4. Associated Data Files

Dataset link

https://drive.google.com/open?id=1qIorA_mC6h4bruPtNOX_S44bPw4rb1Sa

5. Problem Statement

Task 1

DataSet Used

Using spark-sql, Find:

1. What are the total number of gold medal winners every year

Please see the codes used below,

1. ***val SportsData = sc.textFile("/home/acadgild/hadoop/Sports_data.txt")***
2. ***val schemaString =***

   "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"

3. ***val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else IntegerType, true)))***
4. ***val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))***
5. ***val SportsDataDF = spark.createDataFrame(rowRDD, schema)***
6. ***SportsDataDF.createOrReplaceTempView("SportsData")***
7. ***val resultDF = spark.sql("SELECT year,COUNT (*) FROM SportsData WHERE medal_type = 'gold' GROUP BY year")***
8. ***resultDF.show()***

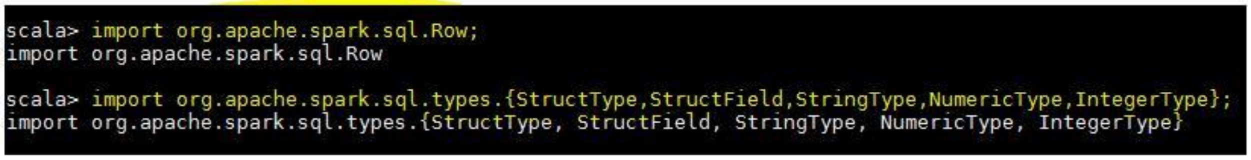
We will proceed with the tasks,

In order to proceed we need to import some dependencies as shown below,

import org.apache.spark.sql.Row;

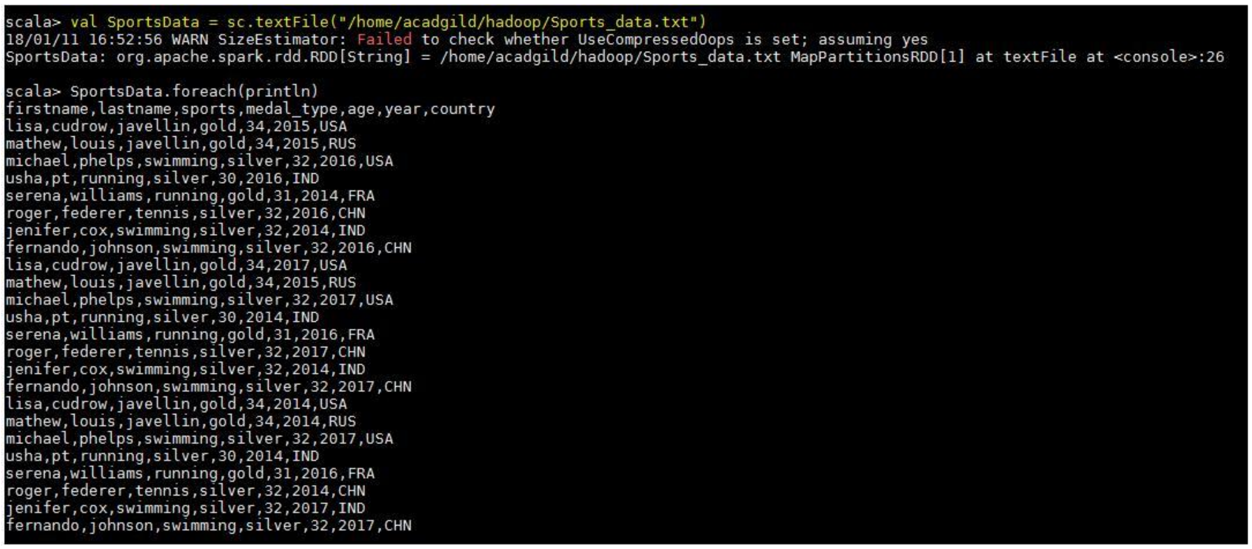
import

org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};



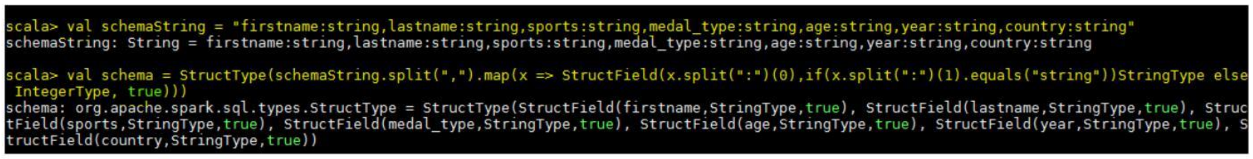
```
scala> import org.apache.spark.sql.Row;
import org.apache.spark.sql.Row

scala> import org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};
import org.apache.spark.sql.types.{StructType, StructField, StringType, NumericType, IntegerType}
```

Step -1 – we are creating a RDD from Input DataSet,

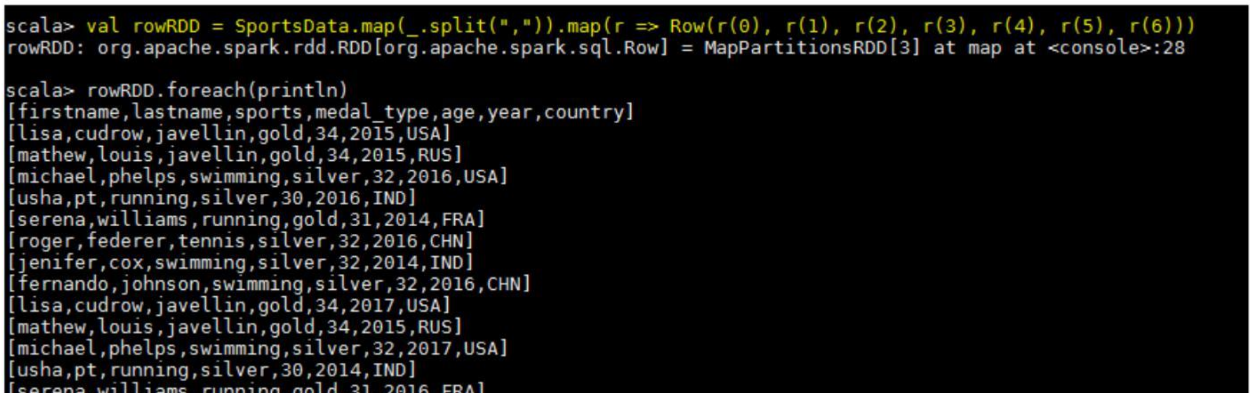


```
scala> val SportsData = sc.textFile("/home/acadgild/hadoop/Sports_data.txt")
18/01/11 16:52:56 WARN SizeEstimator: Failed to check whether UseCompressedOops is set; assuming yes
SportsData: org.apache.spark.rdd.RDD[String] = /home/acadgild/hadoop/Sports_data.txt MapPartitionsRDD[1] at textFile at <console>:26

scala> SportsData.foreach(println)
firstname,lastname,sports,medal_type,age,year,country
lisa,cudrow,javellin,gold,34,2015,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2016,USA
usha,pt,running,silver,30,2016,IND
serena,williams,running,gold,31,2014,FRA
roger,federer,tennis,silver,32,2016,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2016,CHN
lisa,cudrow,javellin,gold,34,2017,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2017,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2017,CHN
lisa,cudrow,javellin,gold,34,2014,USA
mathew,louis,javellin,gold,34,2014,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2014,CHN
jenifer,cox,swimming,silver,32,2017,IND
fernando,johnson,swimming,silver,32,2017,CHN
```

Step -2 – we are defining a schema since it is a text file and splitting the input file using the delimiters and extracting the rows from it.



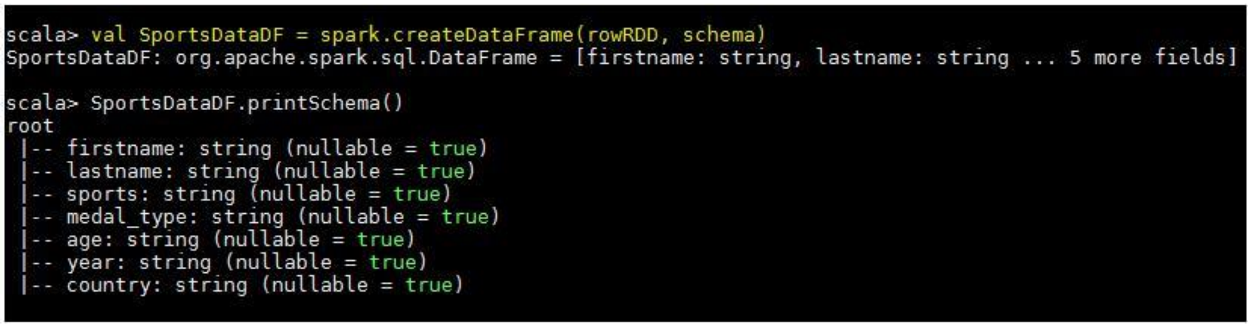
```
scala> val schemaString = "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"
schemaString: String = firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string

scala> val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else
 IntegerType, true)))
schema: org.apache.spark.sql.types.StructType = StructType(StructField(firstname,StringType,true), StructField(lastname,StringType,true), Struc
tField(sports,StringType,true), StructField(medal_type,StringType,true), StructField(age,StringType,true), StructField(year,StringType,true), S
tructField(country,StringType,true))
```



```
scala> val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))
rowRDD: org.apache.spark.rdd.RDD[org.apache.spark.sql.Row] = MapPartitionsRDD[3] at map at <console>:28

scala> rowRDD.foreach(println)
[firstname,lastname,sports,medal_type,age,year,country]
[lisa,cudrow,javellin,gold,34,2015,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2016,USA]
[usha,pt,running,silver,30,2016,IND]
[serena,williams,running,gold,31,2014,FRA]
[roger,federer,tennis,silver,32,2016,CHN]
[jenifer,cox,swimming,silver,32,2014,IND]
[fernando,johnson,swimming,silver,32,2016,CHN]
[lisa,cudrow,javellin,gold,34,2017,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2017,USA]
[usha,pt,running,silver,30,2014,IND]
[serena,williams,running,gold,31,2016,FRA]
```

We have created the **dataframe** by passing the RDD which reads the file and schema to spark session object-

The schema of the created **Dataframe** can be seen below.



```
scala> val SportsDataDF = spark.createDataFrame(rowRDD, schema)
SportsDataDF: org.apache.spark.sql.DataFrame = [firstname: string, lastname: string ... 5 more fields]

scala> SportsDataDF.printSchema()
root
 |-- firstname: string (nullable = true)
 |-- lastname: string (nullable = true)
 |-- sports: string (nullable = true)
 |-- medal_type: string (nullable = true)
 |-- age: string (nullable = true)
 |-- year: string (nullable = true)
 |-- country: string (nullable = true)
```

Expected Result

Now, we are using the simple SQL query so that we can execute our query by applying it on the temporary table created,

2. How many silver medals have been won by USA in each sport

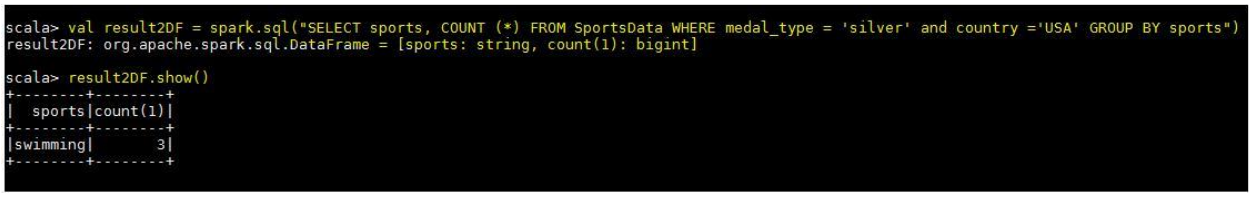
Here we use the same **DataFrame** to get the desired result,

We are using the simple SQL query so that we can execute our query by applying it on the temporary table created,

The code used is,

1. ***val result2DF = spark.sql("SELECT sports, COUNT (*) FROM SportsData WHERE medal_type = 'silver' and country ='USA' GROUP BY sports")***
2. ***result2DF.show()***

Expected Output



```
scala> val result2DF = spark.sql("SELECT sports, COUNT (*) FROM SportsData WHERE medal_type = 'silver' and country ='USA' GROUP BY sports")
result2DF: org.apache.spark.sql.DataFrame = [sports: string, count(1): bigint]

scala> result2DF.show()
+--------+--------+
|  sports|count(1)|
+--------+--------+
|swimming|       3|
+--------+--------+
```

Task 2

Using udfs on dataframe

1. Change firstname, lastname columns into

Mr.first_two_letters_of_firstname<space>lastname

for example - michael, phelps becomes Mr.mi phelps

Code Used

1. ***val SportsData = sc.textFile("/home/acadgild/hadoop/Sports_data.txt")***
2. ***val schemaString =***

   "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"

3. ***val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else IntegerType, true)))***
4. ***val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))***
5. ***val SportsDataDF = spark.createDataFrame(rowRDD, schema)***
6. ***SportsDataDF.createOrReplaceTempView("Sports_Data")***
7. ***val Name = udf((firstname:String, lastname:String)=>"Mr. ".concat(firstname.substring(0,2)).concat(" ")concat(lastname))***
8. ***spark.udf.register("Full_Name", Name)***
9. ***val fname = spark.sql("SELECT Full_Name(firstname, lastname) FROM SportsData").show()***

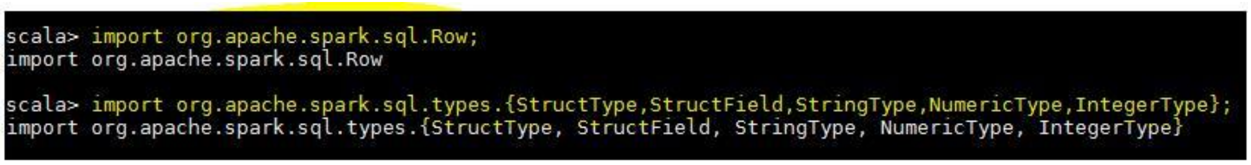
Imports Used-:

import org.apache.spark.sql.Row;

import

org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};

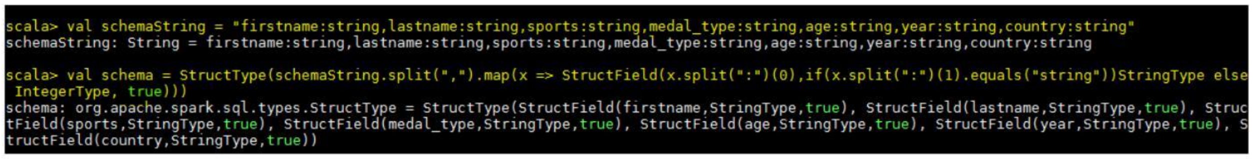
import org.apache.spark.sql.functions.udf


```
scala> import org.apache.spark.sql.Row;
import org.apache.spark.sql.Row

scala> import org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};
import org.apache.spark.sql.types.{StructType, StructField, StringType, NumericType, IntegerType}
```

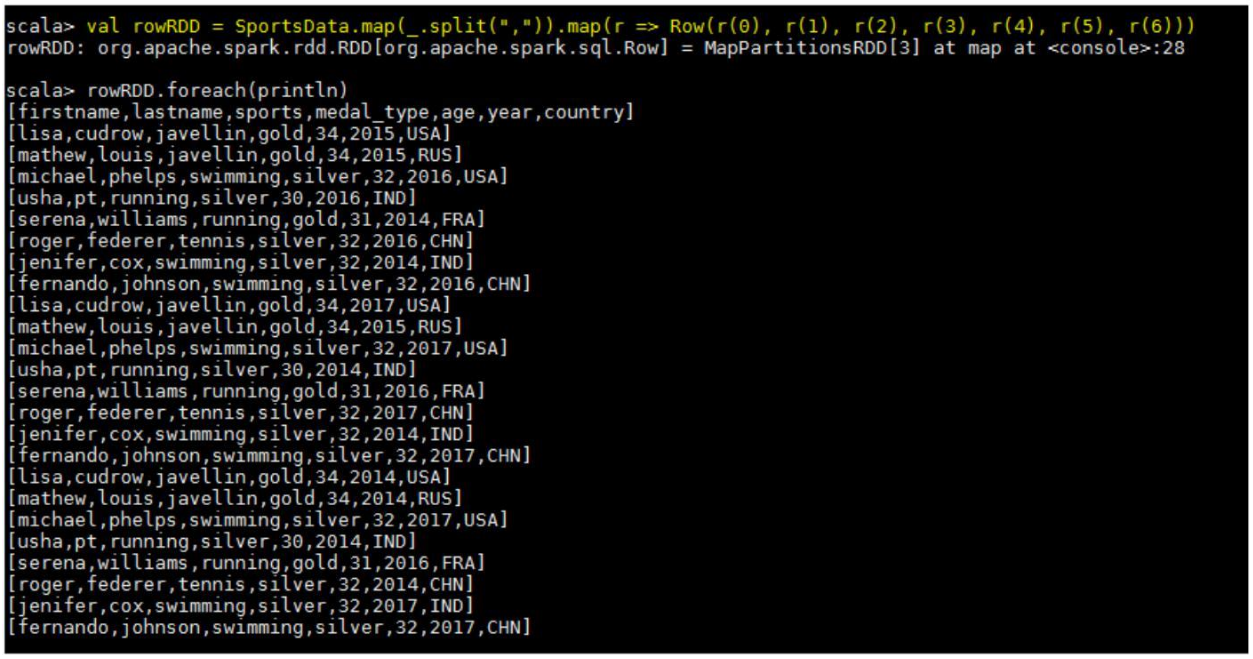
2. Add a new column called ranking using udfs on dataframe, where :

Step -1 – we are creating a RDD from Input DataSet,

Step -2 – we are defining a schema since it is a text file and splitting the input file using the delimiters and extracting the rows from it.



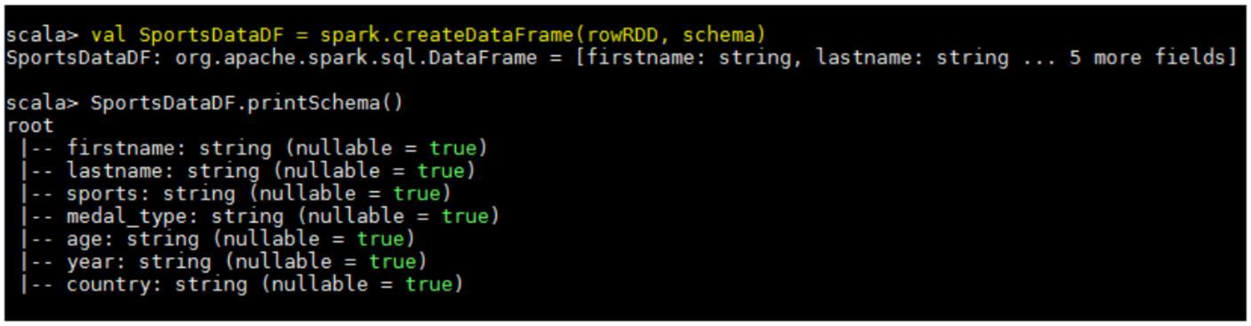
```
scala> val schemaString = "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"
schemaString: String = firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string

scala> val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else
 IntegerType, true)))
schema: org.apache.spark.sql.types.StructType = StructType(StructField(firstname,StringType,true), StructField(lastname,StringType,true), Struc
tField(sports,StringType,true), StructField(medal_type,StringType,true), StructField(age,StringType,true), StructField(year,StringType,true), S
tructField(country,StringType,true))
```



```
scala> val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))
rowRDD: org.apache.spark.rdd.RDD[org.apache.spark.sql.Row] = MapPartitionsRDD[3] at map at <console>:28

scala> rowRDD.foreach(println)
[firstname,lastname,sports,medal_type,age,year,country]
[lisa,cudrow,javellin,gold,34,2015,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2016,USA]
[usha,pt,running,silver,30,2016,IND]
[serena,williams,running,gold,31,2014,FRA]
[roger,federer,tennis,silver,32,2016,CHN]
[jenifer,cox,swimming,silver,32,2014,IND]
[fernando,johnson,swimming,silver,32,2016,CHN]
[lisa,cudrow,javellin,gold,34,2017,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2017,USA]
[usha,pt,running,silver,30,2014,IND]
[serena,williams,running,gold,31,2016,FRA]
[roger,federer,tennis,silver,32,2017,CHN]
[jenifer,cox,swimming,silver,32,2014,IND]
[fernando,johnson,swimming,silver,32,2017,CHN]
[lisa,cudrow,javellin,gold,34,2014,USA]
[mathew,louis,javellin,gold,34,2014,RUS]
[michael,phelps,swimming,silver,32,2017,USA]
[usha,pt,running,silver,30,2014,IND]
[serena,williams,running,gold,31,2016,FRA]
[roger,federer,tennis,silver,32,2014,CHN]
[jenifer,cox,swimming,silver,32,2017,IND]
[fernando,johnson,swimming,silver,32,2017,CHN]
```

We have created the **dataframe** by passing the RDD which reads the file and schema to spark session object-

The schema of the created **Dataframe** can be seen below.

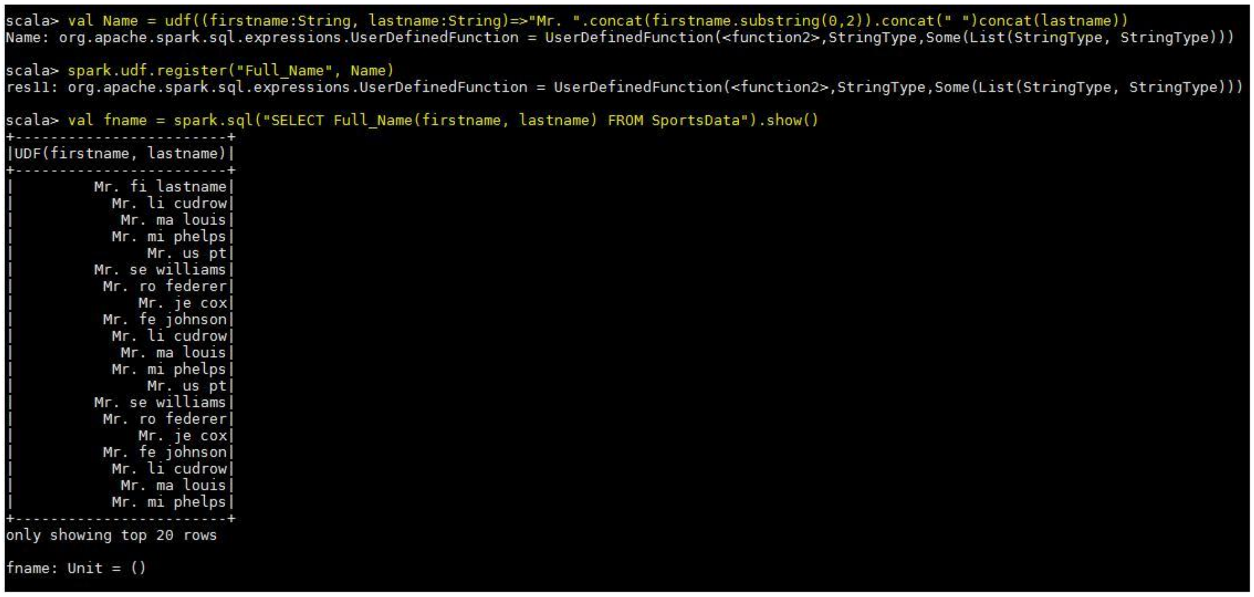


```
scala> val SportsDataDF = spark.createDataFrame(rowRDD, schema)
SportsDataDF: org.apache.spark.sql.DataFrame = [firstname: string, lastname: string ... 5 more fields]

scala> SportsDataDF.printSchema()
root
 |-- firstname: string (nullable = true)
 |-- lastname: string (nullable = true)
 |-- sports: string (nullable = true)
 |-- medal_type: string (nullable = true)
 |-- age: string (nullable = true)
 |-- year: string (nullable = true)
 |-- country: string (nullable = true)
```

Step – 3 - Here we are defining the UDF which will take 2 strings (columns) as input and will concatenate them with Mr. appended in it and now we need to register the UDF. Here we doing the same and giving it an alias as **Full_Name.**

Finally we can apply this UDF on the columns to give the required result-

Expected Output



```
scala> val Name = udf((firstname:String, lastname:String)=>"Mr. ".concat(firstname.substring(0,2)).concat(" ")concat(lastname))
Name: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, StringType)))

scala> spark.udf.register("Full_Name", Name)
res11: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, StringType)))

scala> val fname = spark.sql("SELECT Full_Name(firstname, lastname) FROM SportsData").show()
+-----------------------+
|UDF(firstname, lastname)|
+-----------------------+
|         Mr. fi lastname|
|           Mr. li cudrow|
|            Mr. ma louis|
|           Mr. mi phelps|
|               Mr. us pt|
|         Mr. se williams|
|          Mr. ro federer|
|              Mr. je cox|
|          Mr. fe johnson|
|           Mr. li cudrow|
|            Mr. ma louis|
|           Mr. mi phelps|
|               Mr. us pt|
|         Mr. se williams|
|          Mr. ro federer|
|              Mr. je cox|
|          Mr. fe johnson|
|           Mr. li cudrow|
|            Mr. ma louis|
|           Mr. mi phelps|
+-----------------------+
only showing top 20 rows

fname: Unit = ()
```

Task – 2 - Add a new column called ranking using **udfs** on **dataframe**, where:

1. gold medalist, with age >= 32 are ranked as pro
2. gold medalists, with age <= 31 are ranked amateur
3. silver medalist, with age >= 32 are ranked as expert
4. silver medalists, with age <= 31 are ranked rookie

The UDF below, UDF that we have used to define the new column

val Ranking = udf((medal: String, age: Int) => (medal,age) match

{

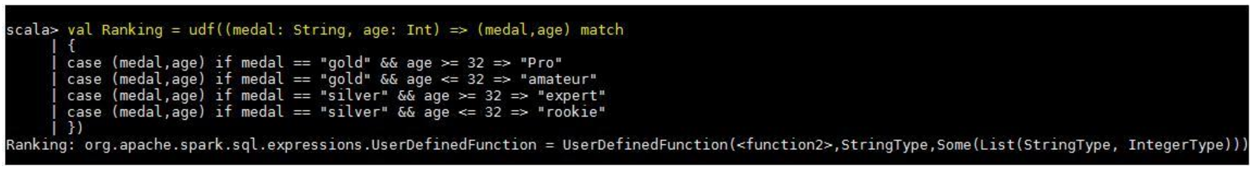
case (medal,age) if medal == "gold" && age >= 32 => "Pro" case

(medal,age) if medal == "gold" && age <= 32 => "amateur" case

(medal,age) if medal == "silver" && age >= 32 => "expert" case

(medal,age) if medal == "silver" && age <= 32 => "rookie" })

Here we are classifying each player based on age and the medal he has got,

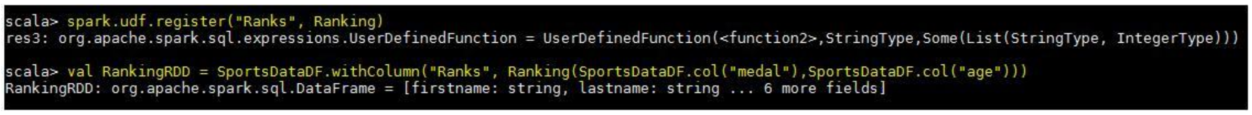


```
scala> val Ranking = udf((medal: String, age: Int) => (medal,age) match
     | {
     | case (medal,age) if medal == "gold" && age >= 32 => "Pro"
     | case (medal,age) if medal == "gold" && age <= 32 => "amateur"
     | case (medal,age) if medal == "silver" && age >= 32 => "expert"
     | case (medal,age) if medal == "silver" && age <= 32 => "rookie"
     | })
Ranking: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, IntegerType)))
```

Below code shows the registering of UDF and command to add a new column,

- ***spark.udf.register("Ranks", Ranking)***
-

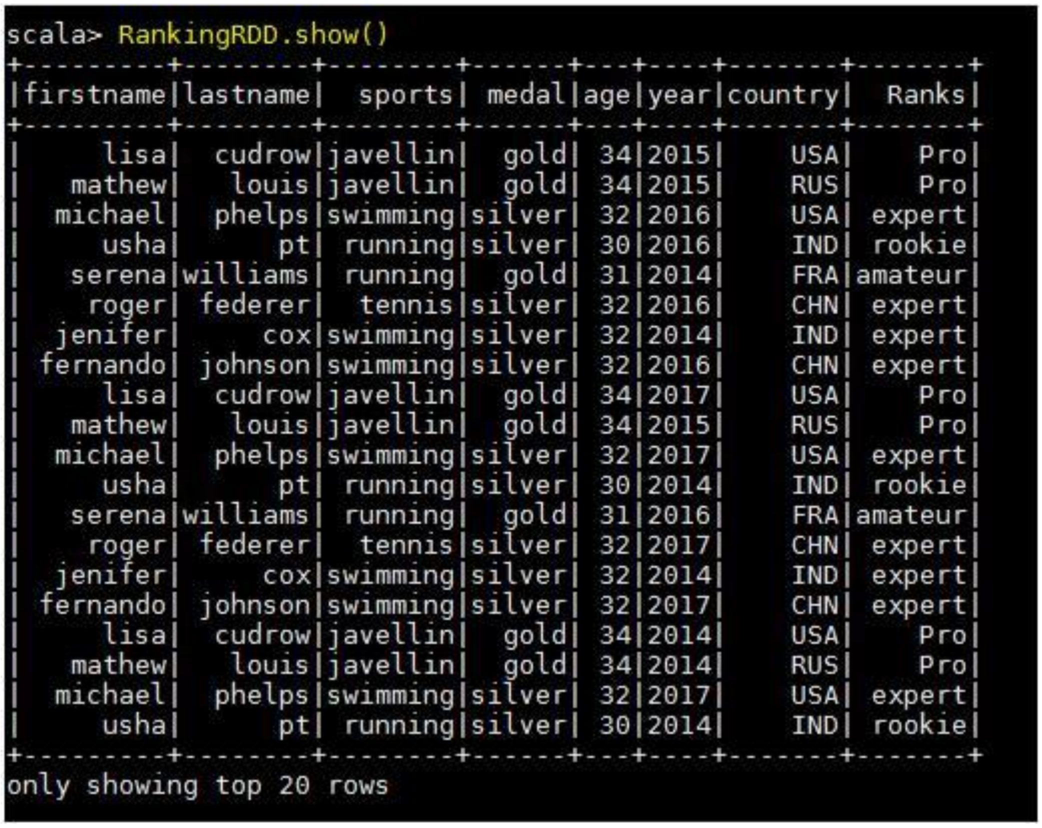
val RankingRDD = SportsDataDF.withColumn("Ranks", Ranking(SportsDataDF.col("medal"),SportsDataDF.col("age")))



```
scala> spark.udf.register("Ranks", Ranking)
res3: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, IntegerType)))

scala> val RankingRDD = SportsDataDF.withColumn("Ranks", Ranking(SportsDataDF.col("medal"),SportsDataDF.col("age")))
RankingRDD: org.apache.spark.sql.DataFrame = [firstname: string, lastname: string ... 6 more fields]
```

And the desired result is shown in the below screen shot,

Expected Output



```
scala> RankingRDD.show()
+---------+--------+--------+------+---+----+-------+-------+
|firstname|lastname|  sports| medal|age|year|country|  Ranks|
+---------+--------+--------+------+---+----+-------+-------+
|     lisa|  cudrow|javellin|  gold| 34|2015|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2015|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2016|    USA| expert|
|     usha|      pt| running|silver| 30|2016|    IND| rookie|
|   serena|williams| running|  gold| 31|2014|    FRA|amateur|
|    roger| federer|  tennis|silver| 32|2016|    CHN| expert|
|  jenifer|     cox|swimming|silver| 32|2014|    IND| expert|
| fernando| johnson|swimming|silver| 32|2016|    CHN| expert|
|     lisa|  cudrow|javellin|  gold| 34|2017|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2015|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2017|    USA| expert|
|     usha|      pt| running|silver| 30|2014|    IND| rookie|
|   serena|williams| running|  gold| 31|2016|    FRA|amateur|
|    roger| federer|  tennis|silver| 32|2017|    CHN| expert|
|  jenifer|     cox|swimming|silver| 32|2014|    IND| expert|
| fernando| johnson|swimming|silver| 32|2017|    CHN| expert|
|     lisa|  cudrow|javellin|  gold| 34|2014|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2014|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2017|    USA| expert|
|     usha|      pt| running|silver| 30|2014|    IND| rookie|
+---------+--------+--------+------+---+----+-------+-------+
only showing top 20 rows
```