Task 1

In [1]:
```
from pyspark.sql import SparkSession

spark = SparkSession.builder \
  .remote("sc://192.168.1.7:15002") \
  .appName("RetailStoreInsights") \
  .getOrCreate()

# limit() shows a nice HTML table in Jupyter, while show() prints plain text
spark.conf.set('spark.sql.repl.eagerEval.enabled', True)

spark
```

Out[1]:
```
<pyspark.sql.connect.session.SparkSession at 0x29256293a10>
```

In [2]:
```
from pyspark.sql import Row

data = [
  ('Ulysses', 'Book', 23.17, 16),
  ('Apple', 'Fruit', 2.34, 8),
  ('Pineapple', 'Fruit', 2.57, 1),
  ('Apple', 'Fruit', 2.43, 6),
  ('To Kill a Mockingbird', 'Book', 24.14, 19),
  ('To Kill a Mockingbird', 'Book', 11.18, 11),
  ('Watermelon', 'Fruit', 3.35, 15),
  ('Pride and Prejudice', 'Book', 24.99, 3),
  ('To Kill a Mockingbird', 'Book', 21.82, 17),
  ('Moby Dick', 'Book', 14.83, 20),
  ('Pride and Prejudice', 'Book', 5.03, 16),
  ('Jane Eyre', 'Book', 20.40, 8),
  ('Moby Dick', 'Book', 5.55, 20),
  ('Don Quixote', 'Book', 19.75, 17),
  ('Watermelon', 'Fruit', 2.31 , 9),
  ('Hamlet', 'Book', 18.20, 12),
  ('Mango', 'Fruit', 4.10, 7),
  ('1984', 'Book', 16.75, 14),
  ('Strawberry', 'Fruit', 1.90, 25),
  ('War and Peace', 'Book', 22.50, 9),
  ('Orange', 'Fruit', 3.05, 13),
  ('The Great Gatsby', 'Book', 12.30, 10),
  ('Peach', 'Fruit', 2.80, 11),
  ('Grapes', 'Fruit', 2.60, 18),
  ('Pride and Prejudice', 'Book', 9.50, 5)
]

df = spark.createDataFrame([
  Row(product_name=row[0], category=row[1], price=row[2], quantity=row[3])
  for row in data
], schema = 'product_name STRING, category STRING, price FLOAT, quantity SHORT')
df.createOrReplaceTempView("retail_sales") # give it a name for sql
df.limit(10)
```

```
Out[2]:  +--------------------+--------+-----+--------+
         |        product_name|category|price|quantity|
         +--------------------+--------+-----+--------+
         |             Ulysses|    Book|23.17|      16|
         |               Apple|   Fruit| 2.34|       8|
         |           Pineapple|   Fruit| 2.57|       1|
         |               Apple|   Fruit| 2.43|       6|
         |To Kill a Mocking...|    Book|24.14|      19|
         |To Kill a Mocking...|    Book|11.18|      11|
         |          Watermelon|   Fruit| 3.35|      15|
         | Pride and Prejudice|    Book|24.99|       3|
         |To Kill a Mocking...|    Book|21.82|      17|
         |           Moby Dick|    Book|14.83|      20|
         +--------------------+--------+-----+--------+
```

```
In [3]:  df.printSchema()
```

```
root
 |-- product_name: string (nullable = true)
 |-- category: string (nullable = true)
 |-- price: float (nullable = true)
 |-- quantity: short (nullable = true)
```

```
In [4]:  spark.sql("""
           select * from retail_sales
           where price > 2
           order by price
         """)
```

```
Out[4]:  +--------------------+--------+-----+--------+
         |        product_name|category|price|quantity|
         +--------------------+--------+-----+--------+
         |          Watermelon|   Fruit| 2.31|       9|
         |               Apple|   Fruit| 2.34|       8|
         |               Apple|   Fruit| 2.43|       6|
         |           Pineapple|   Fruit| 2.57|       1|
         |              Grapes|   Fruit|  2.6|      18|
         |               Peach|   Fruit|  2.8|      11|
         |              Orange|   Fruit| 3.05|      13|
         |          Watermelon|   Fruit| 3.35|      15|
         |               Mango|   Fruit|  4.1|       7|
         | Pride and Prejudice|    Book| 5.03|      16|
         |           Moby Dick|    Book| 5.55|      20|
         | Pride and Prejudice|    Book|  9.5|       5|
         |To Kill a Mocking...|    Book|11.18|      11|
         |    The Great Gatsby|    Book| 12.3|      10|
         |           Moby Dick|    Book|14.83|      20|
         |                1984|    Book|16.75|      14|
         |              Hamlet|    Book| 18.2|      12|
         |          Don Quixote|    Book|19.75|      17|
         |           Jane Eyre|    Book| 20.4|       8|
         |To Kill a Mocking...|    Book|21.82|      17|
+--------------------+--------+-----+--------+
only showing top 20 rows
```

In [5]:
```
# https://spark.apache.org/docs/latest/sql-pipe-syntax.html
spark.sql("""
  from retail_sales
  |> aggregate count(*) as category_count
     group by category
""")
```

Out[5]:
```
+--------+--------------+
|category|category_count|
+--------+--------------+
|    Book|            15|
|   Fruit|            10|
+--------+--------------+
```

In [6]:
```
spark.sql("""
  from retail_sales
  |> aggregate avg(price) as avg_price
     group by product_name
  |> set avg_price = round(avg_price, 2)
""")
```

Out[6]:
```
+--------------------+---------+
|        product_name|avg_price|
+--------------------+---------+
|           Pineapple|     2.57|
|To Kill a Mocking...|    19.05|
|             Ulysses|    23.17|
|               Apple|     2.38|
|           Jane Eyre|     20.4|
|           Moby Dick|    10.19|
|          Watermelon|     2.83|
| Pride and Prejudice|    13.17|
|                1984|    16.75|
|               Mango|      4.1|
|         Don Quixote|    19.75|
|              Hamlet|     18.2|
|              Orange|     3.05|
|               Peach|      2.8|
|    The Great Gatsby|     12.3|
|              Grapes|      2.6|
|          Strawberry|      1.9|
|       War and Peace|     22.5|
+--------------------+---------+
```

In [7]:
```
spark.sql("""
  from retail_sales
  |> extend price - (price * 0.1) as discounted_price
  |> set discounted_price = round(discounted_price, 2)
  |> select product_name, discounted_price, price as original_price
""")
```

Out[7]:
```
+--------------------+---------------+--------------+
|        product_name|discounted_price|original_price|
+--------------------+---------------+--------------+
|             Ulysses|          20.85|         23.17|
|               Apple|           2.11|          2.34|
|           Pineapple|           2.31|          2.57|
|               Apple|           2.19|          2.43|
|To Kill a Mocking...|          21.73|         24.14|
|To Kill a Mocking...|          10.06|         11.18|
|          Watermelon|           3.01|          3.35|
| Pride and Prejudice|          22.49|         24.99|
|To Kill a Mocking...|          19.64|         21.82|
|           Moby Dick|          13.35|         14.83|
| Pride and Prejudice|           4.53|          5.03|
|           Jane Eyre|          18.36|          20.4|
|           Moby Dick|            5.0|          5.55|
|         Don Quixote|          17.78|         19.75|
|          Watermelon|           2.08|          2.31|
|              Hamlet|          16.38|          18.2|
|               Mango|           3.69|           4.1|
|                1984|          15.08|         16.75|
|          Strawberry|           1.71|           1.9|
|       War and Peace|          20.25|          22.5|
+--------------------+---------------+--------------+
only showing top 20 rows
```

In [8]:
```
spark.sql("""
  from retail_sales
  |> aggregate sum(quantity) as n_sold_total
""")
```

Out[8]:
```
+------------+
|n_sold_total|
+------------+
|         310|
+------------+
```

In [9]:
```
spark.sql("""
  from retail_sales
  |> aggregate sum(quantity) as n_sold
     group by category
""")
```

Out[9]:
```
+--------+------+
|category|n_sold|
+--------+------+
|    Book|   197|
|   Fruit|   113|
+--------+------+
```

In [10]:
```
spark.sql("""
  from retail_sales
  |> aggregate sum(price * quantity) as revenue
```

```
    group by category
""")
```

Out[10]:

```
+--------+------------------+
|category|           revenue|
+--------+------------------+
|    Book|3211.2000007629395|
|   Fruit| 300.3599935770035|
+--------+------------------+
```

In [11]:

```
spark.sql("""
  from retail_sales
  |> aggregate sum(quantity) as n_sold
     group by category, product_name
  |> order by n_sold desc
""")
```

Out[11]:

```
+--------+--------------------+------+
|category|        product_name|n_sold|
+--------+--------------------+------+
|    Book|To Kill a Mocking...|    47|
|    Book|           Moby Dick|    40|
|   Fruit|          Strawberry|    25|
|   Fruit|          Watermelon|    24|
|    Book| Pride and Prejudice|    24|
|   Fruit|              Grapes|    18|
|    Book|         Don Quixote|    17|
|    Book|             Ulysses|    16|
|   Fruit|               Apple|    14|
|    Book|                1984|    14|
|   Fruit|              Orange|    13|
|    Book|              Hamlet|    12|
|   Fruit|               Peach|    11|
|    Book|    The Great Gatsby|    10|
|    Book|       War and Peace|     9|
|    Book|          Jane Eyre|     8|
|   Fruit|               Mango|     7|
|   Fruit|           Pineapple|     1|
+--------+--------------------+------+
```

teste

In [ ]:

```
spark.stop()
```

Task 2

In [1]:

```
from pyspark.sql import SparkSession
```

```
spark = SparkSession.builder \
  .remote("sc://192.168.1.7:15002") \
  .appName("UDFTransformation") \
  .config("spark.sql.ansi.enabled", "false") \
  .config("spark.sql.execution.pythonUDF.arrow.enabled", "true") \
  .getOrCreate()

# limit() shows a nice HTML table in Jupyter, while show() prints plain text
spark.conf.set('spark.sql.repl.eagerEval.enabled', True)

spark
```

```
Out[1]:  <pyspark.sql.connect.session.SparkSession at 0x23f824ef550>
```

In [2]:

```
from pyspark.sql.functions import udf

@udf(returnType='int')
def mult_by_3(s: int) -> int:
  return s * 3

df = spark.createDataFrame([(4, ), (5, ), (6, )], ['value'])
df
```

```
Out[2]:  +-----+
         |value|
         +-----+
         |    4|
         |    5|
         |    6|
         +-----+
```

In [3]:

```
dff = df.withColumn('value_x3', mult_by_3(df.value))
dff
```

```
Out[3]:  +-----+--------+
         |value|value_x3|
         +-----+--------+
         |    4|      12|
         |    5|      15|
         |    6|      18|
         +-----+--------+
```

In [4]:

```
import pandas as pd
import pyspark.pandas as ps
from pyspark.sql.functions import pandas_udf

@pandas_udf("int")
def sub_2(s: pd.Series) -> pd.Series:
  return s - 2

dffs = dff.withColumn('value_minus_2', sub_2(dff.value))
dffs
```

```
c:\Users\plancha\spark-lab1\.venv\lib\site-packages\pyspark\pandas\__init__.py:43:
UserWarning: 'PYARROW_IGNORE_TIMEZONE' environment variable was not set. It is
required to set this environment variable to '1' in both driver and executor sides
if you use pyarrow>=2.0.0. pandas-on-Spark will set it for you but it does not work
if there is a Spark context already launched.
  warnings.warn(
```

```
Out[4]: +-----+--------+-------------+
        |value|value_x3|value_minus_2|
        +-----+--------+-------------+
        |    4|      12|            2|
        |    5|      15|            3|
        |    6|      18|            4|
        +-----+--------+-------------+
```

```
In [ ]: spark.stop()
```