## GroupBy with Aggregate Functions

**Single Column**:

Use groupBy("column_name") and apply an aggregate function (e.g., sum(), avg(), count()).

```
df.groupBy("category").agg({"sales": "sum"}).show()
```

**Multiple Columns**:

Group by multiple columns by passing a list.

```
df.groupBy("category", "region").agg({"sales": "avg"}).show()
```

## Pivot

Reshape data, turning unique values of a column into new column headers.

Used with aggregation.

```
df.groupBy("category").pivot("year").sum("sales").show()
```

## Dropping Null Values

Use dropna() to remove rows containing null values.

Drop rows with nulls in **any column**:

```
df.dropna().show()
```

Drop rows with nulls in **specific columns**:

```
df.dropna(subset=["column1", "column2"]).show()
```

Drop rows based on a **threshold** of non-null values:

```
df.dropna(thresh=2).show()  # At least 2 non-null values
```

## Sorting in PySpark: sortBy and orderBy

**sort()** Sorts a **DataFrame** based on one or more columns.

**Equivalent to orderBy** in PySpark; they perform the same function.

```
df.sort("column1", "column2").show()  # Default is ascending
df.sort(df["column1"].desc()).show()  # Specify descending
```

**orderBy()** Another way to sort a DataFrame. Allows sorting by **multiple columns**.

Offers more flexibility by supporting column expressions for sorting.

```
df.orderBy("column1", "column2").show()  # Default ascending
df.orderBy(df["column1"].desc(), df["column2"].asc()).show()  # Mixed order
```

## Types of Sorting

**Single Column Sorting**:

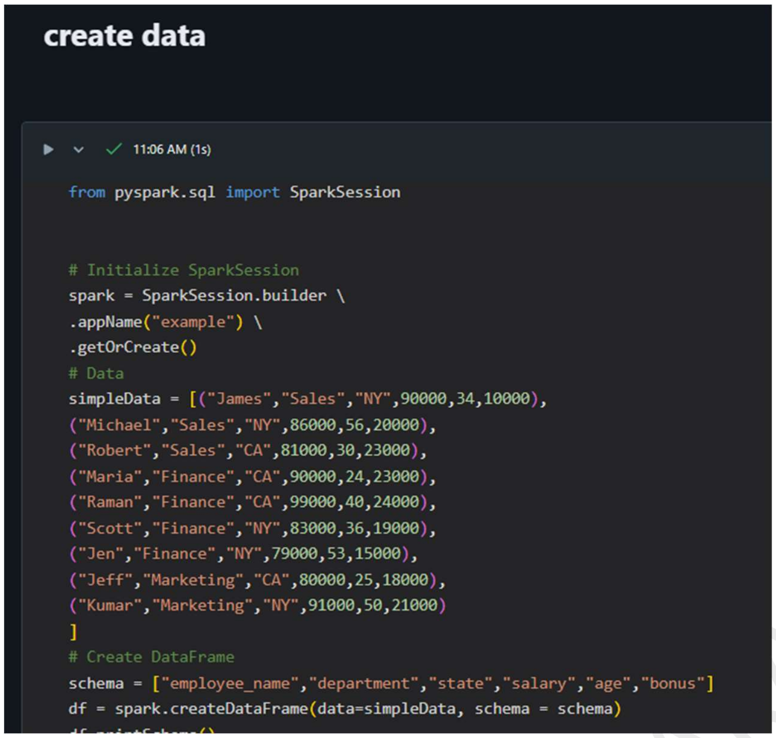
```
df.orderBy("column1").show()
df.orderBy(df["column1"].desc()).show()
```

**Multiple Column Sorting**:

| | |
|---|---|
| Ascending for all: | df.orderBy("column1", "column2").show() |
| Mixed order: | df.orderBy(df["column1"].asc(), df["column2"].desc()).show() |

**Using Expressions**: Sorting can involve transformations:

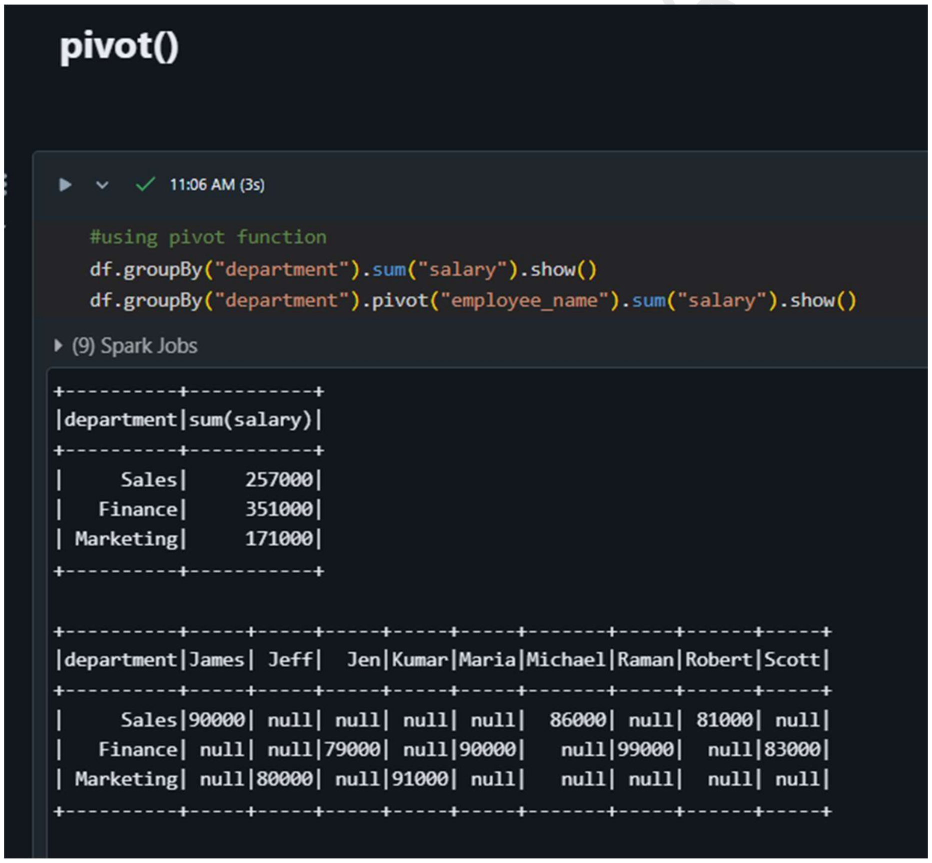
```
from pyspark.sql.functions import col
df.orderBy(col("column1") + 1).show()  # Sort by column1 incremented by 1
```



create data

11:06 AM (1s)

```
from pyspark.sql import SparkSession


# Initialize SparkSession
spark = SparkSession.builder \
.appName("example") \
.getOrCreate()
# Data
simpleData = [("James","Sales","NY",90000,34,10000),
("Michael","Sales","NY",86000,56,20000),
("Robert","Sales","CA",81000,30,23000),
("Maria","Finance","CA",90000,24,23000),
("Raman","Finance","CA",99000,40,24000),
("Scott","Finance","NY",83000,36,19000),
("Jen","Finance","NY",79000,53,15000),
("Jeff","Marketing","CA",80000,25,18000),
("Kumar","Marketing","NY",91000,50,21000)
]
# Create DataFrame
schema = ["employee_name","department","state","salary","age","bonus"]
df = spark.createDataFrame(data=simpleData, schema = schema)
```



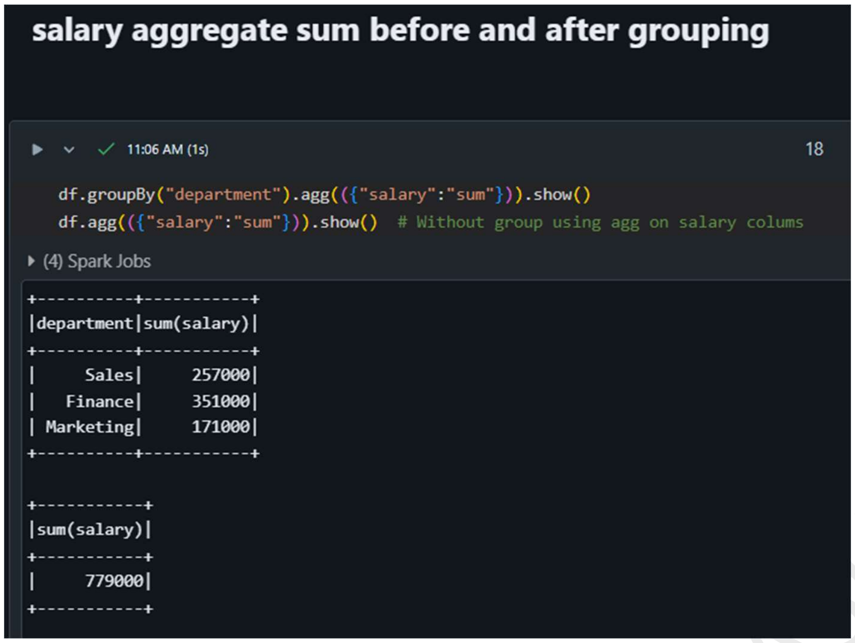
pivot()

11:06 AM (3s)

```
#using pivot function
df.groupBy("department").sum("salary").show()
df.groupBy("department").pivot("employee_name").sum("salary").show()
```

(9) Spark Jobs

```
+----------+-----------+
|department|sum(salary)|
+----------+-----------+
|     Sales|     257000|
|   Finance|     351000|
| Marketing|     171000|
+----------+-----------+

+----------+-----+-----+-----+-----+-----+-------+-----+------+-----+
|department|James| Jeff|  Jen|Kumar|Maria|Michael|Raman|Robert|Scott|
+----------+-----+-----+-----+-----+-----+-------+-----+------+-----+
|     Sales|90000| null| null| null| null|  86000| null| 81000| null|
|   Finance| null| null|79000| null|90000|   null|99000|  null|83000|
| Marketing| null|80000| null|91000| null|   null| null|  null| null|
+----------+-----+-----+-----+-----+-----+-------+-----+------+-----+
```



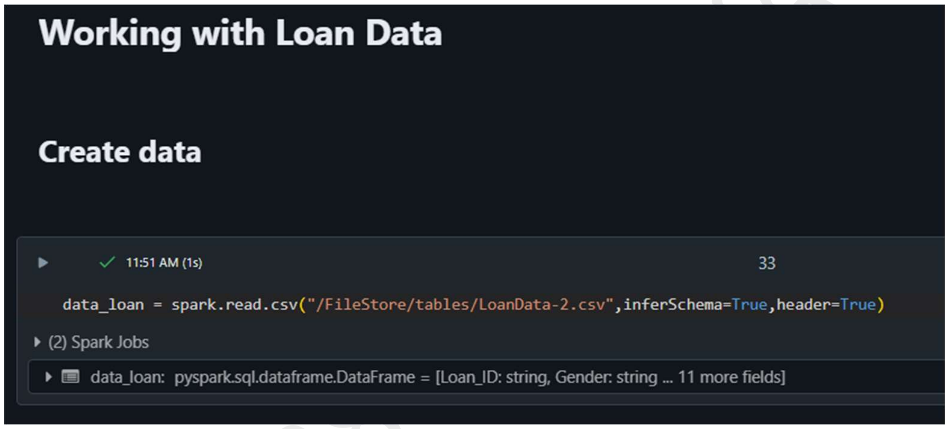
## salary aggregate sum before and after grouping

11:06 AM (1s) 18

```
df.groupBy("department").agg(({"salary":"sum"})).show()
df.agg(({"salary":"sum"})).show()  # Without group using agg on salary colums
```

(4) Spark Jobs

```
+----------+-----------+
|department|sum(salary)|
+----------+-----------+
|     Sales|     257000|
|   Finance|     351000|
| Marketing|     171000|
+----------+-----------+

+-----------+
|sum(salary)|
+-----------+
|     779000|
+-----------+
```



## Working with Loan Data

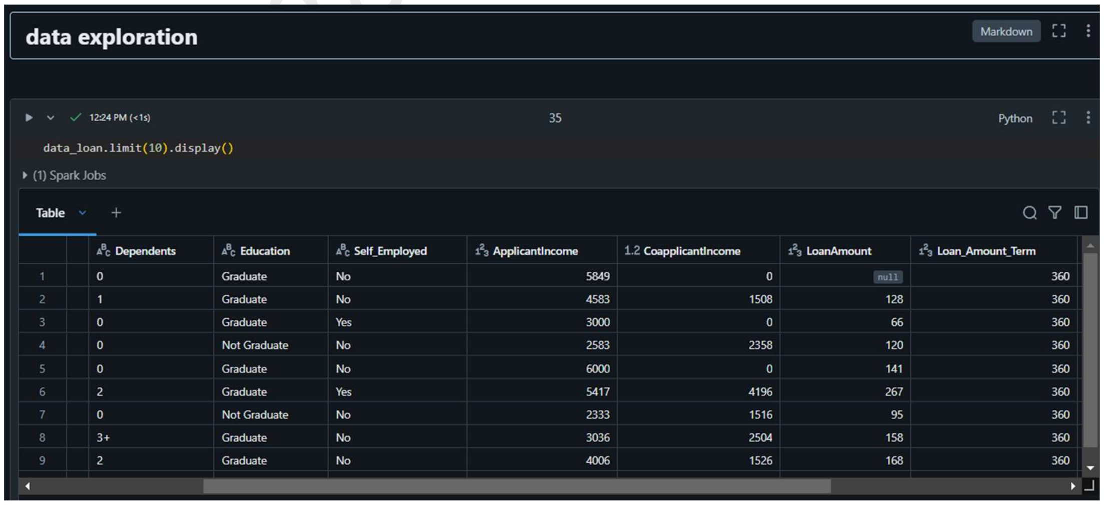
### Create data

11:51 AM (1s) 33

```
data_loan = spark.read.csv("/FileStore/tables/LoanData-2.csv",inferSchema=True,header=True)
```

(2) Spark Jobs

data_loan: pyspark.sql.dataframe.DataFrame = [Loan_ID: string, Gender: string ... 11 more fields]



### data exploration

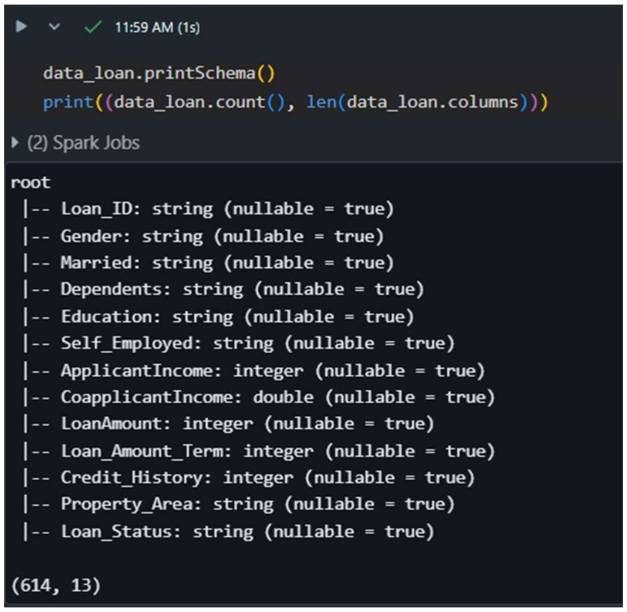
12:24 PM (<1s) 35 Python

```
data_loan.limit(10).display()
```

(1) Spark Jobs

Table

| | | Dependents | Education | Self_Employed | ApplicantIncome | CoapplicantIncome | LoanAmount | Loan_Amount_Term |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0 | Graduate | No | 5849 | 0 | null | 360 |
| 2 | | 1 | Graduate | No | 4583 | 1508 | 128 | 360 |
| 3 | | 0 | Graduate | Yes | 3000 | 0 | 66 | 360 |
| 4 | | 0 | Not Graduate | No | 2583 | 2358 | 120 | 360 |
| 5 | | 0 | Graduate | No | 6000 | 0 | 141 | 360 |
| 6 | | 2 | Graduate | Yes | 5417 | 4196 | 267 | 360 |
| 7 | | 0 | Not Graduate | No | 2333 | 1516 | 95 | 360 |
| 8 | | 3+ | Graduate | No | 3036 | 2504 | 158 | 360 |
| 9 | | 2 | Graduate | No | 4006 | 1526 | 168 | 360 |

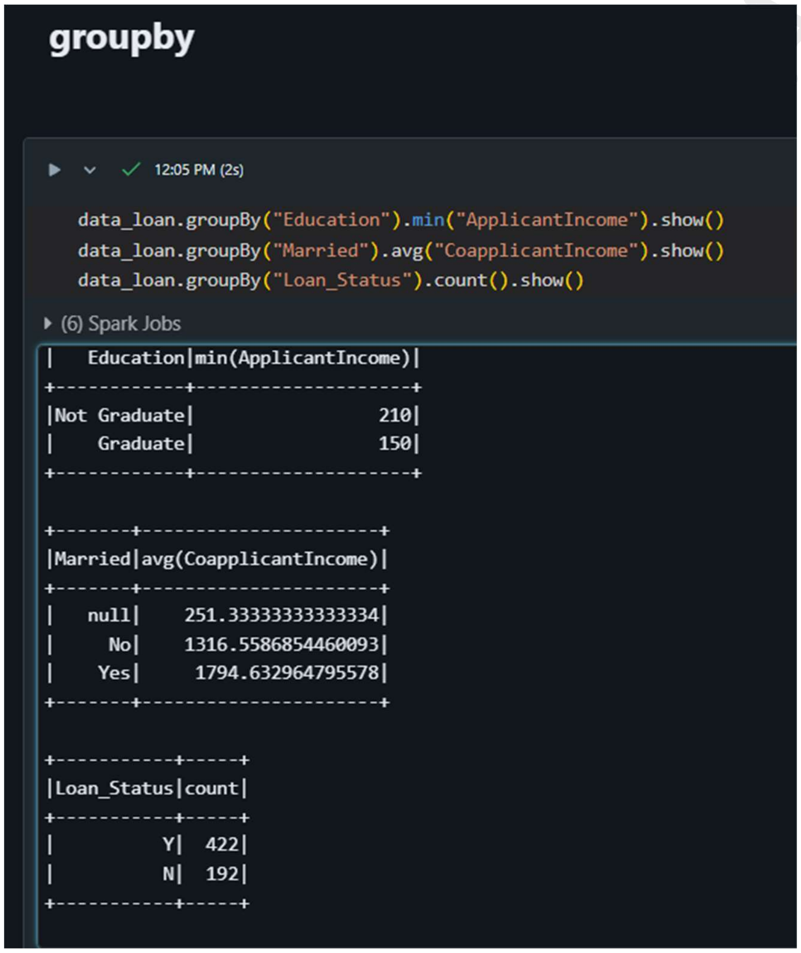


11:59 AM (1s)

```
data_loan.printSchema()
print((data_loan.count(), len(data_loan.columns)))
```

(2) Spark Jobs

```
root
 |-- Loan_ID: string (nullable = true)
 |-- Gender: string (nullable = true)
 |-- Married: string (nullable = true)
 |-- Dependents: string (nullable = true)
 |-- Education: string (nullable = true)
 |-- Self_Employed: string (nullable = true)
 |-- ApplicantIncome: integer (nullable = true)
 |-- CoapplicantIncome: double (nullable = true)
 |-- LoanAmount: integer (nullable = true)
 |-- Loan_Amount_Term: integer (nullable = true)
 |-- Credit_History: integer (nullable = true)
 |-- Property_Area: string (nullable = true)
 |-- Loan_Status: string (nullable = true)

(614, 13)
```



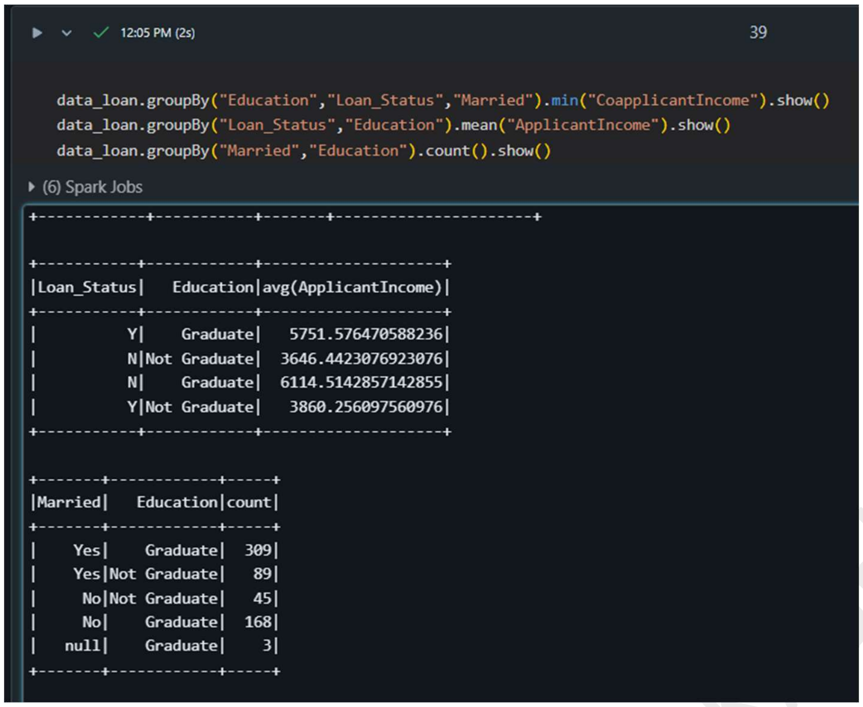
## groupby

12:05 PM (2s)

```
data_loan.groupBy("Education").min("ApplicantIncome").show()
data_loan.groupBy("Married").avg("CoapplicantIncome").show()
data_loan.groupBy("Loan_Status").count().show()
```

(6) Spark Jobs

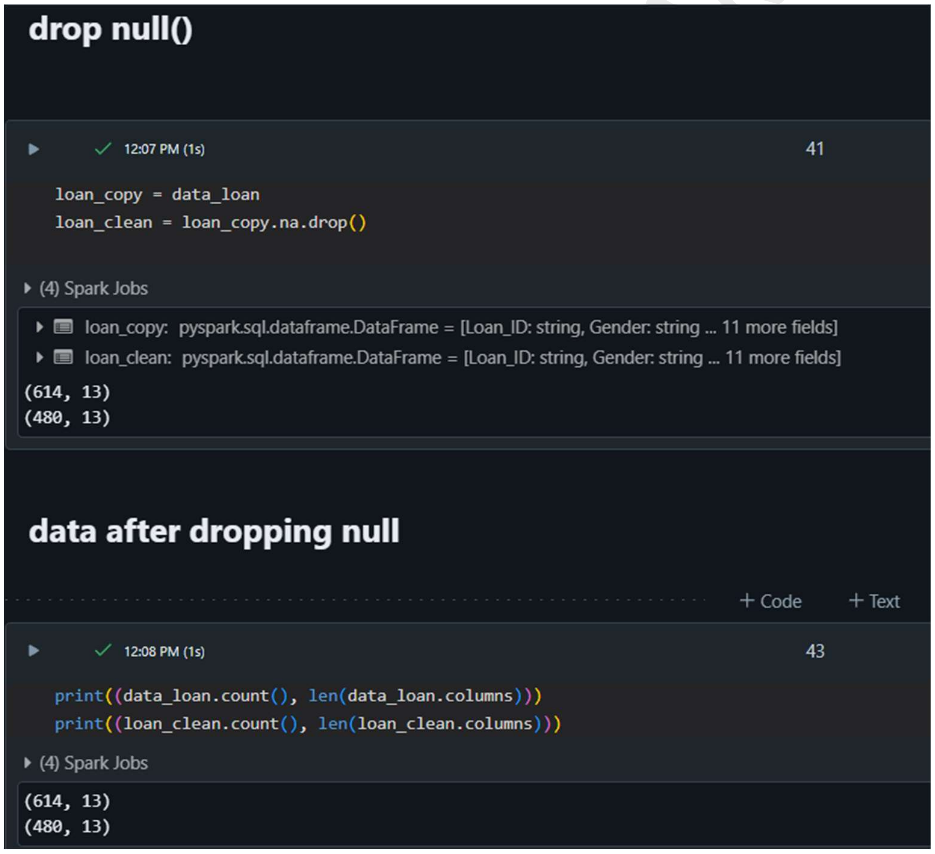
```
|   Education|min(ApplicantIncome)|
+------------+--------------------+
|Not Graduate|                 210|
|    Graduate|                 150|
+------------+--------------------+

+-------+----------------------+
|Married|avg(CoapplicantIncome)|
+-------+----------------------+
|   null|     251.333333333334|
|     No|    1316.5586854460093|
|    Yes|     1794.632964795578|
+-------+----------------------+

+-----------+-----+
|Loan_Status|count|
+-----------+-----+
|          Y|  422|
|          N|  192|
+-----------+-----+
```



```
12:05 PM (2s)                                                39

data_loan.groupBy("Education","Loan_Status","Married").min("CoapplicantIncome").show()
data_loan.groupBy("Loan_Status","Education").mean("ApplicantIncome").show()
data_loan.groupBy("Married","Education").count().show()
```

(6) Spark Jobs

```
+------------+----------+-------+--------------------+

+----------+----------+-------------------+
|Loan_Status| Education|avg(ApplicantIncome)|
+----------+----------+-------------------+
|         Y|  Graduate|  5751.576470588236|
|         N|Not Graduate| 3646.4423076923076|
|         N|  Graduate| 6114.5142857142855|
|         Y|Not Graduate|  3860.256097560976|
+----------+----------+-------------------+

+-------+-----------+-----+
|Married|  Education|count|
+-------+-----------+-----+
|    Yes|   Graduate|  309|
|    Yes|Not Graduate|   89|
|     No|Not Graduate|   45|
|     No|   Graduate|  168|
|   null|   Graduate|    3|
+-------+-----------+-----+
```



## drop null()

```
12:07 PM (1s)                                                41

loan_copy = data_loan
loan_clean = loan_copy.na.drop()
```

(4) Spark Jobs

loan_copy: pyspark.sql.dataframe.DataFrame = [Loan_ID: string, Gender: string ... 11 more fields]
loan_clean: pyspark.sql.dataframe.DataFrame = [Loan_ID: string, Gender: string ... 11 more fields]

```
(614, 13)
(480, 13)
```

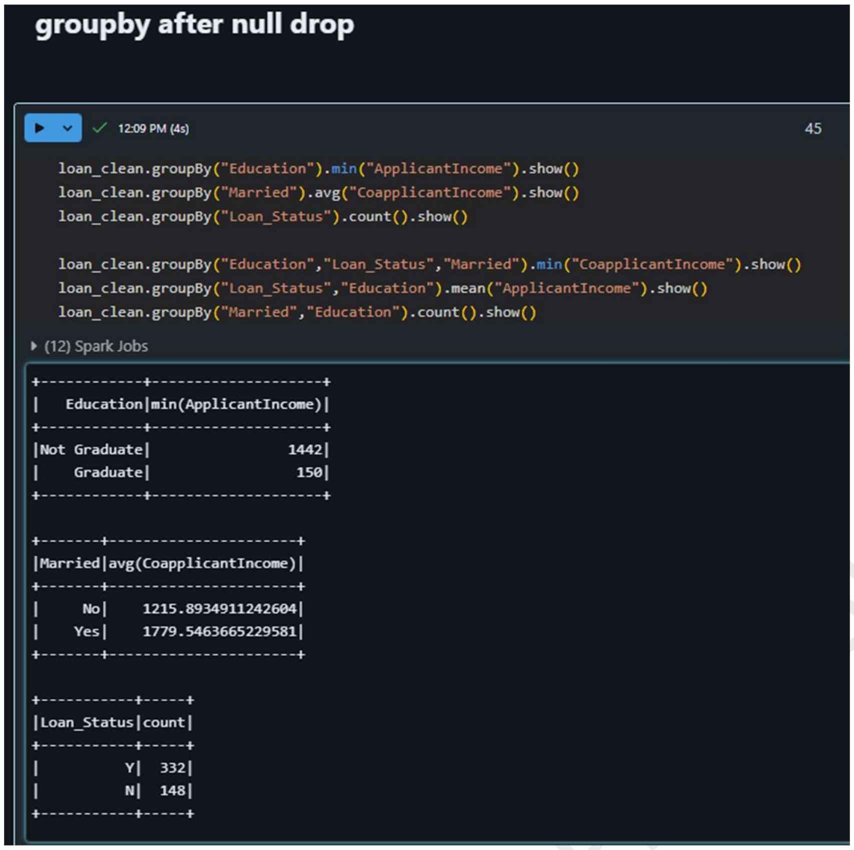
## data after dropping null

+ Code + Text

```
12:08 PM (1s)                                                43

print((data_loan.count(), len(data_loan.columns)))
print((loan_clean.count(), len(loan_clean.columns)))
```

(4) Spark Jobs

```
(614, 13)
(480, 13)
```



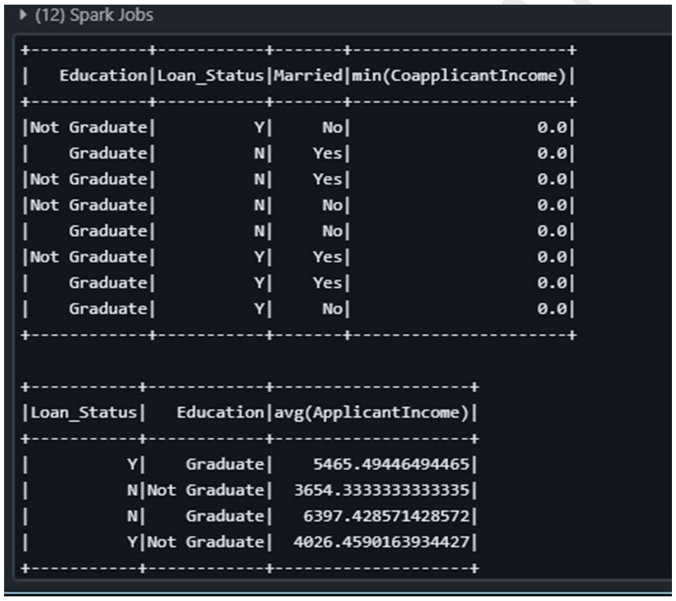
## groupby after null drop

12:09 PM (4s) 45

```
loan_clean.groupBy("Education").min("ApplicantIncome").show()
loan_clean.groupBy("Married").avg("CoapplicantIncome").show()
loan_clean.groupBy("Loan_Status").count().show()

loan_clean.groupBy("Education","Loan_Status","Married").min("CoapplicantIncome").show()
loan_clean.groupBy("Loan_Status","Education").mean("ApplicantIncome").show()
loan_clean.groupBy("Married","Education").count().show()
```

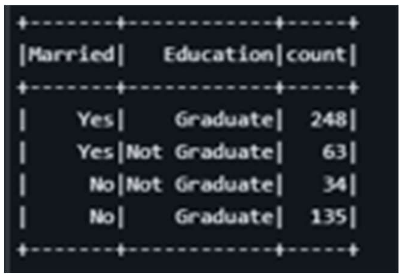
(12) Spark Jobs

```
+------------+-------------------+
|   Education|min(ApplicantIncome)|
+------------+-------------------+
|Not Graduate|               1442|
|    Graduate|                150|
+------------+-------------------+

+-------+---------------------+
|Married|avg(CoapplicantIncome)|
+-------+---------------------+
|     No|   1215.8934911242604|
|    Yes|   1779.5463665229581|
+-------+---------------------+

+-----------+-----+
|Loan_Status|count|
+-----------+-----+
|          Y|  332|
|          N|  148|
+-----------+-----+
```

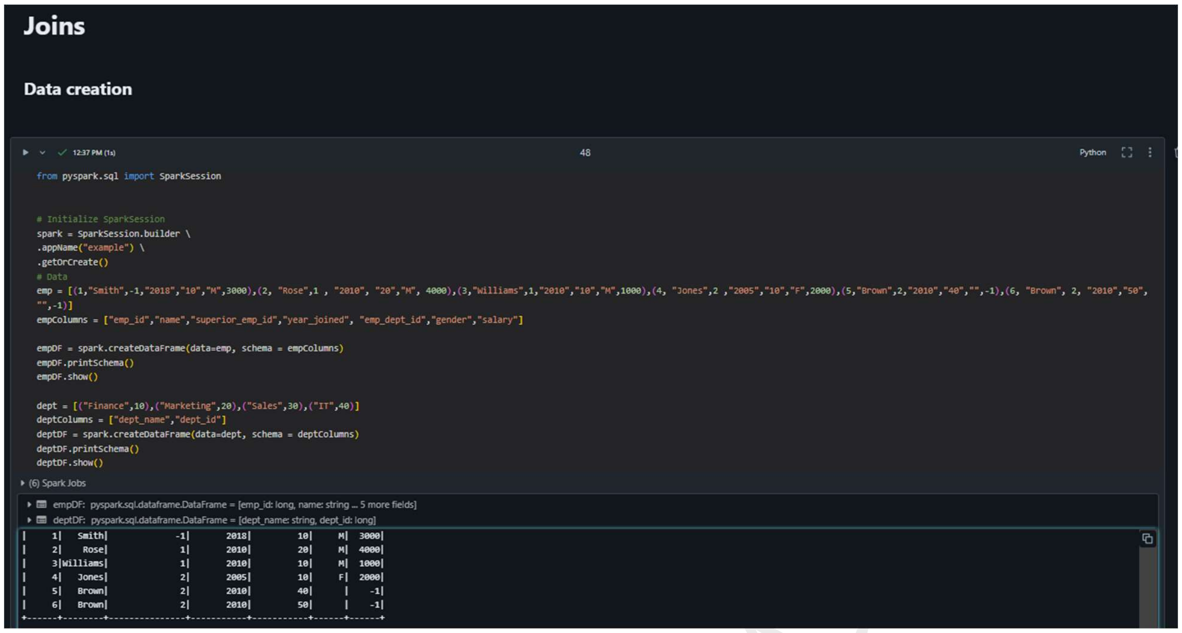


(12) Spark Jobs

```
+------------+-----------+-------+---------------------+
|   Education|Loan_Status|Married|min(CoapplicantIncome)|
+------------+-----------+-------+---------------------+
|Not Graduate|          Y|     No|                  0.0|
|    Graduate|          N|    Yes|                  0.0|
|Not Graduate|          N|    Yes|                  0.0|
|Not Graduate|          N|     No|                  0.0|
|    Graduate|          N|     No|                  0.0|
|Not Graduate|          Y|    Yes|                  0.0|
|    Graduate|          Y|    Yes|                  0.0|
|    Graduate|          Y|     No|                  0.0|
+------------+-----------+-------+---------------------+

+-----------+------------+--------------------+
|Loan_Status|   Education|avg(ApplicantIncome)|
+-----------+------------+--------------------+
|          Y|    Graduate|    5465.49446494465|
|          N|Not Graduate|  3654.3333333333335|
|          N|    Graduate|   6397.428571428572|
|          Y|Not Graduate|  4026.4590163934427|
+-----------+------------+--------------------+
```



```
+-------+------------+-----+
|Married|   Education|count|
+-------+------------+-----+
|    Yes|    Graduate|  248|
|    Yes|Not Graduate|   63|
|     No|Not Graduate|   34|
|     No|    Graduate|  135|
+-------+------------+-----+
```



## Joins

### Data creation

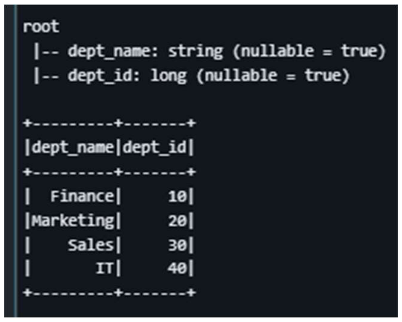
```
12:37 PM (1s)                                   48                                   Python
from pyspark.sql import SparkSession


# Initialize SparkSession
spark = SparkSession.builder \
.appName("example") \
.getOrCreate()
# Data
emp = [(1,"Smith",-1,"2018","10","M",3000),(2, "Rose",1 , "2010", "20","M", 4000),(3,"Williams",1,"2010","10","M",1000),(4, "Jones",2 ,"2005","10","F",2000),(5,"Brown",2,"2010","40","",-1),(6, "Brown", 2, "2010","50",
"",-1)]
empColumns = ["emp_id","name","superior_emp_id","year_joined", "emp_dept_id","gender","salary"]

empDF = spark.createDataFrame(data=emp, schema = empColumns)
empDF.printSchema()
empDF.show()

dept = [("Finance",10),("Marketing",20),("Sales",30),("IT",40)]
deptColumns = ["dept_name","dept_id"]
deptDF = spark.createDataFrame(data=dept, schema = deptColumns)
deptDF.printSchema()
deptDF.show()
```

(6) Spark Jobs

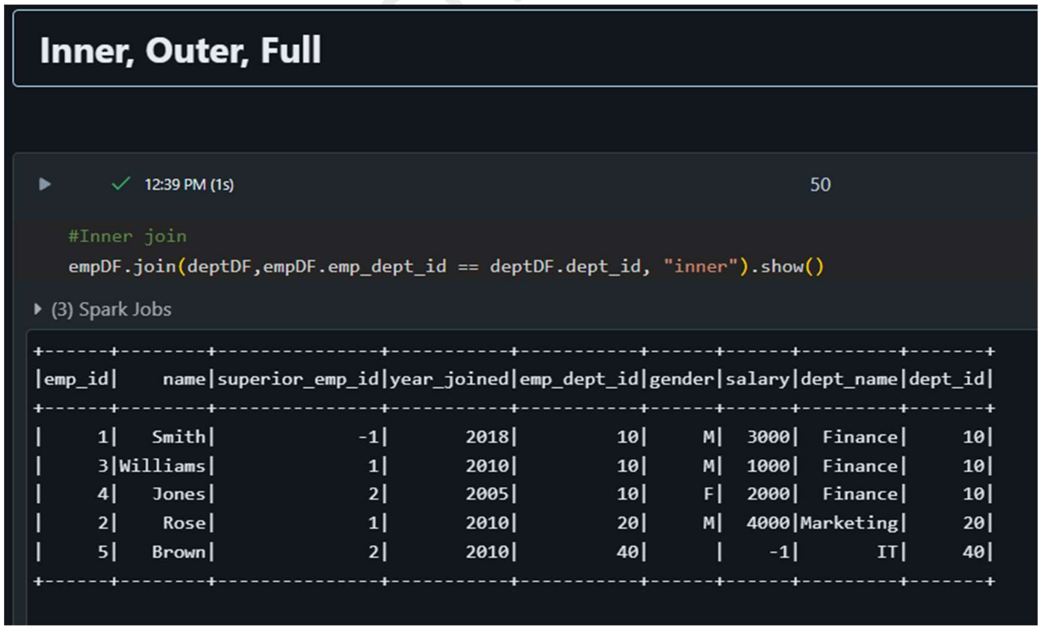
empDF: pyspark.sql.dataframe.DataFrame = [emp_id: long, name: string ... 5 more fields]

deptDF: pyspark.sql.dataframe.DataFrame = [dept_name: string, dept_id: long]

```
|     1|   Smith|             -1|       2018|         10|     M|  3000|
|     2|    Rose|              1|       2010|         20|     M|  4000|
|     3|Williams|              1|       2010|         10|     M|  1000|
|     4|   Jones|              2|       2005|         10|     F|  2000|
|     5|   Brown|              2|       2010|         40|      |    -1|
|     6|   Brown|              2|       2010|         50|      |    -1|
+------+--------+---------------+-----------+-----------+------+------+
```



```
root
 |-- dept_name: string (nullable = true)
 |-- dept_id: long (nullable = true)

+---------+-------+
|dept_name|dept_id|
+---------+-------+
|  Finance|     10|
|Marketing|     20|
|    Sales|     30|
|       IT|     40|
+---------+-------+
```

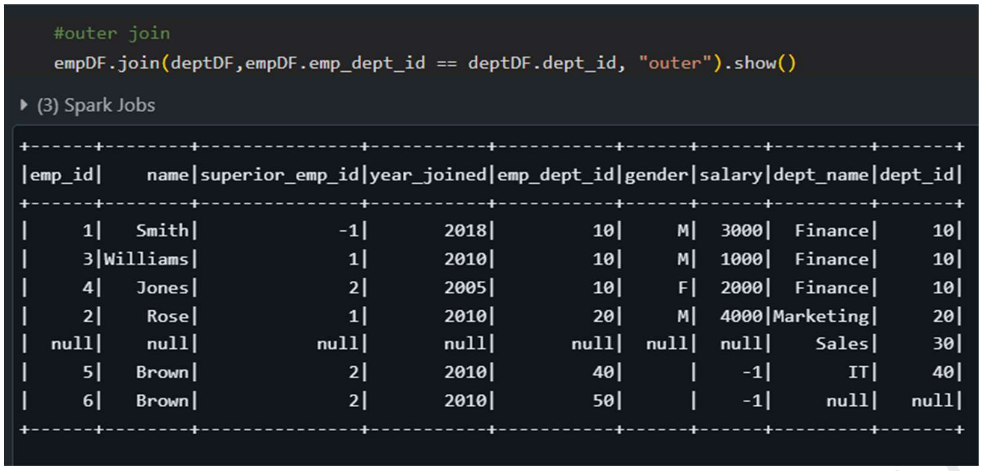


## Inner, Outer, Full

```
12:39 PM (1s)                                   50
#Inner join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "inner").show()
```

(3) Spark Jobs

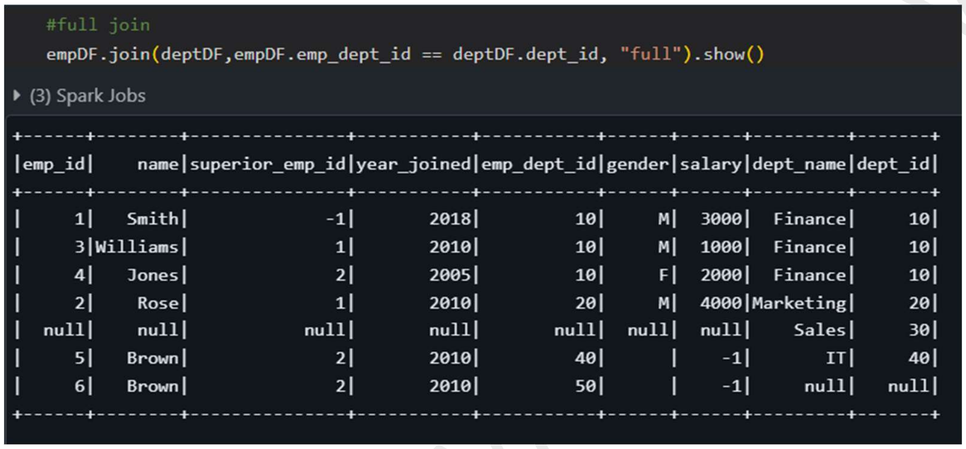
```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



```
#outer join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "outer").show()
```

▸ (3) Spark Jobs

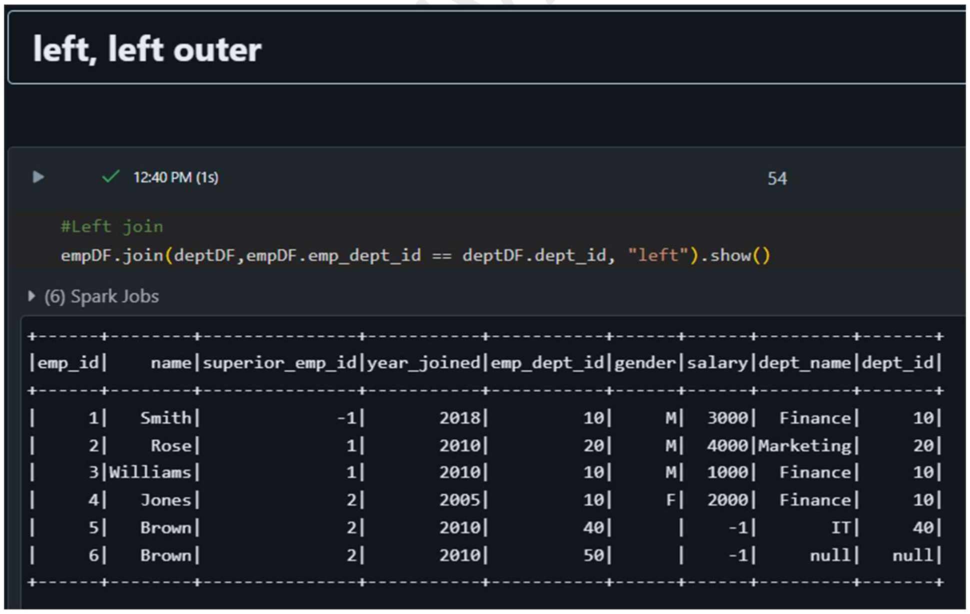
```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|  null|    null|           null|       null|       null|  null|  null|    Sales|     30|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
|     6|   Brown|              2|       2010|         50|      |    -1|     null|   null|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



```
#full join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "full").show()
```

▸ (3) Spark Jobs

```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|  null|    null|           null|       null|       null|  null|  null|    Sales|     30|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
|     6|   Brown|              2|       2010|         50|      |    -1|     null|   null|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



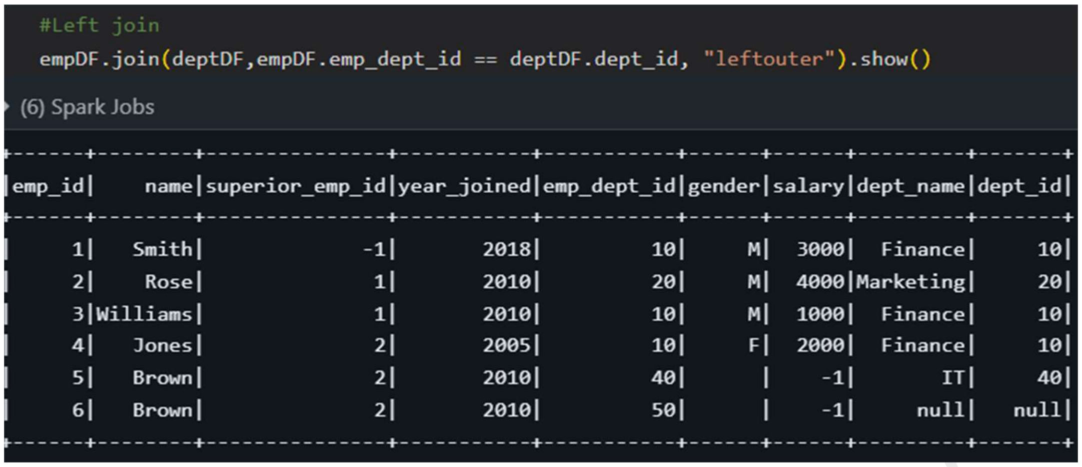
## left, left outer

▶ ✓ 12:40 PM (1s) 54

```
#Left join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "left").show()
```

▸ (6) Spark Jobs

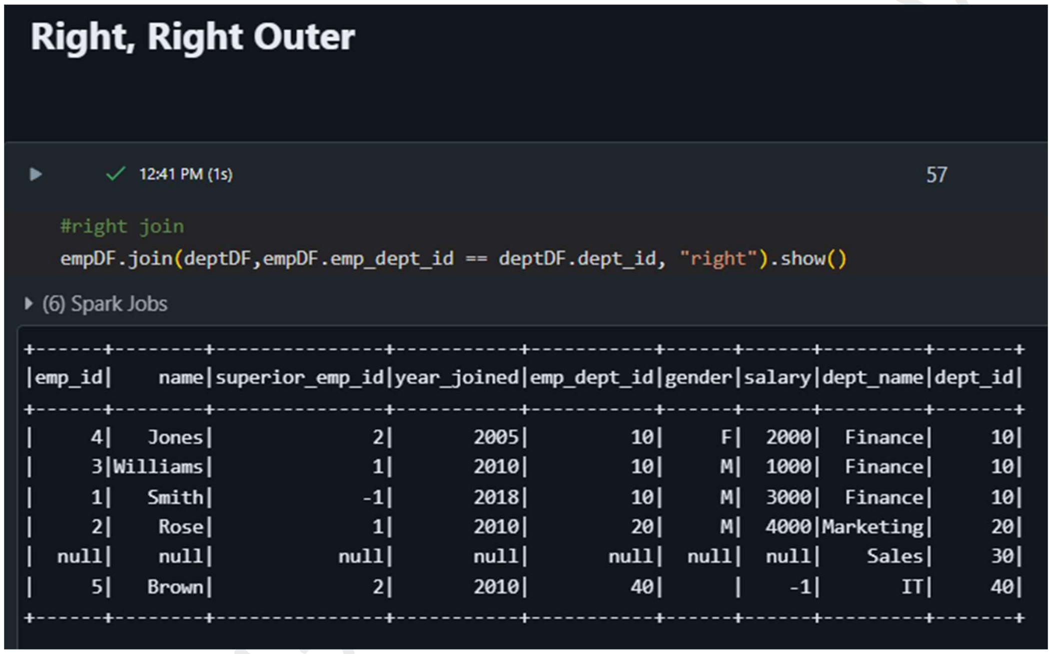
```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
|     6|   Brown|              2|       2010|         50|      |    -1|     null|   null|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



```
#Left join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "leftouter").show()
```

(6) Spark Jobs

```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
|     6|   Brown|              2|       2010|         50|      |    -1|     null|   null|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



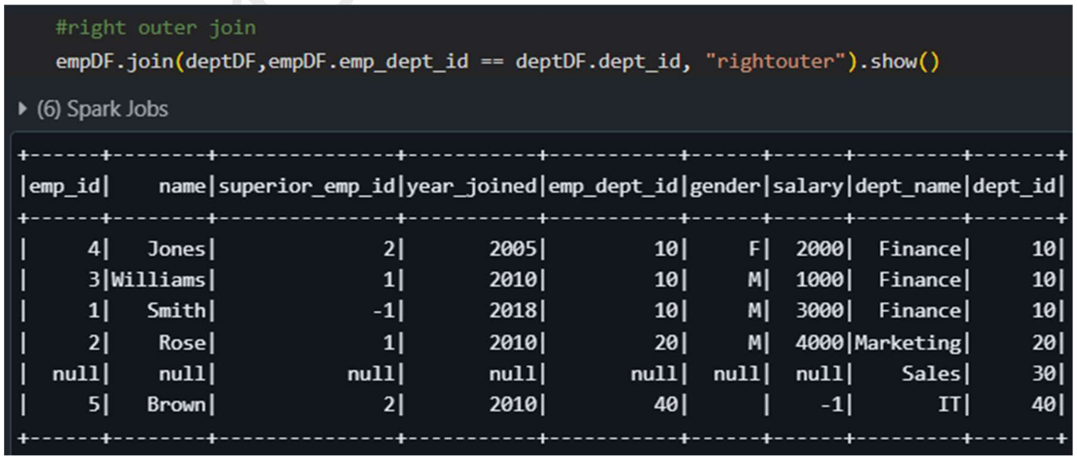
## Right, Right Outer

12:41 PM (1s) 57

```
#right join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "right").show()
```

(6) Spark Jobs

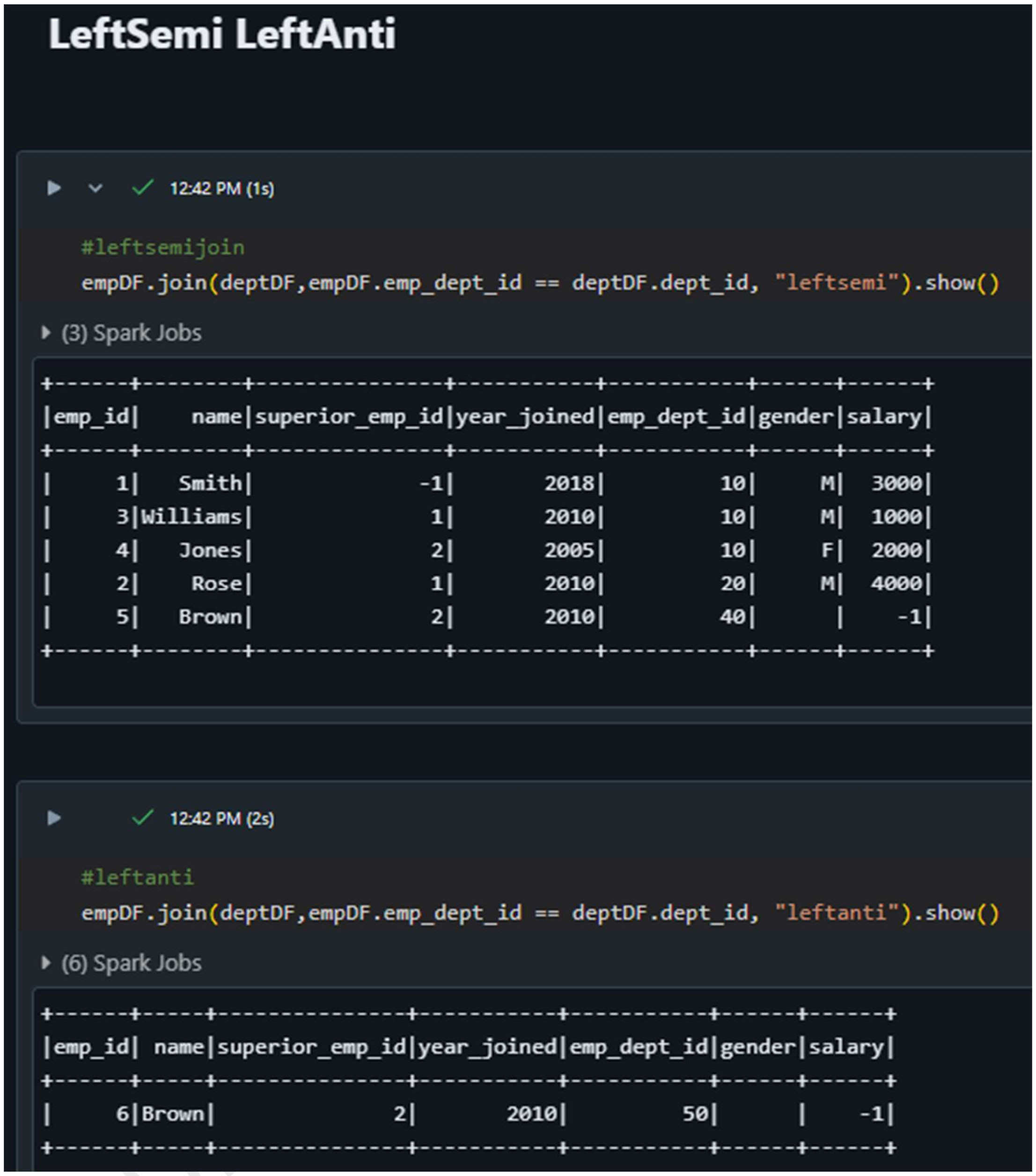
```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|  null|    null|           null|       null|       null|  null|  null|    Sales|     30|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



```
#right outer join
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "rightouter").show()
```

(6) Spark Jobs

```
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|dept_name|dept_id|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
|     4|   Jones|              2|       2005|         10|     F|  2000|  Finance|     10|
|     3|Williams|              1|       2010|         10|     M|  1000|  Finance|     10|
|     1|   Smith|             -1|       2018|         10|     M|  3000|  Finance|     10|
|     2|    Rose|              1|       2010|         20|     M|  4000|Marketing|     20|
|  null|    null|           null|       null|       null|  null|  null|    Sales|     30|
|     5|   Brown|              2|       2010|         40|      |    -1|       IT|     40|
+------+--------+---------------+-----------+-----------+------+------+---------+-------+
```



## LeftSemi LeftAnti

12:42 PM (1s)

```
#leftsemijoin
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "leftsemi").show()
```

(3) Spark Jobs

```
+------+--------+---------------+-----------+-----------+------+------+
|emp_id|    name|superior_emp_id|year_joined|emp_dept_id|gender|salary|
+------+--------+---------------+-----------+-----------+------+------+
|     1|   Smith|             -1|       2018|         10|     M|  3000|
|     3|Williams|              1|       2010|         10|     M|  1000|
|     4|   Jones|              2|       2005|         10|     F|  2000|
|     2|    Rose|              1|       2010|         20|     M|  4000|
|     5|   Brown|              2|       2010|         40|      |    -1|
+------+--------+---------------+-----------+-----------+------+------+
```

12:42 PM (2s)

```
#leftanti
empDF.join(deptDF,empDF.emp_dept_id == deptDF.dept_id, "leftanti").show()
```

(6) Spark Jobs

```
+------+-----+---------------+-----------+-----------+------+------+
|emp_id| name|superior_emp_id|year_joined|emp_dept_id|gender|salary|
+------+-----+---------------+-----------+-----------+------+------+
|     6|Brown|              2|       2010|         50|      |    -1|
+------+-----+---------------+-----------+-----------+------+------+
```