Big Data Hadoop and Spark Developer
Retail Business Analytics

Final Project – An Nguyen

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1. Explore the customer records saved in the "customers-tab-delimited" directory on HDFS • Show the client information for those who live in California • Save the results in the result/scenario1/solution folder • Only the customer's entire name should be included in the output

```
# final code for submitting spark job (scenario 1)
from pyspark.sql import SparkSession

#create spark session
spark = SparkSession.builder.appName('spark').getOrCreate()

#input data
df = spark.read.option('delimiter','\t').csv(r'data-files/customers-tab-delimited/part-

#apply schema on data, making it a dataframe
df = df.toDF('index','first_name','last_name','x1','x2','street','city','state','zip_co

#using filter function, select only rows with state == CA
ca_df = df.filter('state == "CA"')

#now we combine first and last name into full name
from pyspark.sql import functions as F
final_df = ca_df.select(F.concat(F.col('first_name'),\
                                 F.lit(' '),\
                                 F.col('last_name')).alias('full_name'))

#save file to the correct directory
final_df.write.format('csv').option('header',True).option('sep','\t').save(r'results/sc

#close out app to save resource
spark.stop()
```

submit job via

```
spark3-submit --conf spark.ui.port=6065 --deploy-mode client ca.py
```

/ user/ antnguyen72gmail/ results/ sc1/ task1/
part-00000-edf51616-21d3-42ca-ac49-89622e92b907-c000.csv

```
full_name
Mary Jones
Katherine Smith
Jane Luna
Robert Smith
Margaret Wright
Mary Smith
Howard Smith
Mary Kim
Douglas James
Mary Simmons
Frank Gillespie
Joseph Young
Sean Smith
Lauren Freeman
Alice Warner
Mary Smith
Mary Gallagher
```

2. Explore the order records saved in the “orders parquet” directory on HDFS • Show all orders with the order status value "COMPLETE “• Save the data in the "result/scenario2/solution" directory on HDFS • The "order date" column should be in the "YYYY-MM-DD" format Use GZIP compression to compress the output Include order number, order date, and current situation in the output

```python
# final code for submitting spark job (scenario 2)
from pyspark.sql import SparkSession

#create spark session
spark = SparkSession.builder.appName('spark').getOrCreate()

#input data
df = spark.read.parquet(r'data-files/orders_parquet/shortName.parquet',inferSchema=True)

#apply schema on data is not needed because header is included

#using filter function, select only rows with order_status == COMPLETE
complete_df = df.filter('order_status == "COMPLETE"')

# after applying the first filter, convert time stamp into standard date format
from pyspark.sql.functions import from_utc_timestamp, from_unixtime, date_format, col
# convert timestamp
normalized_date_df = complete_df.withColumn('new_date',from_utc_timestamp(from_unixtime(df['order_date']/10
# extract date
final_df = normalized_date_df.withColumn('date',date_format(col('new_date'),'yyyy-MM-dd').cast('date'))
# select columns we need
final_df = final_df['order_id','order_customer_id','date','order_status']

# save file to the correct directory using gzip compression
final_df.write.format('csv').option('header',True).option('sep','\t').option('compression','gzip').save(r'r

#close out app to save resource
spark.stop()
```

/ user/ antnguyen72gmail/ results/ sc1/ task2/
part-00000-a5a6d978-2296-4933-906c-d8241075db2c-c000.csv.gz

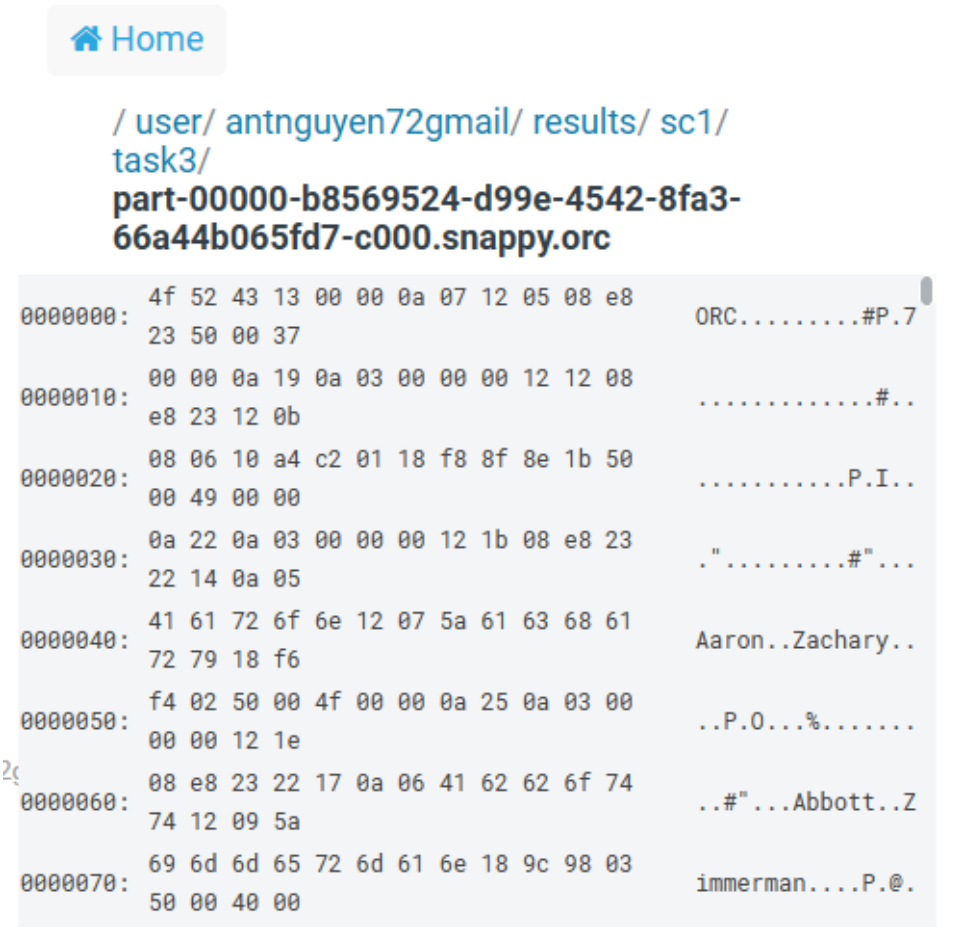
Output rendered from compressed gzip file.

order_id	order_customer_id	date	order_status
3	12111	2013-07-24	COMPLETE
5	11318	2013-07-24	COMPLETE
6	7130	2013-07-24	COMPLETE
7	4530	2013-07-24	COMPLETE
15	2568	2013-07-24	COMPLETE
17	2667	2013-07-24	COMPLETE
22	333	2013-07-24	COMPLETE
26	7562	2013-07-24	COMPLETE
28	656	2013-07-24	COMPLETE
32	3960	2013-07-24	COMPLETE
35	4840	2013-07-24	COMPLETE
45	2636	2013-07-24	COMPLETE
56	10519	2013-07-24	COMPLETE
63	1148	2013-07-24	COMPLETE
65	5903	2013-07-24	COMPLETE
67	1406	2013-07-24	COMPLETE
71	8646	2013-07-24	COMPLETE
72	4349	2013-07-24	COMPLETE

3. Explore the customer records saved in the "customers-tab-delimited“ directory on HDFS • Produce a list of all consumers who live in the city of "Caguas" • Save the results in the result/scenario3/solution folder • The result should only contain records with the value "Caguas" for the customer city

Use snappy compression to compress the output
Save the file in the orc format

```
# final code for submitting spark job (scenario 3)
from pyspark.sql import SparkSession

#create spark session
spark = SparkSession.builder.appName('spark').getOrCreate()

#input data
df = spark.read.option('delimiter','\t').csv(r'data-files/customers-tab-delimited/part-m-00000',inferSchema

#apply schema on data, making it a dataframe
df = df.toDF('index','first_name','last_name','x1','x2',\
             'street','city','state','zip_code')

#using filter function, select only rows with city = Caguas
ca_df = df.filter('city == "Caguas"')

#save file to the correct directory
ca_df.write.format('orc').option('compression','snappy').option('header',True).save(r'results/sc1/task3/')

#close out app to save resource
spark.stop()
```



4. Explore the order records saved in the “categories” directory on HDFS • Save the result files in CSV format • Save the data in the result/scenario4/solution directory on HDFS • Use lz4 compression to compress the output

```python
# final code for submitting spark job (scenario 4)
from pyspark.sql import SparkSession

#create spark session
spark = SparkSession.builder.appName('spark').getOrCreate()

#input data
df = spark.read.option('delimiter',',').csv(r'data-files/categories/part-m-00000',inferSchema=True)

#apply schema on data, making it a dataframe
df = df.toDF('index','type','category')

#save file to the correct directory
df.write.format('csv').option('header',True).option('compression','lz4')\
        .option('sep',',').save(r'results/sc1/task4/')

#close out app to save resource
spark.stop()
```

submit job via

spark3-submit --conf spark.ui.port=6065 --deploy-mode client categories.py

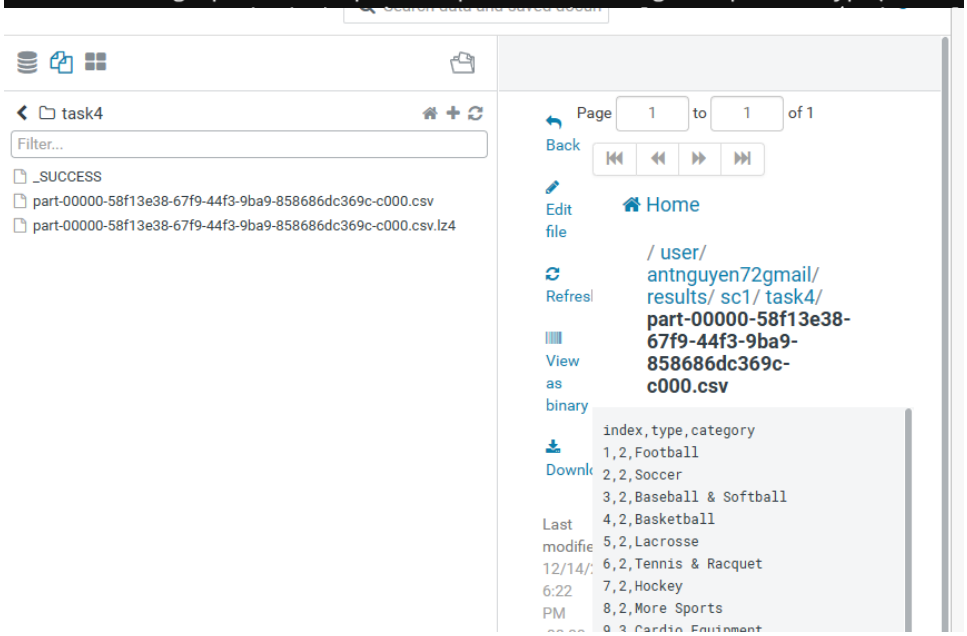
for compressing, I could not find a way to compressfile straight in the hdfs system, so I resorted to copying it to the local linux file system, compress it then copy it back. Your kernel did not have lz4 library installed

hdfs dfs -copyToLocal /user/antnguyen72gmail/results/sc1/task4/part-00000-58f13e38-67f9-44f3-9ba9-858686dc369c-c000.csv

lz4 part-00000-58f13e38-67f9-44f3-9ba9-858686dc369c-c000.csv

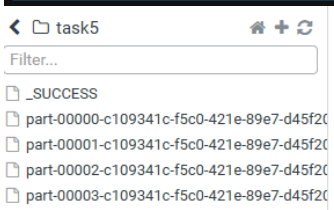
hdfs dfs -put part-00000-58f13e38-67f9-44f3-9ba9-858686dc369c-c000.csv.lz4 /user/antnguyen72gmail/results/sc1/task4/part-00000-58f13e38-67f9-44f3-9ba9-858686dc369c-c000.csv.lz4

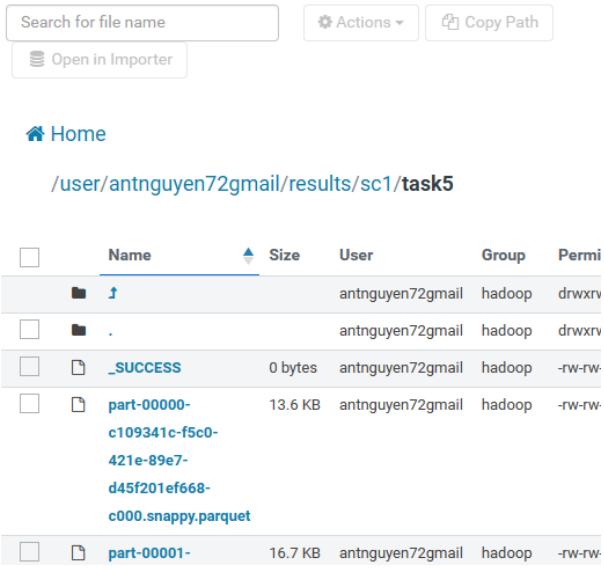
```
        ... 41 more
Caused by: java.lang.RuntimeException: native lz4 library not available
        at org.apache.hadoop.io.compress.Lz4Codec.getCompressorType(Lz4Cod
```



5. Only products with a price of more than 1000.0 should be included in the output
Save the output files in parquet format
Remove data from the table if the product price is greater than 1000.0
Save the data in the result/scenario5/solution directory on HDFS
Use snappy compression to compress the output

```python
from pyspark.sql import SparkSession
spark = SparkSession.builder.appName('spark').getOrCreate()

# read all files

# get a list of all file names from the directory
import os
file_list = os.listdir(r'data-files/products_avro/')

# using loop, add each dataframe objects onto a list
df_list = []
for line in file_list:
    df = spark.read.format("avro").load(f'data-files/products_avro/{line}')
    df_list.append(df)

# use reduce functional tool to apply a lambda function to am iterable list
# in this case, we unioned all the dataframes togther
from functools import reduce
combined_df = reduce(lambda x,y: x.union(y),df_list)

# output rows with product_price is greater than 1000.0
combined_df.filter('product_price > 1000.0').show()

# remove data from table if the product price is greater than 1000.0
final_df = combined_df.filter('product_price <= 1000.0')

# save file
# tried to save as avro with compression but avro is not compat with snappy
# turns out orc is the only compatiable with snappy??
final_df.write.format('orc').option('compression','snappy').save(r'results/sc1/task5/')

# close out spark session
spark.stop()
```





```
for this job
22/12/15 04:09:58 INFO cluster.YarnScheduler: Killing all running tasks in stage 1: Stage finished
22/12/15 04:09:58 INFO scheduler.DAGScheduler: Job 1 finished: showString at NativeMethodAccessorImpl.java:0, took
4.616677 s
22/12/15 04:09:58 INFO codegen.CodeGenerator: Code generated in 13.834702 ms
+----------+------------------+--------------------+------------------+-------------+--------------------+
|product_id|product_category_id|        product_name|product_description|product_price|       product_image|
+----------+------------------+--------------------+------------------+-------------+--------------------+
|        66|                 4|  SOLE F85 Treadmill|                  |      1799.99|http://images.acm...|
|       199|                10|  SOLE F85 Treadmill|                  |      1799.99|http://images.acm...|
|       208|                10| SOLE E35 Elliptical|                  |      1999.99|http://images.acm...|
|       496|                22|  SOLE F85 Treadmill|                  |      1799.99|http://images.acm...|
|      1048|                47|Spalding Beast 60...|                  |      1099.99|http://images.acm...|
+----------+------------------+--------------------+------------------+-------------+--------------------+

22/12/15 04:09:58 INFO datasources.FileSourceStrategy: Pushed Filters: IsNotNull(product_price),LessThanOrEqual(pro
duct_price,1000.0)
22/12/15 04:09:58 INFO datasources.FileSourceStrategy: Post-Scan Filters: isnotnull(product_price#4),(product_price
#4 <= 1000.0)
22/12/15 04:09:58 INFO datasources.FileSourceStrategy: Output Data Schema: struct<product_id: int, product_category
_id: int, product_name: string, product_description: string, product_price: float ... 1 more field>
22/12/15 04:09:58 INFO datasources.FileSourceStrategy: Pushed Filters: IsNotNull(product_price),LessThanOrEqual(pro
duct_price,1000.0)
22/12/15 04:09:58 INFO datasources.FileSourceStrategy: Post-Scan Filters: isnotnull(product_price#16),(product_pric
```

6. Explore the “products_avro” stored in product records

REQUIREMENT:

Only products with a price of more than 1000.0 should be in the output

The pattern "Treadmill" appears in the product name

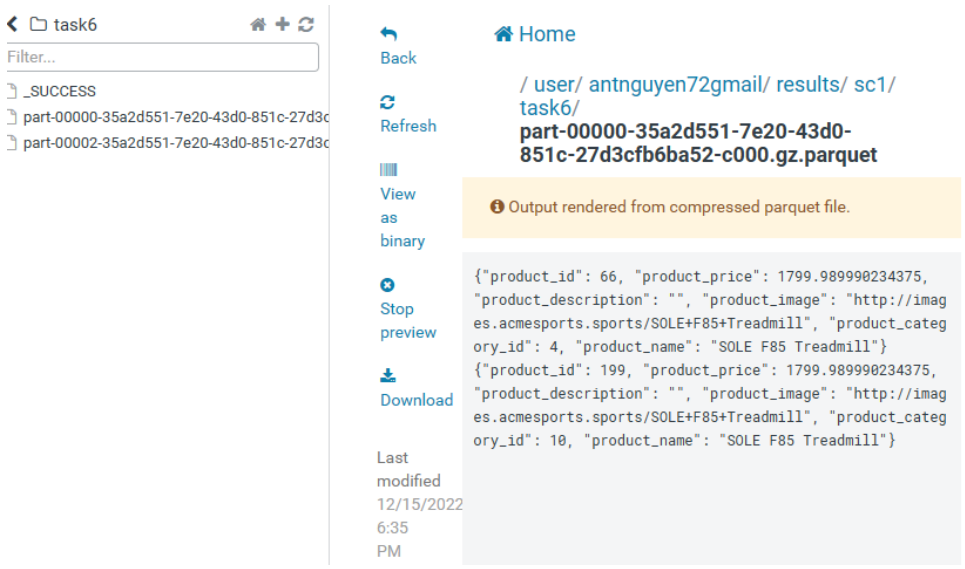
Save the output files in parquet format

Save the data in the result/scenario6/solution directory on HDFS

Use GZIP compression to compress the output

```python
from pyspark.sql import SparkSession
spark = SparkSession.builder.appName('spark').getOrCreate()

# read all files

# get a list of all file names from the directory
import os
file_list = os.listdir(r'data-files/products_avro/')

# using loop, add each dataframe objects onto a list
df_list = []
for line in file_list:
    df = spark.read.format("avro").load(f'data-files/products_avro/{line}')
    df_list.append(df)

# use reduce functional tool to apply a lambda function to am iterable list
# in this case, we unioned all the dataframes togther
from functools import reduce
combined_df = reduce(lambda x,y: x.union(y),df_list)

# output rows with product_price is greater than 1000.0
greater_df = combined_df.filter('product_price > 1000.0')

# create a temp view for easier querying
greater_df.createOrReplaceTempView('table')

# query rows with the pattern "Treadmill"
final_df = spark.sql("select * from table where lower(product_name) like '%treadmill%'")

# save file as parquet format using gzip compression
final_df.write.format('parquet').option('compression','gzip').save(r'results/sc1/task6/')

# close out spark session
spark.stop()
```

```
spark3-submit --conf spark.ui.port=6065 --deploy-mode client avro_2.py
```

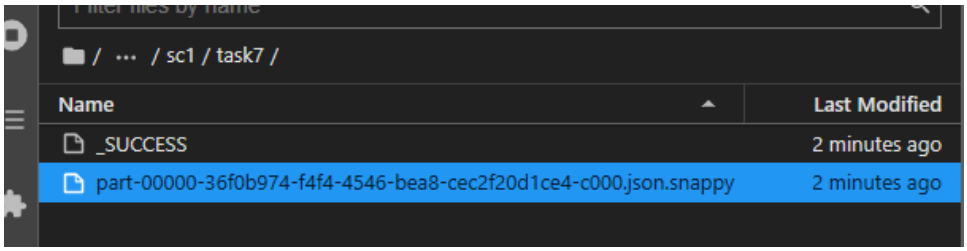


7. Explore the order records that are saved in the “orders parquet” table on HDFS
REQUIREMENT:
Output all PENDING orders in July 2013
Output files should be in JSON format
Save the data in the result/scenario7/solution directory on HDFS.
Only entries with the order status value of "PENDING" should be included in the result
Order date should be in the YYY-MM-DD format
Use snappy compression to compress the output, which should just contain the order date and order status

Your environment was not setup in such a way that allowed me to save a json file with snappy compression. Therefore, I used my local setup to perform the same task

```
# final code for submitting spark job (scenario 7)
from pyspark.sql import SparkSession

#create spark session
spark = SparkSession.builder.appName('spark').getOrCreate()

#input data
df = spark.read.parquet('data-files/orders_parquet/shortName.parquet',inferSchema=True)

#apply schema on data is not needed because header is included

#using filter function, select only rows with order_status == PENDING
pending_df = df.filter('order_status == "PENDING"')

# after applying the first filter, convert time stamp into standard date format
from pyspark.sql.functions import from_utc_timestamp, from_unixtime, date_format, col
# convert timestamp
normalized_date_df = pending_df.withColumn('new_date',from_utc_timestamp(from_unixtime(df['order_date']/1000),'UTC-8'))
# extract date
final_df = normalized_date_df.withColumn('date',date_format(col('new_date'),'yyyy-MM-dd').cast('date'))

# select columns we need
final_df = final_df['date','order_status']

# save file
final_df.write.format('json').option('compression','snappy').save(r'results/sc1/task7/')

spark.stop()
```

```
spark3-submit --conf spark.ui.port=6065 --deploy-mode client pending.py
```


/ ... / sc1 / task7 /
Name
Last Modified
_SUCCESS
2 minutes ago
part-00000-36f0b974-f4f4-4546-bea8-cec2f20d1ce4-c000.json.snappy
2 minutes ago