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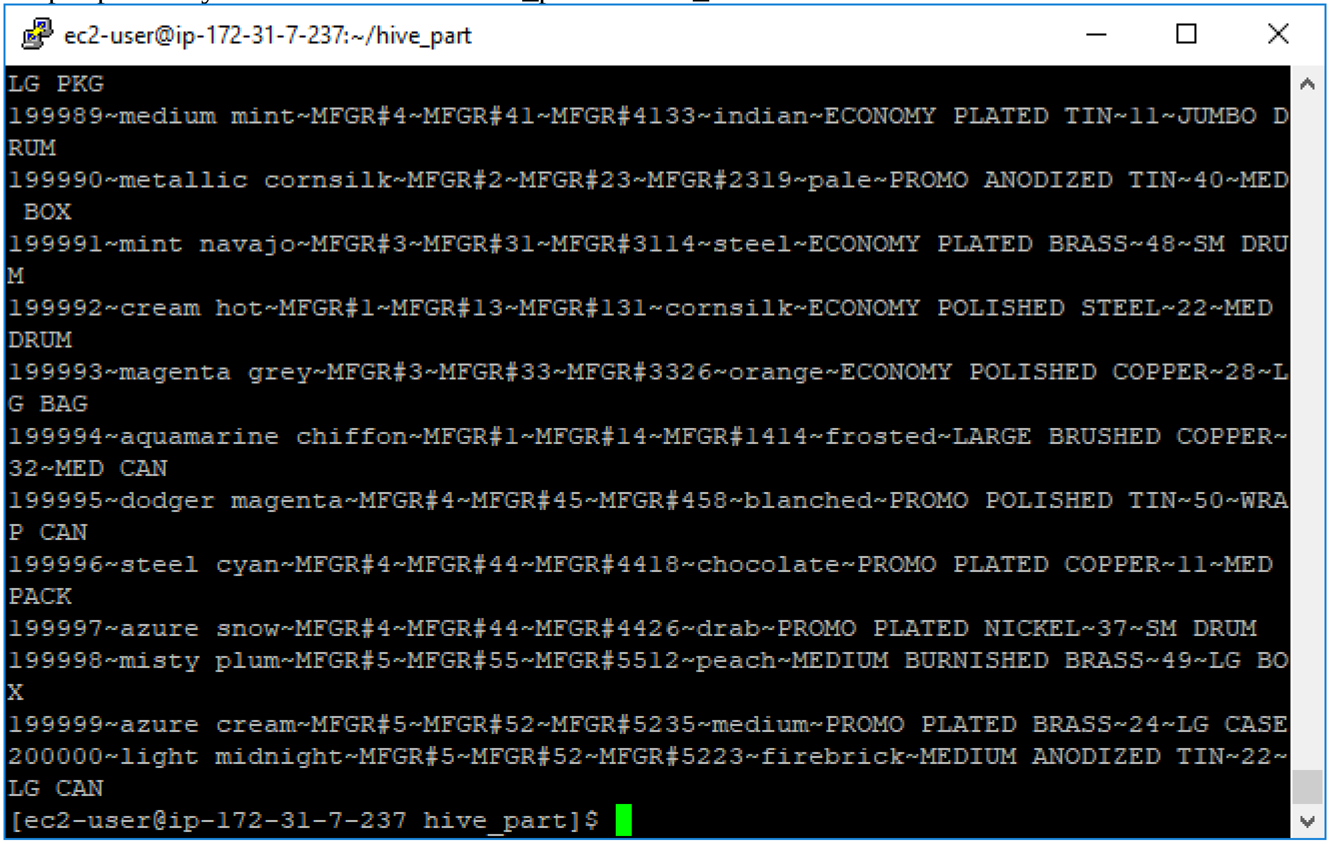
CSC555
Project Phase 2
6/12/19

Note: I used the 4-node cluster for this assignment. Almost all commands are listed in the code files attached to this project.

Part 1:

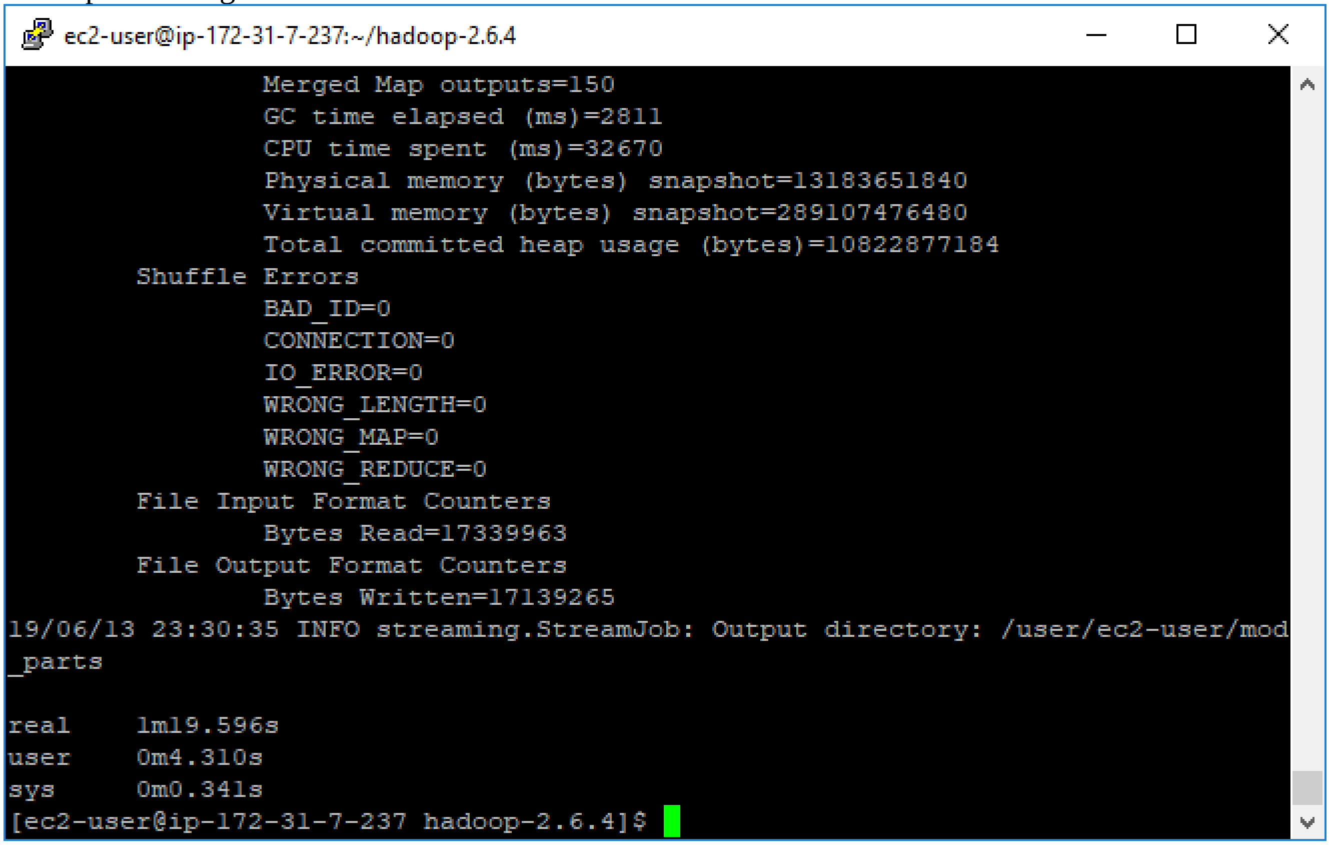
Hive:

Output pulled by this command: cat hive_part/000000_0



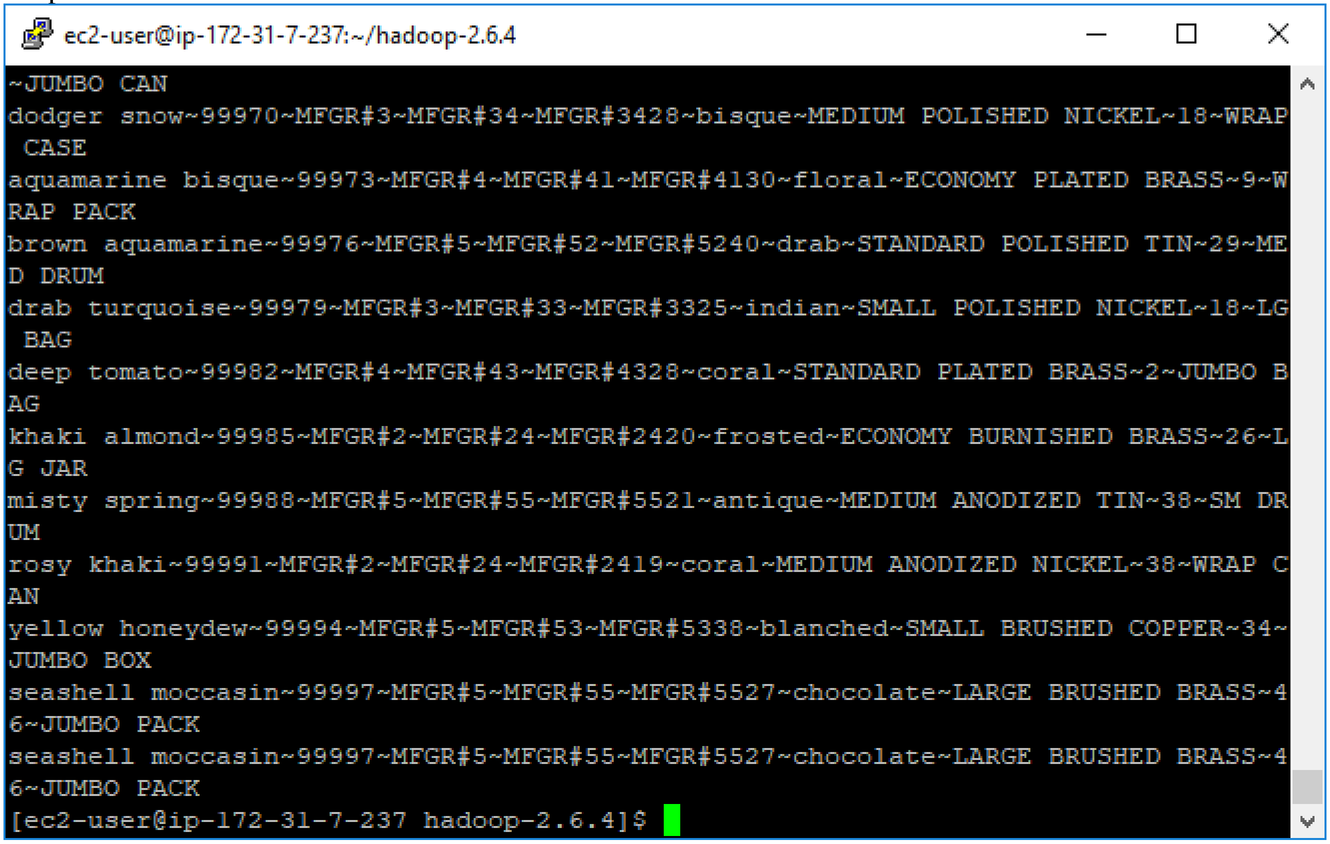
```
LG PKG
199989~medium mint~MFGR#4~MFGR#41~MFGR#4133~indian~ECONOMY PLATED TIN~11~JUMBO D
RUM
199990~metallic cornsilk~MFGR#2~MFGR#23~MFGR#2319~pale~PROMO ANODIZED TIN~40~MED
 BOX
199991~mint navajo~MFGR#3~MFGR#31~MFGR#3114~steel~ECONOMY PLATED BRASS~48~SM DRU
M
199992~cream hot~MFGR#1~MFGR#13~MFGR#131~cornsilk~ECONOMY POLISHED STEEL~22~MED
DRUM
199993~magenta grey~MFGR#3~MFGR#33~MFGR#3326~orange~ECONOMY POLISHED COPPER~28~L
G BAG
199994~aquamarine chiffon~MFGR#1~MFGR#14~MFGR#1414~frosted~LARGE BRUSHED COPPER~
32~MED CAN
199995~dodger magenta~MFGR#4~MFGR#45~MFGR#458~blanched~PROMO POLISHED TIN~50~WRA
P CAN
199996~steel cyan~MFGR#4~MFGR#44~MFGR#4418~chocolate~PROMO PLATED COPPER~11~MED
PACK
199997~azure snow~MFGR#4~MFGR#44~MFGR#4426~drab~PROMO PLATED NICKEL~37~SM DRUM
199998~misty plum~MFGR#5~MFGR#55~MFGR#5512~peach~MEDIUM BURNISHED BRASS~49~LG BO
X
199999~azure cream~MFGR#5~MFGR#52~MFGR#5235~medium~PROMO PLATED BRASS~24~LG CASE
200000~light midnight~MFGR#5~MFGR#52~MFGR#5223~firebrick~MEDIUM ANODIZED TIN~22~
LG CAN
[ec2-user@ip-172-31-7-237 hive_part]$
```

Hadoop streaming:



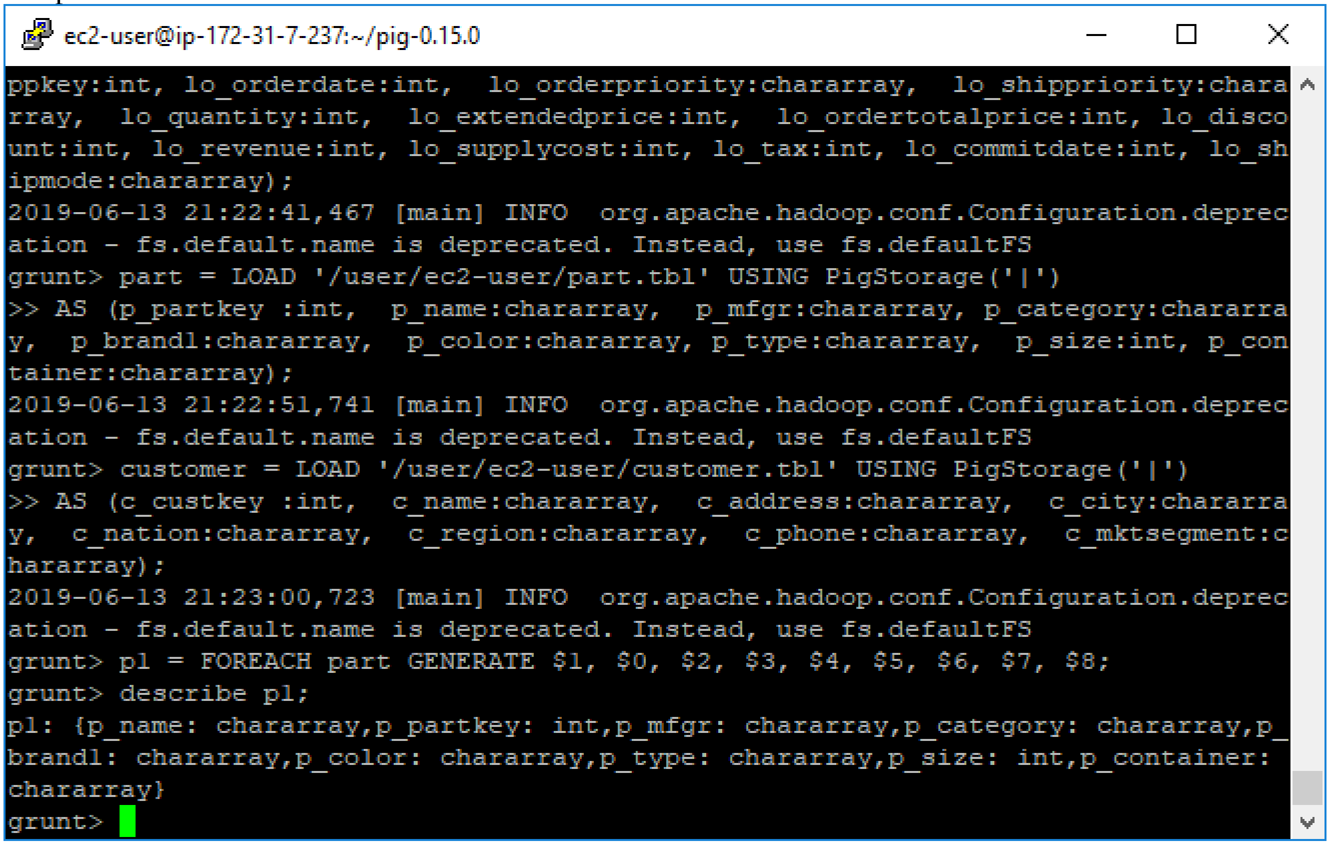
```
                Merged Map outputs=150
                GC time elapsed (ms)=2811
                CPU time spent (ms)=32670
                Physical memory (bytes) snapshot=13183651840
                Virtual memory (bytes) snapshot=289107476480
                Total committed heap usage (bytes)=10822877184
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=17339963
        File Output Format Counters
                Bytes Written=17139265
19/06/13 23:30:35 INFO streaming.StreamJob: Output directory: /user/ec2-user/mod
_parts

real    1m19.596s
user    0m4.310s
sys     0m0.341s
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Output file:



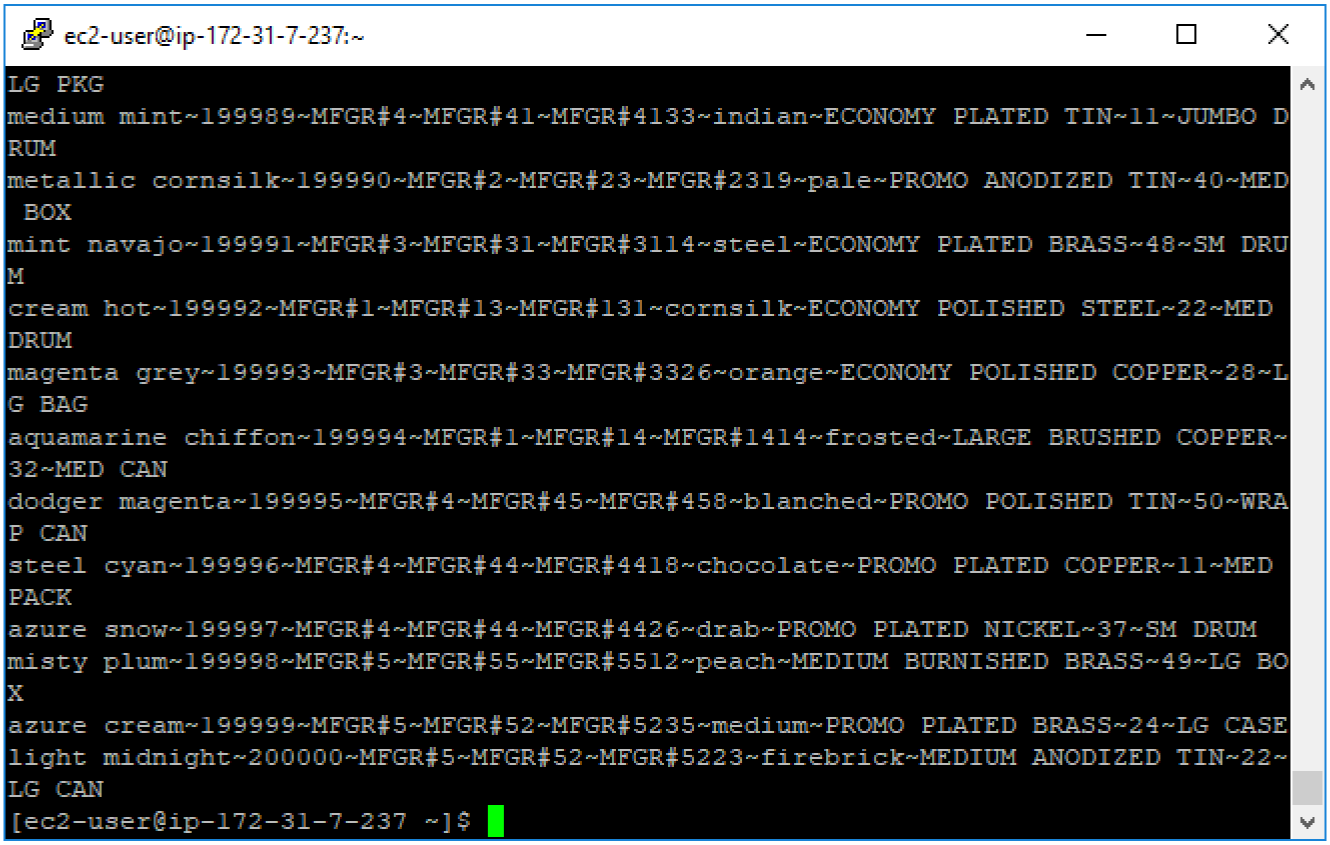
```
~JUMBO CAN
dodger snow~99970~MFGR#3~MFGR#34~MFGR#3428~bisque~MEDIUM POLISHED NICKEL~18~WRAP
 CASE
aquamarine bisque~99973~MFGR#4~MFGR#41~MFGR#4130~floral~ECONOMY PLATED BRASS~9~W
RAP PACK
brown aquamarine~99976~MFGR#5~MFGR#52~MFGR#5240~drab~STANDARD POLISHED TIN~29~ME
D DRUM
drab turquoise~99979~MFGR#3~MFGR#33~MFGR#3325~indian~SMALL POLISHED NICKEL~18~LG
 BAG
deep tomato~99982~MFGR#4~MFGR#43~MFGR#4328~coral~STANDARD PLATED BRASS~2~JUMBO B
AG
khaki almond~99985~MFGR#2~MFGR#24~MFGR#2420~frosted~ECONOMY BURNISHED BRASS~26~L
G JAR
misty spring~99988~MFGR#5~MFGR#55~MFGR#5521~antique~MEDIUM ANODIZED TIN~38~SM DR
UM
rosy khaki~99991~MFGR#2~MFGR#24~MFGR#2419~coral~MEDIUM ANODIZED NICKEL~38~WRAP C
AN
yellow honeydew~99994~MFGR#5~MFGR#53~MFGR#5338~blanched~SMALL BRUSHED COPPER~34~
JUMBO BOX
seashell moccasin~99997~MFGR#5~MFGR#55~MFGR#5527~chocolate~LARGE BRUSHED BRASS~4
6~JUMBO PACK
seashell moccasin~99997~MFGR#5~MFGR#55~MFGR#5527~chocolate~LARGE BRUSHED BRASS~4
6~JUMBO PACK
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Pig:
Swap columns:



```
ppkey:int, lo_orderdate:int,  lo_orderpriority:chararray,  lo_shippriority:chara
rray,  lo_quantity:int,  lo_extendedprice:int,  lo_ordertotalprice:int, lo_disco
unt:int, lo_revenue:int, lo_supplycost:int, lo_tax:int, lo_commitdate:int, lo_sh
ipmode:chararray);
2019-06-13 21:22:41,467 [main] INFO  org.apache.hadoop.conf.Configuration.deprec
ation - fs.default.name is deprecated. Instead, use fs.defaultFS
grunt> part = LOAD '/user/ec2-user/part.tbl' USING PigStorage('|')
>> AS (p_partkey :int,  p_name:chararray,  p_mfgr:chararray, p_category:chararra
y,  p_brandl:chararray,  p_color:chararray, p_type:chararray,  p_size:int, p_con
tainer:chararray);
2019-06-13 21:22:51,741 [main] INFO  org.apache.hadoop.conf.Configuration.deprec
ation - fs.default.name is deprecated. Instead, use fs.defaultFS
grunt> customer = LOAD '/user/ec2-user/customer.tbl' USING PigStorage('|')
>> AS (c_custkey :int,  c_name:chararray,  c_address:chararray,  c_city:chararra
y,  c_nation:chararray,  c_region:chararray,  c_phone:chararray,  c_mktsegment:c
hararray);
2019-06-13 21:23:00,723 [main] INFO  org.apache.hadoop.conf.Configuration.deprec
ation - fs.default.name is deprecated. Instead, use fs.defaultFS
grunt> pl = FOREACH part GENERATE $1, $0, $2, $3, $4, $5, $6, $7, $8;
grunt> describe pl;
pl: {p_name: chararray,p_partkey: int,p_mfgr: chararray,p_category: chararray,p_
brandl: chararray,p_color: chararray,p_type: chararray,p_size: int,p_container:
chararray}
grunt>
```

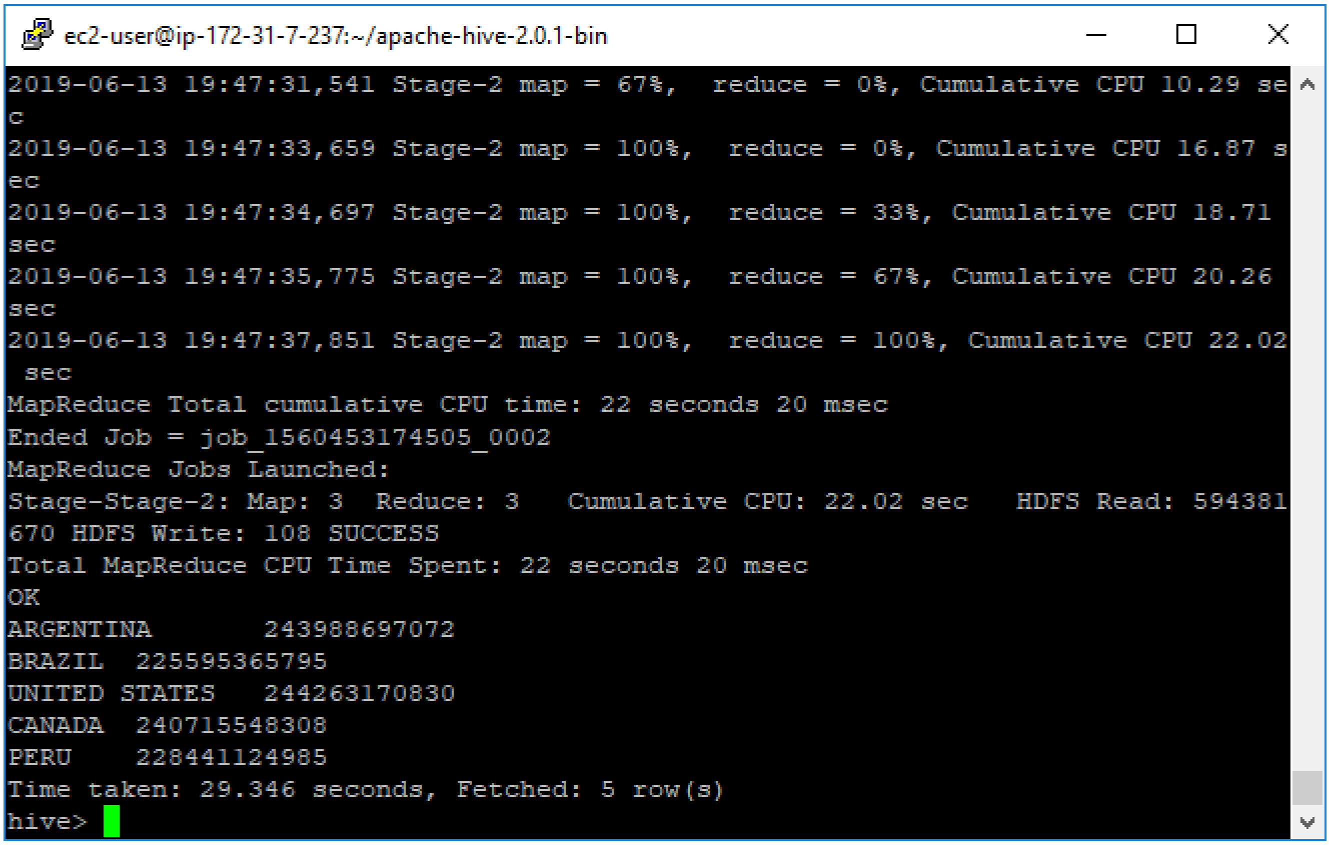
Output: hdfs dfs -cat /user/ec2-user/pig_part.txt/part-m-00000



```
LG PKG
medium mint~199989~MFGR#4~MFGR#41~MFGR#4133~indian~ECONOMY PLATED TIN~11~JUMBO D
RUM
metallic cornsilk~199990~MFGR#2~MFGR#23~MFGR#2319~pale~PROMO ANODIZED TIN~40~MED
 BOX
mint navajo~199991~MFGR#3~MFGR#31~MFGR#3114~steel~ECONOMY PLATED BRASS~48~SM DRU
M
cream hot~199992~MFGR#1~MFGR#13~MFGR#131~cornsilk~ECONOMY POLISHED STEEL~22~MED
DRUM
magenta grey~199993~MFGR#3~MFGR#33~MFGR#3326~orange~ECONOMY POLISHED COPPER~28~L
G BAG
aquamarine chiffon~199994~MFGR#1~MFGR#14~MFGR#1414~frosted~LARGE BRUSHED COPPER~
32~MED CAN
dodger magenta~199995~MFGR#4~MFGR#45~MFGR#458~blanched~PROMO POLISHED TIN~50~WRA
P CAN
steel cyan~199996~MFGR#4~MFGR#44~MFGR#4418~chocolate~PROMO PLATED COPPER~11~MED
PACK
azure snow~199997~MFGR#4~MFGR#44~MFGR#4426~drab~PROMO PLATED NICKEL~37~SM DRUM
misty plum~199998~MFGR#5~MFGR#55~MFGR#5512~peach~MEDIUM BURNISHED BRASS~49~LG BO
X
azure cream~199999~MFGR#5~MFGR#52~MFGR#5235~medium~PROMO PLATED BRASS~24~LG CASE
light midnight~200000~MFGR#5~MFGR#52~MFGR#5223~firebrick~MEDIUM ANODIZED TIN~22~
LG CAN
[ec2-user@ip-172-31-7-237 ~]$
```

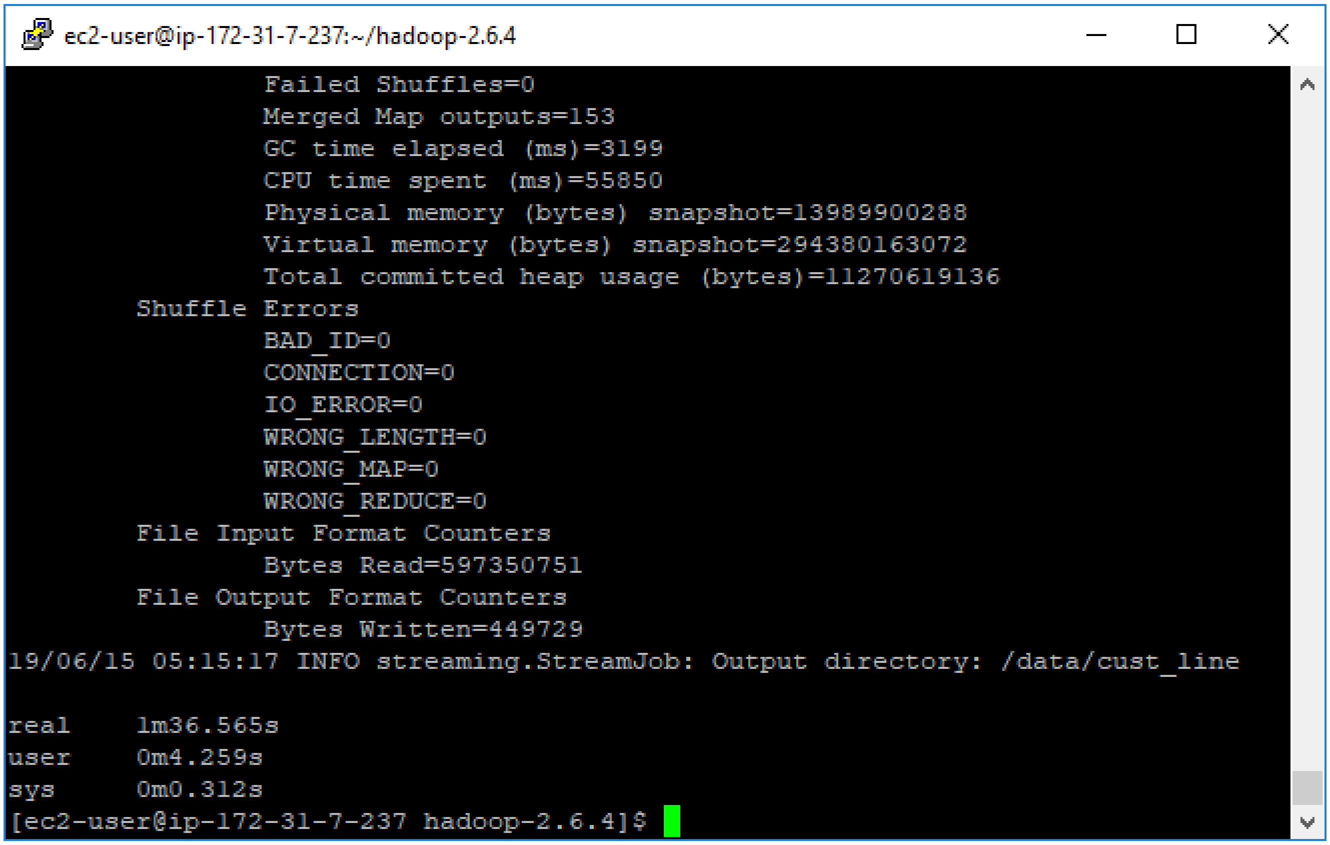
Part 2:

Hive: time 29.346 seconds



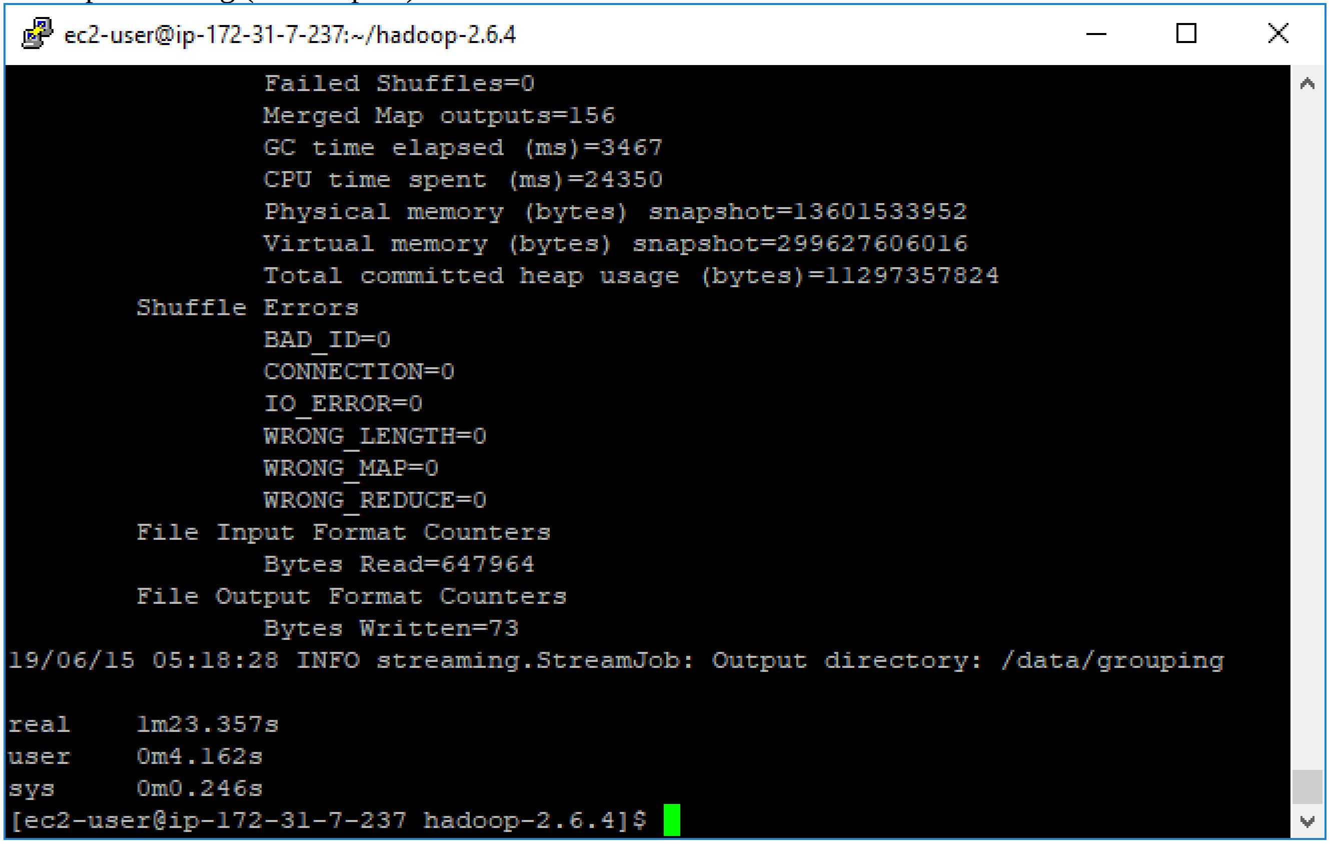
```
2019-06-13 19:47:31,541 Stage-2 map = 67%,  reduce = 0%, Cumulative CPU 10.29 se
c
2019-06-13 19:47:33,659 Stage-2 map = 100%,  reduce = 0%, Cumulative CPU 16.87 s
ec
2019-06-13 19:47:34,697 Stage-2 map = 100%,  reduce = 33%, Cumulative CPU 18.71
sec
2019-06-13 19:47:35,775 Stage-2 map = 100%,  reduce = 67%, Cumulative CPU 20.26
sec
2019-06-13 19:47:37,851 Stage-2 map = 100%,  reduce = 100%, Cumulative CPU 22.02
 sec
MapReduce Total cumulative CPU time: 22 seconds 20 msec
Ended Job = job_1560453174505_0002
MapReduce Jobs Launched:
Stage-Stage-2: Map: 3  Reduce: 3   Cumulative CPU: 22.02 sec   HDFS Read: 594381
670 HDFS Write: 108 SUCCESS
Total MapReduce CPU Time Spent: 22 seconds 20 msec
OK
ARGENTINA       243988697072
BRAZIL  225595365795
UNITED STATES   244263170830
CANADA  240715548308
PERU    228441124985
Time taken: 29.346 seconds, Fetched: 5 row(s)
hive>
```

Hadoop streaming (first pass): time 1 minute 36.565 seconds



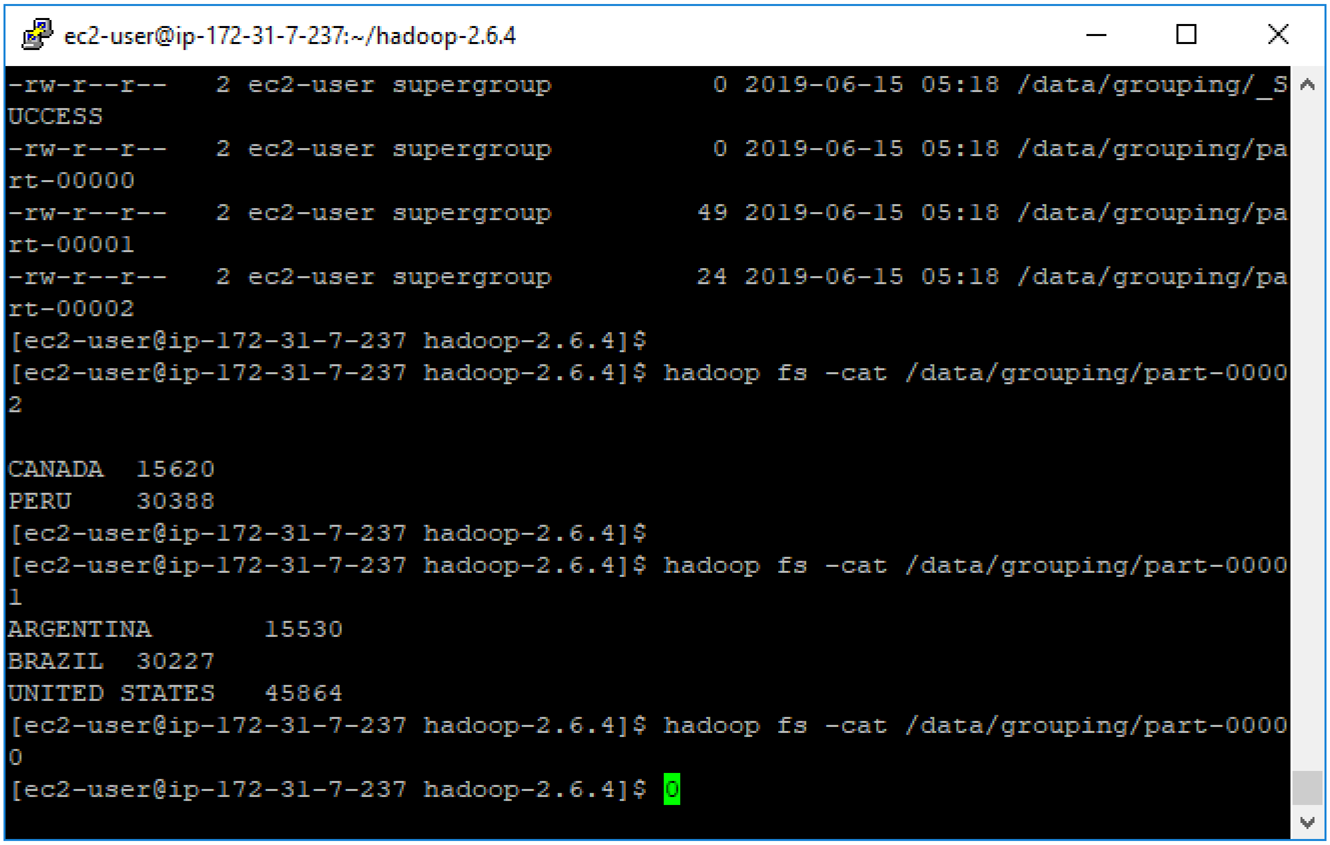
```
                Failed Shuffles=0
                Merged Map outputs=153
                GC time elapsed (ms)=3199
                CPU time spent (ms)=55850
                Physical memory (bytes) snapshot=13989900288
                Virtual memory (bytes) snapshot=294380163072
                Total committed heap usage (bytes)=11270619136
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=597350751
        File Output Format Counters
                Bytes Written=449729
19/06/15 05:15:17 INFO streaming.StreamJob: Output directory: /data/cust_line

real    1m36.565s
user    0m4.259s
sys     0m0.312s
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Hadoop streaming (second pass): time 1 minutes 23.357 seconds



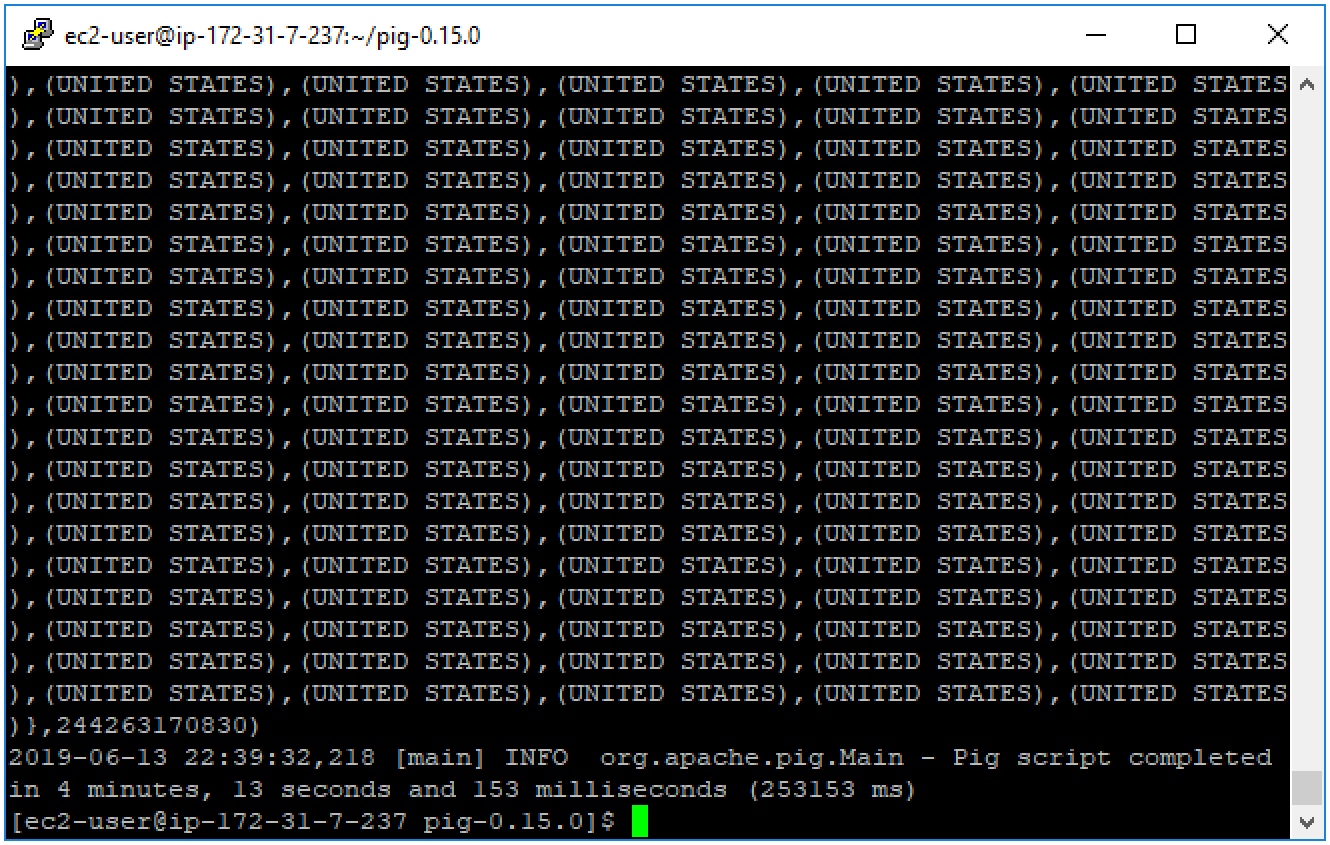
```
                Failed Shuffles=0
                Merged Map outputs=156
                GC time elapsed (ms)=3467
                CPU time spent (ms)=24350
                Physical memory (bytes) snapshot=13601533952
                Virtual memory (bytes) snapshot=299627606016
                Total committed heap usage (bytes)=11297357824
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=647964
        File Output Format Counters
                Bytes Written=73
19/06/15 05:18:28 INFO streaming.StreamJob: Output directory: /data/grouping

real    1m23.357s
user    0m4.162s
sys     0m0.246s
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Output:



```
-rw-r--r--   2 ec2-user supergroup          0 2019-06-15 05:18 /data/grouping/_S
UCCESS
-rw-r--r--   2 ec2-user supergroup          0 2019-06-15 05:18 /data/grouping/pa
rt-00000
-rw-r--r--   2 ec2-user supergroup         49 2019-06-15 05:18 /data/grouping/pa
rt-00001
-rw-r--r--   2 ec2-user supergroup         24 2019-06-15 05:18 /data/grouping/pa
rt-00002
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat /data/grouping/part-0000
2

CANADA  15620
PERU    30388
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat /data/grouping/part-0000
1
ARGENTINA       15530
BRAZIL  30227
UNITED STATES   45864
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat /data/grouping/part-0000
0
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ 0
```

Pig: time 4 minutes, 13.153 seconds



```
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)},244263170830)
2019-06-13 22:39:32,218 [main] INFO  org.apache.pig.Main - Pig script completed
in 4 minutes, 13 seconds and 153 milliseconds (253153 ms)
[ec2-user@ip-172-31-7-237 pig-0.15.0]$
```
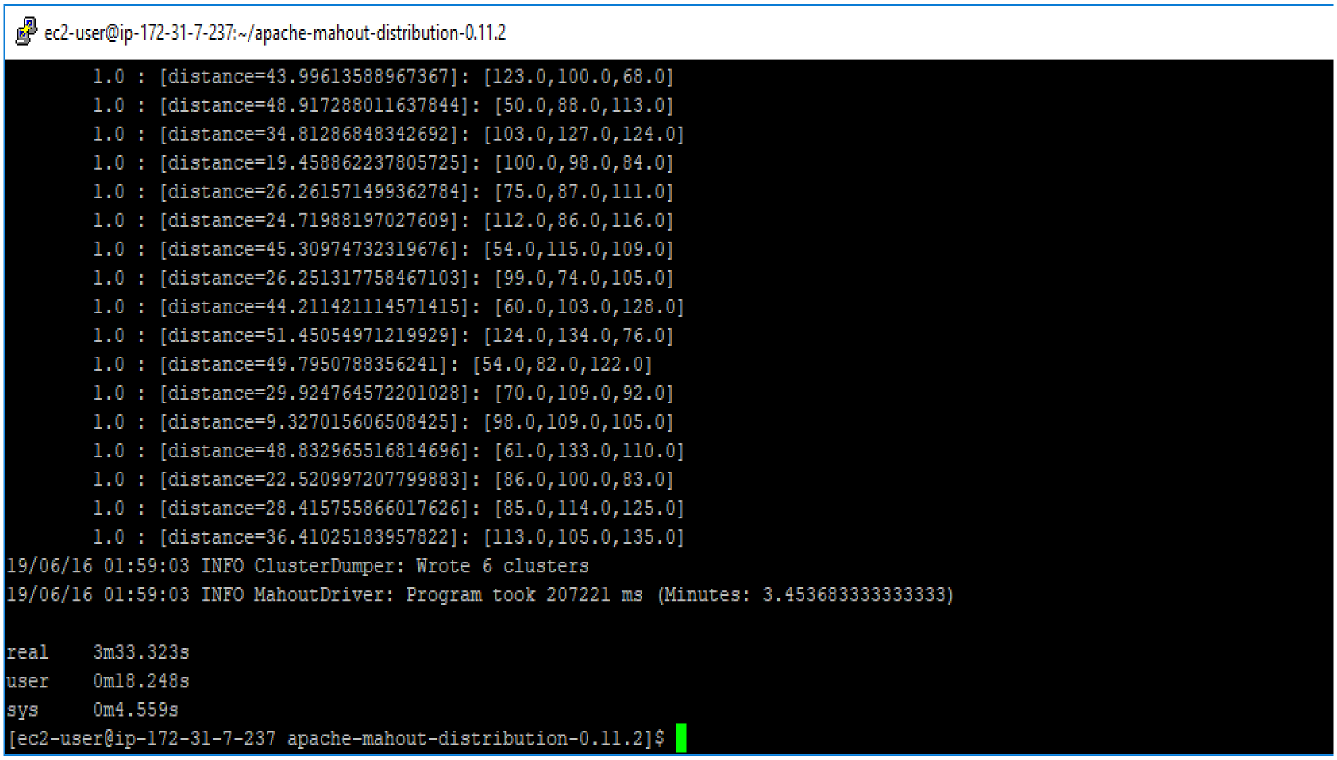
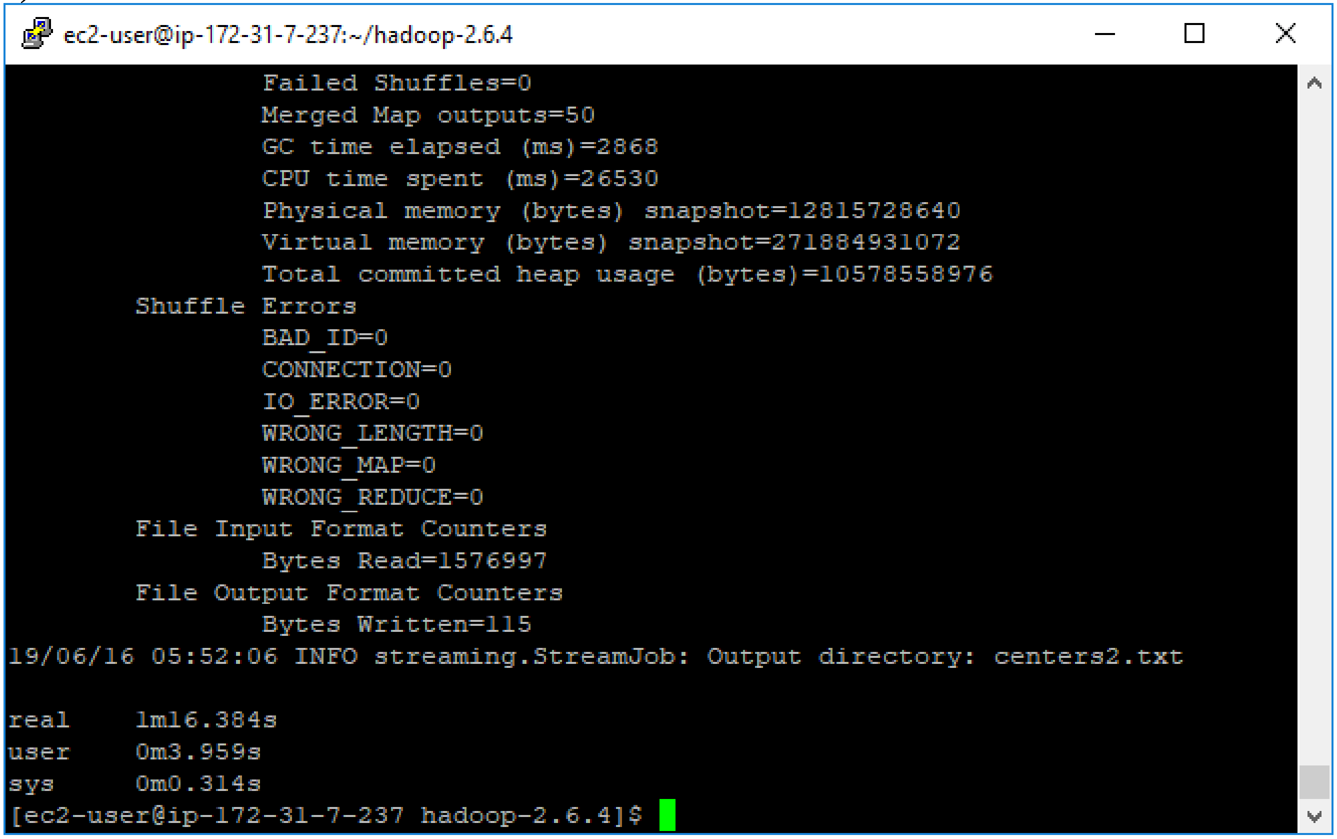

Part 3:

a) Mahout run on sample data created. Time: 3 minutes 33.323 seconds


ec2-user@ip-172-31-7-237:~/apache-mahout-distribution-0.11.2

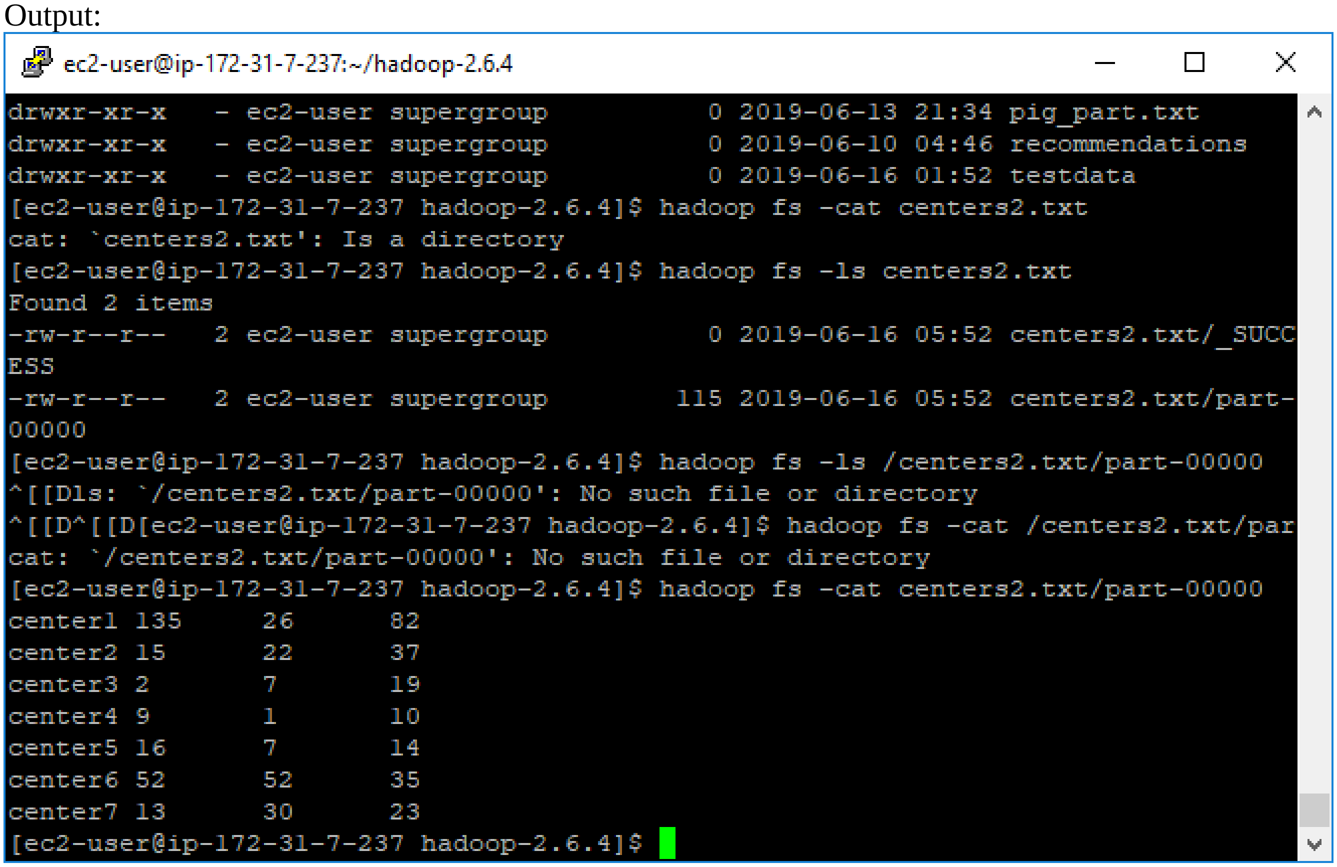
```
        1.0 : [distance=43.99613588967367]: [123.0,100.0,68.0]
        1.0 : [distance=48.917288011637844]: [50.0,88.0,113.0]
        1.0 : [distance=34.81286848342692]: [103.0,127.0,124.0]
        1.0 : [distance=19.458862237805725]: [100.0,98.0,84.0]
        1.0 : [distance=26.261571499362784]: [75.0,87.0,111.0]
        1.0 : [distance=24.71988197027609]: [112.0,86.0,116.0]
        1.0 : [distance=45.30974732319676]: [54.0,115.0,109.0]
        1.0 : [distance=26.251317758467103]: [99.0,74.0,105.0]
        1.0 : [distance=44.211421114571415]: [60.0,103.0,128.0]
        1.0 : [distance=51.45054971219929]: [124.0,134.0,76.0]
        1.0 : [distance=49.7950788356241]: [54.0,82.0,122.0]
        1.0 : [distance=29.924764572201028]: [70.0,109.0,92.0]
        1.0 : [distance=9.327015606508425]: [98.0,109.0,105.0]
        1.0 : [distance=48.832965516814696]: [61.0,133.0,110.0]
        1.0 : [distance=22.520997207799883]: [86.0,100.0,83.0]
        1.0 : [distance=28.415755866017626]: [85.0,114.0,125.0]
        1.0 : [distance=36.41025183957822]: [113.0,105.0,135.0]
19/06/16 01:59:03 INFO ClusterDumper: Wrote 6 clusters
19/06/16 01:59:03 INFO MahoutDriver: Program took 207221 ms (Minutes: 3.4536833333333333)

real    3m33.323s
user    0m18.248s
sys     0m4.559s
[ec2-user@ip-172-31-7-237 apache-mahout-distribution-0.11.2]$
```

b) First Pass: time 1 minute 16.384 seconds



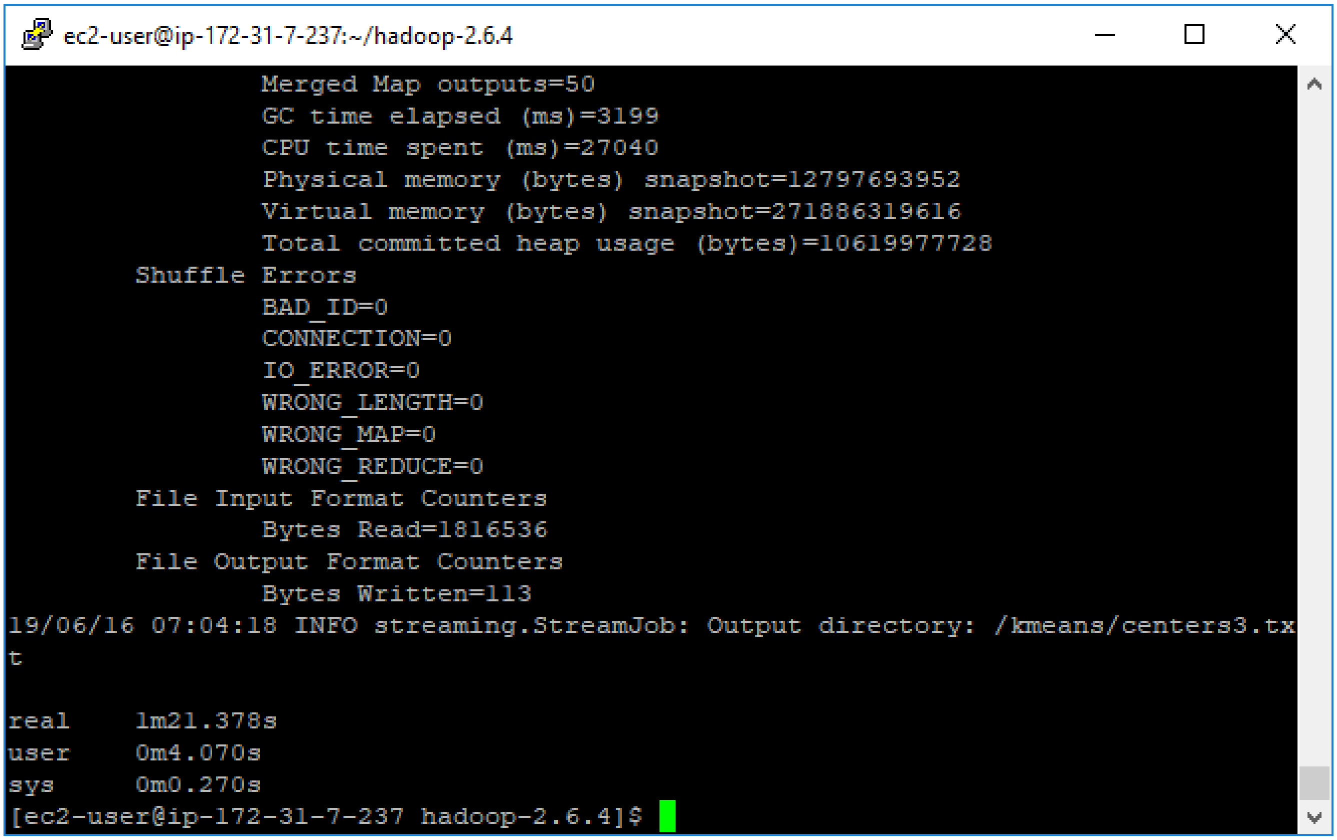
```
                Failed Shuffles=0
                Merged Map outputs=50
                GC time elapsed (ms)=2868
                CPU time spent (ms)=26530
                Physical memory (bytes) snapshot=12815728640
                Virtual memory (bytes) snapshot=271884931072
                Total committed heap usage (bytes)=10578558976
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=1576997
        File Output Format Counters
                Bytes Written=115
19/06/16 05:52:06 INFO streaming.StreamJob: Output directory: centers2.txt

real    1m16.384s
user    0m3.959s
sys     0m0.314s
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Output:



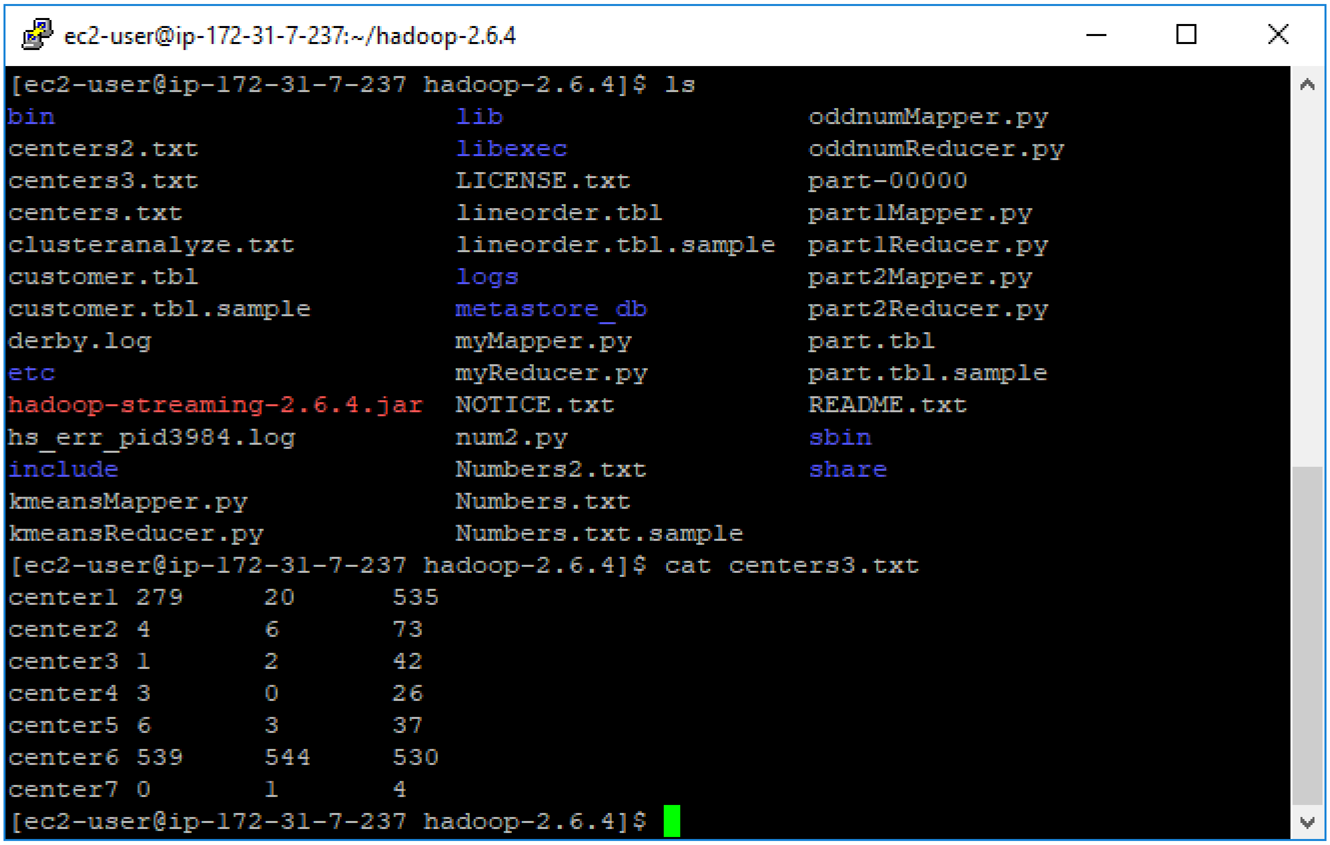
```
drwxr-xr-x   - ec2-user supergroup          0 2019-06-13 21:34 pig_part.txt
drwxr-xr-x   - ec2-user supergroup          0 2019-06-10 04:46 recommendations
drwxr-xr-x   - ec2-user supergroup          0 2019-06-16 01:52 testdata
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat centers2.txt
cat: `centers2.txt': Is a directory
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -ls centers2.txt
Found 2 items
-rw-r--r--   2 ec2-user supergroup          0 2019-06-16 05:52 centers2.txt/_SUCC
ESS
-rw-r--r--   2 ec2-user supergroup        115 2019-06-16 05:52 centers2.txt/part-
00000
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -ls /centers2.txt/part-00000
^[[Dls: `/centers2.txt/part-00000': No such file or directory
^[[D^[[D[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat /centers2.txt/par
cat: `/centers2.txt/part-00000': No such file or directory
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ hadoop fs -cat centers2.txt/part-00000
center1 135     26      82
center2 15      22      37
center3 2       7       19
center4 9       1       10
center5 16      7       14
center6 52      52      35
center7 13      30      23
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Use command to copy centers2.txt to local:
hadoop fs -copyToLocal centers2.txt/part-00000 /home/ec2-user/hadoop-2.6.4/centers2.txt
Second Pass: time 1 minute 21.378 seconds



```
                Merged Map outputs=50
                GC time elapsed (ms)=3199
                CPU time spent (ms)=27040
                Physical memory (bytes) snapshot=12797693952
                Virtual memory (bytes) snapshot=271886319616
                Total committed heap usage (bytes)=10619977728
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=1816536
        File Output Format Counters
                Bytes Written=113
19/06/16 07:04:18 INFO streaming.StreamJob: Output directory: /kmeans/centers3.tx
t

real    1m21.378s
user    0m4.070s
sys     0m0.270s
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```

Output:



```
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ ls
bin                         lib                   oddnumMapper.py
centers2.txt                libexec               oddnumReducer.py
centers3.txt                LICENSE.txt           part-00000
centers.txt                 lineorder.tbl         part1Mapper.py
clusteranalyze.txt          lineorder.tbl.sample  part1Reducer.py
customer.tbl                logs                  part2Mapper.py
customer.tbl.sample         metastore_db          part2Reducer.py
derby.log                   myMapper.py           part.tbl
etc                         myReducer.py          part.tbl.sample
hadoop-streaming-2.6.4.jar  NOTICE.txt            README.txt
hs_err_pid3984.log          num2.py               sbin
include                     Numbers2.txt          share
kmeansMapper.py             Numbers.txt
kmeansReducer.py            Numbers.txt.sample
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$ cat centers3.txt
center1 279     20      535
center2 4       6       73
center3 1       2       42
center4 3       0       26
center5 6       3       37
center6 539     544     530
center7 0       1       4
[ec2-user@ip-172-31-7-237 hadoop-2.6.4]$
```