Module 3 Assignment | Analysis with MapReduce/Pig/Hive

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ALY6110 | Data Management and Big Data

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Set up the directory and subfolders in HDFS.

hadoop fs -mkdir lab

hadoop fs -mkdir lab/input

hadoop fs -mkdir lab/output

#transfer files into HDFS

hadoop fs -copyFromLocal orders.csv lab/input

hadoop fs -copyFromLocal inventory.csv lab/input

nano inventory.csv #then delete the header and save it back into the file

cat inventory.csv

Pig # launches the Pig shell

1. orders = LOAD 'lab/input/orders.csv' USING PigStorage(',') AS (table_id: chararray, order_id: chararray, product_id: int, date: chararray);

Load the 'orders.csv' file using PigStorage with comma as the delimiter, also assign aliases to the columns, specifying the data types for each column: table_id as a chararray, order_id as a chararray, product_id as an integer, and date as a chararray.

2. inventory = LOAD 'lab/input/inventory.csv' USING PigStorage(',') AS (table_id: chararray, product_id: int, name: chararray, category: chararray, inventory: int);

Load the 'inventory.csv' file using PigStorage with comma as the delimiter, also assign aliases to the columns, specifying the data types for each column: table_id as a chararray, product_id as an integer, name as a chararray, category as a chararray, and inventory as an integer.

3. grouped_orders = GROUP orders BY product_id;

Group the 'orders' table by the 'product_id' column, and store the result in the new table named 'grouped_orders'.

4. orders_count = FOREACH grouped_orders GENERATE group AS product_id,COUNT(orders) AS order_count;

For each group in 'grouped_orders', calculate the count of orders for each 'product_id, then generate a relation named 'orders_count' with columns product_id and order_count.

5. grouped_inventory = GROUP inventory BY product_id;

Group the 'inventory' relation by the 'product_id' column, and store the result in the new table named 'grouped_inventory'.

6. inventory_sum = FOREACH grouped_inventory GENERATE group AS product_id,SUM(inventory.inventory) AS total_inventory;

For each group in 'grouped_inventory', calculate the sum of 'inventory' values for each product_id, then generate a relation 'inventory_sum' with columns product_id and total_inventory.

7. joined_data = JOIN orders_count BY product_id LEFT OUTER, inventory_sum BY product_id;

Perform a left join between orders_count and inventory_sum based on the 'product_id' column, then store a relation 'joined_data' with columns from both orders_count and inventory_sum.

8. joined_data = FOREACH joined_data GENERATE orders_count::product_id AS product_id, orders_count::order_count AS order_count, inventory_sum::total_inventory AS total_inventory, (order_count - total_inventory) AS difference;

For each row in 'joined_data', calculate the difference between the order_count and total_inventory columns, and generate a new column named 'difference'.

9. insufficient_stock = FILTER joined_data BY difference > 0;

Filter the rows in 'joined_data' to retain only those where the difference column is greater than 0 (where order_count > total_inventory), indicating insufficient stock for orders.

10. result = FOREACH insufficient_stock GENERATE product_id, difference AS additional_items;

For each row in 'insufficient_stock', generate the product_id and additional_items columns, where additional_items is the value of the difference column, then store it in the 'result' table (shown below).

HIVE

hadoop fs -mkdir HV

hadoop fs -mkdir HV/input

#transfer files into the directory

hadoop fs -copyFromLocal orders.csv HV/input

hadoop fs -copyFromLocal inventory.csv HV/input

Hive

1. CREATE TABLE orders (table_id STRING, order_id STRING, product_id INT) ROW FORMAT DELIMITED FIELDS TERMINATED BY ',' STORED AS TEXTFILE;

Create a new blank table named 'orders' with three columns: table_id of type STRING, order_id of type STRING, and product_id of type INT. The data in this table will be delimited by commas, and it will be stored in text file format.

2. LOAD DATA INPATH 'hdfs:///user/hadoop/HV/input/orders.csv' OVERWRITE INTO TABLE orders;

Load data from the specified file 'orders.csv' from the HDFS HV/input directory into the 'orders' table.

then we do the same thing with the 'inventory' table in lines 3 and 4 below

- 3. CREATE TABLE inventory (table_id STRING, product_id INT, name STRING, category STRING, inventory INT) ROW FORMAT DELIMITED FIELDS TERMINATED BY ','
 STORED AS TEXTFILE;
- 4. LOAD DATA INPATH 'hdfs:///user/hadoop/HV/input/inventory.csv' OVERWRITE INTO TABLE inventory;
- 5. CREATE TABLE orders_count AS SELECT product_id, COUNT(order_id) AS order_count FROM orders GROUP BY product_id;

Create a new table named 'orders_count' by selecting the 'product_id' column and calculate the count of orders for each product_id and assign the result to the 'order_count' column.

6. CREATE TABLE inventory_sum AS SELECT product_id, SUM(inventory) AS total_inventory FROM inventory GROUP BY product_id;

Create a new table named 'inventory_sum' by calculating the sum of inventory values for each 'product_id' and assign the result to the 'total_inventory' column.

7. CREATE TABLE joined_data AS SELECT o.product_id, o.order_count, i.total_inventory, (o.order_count - i.total_inventory) AS difference FROM orders_count o LEFT JOIN inventory_sum i ON o.product_id = i.product_id;

Create a new table named 'joined_data' by performing a LEFT JOIN between the 'orders_count' and 'inventory_sum' tables by the 'product_id' column.

8. CREATE TABLE insufficient_stock AS SELECT product_id, difference AS additional_items FROM joined_data WHERE difference > 0;

Create a new table named 'insufficient_stock' by filtering and selecting rows where the difference column is greater than 0 and rename the difference column as 'additional_items'.

9. SELECT * FROM insufficient_stock;

View all content in the 'insufficient_stock' table (shown below).

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```
|hive> select * from insufficient_stock;
OK
35274 1
35362 8
 35387
 35393
                    1
158
26
27
2
664
 35516
 35538
35579
35585
35915
36444
37195
38014
43501
 46897
 47626
50613
53721
54183
57668
58930
61731
65026
 71334
 72611
 75080
75091
81260
86954
202497
228114
 239984
 282384
 306207
 312638
 312651
312652
312661
312666
312675
312752
 312760
312775
312808
312812
312812
312960
313049
313136
313143
313151
389589
                   105
1072
                   1
1803
                   1
10
389626
389643
389942
389942
390025
390603
392633
393019
393020
393085
393738
393739
400454
                   4
73
1
18
                   6
24
259
400479
402184
402189
402190
402198
402209
402475
402492
35240
 35242
 35270
```

MapReduce

```
hadoop fs -mkdir lab/MR
hadoop fs -copyFromLocal combined.csv lab/MR
hadoop fs -copyFromLocal inventory_mapper.py lab/MR
hadoop fs -copyFromLocal inventory_reducer.py lab/MR
chmod +x inventory_mapper.py
chmod +x inventory_reducer.py
hadoop jar /usr/lib/hadoop/hadoop-streaming.jar -files
inventory_mapper.py,inventory_reducer.py -mapper inventory_mapper.py -reducer
inventory_reducer.py -input lab/MR/combined.csv -output lab/MR/output
Mapper
# import the module for reading and writing data
import sys
# input is read by STDIN (standard input) and do the following for each input line
for line in sys.stdin:
  # remove leading and trailing whitespace
  line = line.strip()
  # split the line by comma separator, a list is produced
  line = line.split(",")
  # assign values of the list to the variable names
  table_name = line[0]
  product_id = line[1]
  inventory_value = line[-1] # Assuming inventory value is the last column
```

```
if table_name == 'order_id':
     print('%s\t%s' % (product_id, 'order'))
  elif table_name == 'inventory_id':
     print('%s\t%s' % (product_id, inventory_value))
Reducer
# import the module for reading and writing data
import sys
# Initialize variables: lastKey as None and maxValue as 0
(lastKey, maxValue) = (None, 0)
# Read input from STDIN (standard input) line by line
for line in sys.stdin:
  # Remove leading and trailing whitespace
  line = line.strip()
  # Split the line into key and value based on tab separation
  (\text{key}, \text{value}) = \text{line.split}('\t', 1)
  # Convert the value to an integer
  value = int(value)
  # Check if lastKey is defined and not equal to the current key
  if lastKey and lastKey != key:
    # Output the product_id and the difference between inventory and orders
     print('%s\t%s' % (lastKey, maxValue - value))
     (lastKey, maxValue) = (key, value)
```

```
else:
```

```
# Update maxValue if the current value is larger

maxValue = max(maxValue, value)

lastKey = key
```

Output the result for the last product_id

if lastKey:

print('%s\t%s' % (lastKey, maxValue))

```
[[hadoop@ip-172-31-60-70 ~]$ hadoop jar /usr/lib/hadoop/hadoop-streaming.jar -files inventory_mapper.py,inventory_reducer.py -mapper inventory_mapper.py -reducer inventory_reducer.py -input lab/MR/combined.csv -output lab/MR/output6 packageJobJar: [] [/usr/lib/hadoop/hadoop-streaming-3.3.3-amzn-4.jar] /tmp/streamjob7107236983720592866.jar tmpDir=null 2023-08-11 03:38:26,863 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at ip-172-31-60-70 .ec2.internal/172.31.60.70:8032 2023-08-11 03:38:27,118 INFO client.AHSProxy: Connecting to Application History server at ip-172-31-60-70.ec2.internal/172.31.60.70:8032
      72.31.60.70:10200
2023-08-11 03:38:27,177 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at ip-172-31-60-70
       ce2.internal/172.31.60.70:8032
2023-08-11 03:38:27,178 INFO client.AHSProxy: Connecting to Application History server at ip-172-31-60-70.ec2.internal/1
.ec2.internal/172.31.60.70:8032
2023-08-11 03:38:27,178 INFO client.AHSProxy: Connecting to Application History server at ip-172-31-60-70.ec2.internal/17.31.60.70:10200
2023-08-11 03:38:27,499 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/hadoop/.staging/job_1691721480693_0003
2023-08-11 03:38:27,899 INFO lzo.GPLNativeCodeLoader: Loaded native gpl library
2023-08-11 03:38:27,993 INFO lzo.LzoCodec: Successfully loaded & initialized native-lzo library [hadoop-lzo rev 049362b7 ccf53ff5f739d6bl532457f2c6cd495e8]
2023-08-11 03:38:27,945 INFO mapred.FileInputFormat: Total input files to process: 1
2023-08-11 03:38:28,003 INFO mapreduce.JobSubmitter: number of splits:4
2023-08-11 03:38:28,585 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1691721480693_0003
2023-08-11 03:38:28,585 INFO mapreduce.JobSubmitter: Executing with tokens: []
2023-08-11 03:38:28,593 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2023-08-11 03:38:28,593 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2023-08-11 03:38:28,484 INFO mapreduce.Job: The url to track the job: http://ip-172-31-60-70.ec2.internal:20888/proxy/arplication_1691721480693_0003/
2023-08-11 03:38:28,548 INFO mapreduce.Job: Running job: job_1691721480693_0003
2023-08-11 03:38:28,593 INFO mapreduce.Job: Running job: job_1691721480693_0003
2023-08-11 03:38:38,015 INFO mapreduce.Job: map 50% reduce 0%
2023-08-11 03:38:38,015 INFO mapreduce.Job: map 50% reduce 0%
2023-08-11 03:39:03,07,306 INFO mapreduce.Job: map 50% reduce 0%
2023-08-11 03:39:03,07,306 INFO mapreduce.Job: map 100% reduce 0%
2023-08-11 03:39:03,07,306 INFO mapreduce.Job: Task Id : attempt_1691721480693_0003_r_00000_0, Status : FAILED Error: java.lang.RuntimeException: PipeMapRed.waitOutputThreads(PipeMapRed.java:539)
at org.apache.hadoop.streaming.PipeMapRed.waitOutputThreads(PipeMapRed.java:539)
at org.apache.hadoop.streaming.PipeMapRed.waitOutputThreads(PipeMapRed.java:539)
at org.apache.hadoop.mapred.ReduceTask.r
                                                   at org.apache.hadoop.mapred.ReduceTask.run(ReduceTask.java:394)
at org.apache.hadoop.mapred.ReduceTask.run(ReduceTask.java:394)
at java.security.AccessController.doPrivileged(Native Method)
at javax.security.auth.Subject.doAs(Subject.java:422)
                                                    at org.apache.hadoop.security.UserGroupInformation.doAs(UserGroupInformation.java:1878) at org.apache.hadoop.mapred.YarnChild.main(YarnChild.java:172)
    2023-08-11 03:39:14,463 INFO mapreduce.Job: Task Id : attempt_1691721480693_0003_r_000000_1, Status : FAILED Error: java.lang.RuntimeException: PipeMapRed.waitOutputThreads(): subprocess failed with code 1 at org.apache.hadoop.streaming.PipeMapRed.waitOutputThreads(PipeMapRed.java:326) at org.apache.hadoop.streaming.PipeMapRed.mapRedFinished(PipeMapRed.java:539) at org.apache.hadoop.streaming.PipeReducer.reduce(PipeReducer.java:128) at org.apache.hadoop.mapred.ReduceTask.runOldReducer(ReduceTask.java:446) at org.apache.hadoop.mapred.ReduceTask.run(ReduceTask.java:394) at org.apache.hadoop.mapred.YarnChild$2.run(YarnChild.java:178) at java.security.AccessController.doPrivileged(Native Method) at java.security.auth.Subject.doAs(Subject.java:422) at org.apache.hadoop.security.UserGroupInformation.doAs(UserGroupInformation.java:1878) at org.apache.hadoop.mapred.YarnChild.main(YarnChild.java:172)
     2023-08-11 03:39:22,513 INFO mapreduce.Job: Task Id : attempt_1691721480693_0003_r_000000_2, Status : FAILED Error: java.lang.RuntimeException: PipeMapRed.waitOutputThreads(): subprocess failed with code 1 at org.apache.hadoop.streaming.PipeMapRed.waitOutputThreads(PipeMapRed.java:326) at org.apache.hadoop.streaming.PipeMapRed.mapRedFinished(PipeMapRed.java:539) at org.apache.hadoop.streaming.PipeReducer.reduce(PipeReducer.java:128) at org.apache.hadoop.mapred.ReduceTask.runOldReducer(ReduceTask.java:446) at org.apache.hadoop.mapred.ReduceTask.run(ReduceTask.java:394) at org.apache.hadoop.mapred.YarnChild$2.run(YarnChild.java:178) at java.security.AccessController.doPrivileged(Native Method) at java.security.auth.Subject.doAs(Subject.java:422)
                                                    at javax.security.auth.Subject.doAs(Subject.java:422)
at org.apache.hadoop.security.UserGroupInformation.doAs(UserGroupInformation.java:1878)
at org.apache.hadoop.mapred.YarnChild.main(YarnChild.java:172)
```

***I followed all the steps above and used 2 Python files as stated for 'Mapper' and 'Reducer', but I still couldn't go through the final streaming result. I tried editing the script several times and run it again and again but still cannot figure out the errors in this case.