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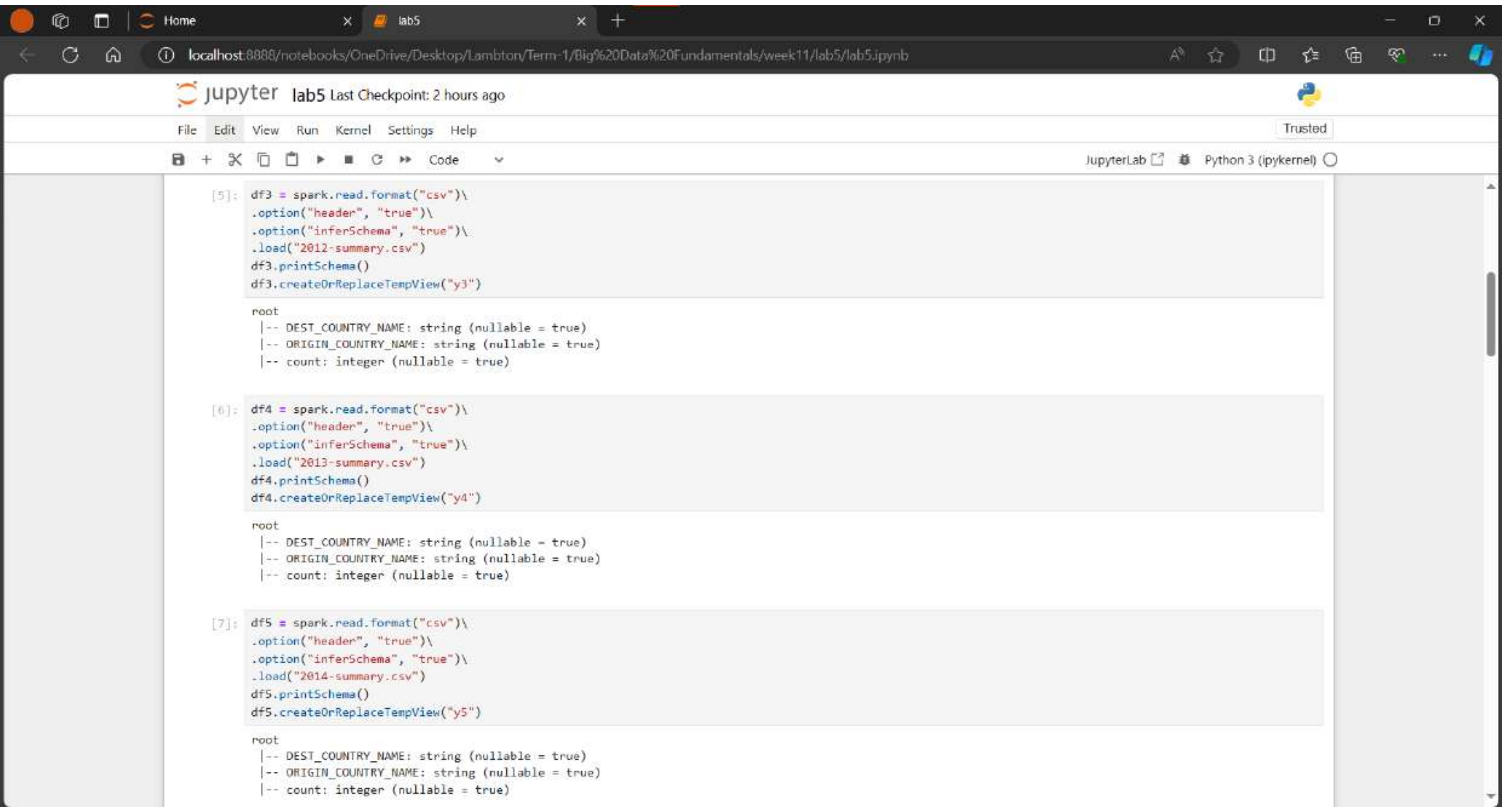
Std ID: C0934419

LAB 5

1. Created six different dataframes using six csv files.



```
[5]: df3 = spark.read.format("csv")\
.option("header", "true")\
.option("inferSchema", "true")\
.load("2012-summary.csv")
df3.printSchema()
df3.createOrReplaceTempView("y3")
```

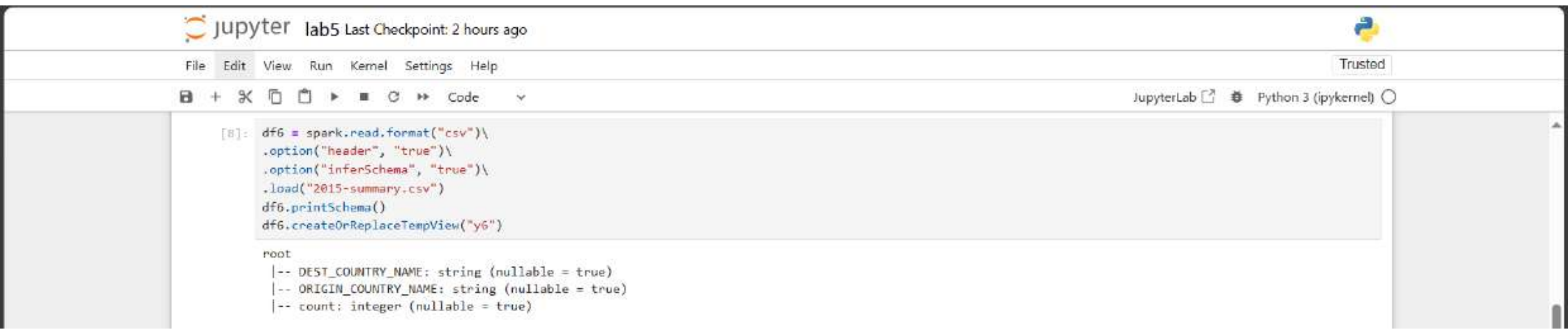
```
root
 |-- DEST_COUNTRY_NAME: string (nullable = true)
 |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
 |-- count: integer (nullable = true)
```

```
[6]: df4 = spark.read.format("csv")\
.option("header", "true")\
.option("inferSchema", "true")\
.load("2013-summary.csv")
df4.printSchema()
df4.createOrReplaceTempView("y4")
```

```
root
 |-- DEST_COUNTRY_NAME: string (nullable = true)
 |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
 |-- count: integer (nullable = true)
```

```
[7]: df5 = spark.read.format("csv")\
.option("header", "true")\
.option("inferSchema", "true")\
.load("2014-summary.csv")
df5.printSchema()
df5.createOrReplaceTempView("y5")
```

```
root
 |-- DEST_COUNTRY_NAME: string (nullable = true)
 |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
 |-- count: integer (nullable = true)
```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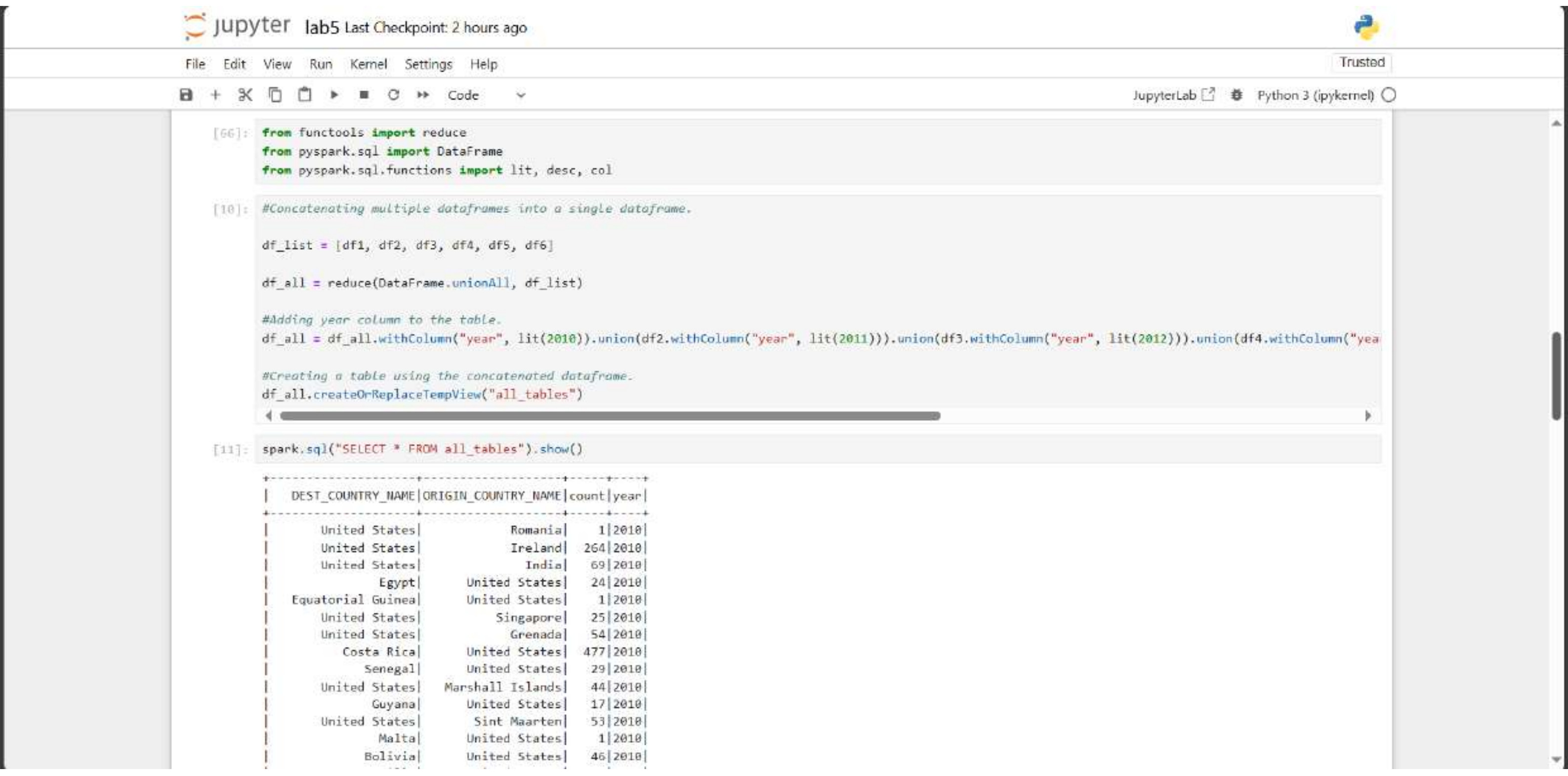
```
[8]: df6 = spark.read.format("csv")\
     .option("header", "true")\
     .option("inferSchema", "true")\
     .load("2015-summary.csv")
     df6.printSchema()
     df6.createOrReplaceTempView("y6")
```

```
root
 |-- DEST_COUNTRY_NAME: string (nullable = true)
 |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
 |-- count: integer (nullable = true)
```

2. Importing necessary modules and Concatenate all six DataFrames into one single DataFrame.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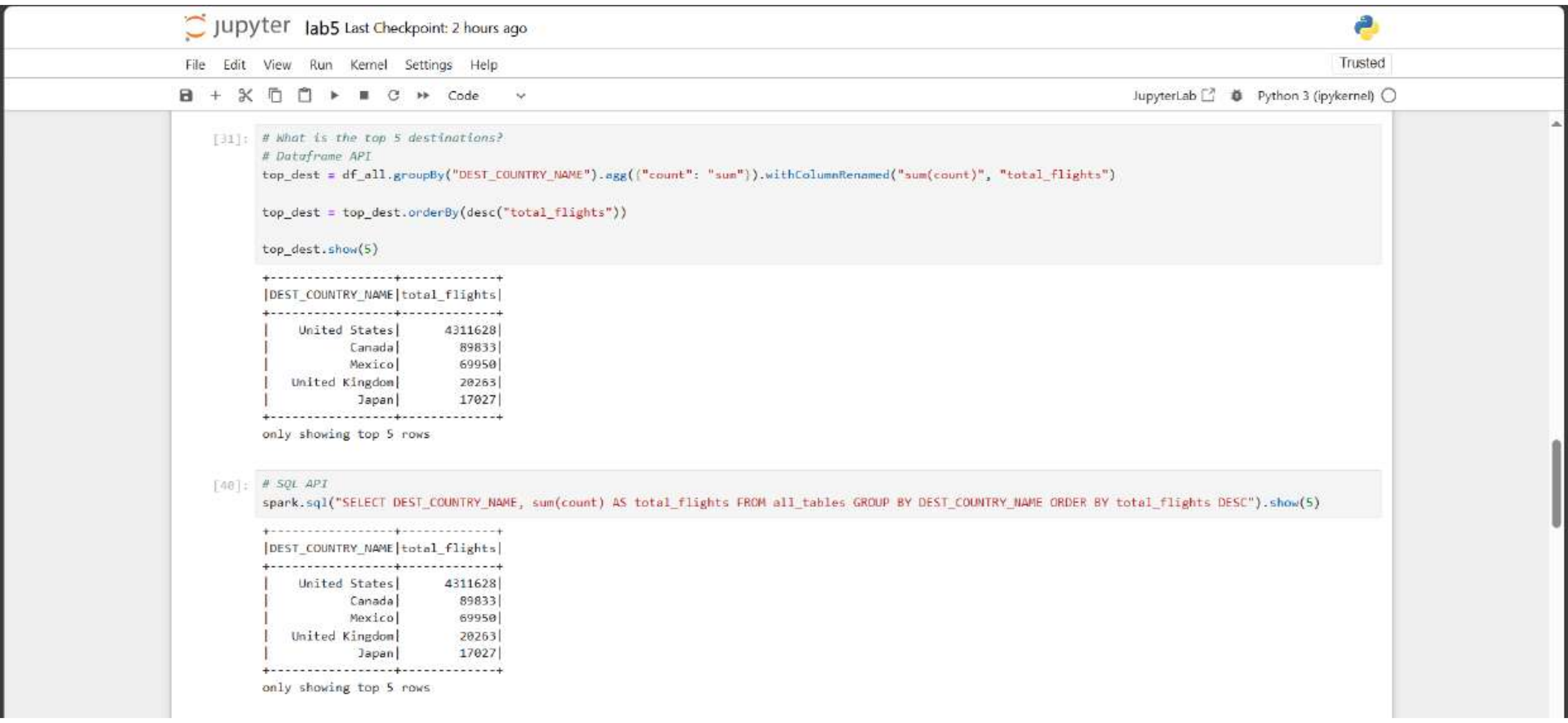
```
[66]: from functools import reduce
      from pyspark.sql import DataFrame
      from pyspark.sql.functions import lit, desc, col
```

```
[10]: #Concatenating multiple dataframes into a single dataframe.

      df_list = [df1, df2, df3, df4, df5, df6]

      df_all = reduce(DataFrame.unionAll, df_list)

      #Adding year column to the table.
      df_all = df_all.withColumn("year", lit(2010)).union(df2.withColumn("year", lit(2011))).union(df3.withColumn("year", lit(2012))).union(df4.withColumn("yea

      #Creating a table using the concatenated dataframe.
      df_all.createOrReplaceTempView("all_tables")
```

```
[11]: spark.sql("SELECT * FROM all_tables").show()
```

```
+--------------------+-------------------+-----+----+
|   DEST_COUNTRY_NAME|ORIGIN_COUNTRY_NAME|count|year|
+--------------------+-------------------+-----+----+
|       United States|            Romania|    1|2010|
|       United States|            Ireland|  264|2010|
|       United States|              India|   69|2010|
|               Egypt|      United States|   24|2010|
|   Equatorial Guinea|      United States|    1|2010|
|       United States|          Singapore|   25|2010|
|       United States|            Grenada|   54|2010|
|          Costa Rica|      United States|  477|2010|
|             Senegal|      United States|   29|2010|
|       United States|   Marshall Islands|   44|2010|
|              Guyana|      United States|   17|2010|
|       United States|       Sint Maarten|   53|2010|
|               Malta|      United States|    1|2010|
|             Bolivia|      United States|   46|2010|
```

3. Top 5 Destinations.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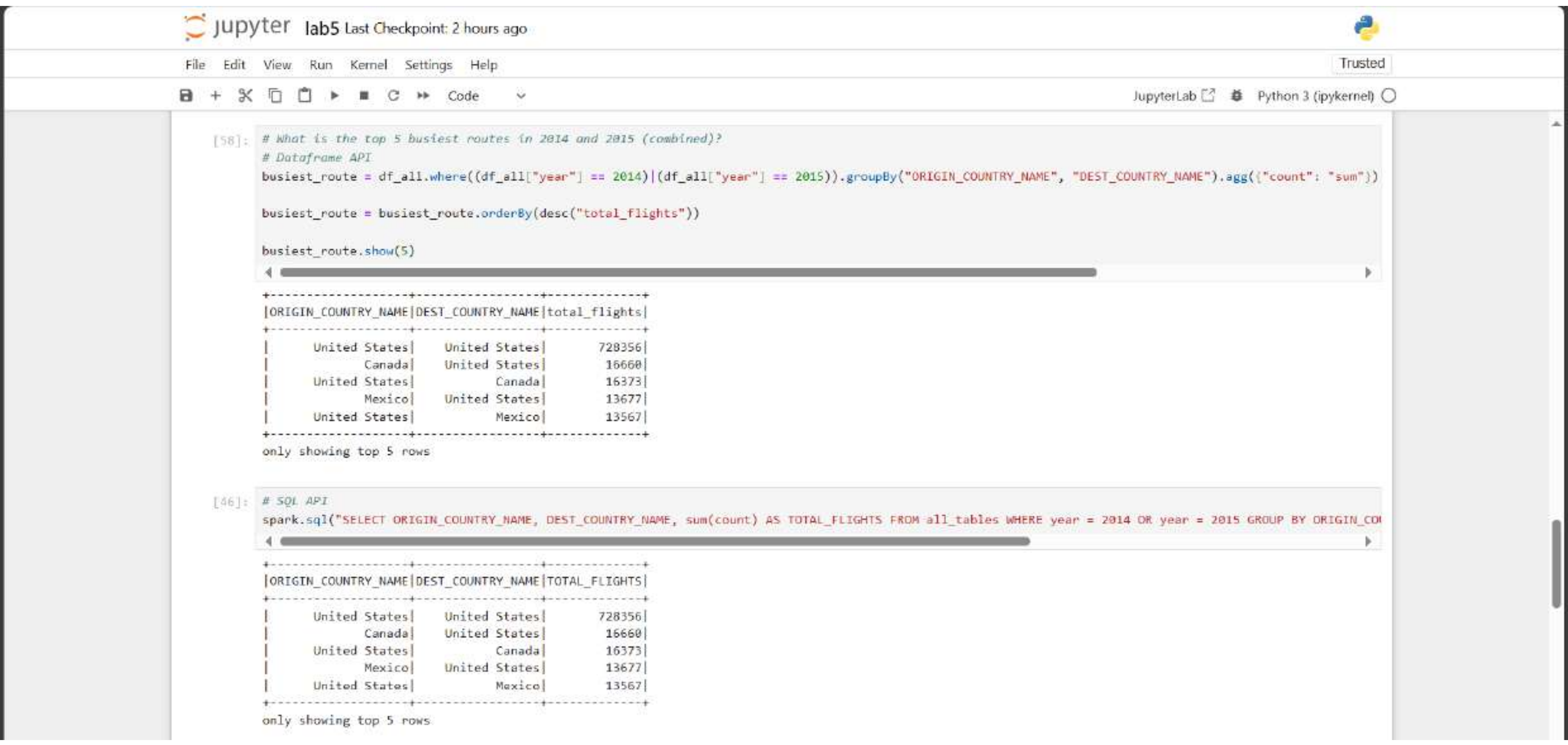
[31]:
```python
# What is the top 5 destinations?
# Dataframe API
top_dest = df_all.groupBy("DEST_COUNTRY_NAME").agg({"count": "sum"}).withColumnRenamed("sum(count)", "total_flights")

top_dest = top_dest.orderBy(desc("total_flights"))

top_dest.show(5)
```

```
+-----------------+-------------+
|DEST_COUNTRY_NAME|total_flights|
+-----------------+-------------+
|    United States|      4311628|
|           Canada|        89833|
|           Mexico|        69950|
|   United Kingdom|        20263|
|            Japan|        17027|
+-----------------+-------------+
only showing top 5 rows
```

[40]:
```python
# SQL API
spark.sql("SELECT DEST_COUNTRY_NAME, sum(count) AS total_flights FROM all_tables GROUP BY DEST_COUNTRY_NAME ORDER BY total_flights DESC").show(5)
```

```
+-----------------+-------------+
|DEST_COUNTRY_NAME|total_flights|
+-----------------+-------------+
|    United States|      4311628|
|           Canada|        89833|
|           Mexico|        69950|
|   United Kingdom|        20263|
|            Japan|        17027|
+-----------------+-------------+
only showing top 5 rows
```

4. Top 5 busiest routes in 2014 and 2015 (combined)



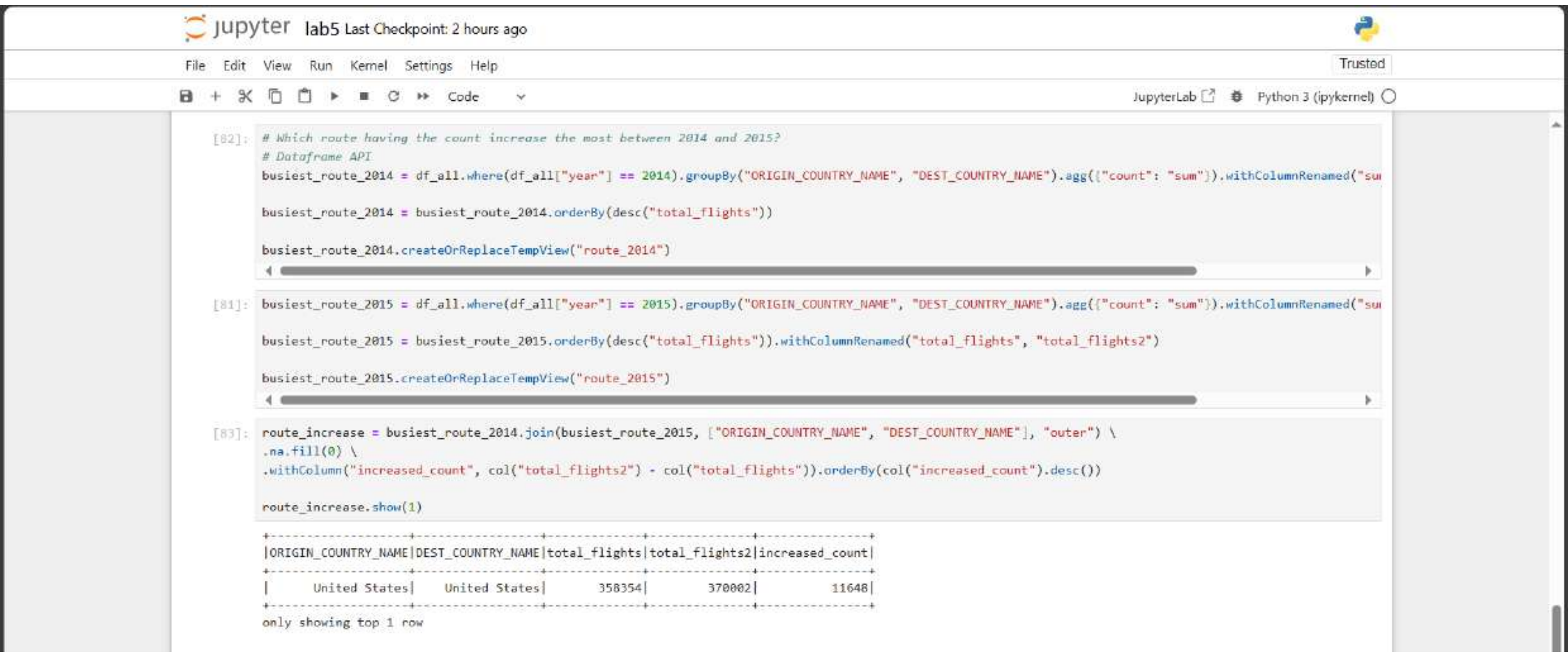
```
[58]: # What is the top 5 busiest routes in 2014 and 2015 (combined)?
      # Dataframe API
      busiest_route = df_all.where((df_all["year"] == 2014)|(df_all["year"] == 2015)).groupBy("ORIGIN_COUNTRY_NAME", "DEST_COUNTRY_NAME").agg({"count": "sum"})

      busiest_route = busiest_route.orderBy(desc("total_flights"))

      busiest_route.show(5)
```

```
+-------------------+-----------------+-------------+
|ORIGIN_COUNTRY_NAME|DEST_COUNTRY_NAME|total_flights|
+-------------------+-----------------+-------------+
|      United States|    United States|       728356|
|             Canada|    United States|        16660|
|      United States|           Canada|        16373|
|             Mexico|    United States|        13677|
|      United States|           Mexico|        13567|
+-------------------+-----------------+-------------+
only showing top 5 rows
```

```
[46]: # SQL API
      spark.sql("SELECT ORIGIN_COUNTRY_NAME, DEST_COUNTRY_NAME, sum(count) AS TOTAL_FLIGHTS FROM all_tables WHERE year = 2014 OR year = 2015 GROUP BY ORIGIN_COU
```

```
+-------------------+-----------------+-------------+
|ORIGIN_COUNTRY_NAME|DEST_COUNTRY_NAME|TOTAL_FLIGHTS|
+-------------------+-----------------+-------------+
|      United States|    United States|       728356|
|             Canada|    United States|        16660|
|      United States|           Canada|        16373|
|             Mexico|    United States|        13677|
|      United States|           Mexico|        13567|
+-------------------+-----------------+-------------+
only showing top 5 rows
```

5. Route having the count increase the most between 2014 and 2015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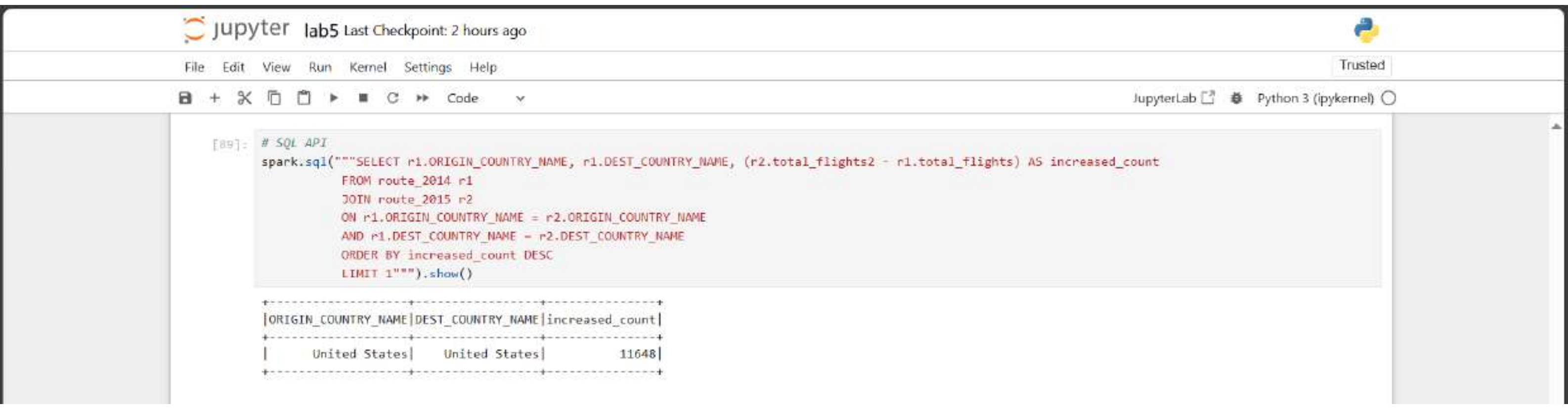
[82]:
```
# Which route having the count increase the most between 2014 and 2015?
# Dataframe API
busiest_route_2014 = df_all.where(df_all["year"] == 2014).groupBy("ORIGIN_COUNTRY_NAME", "DEST_COUNTRY_NAME").agg({"count": "sum"}).withColumnRenamed("su

busiest_route_2014 = busiest_route_2014.orderBy(desc("total_flights"))

busiest_route_2014.createOrReplaceTempView("route_2014")
```

[81]:
```
busiest_route_2015 = df_all.where(df_all["year"] == 2015).groupBy("ORIGIN_COUNTRY_NAME", "DEST_COUNTRY_NAME").agg({"count": "sum"}).withColumnRenamed("su

busiest_route_2015 = busiest_route_2015.orderBy(desc("total_flights")).withColumnRenamed("total_flights", "total_flights2")

busiest_route_2015.createOrReplaceTempView("route_2015")
```

[83]:
```
route_increase = busiest_route_2014.join(busiest_route_2015, ["ORIGIN_COUNTRY_NAME", "DEST_COUNTRY_NAME"], "outer") \
.na.fill(0) \
.withColumn("increased_count", col("total_flights2") - col("total_flights")).orderBy(col("increased_count").desc())

route_increase.show(1)
```

```
+-------------------+-----------------+-------------+--------------+---------------+
|ORIGIN_COUNTRY_NAME|DEST_COUNTRY_NAME|total_flights|total_flights2|increased_count|
+-------------------+-----------------+-------------+--------------+---------------+
|      United States|    United States|       358354|        370002|          11648|
+-------------------+-----------------+-------------+--------------+---------------+
only showing top 1 row
```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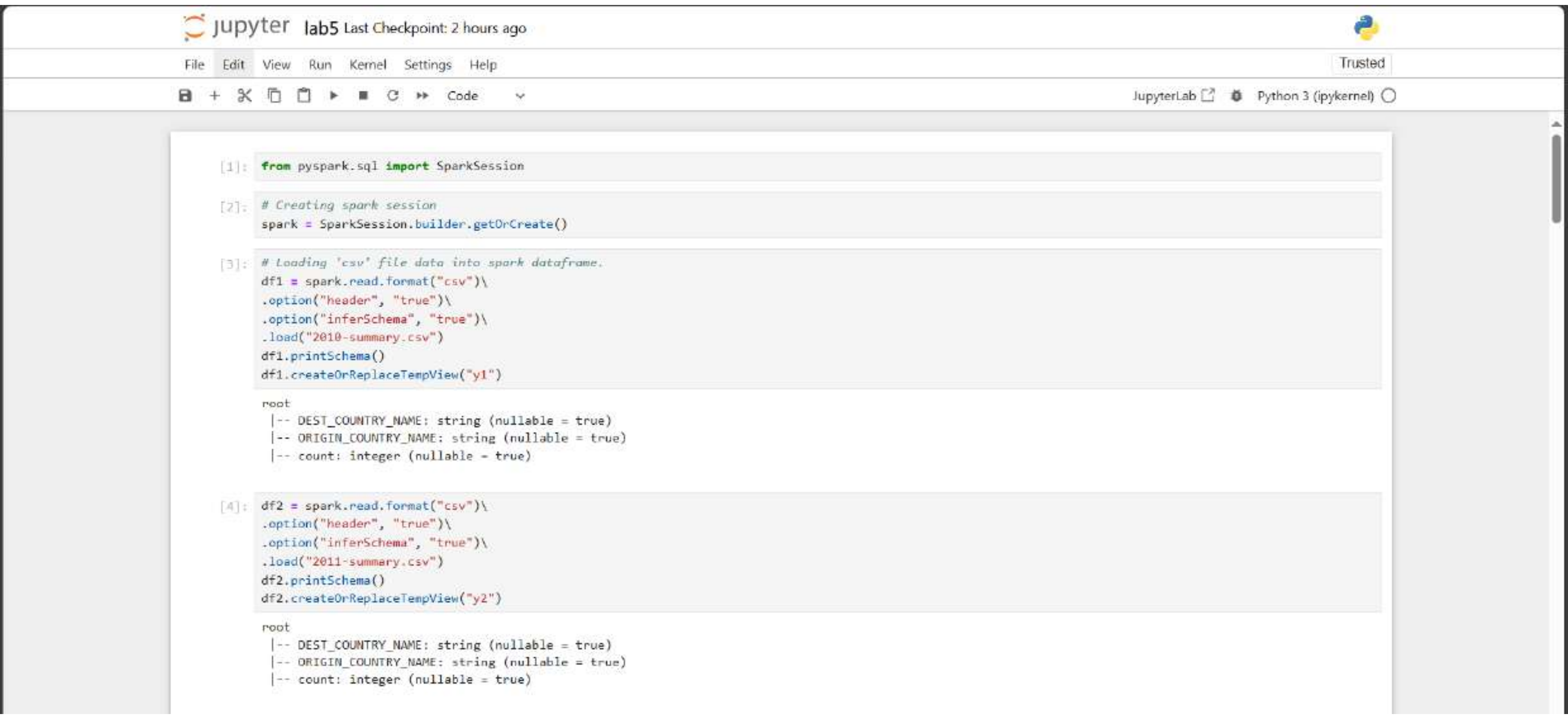
```
[89]: # SQL API
spark.sql("""SELECT r1.ORIGIN_COUNTRY_NAME, r1.DEST_COUNTRY_NAME, (r2.total_flights2 - r1.total_flights) AS increased_count
          FROM route_2014 r1
          JOIN route_2015 r2
          ON r1.ORIGIN_COUNTRY_NAME = r2.ORIGIN_COUNTRY_NAME
          AND r1.DEST_COUNTRY_NAME = r2.DEST_COUNTRY_NAME
          ORDER BY increased_count DESC
          LIMIT 1""").show()
```

```
+-------------------+-----------------+---------------+
|ORIGIN_COUNTRY_NAME|DEST_COUNTRY_NAME|increased_count|
+-------------------+-----------------+---------------+
|      United States|    United States|          11648|
+-------------------+-----------------+---------------+
```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Code
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Python 3 (ipykernel)

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

[2]: # Creating spark session
     spark = SparkSession.builder.getOrCreate()

[3]: # Loading 'csv' file data into spark dataframe.
     df1 = spark.read.format("csv")\
     .option("header", "true")\
     .option("inferSchema", "true")\
     .load("2010-summary.csv")
     df1.printSchema()
     df1.createOrReplaceTempView("y1")

     root
      |-- DEST_COUNTRY_NAME: string (nullable = true)
      |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
      |-- count: integer (nullable = true)

[4]: df2 = spark.read.format("csv")\
     .option("header", "true")\
     .option("inferSchema", "true")\
     .load("2011-summary.csv")
     df2.printSchema()
     df2.createOrReplaceTempView("y2")

     root
      |-- DEST_COUNTRY_NAME: string (nullable = true)
      |-- ORIGIN_COUNTRY_NAME: string (nullable = true)
      |-- count: integer (nullable = true)
```