert into
employee_details(emp_id,emp_name,designation,doj,salary,dept_name) values
(121,'shiva','manager','2020-01-03',35000,'hr') apply batch;
cqlsh:employee_info> select * from employee_details;
 emp_id | salary | dept_name   | designation | doj                             | emp_name
--------+--------+-------------+-------------+---------------------------------+----------
    111 |  25000 | development |   associate | 2020-06-10 18:30:00.000000+0000 |   sriram
    121 |  35000 |          hr |     manager | 2020-01-02 18:30:00.000000+0000 |    shiva
    100 |  30000 |     testing |     manager | 2020-09-10 18:30:00.000000+0000 |    tanya
```

```
(3 rows)
cqlsh:employee_info> update employee_details set emp_name='shaan' where emp_id = 121 and
salary=35000;
cqlsh:employee_info> select * from employee_details;
 emp_id | salary | dept_name   | designation | doj                             | emp_name
--------+--------+-------------+-------------+---------------------------------+----------
   111 |  25000 | development |   associate | 2020-06-10 18:30:00.000000+0000 |   sriram
   121 |  35000 |          hr |     manager | 2020-01-02 18:30:00.000000+0000 |    shaan
   100 |  30000 |     testing |     manager | 2020-09-10 18:30:00.000000+0000 |    tanya
(3 rows)
cqlsh:employee_info> alter table employee_details add project text;
cqlsh:employee_info> update employee_details set project='chat app' where emp_id=111 and
salary=25000;
cqlsh:employee_info> update employee_details set project='campusx' where emp_id=121 and
salary=35000;
cqlsh:employee_info> update employee_details set project='canteen app' where emp_id=100 and
salary=30000;
cqlsh:employee_info> select * from employee_details;
 emp_id | salary | dept_name   | designation | doj                             | emp_name | project
--------+--------+-------------+-------------+---------------------------------+----------+-------------
   111 |  25000 | development |   associate | 2020-06-10 18:30:00.000000+0000 |   sriram |    chat
app
   121 |  35000 |          hr |     manager | 2020-01-02 18:30:00.000000+0000 |    shaan |     campusx
   100 |  30000 |     testing |     manager | 2020-09-10 18:30:00.000000+0000 |    tanya | canteen
app
(3 rows)
cqlsh:employee_info> insert into
employee_details(emp_id,emp_name,designation,doj,salary,dept_name)
values(113,'sam','manager','2020-09-09',30000,'testing') using ttl 30;
cqlsh:employee_info> select ttl(emp_name) from employee_details where emp_id=113 and
salary=30000;
 ttl(emp_name)
---------------
            22

(1 rows)
cqlsh:employee_info> paging off;
Disabled Query paging.
cqlsh:employee_info>  select * from employee_details where emp_id in (111,121,100) order by
salary;

 emp_id | salary | dept_name   | designation | doj                             | emp_name | project
--------+--------+-------------+-------------+---------------------------------+----------+-------------
   111 |  25000 | development |   associate | 2020-06-10 18:30:00.000000+0000 |   sriram |    chat
app
   100 |  30000 |     testing |     manager | 2020-09-10 18:30:00.000000+0000 |    tanya | canteen
app
   121 |  35000 |          hr |     manager | 2020-01-02 18:30:00.000000+0000 |    shaan |     campusx
```

3. MongoDB- CRUD Demonstration:

BDA LAB-3

MongoDB

1. Create a new collection
```
use Student
```

2. Insert a value
```json
db.Student.insert({
   "Name" : "XYZ",
   "RollNo:" : 1,
   "Age" : 21,
   "ContactNo" : "1234567890",
   "EmailId": "user1@lab.com"
})
```

3. Insert multiple values at once
```json
var MyStudents = [
   {
      "Name" : "ABC",
      "RollNo:" : 3,
      "Age" : 22,
      "ContactNo" : "2234567890",
      "EmailId": "user2@lab.com"
   },
   {
      "Name" : "DEF",
      "RollNo:" : 5,
      "Age" : 21,
      "ContactNo" : "3234567890",
      "EmailId" : "user3@lab.com"
   },
   {
      "Name" : "GHI",
      "RollNo:" : 7,
      "Age" : 20,
      "ContactNo" : "4234567890",
      "EmailId" : "user4@lab.com"
   },
   {
      "Name" : "JKL",
      "RollNo:" : 10,
      "Age" : 18,
```

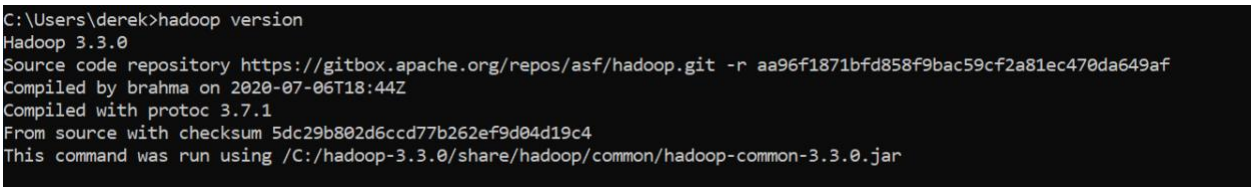
```
      "ContactNo" : "5234567890",
      "EmailId" : "user5@lab.com"
   },
]

db.Student.insert(MyStudents);
```

4. Print all current values
```json
db.getCollection('Student').find({}).forEach(printjson)
```
```json
{
        "_id" : ObjectId("606ad5a6e581cc0b904470a5"),
        "Name" : "XYZ",
        "RollNo:" : 1,
        "Age" : 21,
        "ContactNo" : "1234567890",
        "EmailId" : "user1@lab.com"
}
{
        "_id" : ObjectId("606ad60fe581cc0b904470a6"),
        "Name" : "ABC",
        "RollNo:" : 3,
        "Age" : 22,
        "ContactNo" : "2234567890",
        "EmailId" : "user2@lab.com"
}
{
        "_id" : ObjectId("606ad60fe581cc0b904470a7"),
        "Name" : "DEF",
        "RollNo:" : 5,
        "Age" : 21,
        "ContactNo" : "3234567890",
        "EmailId" : "user3@lab.com"
}
{
        "_id" : ObjectId("606ad60fe581cc0b904470a8"),
        "Name" : "GHI",
        "RollNo:" : 7,
        "Age" : 20,
        "ContactNo" : "4234567890",
        "EmailId" : "user4@lab.com"
}
{
        "_id" : ObjectId("606ad60fe581cc0b904470a9"),
        "Name" : "JKL",
```

```
        "RollNo:" : 10,
        "Age" : 18,
        "ContactNo" : "5234567890",
        "EmailId" : "user5@lab.com"
}
```
5. Update RollNo of a student
```json
db.Student.update(
{"RollNo:" : 10},
{$set: { "EmailId" : "modified@lab.com"}});
```
```json
db.getCollection('Student').find({"RollNo:":10}).forEach(printjson)
```
```json
{
        "_id" : ObjectId("606ad60fe581cc0b904470a9"),
        "Name" : "JKL",
        "RollNo:" : 10,
        "Age" : 18,
        "ContactNo" : "5234567890",
        "EmailId" : "modified@lab.com"
}
```
6. Update Name of a student
```json
db.Student.update(
{"Name" : "XYZ"},
{$set: { "Name" : "EcksWhyZee"}});
```
```json
db.getCollection('Student').find({"Name" : "EcksWhyZee"}).forEach(printjson)
```
```json
{
        "_id" : ObjectId("606ad5a6e581cc0b904470a5"),
        "Name" : "EcksWhyZee",
        "RollNo:" : 1,
        "Age" : 21,
        "ContactNo" : "1234567890",
        "EmailId" : "user1@lab.com"
}
```
7. Export to json
```
mongoexport --db testdb --collection Student --out C:\Users\shaan\Desktop\Exported\Student.json
```

```json
{"_id":{"$oid":"606ad5a6e581cc0b904470a5"},"Name":"EcksWhyZee","RollNo:":1.0,"Age":21.0,"ContactNo":"1234567890","EmailId":"user1@lab.com"}

{"_id":{"$oid":"606ad60fe581cc0b904470a6"},"Name":"ABC","RollNo:":3.0,"Age":22.0,"ContactNo":"2234567890","EmailId":"user2@lab.com"}

{"_id":{"$oid":"606ad60fe581cc0b904470a7"},"Name":"DEF","RollNo:":5.0,"Age":21.0,"ContactNo":"3234567890","EmailId":"user3@lab.com"}

{"_id":{"$oid":"606ad60fe581cc0b904470a8"},"Name":"GHI","RollNo:":7.0,"Age":20.0,"ContactNo":"4234567890","EmailId":"user4@lab.com"}

{"_id":{"$oid":"606ad60fe581cc0b904470a9"},"Name":"JKL","RollNo:":10.0,"Age":18.0,"ContactNo":"5234567890","EmailId":"modified@lab.com"}
```
8. Drop Student
```json
db.getCollection('Student').drop()
```
9. Import from exported file
```
mongoimport --db testdb --collection Student C:\Users\shaan\Desktop\Exported\Student.json
```
---

4. Screenshot of Hadoop installed:



5. Execution of HDFS Commands for interaction with Hadoop Environment:

Hadoop Commands

To start with:

```
hduser@bmsce-Precision-T1700:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [localhost]
hduser@localhost's password:
localhost: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser-namenode-bmsce-Precision-T1700.out
hduser@localhost's password:
localhost: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser-datanode-bmsce-Precision-T1700.out
Starting secondary namenodes [0.0.0.0]
hduser@0.0.0.0's password:
0.0.0.0: starting secondarynamenode, logging to /usr/local/hadoop/logs/hadoop-hduser-secondarynamenode-bmsce-Precision-T1700.out
starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resourcemanager-bmsce-Precision-T1700.out
hduser@localhost's password:
localhost: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduser-nodemanager-bmsce-Precision-T1700.out

hduser@bmsce-Precision-T1700:~$ jps
7097 DataNode
7802 NodeManager
12540 Jps
7469 ResourceManager
6925 NameNode
7310 SecondaryNameNode
```

Commands:

1:

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

2:

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -ls /
Found 1 item
drwxr-xr-x   - hduser supergroup          0 2022-06-06 11:37 /hadoop
```

3:

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -put /home/hduser/Desktop/hadoop.txt /hadoop/hadoop.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /hadoop/hadoop.txt
Hello, I'm Hadoop
```

4:

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -copyFromLocal /home/hduser/Desktop/hadoop.txt /hadoop/hadoop2.txt
hduser@bmsce-Precision-T1700:~$ hdfs dfs -cat /hadoop/hadoop.txt
Hello, I'm Hadoop
```

5:

```
hduser@bmsce-Precision-T1700:~$ hdfs dfs -get /hadoop/hadoop1.txt
/home/hduser/Desktop/hd.txt
hduser@bmsce-Precision-T1700:~$ ls Desktop/hd.txt
Desktop/hd.txt
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
```

6. Map Reduce program for weather data:

Average

MAPPER

```
#!/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

```
#!/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

1901 46

Mean max

MAPPER

```
#!/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

```
#!/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))
```

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

7. Map Reduce program - Top N:

MAPPER

```
#!/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

```
#!/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

```
hadoop@ubuntuVM:~/Downloads$ hadoop fs -cat /user/hadoop/output/part-r-00000

car     7
deer    6
bear    3
```

8. Map Reduce program to demonstrating join operation:

MAPPER

```
#!/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))
```

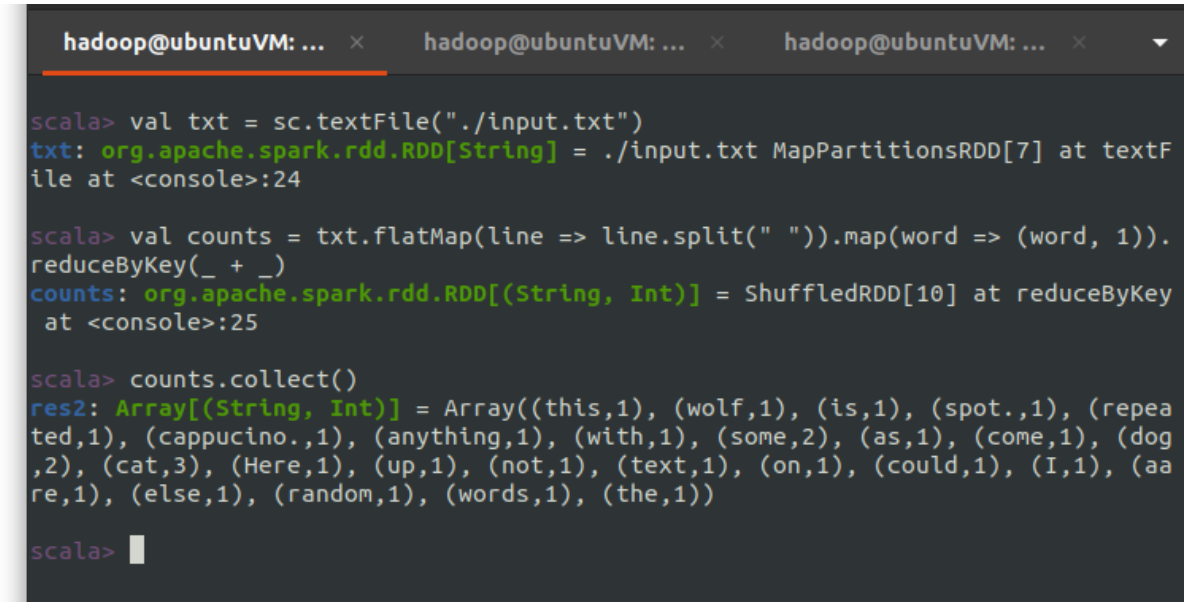
REDUCER

```
#!/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]))
```

OUPUT

```
hdfs dfs -cat /prog/part-00000
C13    Manufacturing      249
B12    HR     99
A11    FINANCE    49
```

9. Word count on Scala shell:



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

```
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 sortedWords=ListMap(counts.collect.sortWith(_._2  _._2)_*)

println(sortedWords)

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

```
Spark,6
```