Session 20:

SPARK SQL 1

Assignment 1

Task 1

1) **What is the distribution of the total number of air-travelers per year**
   Below is the entire code given:

```
package core

import org.apache.spark.sql.SparkSession

object SparkObject2DF {
 //Create a case class globally to be used inside the main method
 //Inferring the Schema Using Reflection.Automatically converting an RDD containing case classes to a DataFrame.
 // The case class defines the schema of the table. The names of the arguments to the case class are read using reflection
 // and become the names of the columns.

 case class User(id:Long,name:String,age:Int)
 case class Transport(transport_mode:String,cost_per_unit:Long)
 // Main method - The execution entry point for the program
 case class Holidays(id:Int,source:String,destination:String,transport_mode:String,distance:Int,year:Int)
 def main(args: Array[String]): Unit  = {
  val spark = SparkSession
   .builder()
   .master("local")
   .appName("Spark file2DF basic example")
   .config("spark.some.config.option", "some-value")
   .getOrCreate()
  //Set the log level as warning
  spark.sparkContext.setLogLevel("WARN")
  //// For implicit conversions like converting RDDs and sequences  to DataFrames

  // Reading a file for the User schema created above & splitting on comma character (,)
  // trim is used to eliminate leading.trailing whitespace

  import spark.implicits._
  val user_schema_DF = spark.sparkContext

.textFile("C:/Users/mypc/Desktop/User_details_schema.txt").map(_.split(",")).map(x=>User(x(0).trim.toInt,x(1),x(2).trim.toInt)).toDF
```

```
   // Reading a file for the Transport schema created above & splitting on comma
character (,)
   // trim is used to eliminate leading.trailing whitespace
   val transport_DF =spark.sparkContext

.textFile("C:/Users/mypc/Desktop/Dataset_Transport_Schema.txt").map(_.split(",")).map
(x=>Transport(x(0),x(1).trim.toLong)).toDF
   // Reading a file for the Holidays schema created above & splitting on comma character
(,)
   // trim is used to eliminate leading.trailing whitespace
   val holidays_DF =spark.sparkContext

.textFile("C:/Users/mypc/Desktop/Dataset_Holidays.txt").map(_.split(",")).map(x=>Holida
ys(x(0).trim.toInt,x(1),x(2),x(3),x(4).trim.toInt,x(5).trim.toInt)).toDF

        println("User Data Frame:")
          user_schema_DF.show()
   println("Transport Data Frame:")
   transport_DF.show()
   println("Holidays Data Frame:")
   holidays_DF.show()
   //Converting each of the above created schemas into an SQL view
   user_schema_DF.createOrReplaceTempView("user")
   transport_DF.createOrReplaceTempView("transport")
   holidays_DF.createOrReplaceTempView("holidays")
   // To find distribution of Air travellers/year we need to find count of id or year for each
using a group by method.
   val x=spark.sql("select year, count(year) as num_of_travelers from holidays group by
year")
   val y =spark.sql("select year, count(id) as num_of_travelers from holidays group by
year")
   x.show
   y.show
   //selecting each id for each user, year for grouping each year & adding total distance to
find the total air by selecting
   //transport_mode as 'airplane' only.
   val x2=spark.sql("select id,year,sum(distance) as total_distance from holidays where
transport_mode='airplane' group by id,  year order by id ,year ASC")
   x2.show
   //Selecting id of all the users & adding up the total distance from holiday view
   val a3_top = spark.sql("select id,  sum(distance) as largest_distance from holidays group
by id   order by  largest_distance desc")
   //Temp view created for saving the result of the query above
   a3_top.createOrReplaceTempView("a3_top")
   a3_top.show
//selecting only those id's from from the view (a3_top) created above to select the user
id's who have travelled max distance till date
```

```
   val large_dist=spark.sql("select id,largest_distance as Largest_Dist_Travelled from
a3_top where largest_distance = (select Max(largest_distance)as total_distance_covered
from a3_top)")

   large_dist.show
   //Selecting destination & count of destination & providing an alias Dest_Visited from
holiday view & creating an Alias
   val a4_top_dest  = spark.sql("select destination, count(destination) as Dest_Visited from
holidays group by destination")
////Temp view created for saving the result of the query above
   a4_top_dest.createOrReplaceTempView("a4_top_dest")
   a4_top_dest.show
   //Selecting the maximum of all the destination grouped above in the view.
   val a5 = spark.sql("select destination as `Most Visited Destination` from a4_top_dest
where Dest_Visited=(select Max(Dest_Visited) as most_visited_dest from a4_top_dest)")

   a5.show
   // Joining two views holiday & transport to fetch cost_per_unit from transport & all
rows from holiday.
   // Joining two views holiday & transport to fetch cost_per_unit from transport & all
rows from holiday.
   val holi_trans_mode  = spark.sql("select h.*, t.cost_per_unit from holidays h join
transport t on h.transport_mode = t.transport_mode")
   ////Temp view created for saving the result of the query above
   holi_trans_mode.createOrReplaceTempView("holi_trans_mode")
   holi_trans_mode.show
   //From the holi_trans view above selecting the route & mutiplying the count of
trnsport_mode with it's respective cost/unit
   //to fetch the revenue generated by a particular route each year.
   val max_revenue_transport = spark.sql("select source,destination,year,
(count(transport_mode) * cost_per_unit) as Revenue from holi_trans_mode group by
source,destination,year,transport_mode,cost_per_unit order by Revenue desc")
   max_revenue_transport.createOrReplaceTempView("max_revenue_transport")
   max_revenue_transport.show
   //selecting the route that genarates maximum revenue each year from
max_revenue_transport view & storing the result in a6.
   val a6 = spark.sql("select source,destination,year,Revenue from max_revenue_transport
group by source ,destination,year,Revenue Having Revenue  IN (select Max(Revenue) as
most_revenue_generated_year from max_revenue_transport)")
    a6.show
   // Joining two views holiday & transport to fetch cost_per_unit from transport for
Air_travellers only & all rows from holiday.
   val holi_trans_mode_airplane  = spark.sql("select h.*, t.cost_per_unit from holidays h
join transport t on h.transport_mode = t.transport_mode where
t.transport_mode='airplane'")
holi_trans_mode_airplane.createOrReplaceTempView("holi_trans_mode_airplane")
   holi_trans_mode_airplane.show
```

```
   //To fetch the total amount spent by a particular user each year grouping by id,year &
counting by each id,year
   // & multiplying it by cost.
   val a7 = spark.sql("select id,year,(count(id,year) * cost_per_unit) as `Total Amount
Spent` from holi_trans_mode_airplane group by id,year ,cost_per_unit order by id,year
asc")

   a7.show
   // Create an RDD of  from a text file User_details.txt.
   val user_schema_DF1 =
spark.sparkContext.textFile("C:/Users/mypc/Desktop/User_details_schema.txt").map(_.s
plit(",")).map(x=>(x(0).trim.toLong,x(1),x(2).trim.toLong))
   // Create an RDD of  from a text file Dataset Holidays.txt.
   val holidays_DF1
=spark.sparkContext.textFile("C:/Users/mypc/Desktop/Dataset_Holidays.txt").map(_.split
(",")).map(x=>(x(0).trim.toLong,x(1),x(2),x(3),x(4).trim.toLong,x(5).trim.toLong))
   val transport_DF1 =spark.sparkContext

.textFile("C:/Users/mypc/Desktop/Dataset_Transport_Schema.txt").map(_.split(",")).map
(x=>Transport(x(0),x(1).trim.toInt))
   // create an RDD AgeGroup from user to get different age-groups from age column.
   val age_group = user_schema_DF1.map(x => x._1 ->{if(x._3<20)"20" else if (x._3>35)"35"
else "25-35"})
   // create an RDD year_holiday_travel from travel to map id as key and (distance and
year) as value
   val year_holiday_travel = holidays_DF1.map(x => (x._1 -> (x._6,x._5)))
   // create an RDD travelMap to join age_Group and year-holiday_travel
val travelMap= age_group.join(year_holiday_travel)
   val ageTravelMap= travelMap.map(x => (x._2._1 ,x._2._2._1) -> x._2._2._2)
   // create an RDD to aggregate the keys year and age-groups
   val ageTravelReduce = ageTravelMap.reduceByKey((x,y)=> x+y).sortByKey()
   //convert the RDD yearGroupSort to a Dataframe
   val yearGroupSort = ageTravelReduce.map( x => (x._1._2,x._1._1,x._2)).toDF
   //Now we use spark-sql to get the output....

   val newName = Seq("year","ageGroup","Distance")
   //Schema of yearGroupSort is (._1,._2,._3),convert it into (year,ageGroup,Distance)  in
yearGroupSortNew
   val yearGroupSortNew = yearGroupSort.toDF(newName: _*)
   // to check the new shema of yearGroupSortNew Data Frame
   yearGroupSortNew.printSchema()
   // Register the DataFrame as a temporary view AGEGROUP
   yearGroupSortNew.createOrReplaceTempView("AGEGROUP")
   val max_distance_per_year = spark.sql("SELECT a.*FROM AGEGROUP a " +
    "INNER JOIN " +
    "(SELECT year, MAX(distance) AS max FROM AGEGROUP " +
    "GROUP BY year) b " +
    "ON a.year = b.year " +
```

```
      "AND a.distance = b.max ").show()

    println("Above results shows the age group travelling the most every year")

  }
}
```

What is the distribution of the total number of air-travelers per year

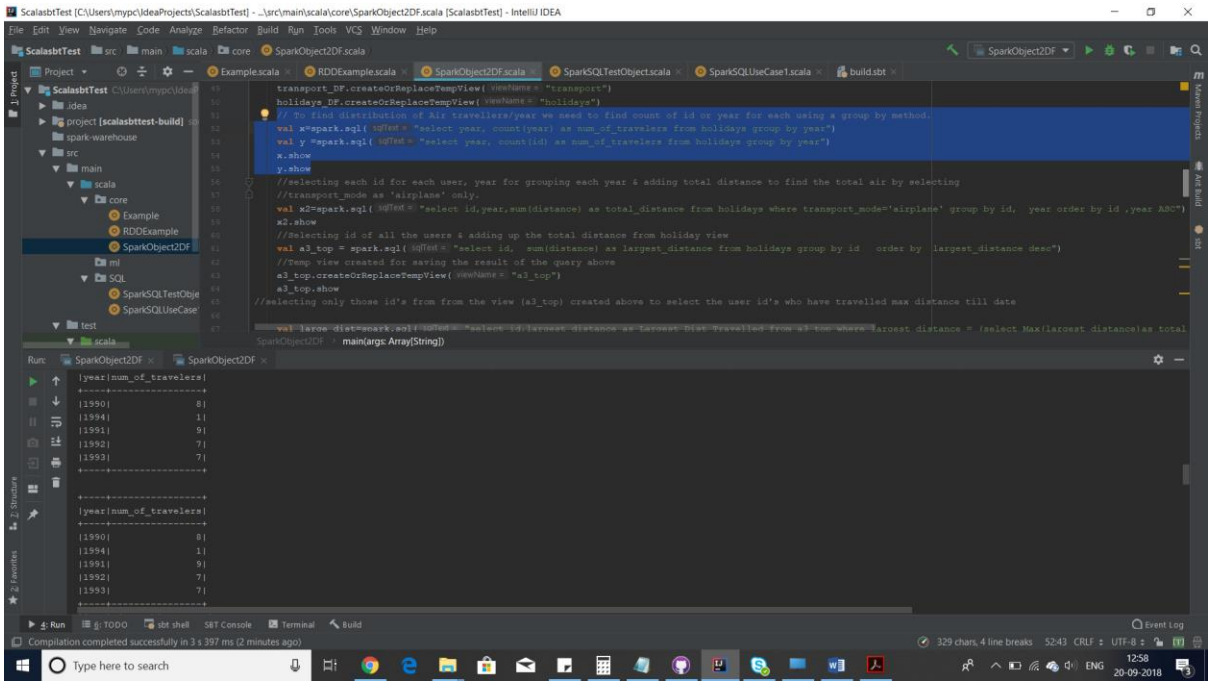
// To find distribution of Air travellers/year we need to find count of id or year for each using a group by method.

```
val x=spark.sql("select year, count(year) as num_of_travelers from holidays group by year")

val y =spark.sql("select year, count(id) as num_of_travelers from holidays group by year")

x.show

y.show
```



2) **What is the total air distance covered by each user per year**
   //selecting each id for each user, year for grouping each year & adding total distance to find the total air by selecting

//transport_mode as 'airplane' only.

val x2=spark.sql("select id,year,sum(distance) as total_distance from holidays where transport_mode='airplane' group by id, year order by id ,year ASC")

x2.show

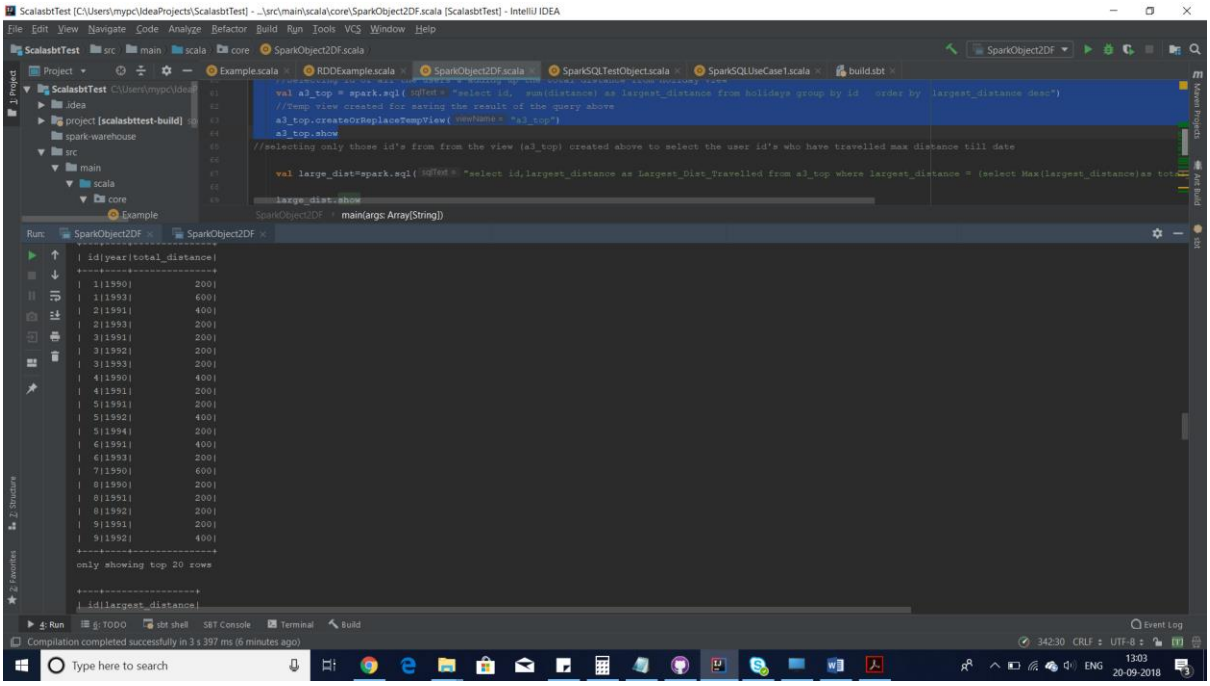
//Selecting id of all the users & adding up the total distance from holiday view

val a3_top = spark.sql("select id, sum(distance) as largest_distance from holidays group by id order by largest_distance desc")

//Temp view created for saving the result of the query above

a3_top.createOrReplaceTempView("a3_top")

a3_top.show



3) Which user has travelled the largest distance till date

```
4)  //selecting only those id's from from the view (a3_top) created above to select the user id's who
    have travelled max distance till date

        val large_dist=spark.sql("select id,largest_distance as Largest_Dist_Travelled from a3_top
    where largest_distance = (select Max(largest_distance)as total_distance_covered   from a3_top)")

        large_dist.show
        //Selecting destination & count of destination & providing an alias Dest_Visited from holiday
    view & creating an Alias
        val a4_top_dest  = spark.sql("select destination, count(destination) as Dest_Visited from
    holidays group by destination")
    ////Temp view created for saving the result of the query above
        a4_top_dest.createOrReplaceTempView("a4_top_dest")
        a4_top_dest.show
```

//selecting only those id's from from the view (a3_top) created above to select the user id's who have travelled max distance till date

val large_dist=spark.sql("select id,largest_distance as Largest_Dist_Travelled from a3_top where largest_distance = (select Max(largest_distance)as total_distance_covered from a3_top)")

large_dist.show

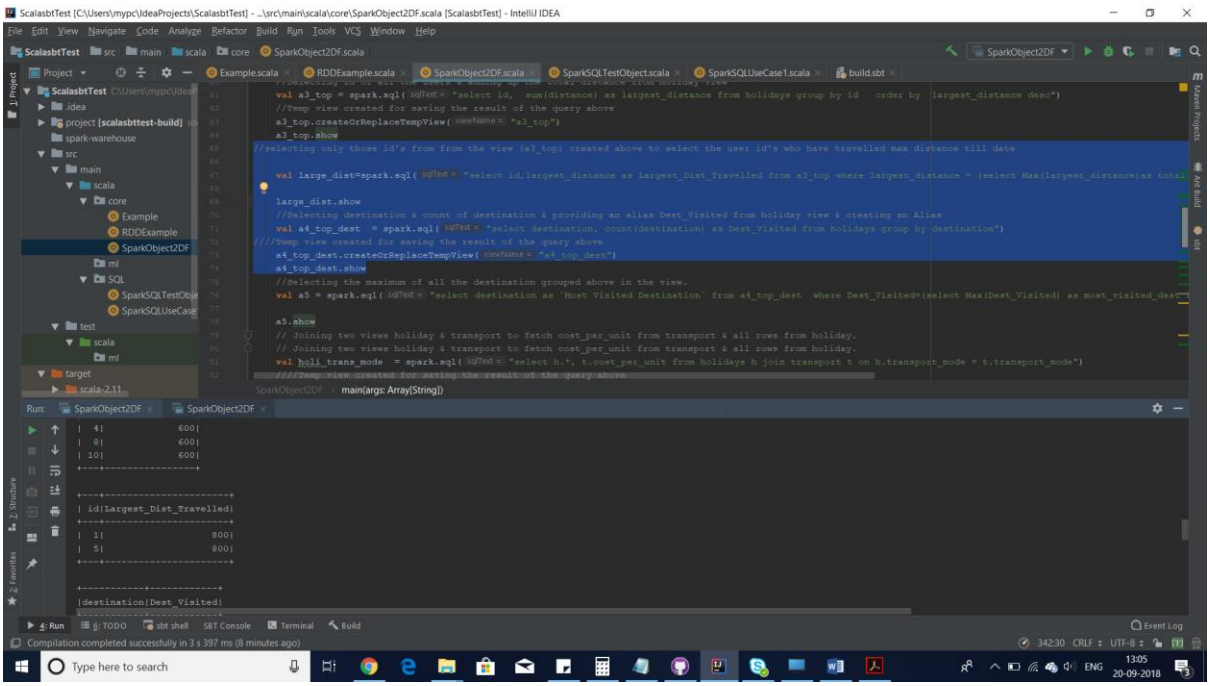
//Selecting destination & count of destination & providing an alias Dest_Visited from holiday view & creating an Alias

val a4_top_dest = spark.sql("select destination, count(destination) as Dest_Visited from holidays group by destination")

////Temp view created for saving the result of the query above

a4_top_dest.createOrReplaceTempView("a4_top_dest")

a4_top_dest.show



5) What is the most preferred destination for all users.

//Selecting destination & count of destination & providing an alias Dest_Visited from holiday view & creating an Alias

val a4_top_dest = spark.sql("select destination, count(destination) as Dest_Visited from holidays group by destination")

////Temp view created for saving the result of the query above

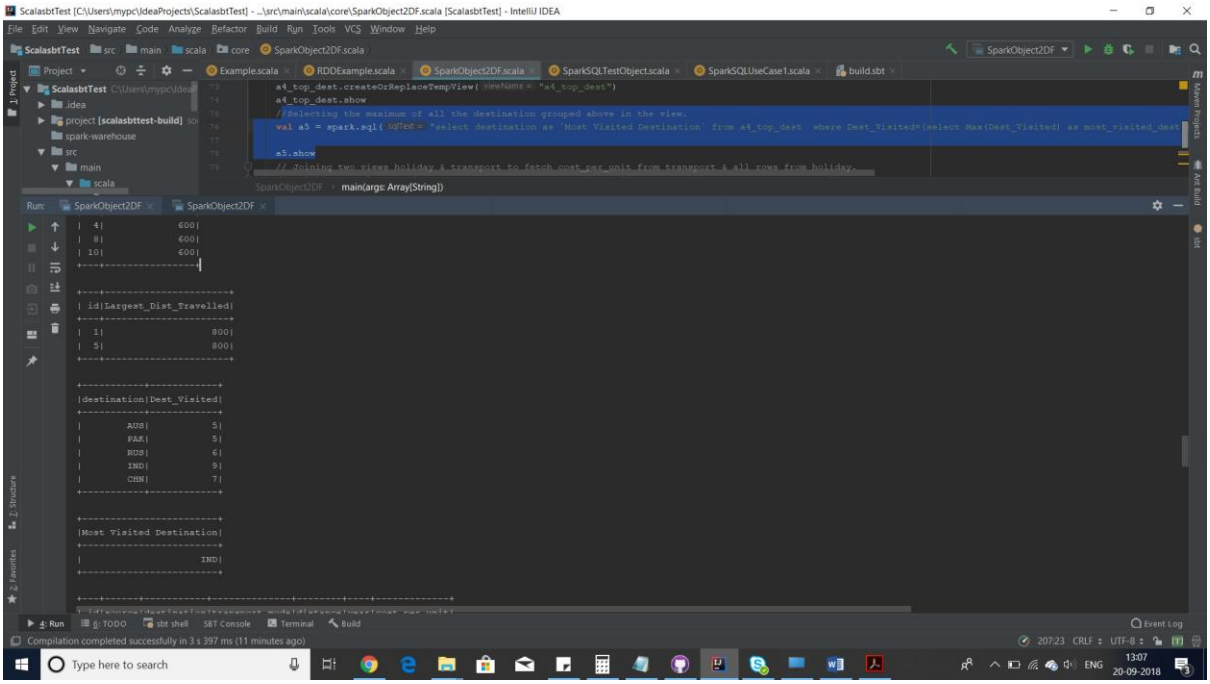
a4_top_dest.createOrReplaceTempView("a4_top_dest")

a4_top_dest.show

//Selecting the maximum of all the destination grouped above in the view.

val a5 = spark.sql("select destination as `Most Visited Destination` from a4_top_dest where Dest_Visited=(select Max(Dest_Visited) as most_visited_dest from a4_top_dest)")

a5.show



5)Which route is generating the most revenue per year

// Joining two views holiday & transport to fetch cost_per_unit from transport & all rows from holiday.

// Joining two views holiday & transport to fetch cost_per_unit from transport & all rows from holiday.

val holi_trans_mode = spark.sql("select h.*, t.cost_per_unit from holidays h join transport t on h.transport_mode = t.transport_mode")

////Temp view created for saving the result of the query above

holi_trans_mode.createOrReplaceTempView("holi_trans_mode")

holi_trans_mode.show

//From the holi_trans view above selecting the route & mutiplying the count of trnsport_mode with it's respective cost/unit

//to fetch the revenue generated by a particular route each year.

val max_revenue_transport = spark.sql("select source,destination,year, (count(transport_mode) * cost_per_unit) as Revenue from holi_trans_mode group by source,destination,year,transport_mode,cost_per_unit order by Revenue desc")

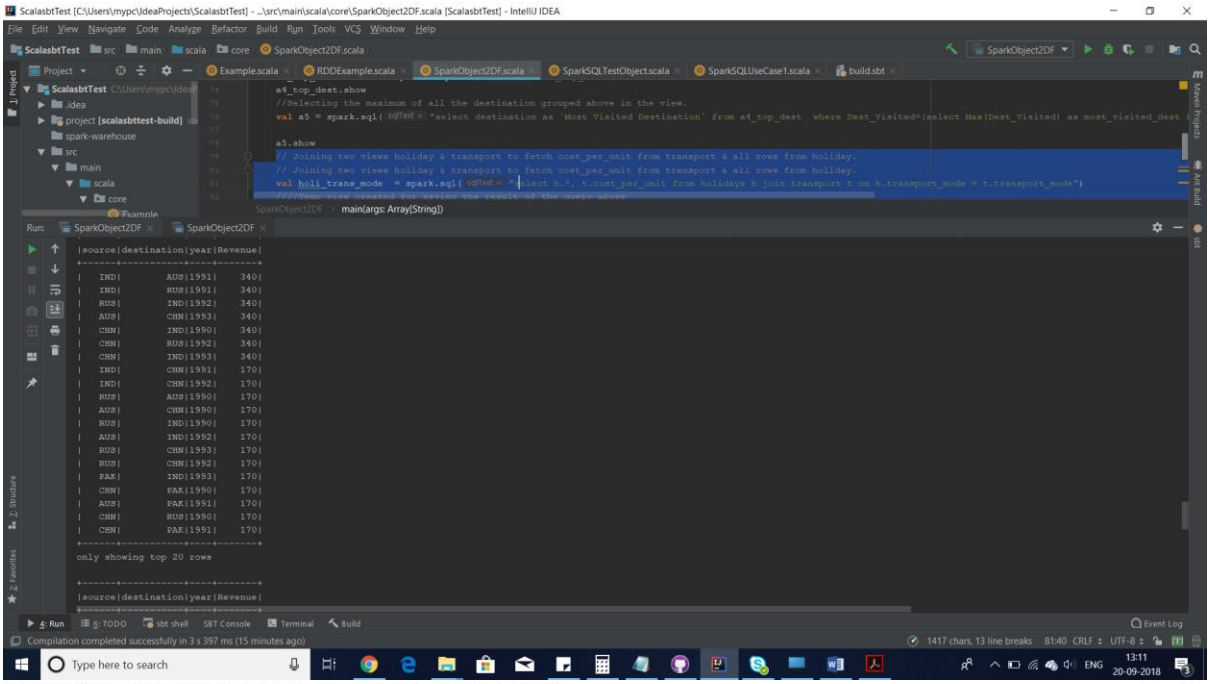
max_revenue_transport.createOrReplaceTempView("max_revenue_transport")

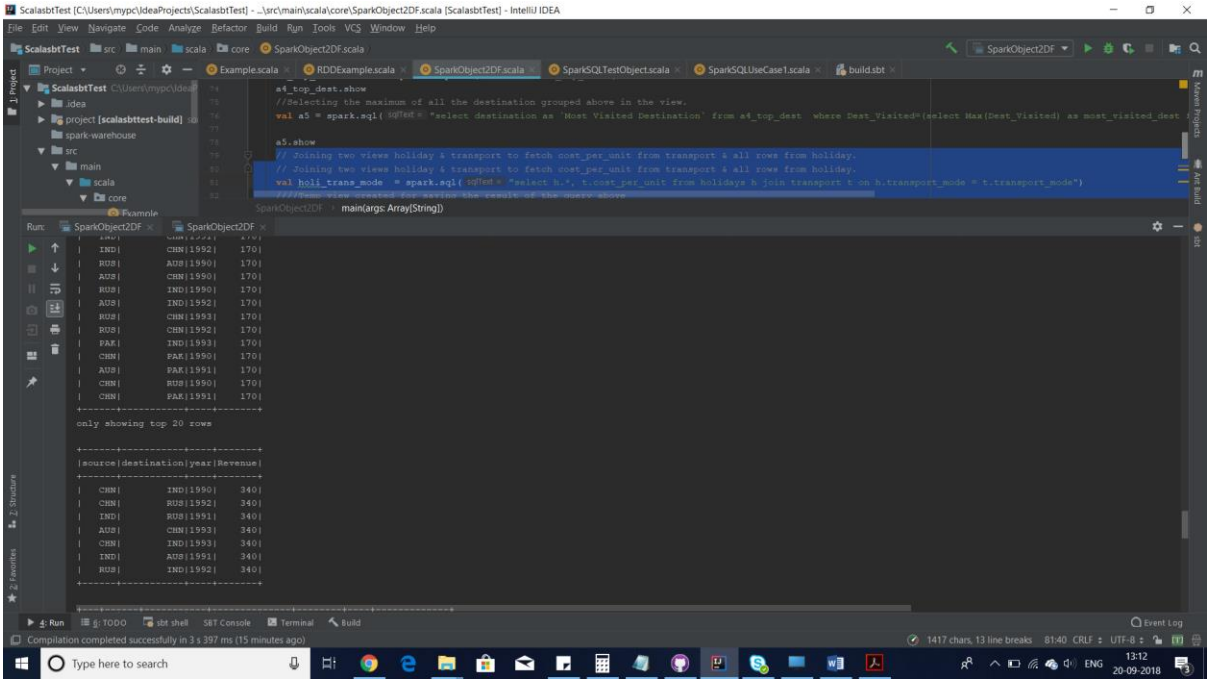
max_revenue_transport.show

//selecting the route that genarates maximum revenue each year from max_revenue_transport view & storing the result in a6.

val a6 = spark.sql("select source,destination,year,Revenue from max_revenue_transport group by source ,destination,year,Revenue Having Revenue IN (select Max(Revenue) as most_revenue_generated_year from max_revenue_transport)")

a6.show





6) What is the total amount spent by every user on air-travel per year

//To fetch the total amount spent by a particular user each year grouping by id,year & counting by each id,year

// & multiplying it by cost.

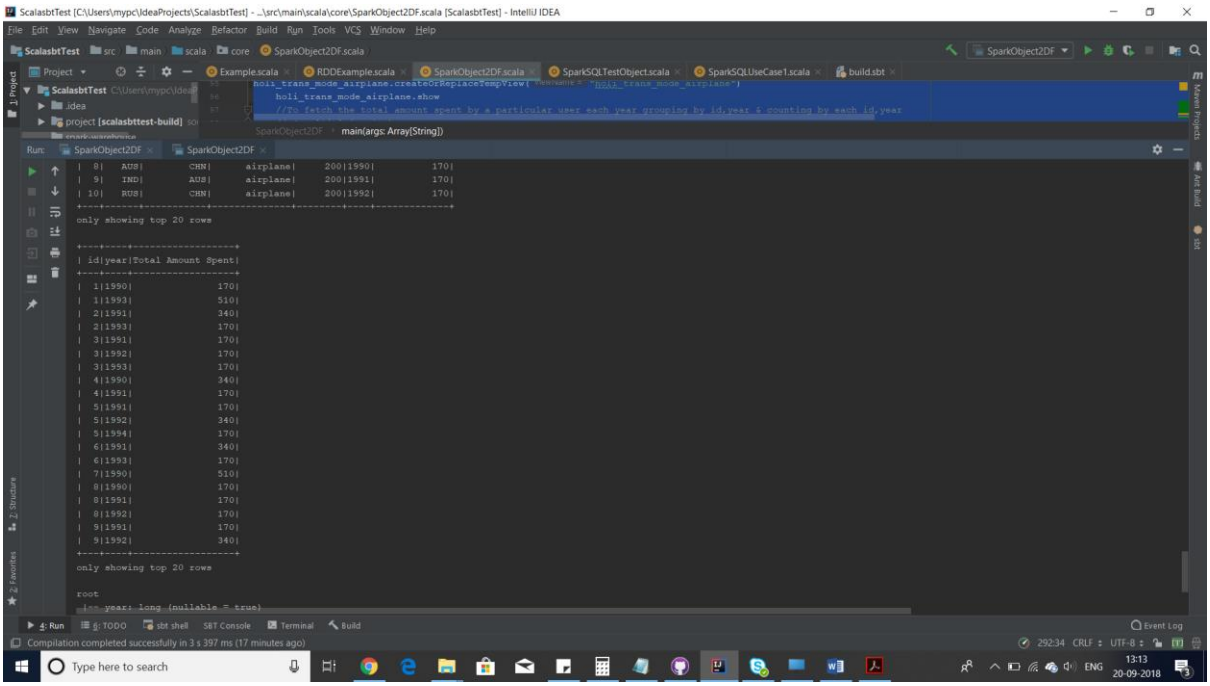
```
val holi_trans_mode_airplane  = spark.sql("select h.*, t.cost_per_unit from holidays h join transport t on h.transport_mode = t.transport_mode where t.transport_mode='airplane'")
holi_trans_mode_airplane.createOrReplaceTempView("holi_trans_mode_airplane")
holi_trans_mode_airplane.show
```

//To fetch the total amount spent by a particular user each year grouping by id,year & counting by each id,year

// & multiplying it by cost.

val a7 = spark.sql("select id,year,(count(id,year) * cost_per_unit) as `Total Amount Spent` from holi_trans_mode_airplane group by id,year ,cost_per_unit order by id,year asc")

a7.show



// Create an RDD of from a text file User_details.txt.

val user_schema_DF1 = spark.sparkContext.textFile("C:/Users/mypc/Desktop/User_details_schema.txt").map(_.split(",")).map(x=>(x(0).trim.toLong,x(1),x(2).trim.toLong))

// Create an RDD of from a text file Dataset Holidays.txt.

val holidays_DF1 =spark.sparkContext.textFile("C:/Users/mypc/Desktop/Dataset_Holidays.txt").map(_.split(",")).map(x=>(x(0).trim.toLong,x(1),x(2),x(3),x(4).trim.toLong,x(5).trim.toLong))

val transport_DF1 =spark.sparkContext

.textFile("C:/Users/mypc/Desktop/Dataset_Transport_Schema.txt").map(_.split(",")).map(x=>Transport(x(0),x(1).trim.toInt))

// create an RDD AgeGroup from user to get different age-groups from age column.

val age_group = user_schema_DF1.map(x => x._1 ->{if(x._3<20)"20" else if (x._3>35)"35" else "25-35"})

// create an RDD year_holiday_travel from travel to map id as key and (distance and year) as value

val year_holiday_travel = holidays_DF1.map(x => (x._1 -> (x._6,x._5)))

// create an RDD travelMap to join age_Group and year-holiday_travel

```
val travelMap= age_group.join(year_holiday_travel)
   val ageTravelMap= travelMap.map(x => (x._2._1 ,x._2._2._1) -> x._2._2._2)
   // create an RDD to aggregate the keys year and age-groups
   val ageTravelReduce = ageTravelMap.reduceByKey((x,y)=> x+y).sortByKey()
   //convert the RDD yearGroupSort to a Dataframe
   val yearGroupSort = ageTravelReduce.map( x => (x._1._2,x._1._1,x._2)).toDF
   //Now we use spark-sql to get the output....

   val newName = Seq("year","ageGroup","Distance")
   //Schema of yearGroupSort is (._1,._2,._3),convert it into (year,ageGroup,Distance)  in
yearGroupSortNew
   val yearGroupSortNew = yearGroupSort.toDF(newName: _*)
   // to check the new shema of yearGroupSortNew Data Frame
   yearGroupSortNew.printSchema()
   // Register the DataFrame as a temporary view AGEGROUP
   yearGroupSortNew.createOrReplaceTempView("AGEGROUP")
   val max_distance_per_year = spark.sql("SELECT a.*FROM AGEGROUP a " +
    "INNER JOIN " +
    "(SELECT year, MAX(distance) AS max FROM AGEGROUP " +
    "GROUP BY year) b " +
    "ON a.year = b.year " +
    "AND a.distance = b.max ").show()

   println("Above results shows the age group travelling the most every year")

  }
}
```