Spark SQL

August 22, 2018

1 Spark SQL

```
In [ ]: # Find path to PySpark.
        import findspark
        findspark.init()
```

```
In [2]: # Import PySpark and initialize SparkContext object.
        import pyspark
        sc = pyspark.SparkContext()
```

```
In [10]: # Read `recent-grads.csv` in to an RDD.
         path ='E:\\OneDrive\\Formation\\2018 - DataQuest\\Codes\\_Solutions-master'
         file = 'recent-grads.csv'
         file_path = '\\'.join([path,file])

         f = sc.textFile(file_path)
```

1.1 RDD Transformations

```
In [11]: # Slice data in lines
         data = f.map(lambda line: line.split('\n'))
```

```
In [6]: data.take(5)
```

```
Out[6]: [['Rank,Major_code,Major,Total,Men,Women,Major_category,ShareWomen,Sample_size,Employed
         ['1,2419,PETROLEUM ENGINEERING,2339,2057,282,Engineering,0.120564344,36,1976,1849,270
         ['2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,556,
         ['3,2415,METALLURGICAL ENGINEERING,856,725,131,Engineering,0.153037383,3,648,558,133,
         ['4,2417,NAVAL ARCHITECTURE AND MARINE ENGINEERING,1258,1123,135,Engineering,0.107313
```

```
In [21]: s = ['2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,5
         for i in s:
             print(i)
```

```
2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,556,170,388,85,0
```

```
In [22]: s[0]
```

```
Out[22]: '2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,556,1
```

```
In [25]: def Search_Job(line):
             id = line[0]
             if 'ENGINEERING' in line[0]:
                 yield id,'Good Job :'

         good_jobs = data.flatMap(lambda x:Search_Job(x))
```

```
In [26]: good_jobs.take(5)
```

```
Out[26]: [('1,2419,PETROLEUM ENGINEERING,2339,2057,282,Engineering,0.120564344,36,1976,1849,27
            'Good Job :'),
           ('2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,556
            'Good Job :'),
           ('3,2415,METALLURGICAL ENGINEERING,856,725,131,Engineering,0.153037383,3,648,558,133
            'Good Job :'),
           ('4,2417,NAVAL ARCHITECTURE AND MARINE ENGINEERING,1258,1123,135,Engineering,0.10731
            'Good Job :'),
           ('5,2405,CHEMICAL ENGINEERING,32260,21239,11021,Engineering,0.341630502,289,25694,23
            'Good Job :')]
```

```
In [27]: def naval_job(line):
             if 'naval' in line[0].lower():
                 return True
             else:
                 return False

         sea_jobs = data.filter(lambda x:naval_job(x))
```

```
In [28]: sea_jobs.take(5)
```

```
Out[28]: [['4,2417,NAVAL ARCHITECTURE AND MARINE ENGINEERING,1258,1123,135,Engineering,0.10731
```

1.2 RDD Actions

```
In [29]: data_count = data.count()
         data_count
```

```
Out[29]: 174
```

```
In [31]: data_collect = data.collect()[:3]
         data_collect
```

```
Out[31]: [['Rank,Major_code,Major,Total,Men,Women,Major_category,ShareWomen,Sample_size,Employe
          ['1,2419,PETROLEUM ENGINEERING,2339,2057,282,Engineering,0.120564344,36,1976,1849,27
          ['2,2416,MINING AND MINERAL ENGINEERING,756,679,77,Engineering,0.101851852,7,640,556
```

1.3 Transforming Dataset

```
In [43]: def return_id(line):
             data = line[0]
             if data[0]!='R':
                 raw_data = data.split(',')
                 return int(raw_data[0])

         data_ids = data.map(lambda line:return_id(line))
```

```
In [45]: list_data_ids = data_ids.collect()
         list_data_ids[:5]
```

```
Out[45]: [None, 1, 2, 3, 4]
```

```
In [46]: real_text = data_ids.filter(lambda x:x is not None)

         list_data_ids = real_text.collect()
         list_data_ids[:5]
```

```
Out[46]: [1, 2, 3, 4, 5]
```

1.4 Spark DataFrames

```
In [62]: import csv
         with open(file_path,'r') as f:
             body=list(csv.reader(f))
```

```
In [65]: header = body[:1][0]
         body = body[1:]
```

```
In [47]: # Import SQLContext
         from pyspark.sql import SQLContext

         # Pass in the SparkContext object `sc`
         sqlCtx = SQLContext(sc)
```

```
In [68]: df = sqlCtx.read.csv(file_path,
                              header=True)
```

```
In [69]: print(type(df))
```

```
<class 'pyspark.sql.dataframe.DataFrame'>
```

```
In [50]: df.printSchema()
```

```
root
 |-- _c0: string (nullable = true)
 |-- _c1: string (nullable = true)
 |-- _c2: string (nullable = true)
 |-- _c3: string (nullable = true)
 |-- _c4: string (nullable = true)
 |-- _c5: string (nullable = true)
 |-- _c6: string (nullable = true)
 |-- _c7: string (nullable = true)
 |-- _c8: string (nullable = true)
 |-- _c9: string (nullable = true)
 |-- _c10: string (nullable = true)
 |-- _c11: string (nullable = true)
 |-- _c12: string (nullable = true)
 |-- _c13: string (nullable = true)
 |-- _c14: string (nullable = true)
 |-- _c15: string (nullable = true)
 |-- _c16: string (nullable = true)
 |-- _c17: string (nullable = true)
 |-- _c18: string (nullable = true)
 |-- _c19: string (nullable = true)
 |-- _c20: string (nullable = true)
```

```
In [70]: df.show(5)
```

```
+----+----------+--------------------+-----+-----+-----+--------------+-----------+------------
|Rank|Major_code|               Major|Total|  Men|Women|Major_category| ShareWomen|Sample_size
+----+----------+--------------------+-----+-----+-----+--------------+-----------+------------
|   1|      2419|PETROLEUM ENGINEE...| 2339| 2057|  282|   Engineering|0.120564344|         36
|   2|      2416|MINING AND MINERA...|  756|  679|   77|   Engineering|0.101851852|          7
|   3|      2415|METALLURGICAL ENG...|  856|  725|  131|   Engineering|0.153037383|          3
|   4|      2417|NAVAL ARCHITECTUR...| 1258| 1123|  135|   Engineering|0.107313196|         16
|   5|      2405|CHEMICAL ENGINEERING|32260|21239|11021|   Engineering|0.341630502|        289
+----+----------+--------------------+-----+-----+-----+--------------+-----------+------------
only showing top 5 rows
```

```
In [71]: df.select('Major','Total','Men','Women').show()
```

```
+--------------------+-----+-----+-----+
|               Major|Total|  Men|Women|
+--------------------+-----+-----+-----+
|PETROLEUM ENGINEE...| 2339| 2057|  282|
|MINING AND MINERA...|  756|  679|   77|
|METALLURGICAL ENG...|  856|  725|  131|
|NAVAL ARCHITECTUR...| 1258| 1123|  135|
|CHEMICAL ENGINEERING|32260|21239|11021|
| NUCLEAR ENGINEERING| 2573| 2200|  373|
|   ACTUARIAL SCIENCE| 3777| 2110| 1667|
|ASTRONOMY AND AST...| 1792|  832|  960|
|MECHANICAL ENGINE...|91227|80320|10907|
|ELECTRICAL ENGINE...|81527|65511|16016|
|COMPUTER ENGINEERING|41542|33258| 8284|
|AEROSPACE ENGINEE...|15058|12953| 2105|
|BIOMEDICAL ENGINE...|14955| 8407| 6548|
|   MATERIALS SCIENCE| 4279| 2949| 1330|
|ENGINEERING MECHA...| 4321| 3526|  795|
|BIOLOGICAL ENGINE...| 8925| 6062| 2863|
|INDUSTRIAL AND MA...|18968|12453| 6515|
| GENERAL ENGINEERING|61152|45683|15469|
|ARCHITECTURAL ENG...| 2825| 1835|  990|
|     COURT REPORTING| 1148|  877|  271|
+--------------------+-----+-----+-----+
only showing top 20 rows
```

```
In [77]: Major_2000 = df[df['Total']>2000]
         Major_2000.select('Major','Total','Men','Women').show(5)
```

```
+--------------------+-----+-----+-----+
|               Major|Total|  Men|Women|
+--------------------+-----+-----+-----+
|PETROLEUM ENGINEE...| 2339| 2057|  282|
|CHEMICAL ENGINEERING|32260|21239|11021|
| NUCLEAR ENGINEERING| 2573| 2200|  373|
|   ACTUARIAL SCIENCE| 3777| 2110| 1667|
|MECHANICAL ENGINE...|91227|80320|10907|
+--------------------+-----+-----+-----+
only showing top 5 rows
```

```
In [83]: Female = df[df['Women']>=df['Men']].select('Major','Total','Men','Women').show(5)
         Female
```

```
+--------------------+-----+----+-----+
|               Major|Total| Men|Women|
+--------------------+-----+----+-----+
|PETROLEUM ENGINEE...| 2339|2057|  282|
|MINING AND MINERA...|  756| 679|   77|
|NAVAL ARCHITECTUR...| 1258|1123|  135|
| NUCLEAR ENGINEERING| 2573|2200|  373|
|ASTRONOMY AND AST...| 1792| 832|  960|
+--------------------+-----+----+-----+
only showing top 5 rows
```

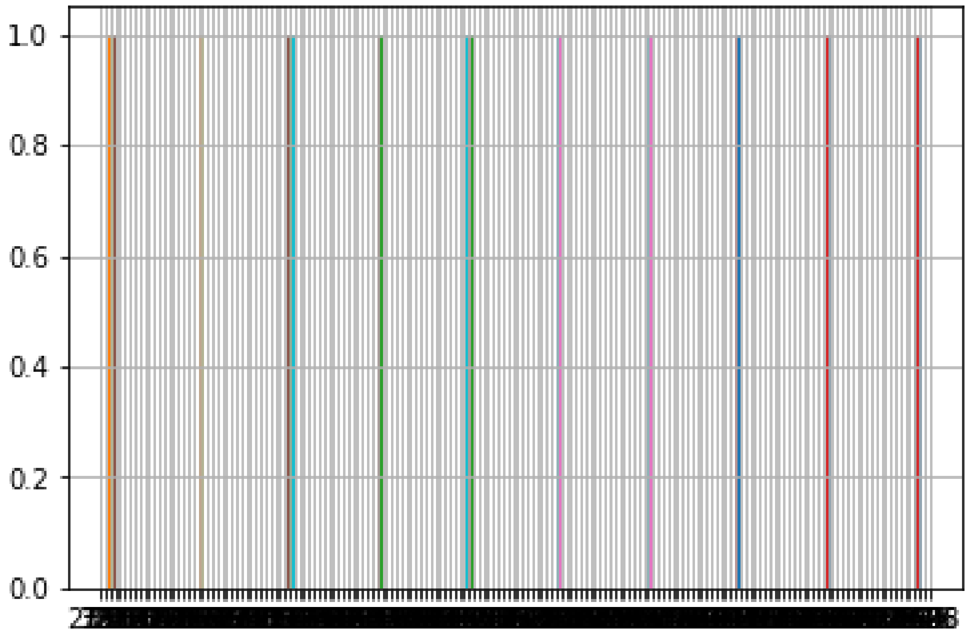
```
In [86]: pandas_df = df.toPandas()
```

```
In [99]: def Men_Women(line):
             if line['Women'] and line['Men']:
                 if line['Women']>=line['Men']:
                     return True
                 else:
                     return False
             else:
                 return False

         pandas_df = pandas_df.dropna()
         pandas_df['Egality']=pandas_df.apply(Men_Women,axis=1)
```

```
In [100]: pandas_df_women = pandas_df.where(pandas_df['Egality']==True)
          pandas_df_women.head(3)
```

```
Out[100]:   Rank Major_code                           Major Total   Men Women  \
          0    1       2419           PETROLEUM ENGINEERING  2339  2057   282
          1    2       2416  MINING AND MINERAL ENGINEERING   756   679    77
          2  NaN        NaN                             NaN   NaN   NaN   NaN

            Major_category   ShareWomen Sample_size Employed   ...    \
          0    Engineering  0.120564344          36     1976   ...
          1    Engineering  0.101851852           7      640   ...
          2            NaN          NaN         NaN      NaN   ...

            Full_time_year_round Unemployed Unemployment_rate  Median  P25th   P75th  \
          0                 1207         37       0.018380527  110000  95000  125000
          1                  388         85       0.117241379   75000  55000   90000
          2                  NaN        NaN               NaN     NaN    NaN     NaN

            College_jobs Non_college_jobs Low_wage_jobs Egality
          0         1534              364           193     1.0
          1          350              257            50     1.0
          2          NaN              NaN           NaN     NaN

          [3 rows x 22 columns]
```

```
In [101]: from matplotlib import pyplot as plt
          %matplotlib inline

          pandas_df['Total'].hist()
          plt.show()
```



1.5 Spark SQL

```
In [110]: # Import SQLContext
          from pyspark.sql import SQLContext

          # Pass in the SparkContext object `sc`
          sqlCtx = SQLContext(sc)

In [111]: df = sqlCtx.read.csv(file_path,
                               header=True)

In [112]: df.registerTempTable('major_results')

          tables = sqlCtx.tableNames()

          print(tables)

['major_results']


In [105]: query = "SELECT women FROM major_results"
          sqlCtx.sql(query).show()

+-----+
|women|
+-----+
|  282|
|   77|
|  131|
|  135|
|11021|
|  373|
| 1667|
|  960|
|10907|
|16016|
| 8284|
| 2105|
| 6548|
| 1330|
|  795|
| 2863|
| 6515|
|15469|
|  990|
|  271|
+-----+
only showing top 20 rows
```

```
In [116]: query = """SELECT men,women FROM major_results"""

          df = sqlCtx.sql(query)

          df.describe().show()
```

```
Out[116]: DataFrame[women: string]
```

```
In [ ]: df1 = sqlCtx.read.csv(file_path,
                              header=True)

        df2 = sqlCtx.read.csv(file_path,
                              header=True)

        tables = sqlCtx.tableNames()
```

```
In [ ]: df1.registerTempTable('major1')
        df2.registerTempTable('major2')

        query = """SELECT
                        t1.total,
                        t2.total
                    FROM
                        major1 as t1
```

```
                INNER JOIN
                    major2 as t2
                    ON t1.major_code = t2.major_code
                """
```

```
In [ ]: sqlCtx.sql(query).show()
```

```
In [ ]: df1.registerTempTable('major1')
        df2.registerTempTable('major2')

        query = """SELECT
                    SUM(t1.total),
                    SUM(t2.total)
                FROM
                    major1 as t1
                INNER JOIN
                    major2 as t2
                    ON t1.major_code = t2.major_code
                """
```

```
In [ ]: sqlCtx.sql(query).show()
```