PYSPARK

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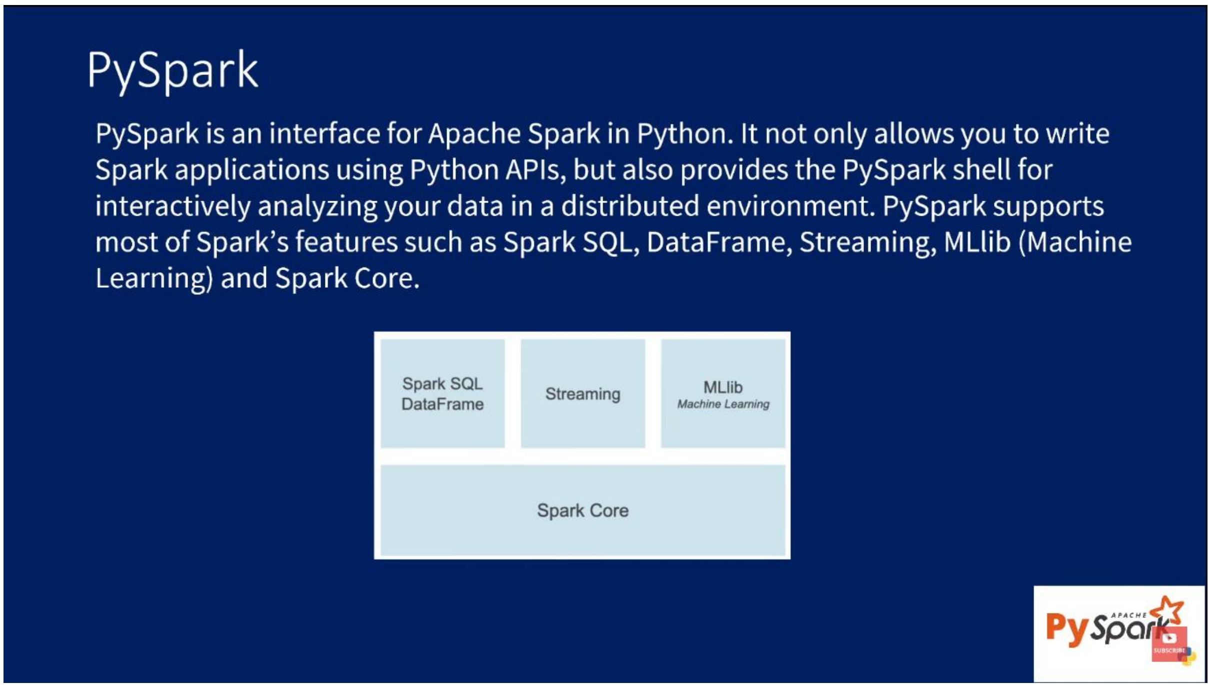
1. What is PySpark?

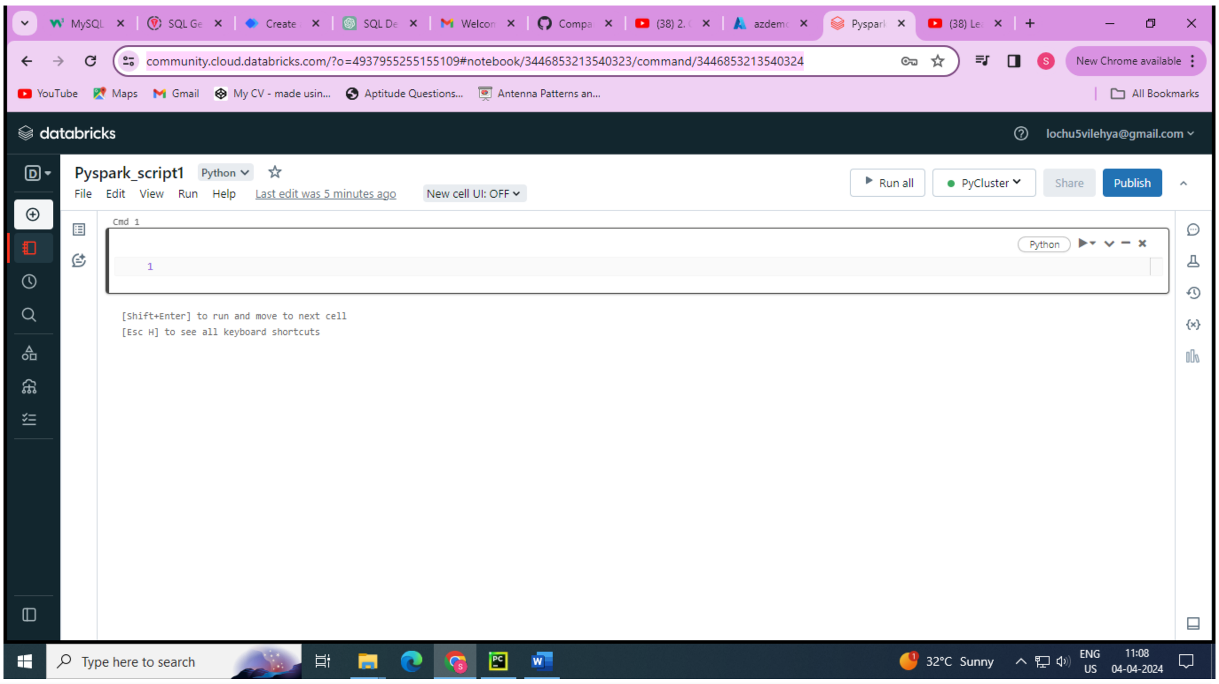

PySpark

PySpark is an interface for Apache Spark in Python. It not only allows you to write Spark applications using Python APIs, but also provides the PySpark shell for interactively analyzing your data in a distributed environment. PySpark supports most of Spark's features such as Spark SQL, DataFrame, Streaming, MLlib (Machine Learning) and Spark Core.

Spark SQL DataFrame
Streaming
MLlib Machine Learning
Spark Core

2. Create Dataframe manually with hard coded values in PySpark

- Use the databricks community edition for free cost using the link [databricks community edition]
- Create a cluster using the option create compute in COMPUTE column
- Now using the +Create option create a notebook under this cluster



```
[Shift+Enter] to run and move to next cell
[Esc H] to see all keyboard shortcuts
```

```
type(spark)
Out[1]: pyspark.sql.session.SparkSession
Command took 2.76 seconds -- by lochu5vilehya@gmail.com at 4/4/2024,
11:12:07 AM on PyCluster
```

```
dir(spark)
Out[2]: ['Builder', '__annotations__', '__class__', '__delattr__', '
__dict__', '__dir__', '__doc__', '__enter__', '__eq__', '__exit__',
'__format__', '__ge__', '__getattribute__', '__gt__', '__hash__', '_
_init__', '__init_subclass__', '__le__', '__lt__', '__module__', '__
ne__', '__new__', '__reduce__', '__reduce_ex__', '__repr__', '__seta
ttr__', '__sizeof__', '__str__', '__subclasshook__', '__weakref__',
'_activeSession', '_convert_from_pandas', '_createFromLocal', '_crea
teFromLocalTrusted', '_createFromRDD', '_create_dataframe', '_create
_from_pandas_with_arrow', '_create_rdd_from_local_trusted', '_create
_shell_session', '_getActiveSessionOrCreate', '_get_numpy_record_dty
pe', '_inferSchema', '_inferSchemaFromList', '_instantiatedSession',
'_jconf', '_jsc', '_jsparkSession', '_jvm', '_repr_html_', '_sc', '_
wrap_data_schema', '_write_to_trusted_path', 'builder', 'catalog', '
conf', 'createDataFrame', 'getActiveSession', 'newSession', 'range',
'read', 'readStream', 'sparkContext', 'sql', 'stop', 'streams', 'tab
le', 'udf', 'version']
Command took 0.07 seconds -- by lochu5vilehya@gmail.com at 4/4/2024,
11:13:05 AM on PyCluster
```

```
help(spark.createDataFrame)
```

➔ To know about the function “createDataFrame” in spark

```
d = [(1,'veena'),(2,'lochu')]

df = spark.createDataFrame(data = d)
df.show()
```

```
_1:long
_2:string

+---+-----+
| _1| _2  |
+---+-----+
| 1 |veena|
| 2 |lochu|
+---+-----+
Command took 11.65 seconds -- by lochu5vilehya@gmail.com at
4/4/2024, 11:22:48 AM on PyCluster
```

```
d = [(1,'veena'),(2,'lochu')]

df = spark.createDataFrame(data = d,schema=['id','name'])
df.show()
df.printSchema()
```

```
id:long
name:string

+---+-----+
| id| name|
+---+-----+
| 1 |veena|
| 2 |lochu|
+---+-----+
root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
Command took 1.03 seconds -- by lochu5vilehya@gmail.com at 4/4/2024,
11:26:03 AM on PyCluster
```

➔ To create a structure variable using pyspark

```
from pyspark.sql.types import *
schema =
StructType([StructField(name='id',dataType=IntegerType()),
StructField(name='name',dataType=StringType())])
type(schema)
```

```
Out[4]: pyspark.sql.types.StructType
```

➔ To set the data type of the column in table

```
from pyspark.sql.types import *
d = [(1,'veena'),(2,'lochu')]

schema =
StructType([StructField(name='id',dataType=IntegerType()),
StructField(name='name',dataType=StringType())])
df = spark.createDataFrame(data = d,schema=schema)
df.show()
df.printSchema()
```

```
id:integer
name:string

+---+-----+
| id| name|
+---+-----+
| 1 |veena|
| 2 |lochu|
+---+-----+
root
|-- id: integer (nullable = true)
|-- name: string (nullable = true)
```

```
schema = StructType([StructField(name='id',dataType=IntegerType()),
StructField(name='name',dataType=StringType())])
type(schema)
```

```
Out[4]: pyspark.sql.types.StructType
```

```
from pyspark.sql.types import *
d = [{'id':1,'name':'veena'},{'id':2,'name':'lochu'}]
df = spark.createDataFrame(data = d)
df.show()
df.printSchema()
```

df:pyspark.sql.dataframe.DataFrame = [id: long, name: string]

```
+---+-----+
| id| name|
+---+-----+
| 1 |veena|
| 2 |lochu|
+---+-----+
root |-- id: long (nullable = true)
|-- name: string (nullable = true)
```

3. Read CSV file in to Dataframe using PySpark

Salary.csv File:

```
id,name,salary
1,veena,76000
2,lochu,55000
3,jyosthna,29090
4,vara,null
```

```
df = spark.read.csv(path='dbfs:/FileStore/Salary_slip.csv')
df.display()
df.printSchema()
```

```
_c0   _c1       _c2

id    name      salary

1     veena     76000

2     lochu     55000
```

```
3     jyosthna  29090

4     vara      null

root

|-- _c0: string (nullable = true)

|-- _c1: string (nullable = true)

|-- _c2: string (nullable = true)
```

```
df =
spark.read.csv(path='dbfs:/FileStore/Salary_slip.csv',header=True)
df.display()
df.printSchema()
```

```
id    name  salary

1     veena 76000

2     lochu 55000

3     jyosthna   29090

4     vara  null

root

|-- id: string (nullable = true)

|-- name: string (nullable = true)

|-- salary: string (nullable = true)
```

```
df =
spark.read.format('csv').option(key='header',value=True).load(path='
dbfs:/FileStore/Salary_slip.csv')
display(df)
df.printSchema()
```

```
id    name  salary

1     veena 76000

2     lochu 55000
```

```
3     jyosthna   29090

4     vara  null
```

```
root |-- id: string (nullable = true) |-- name: string (nullable =
true) |-- salary: string (nullable = true)
```

➔ To read more than one csv file in the same folder

```
df = spark.read.csv(path='dbfs:/FileStore/',header=True)
df.display()
df.printSchema()
```

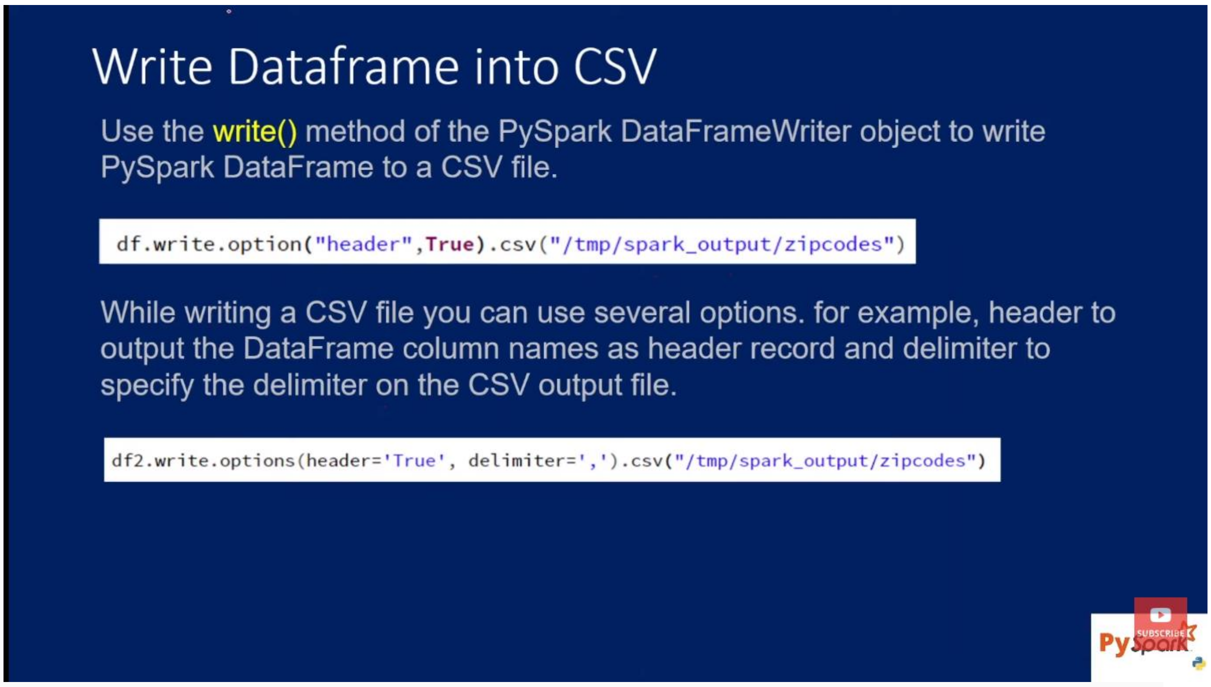
➔ To read to files from 2 different folders (filestrore,filestore1)

```
df = spark.read.csv(path=['dbfs:/FileStore/Salary_slip.csv',
'dbfs:/FileStore1/Salary_slip1.csv'])
df.display()
df.printSchema()
```

➔ Apply schema pf struct type to mention the datatypes of the fields for the loaded csv files

```
from pyspark.sql.types import *
struct = StructType().add(field = 'id',data_type=IntegerType())\
                     .add(field='name',data_type=StringType())\
                     .add(field='salary',data_type=IntegerType())
df=
spark.read.csv(path='dbfs:/FileStore/Salary_slip.csv',schema=stru
ct,header=True)
df.display()
df.printSchema()
```

4. Write DataFrame into CSV file using PySpark



Write Dataframe into CSV

Use the write() method of the PySpark DataFrameWriter object to write PySpark DataFrame to a CSV file.

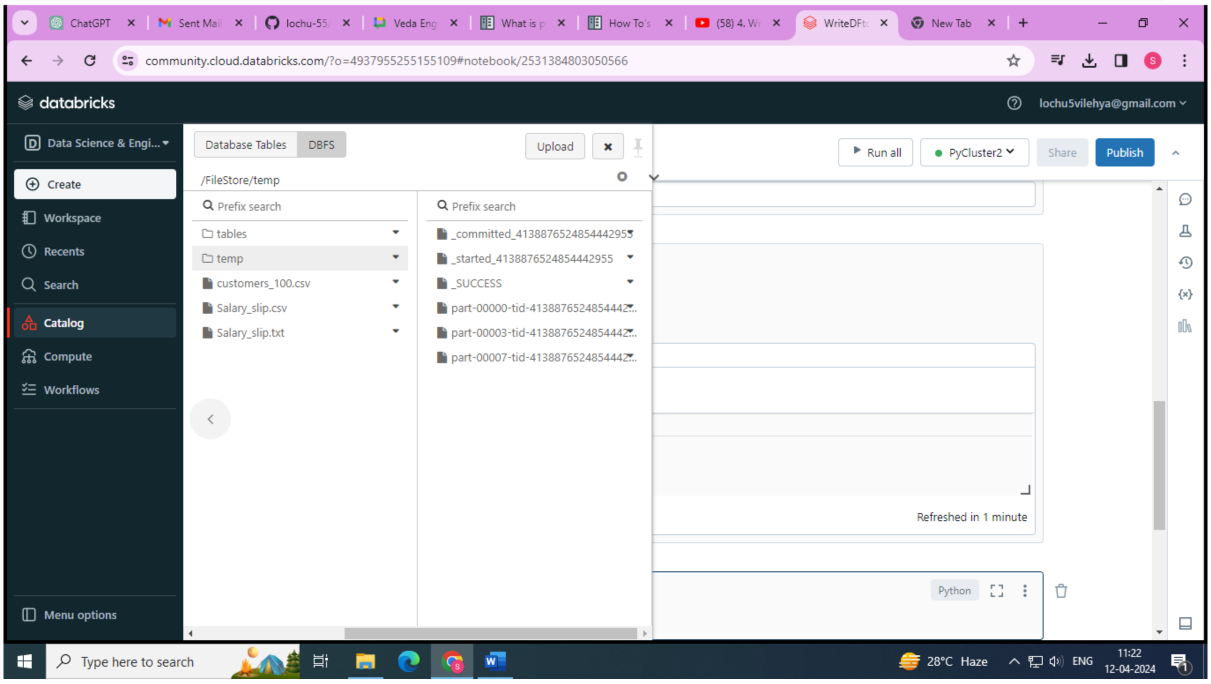
```
df.write.option("header",True).csv("/tmp/spark_output/zipcodes")
```

While writing a CSV file you can use several options. for example, header to output the DataFrame column names as header record and delimiter to specify the delimiter on the CSV output file.

```
df2.write.options(header='True', delimiter=',').csv("/tmp/spark_output/zipcodes")
```

```
d = [(1,'veena'),(2,'lochu')]
schema = ['id','name']
df = spark.createDataFrame(data = d,schema=schema)
df.display()
```

```
df.write.csv(path='dbfs:/FileStore/temp',header=True)
```



community.cloud.databricks.com/?o=4937955255155109#notebook/2531384803050566

/FileStore/temp

tables
temp
customers_100.csv
Salary_slip.csv
Salary_slip.txt

_committed_4138876524854442955
_started_4138876524854442955
_SUCCESS
part-00000-tid-41388765248544429...
part-00003-tid-41388765248544429...
part-00007-tid-41388765248544429...

Refreshed in 1 minute

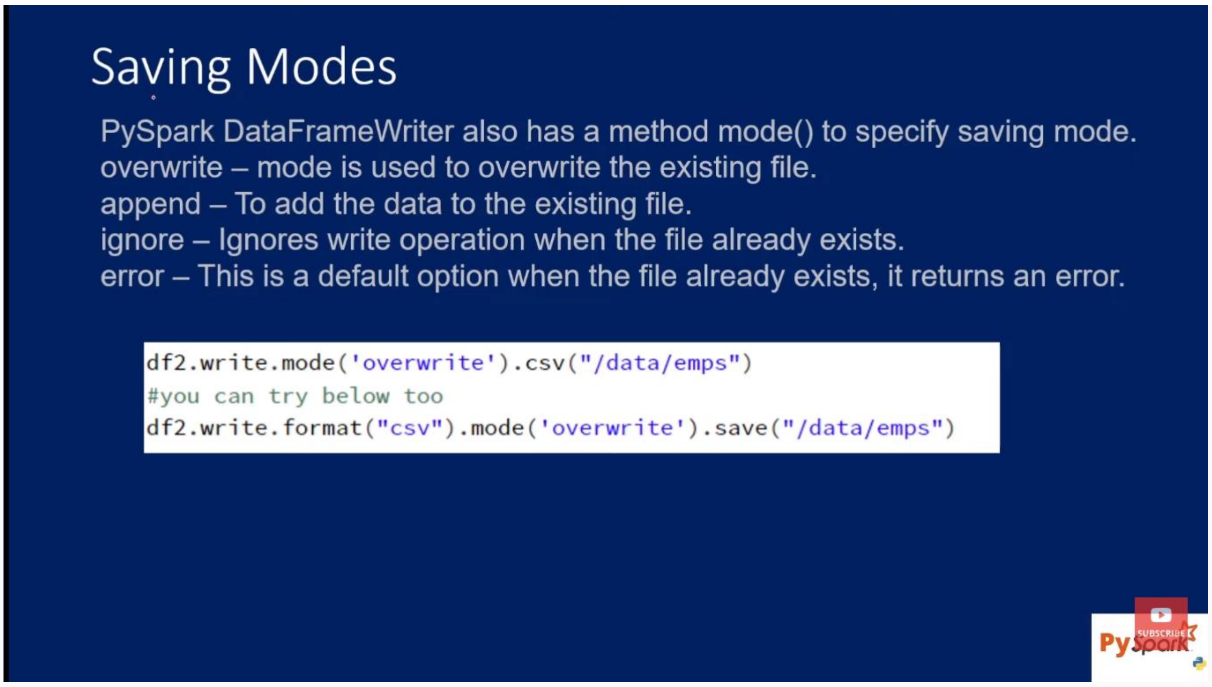
➔ The files are generated ad part files and extra logs files are also generated

```
df = spark.read.csv(path='dbfs:/FileStore/temp',header=True)
display(df)
```

```
id    name
1     veena
2     lochu
```

```
help(df.write.csv)
```

```
Help on method csv in module pyspark.sql.readwriter: csv(path: str, mode: Optional[str] = None, compression: Optional[str] = None, sep: Optional[str] = None, quote: Optional[str] = None, escape: Optional[str] = None, header: Union[bool, str, NoneType] = None, nullValue: Optional[str] = None, escapeQuotes: Union[bool, str, NoneType] = None, quoteAll: Union[bool, str, NoneType] = None, dateFormat: Optional[str] = None, timestampFormat: Optional[str] = None, ignoreLeadingWhiteSpace: Union[bool, str, NoneType] = None, ignoreTrailingWhiteSpace: Union[bool, str, NoneType] = None, charToEscapeQuoteEscaping: Optional[str] = None, encoding: Optional[str] = None, emptyValue: Optional[str] = None, lineSep: Optional[str] = None) -> None method of pyspark.sql.readwriter.DataFrameWriter instance

Saves the content of the :class:`DataFrame` in CSV format at the specified path.

.. versionadded:: 2.0.0

.. versionchanged:: 3.4.0

Support Spark Connect.

Parameters

----------

path : str the path in any Hadoop supported file system

mode : str, optional specifies the behavior of the save operation when data already exists.

* ``append``: Append contents of this :class:`DataFrame` to existing data.
* ``overwrite``: Overwrite existing data.

* ``ignore``: Silently ignore this operation if data already exists.

* ``error`` or ``errorifexists`` (default case): Throw an exception
if data already \ exists.

Other Parameters

----------------

Extra options For the extra options, refer to `Data Source Option
<https://spark.apache.org/docs/latest/sql-data-sources-
csv.html#data-source-option>`_ for the version you use. .. # noqa
Examples -------- Write a DataFrame into a CSV file and read it
back.

>>> import tempfile

>>> with tempfile.TemporaryDirectory() as d:

... # Write a DataFrame into a CSV file

... df = spark.createDataFrame([{"age": 100, "name": "Hyukjin
Kwon"}])

... df.write.csv(d, mode="overwrite")

... ... # Read the CSV file as a DataFrame with 'nullValue' option
set to 'Hyukjin Kwon'.

... spark.read.schema(df.schema).format("csv").option(

... "nullValue", "Hyukjin Kwon").load(d).show()


+---+----+

|age|name|

+---+----+

|100|null|

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


Saving Modes

PySpark DataFrameWriter also has a method mode() to specify saving mode.
overwrite – mode is used to overwrite the existing file.
append – To add the data to the existing file.
ignore – Ignores write operation when the file already exists.
error – This is a default option when the file already exists, it returns an error.

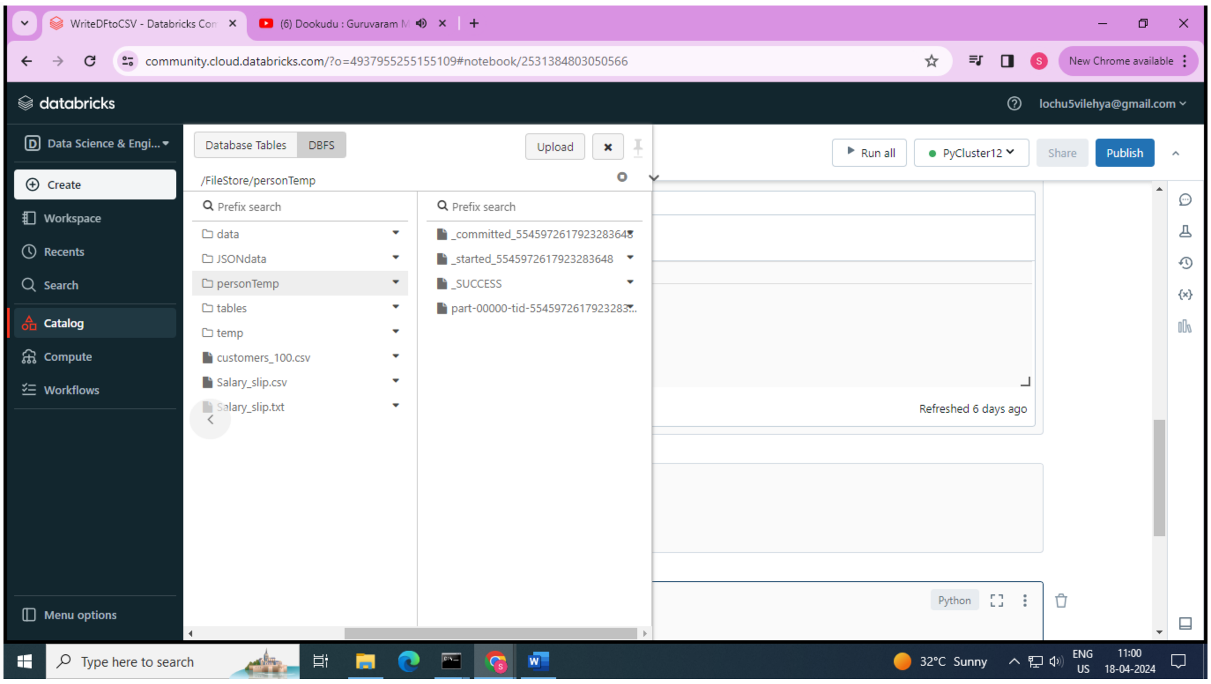
```
df2.write.mode('overwrite').csv("/data/emps")
#you can try below too
df2.write.format("csv").mode('overwrite').save("/data/emps")
```

```
df.write.csv(path='dbfs:/FileStore/temp',header=True,mode='append')
df = spark.read.csv(path='dbfs:/FileStore/temp',header=True)
display(df)
```

id	name
1	veena
2	lochu
1	veena
2	lochu

➔ To save all part files as single .csv file

```
df.coalesce(1).write.csv('FileStore/personTemp',header=True) #it creates one part file
```

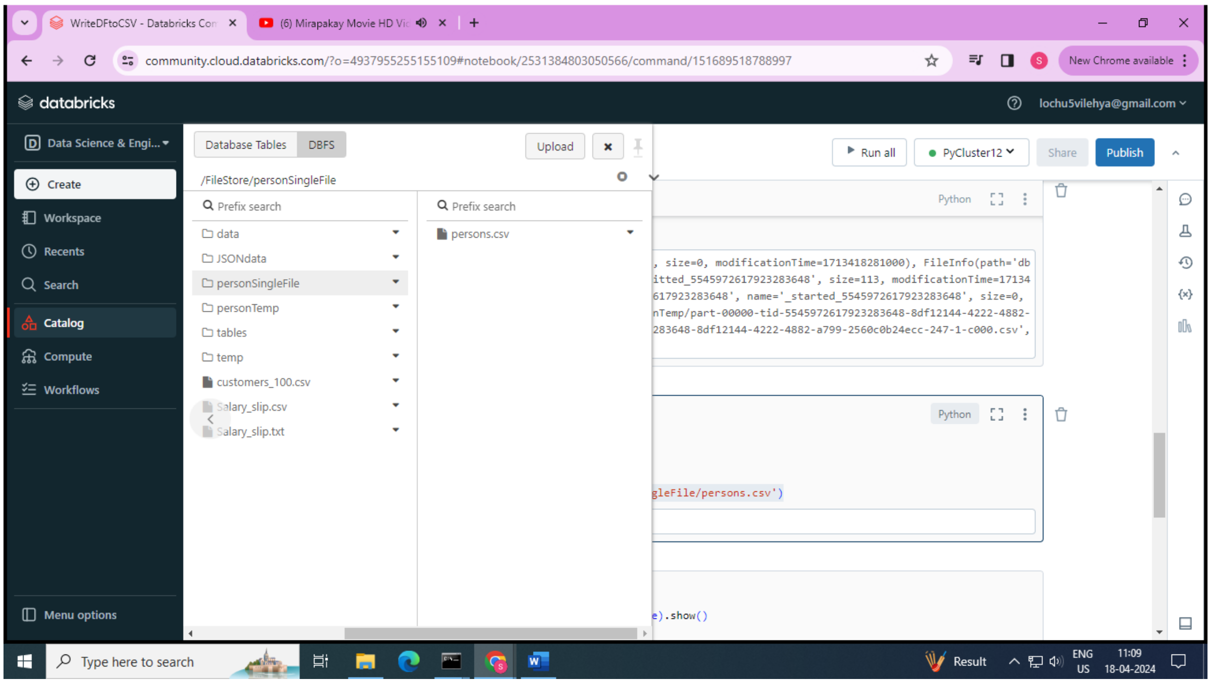


/FileStore/personTemp

data	_committed_5545972617923283648
JSONdata	_started_5545972617923283648
personTemp	_SUCCESS
tables	part-00000-tid-5545972617923283...
temp	
customers_100.csv	
Salary_slip.csv	
Salary_slip.txt	

```
fn = dbutils.fs.ls('FileStore/personTemp')
print(fn)
[FileInfo(path='dbfs:/FileStore/personTemp/_SUCCESS',
name='_SUCCESS', size=0, modificationTime=1713418281000),
FileInfo(path='dbfs:/FileStore/personTemp/_committed_554597261792328
3648', name='_committed_5545972617923283648', size=113,
modificationTime=1713418280000),
FileInfo(path='dbfs:/FileStore/personTemp/_started_55459726179232836
48', name='_started_5545972617923283648', size=0,
modificationTime=1713418279000),
FileInfo(path='dbfs:/FileStore/personTemp/part-00000-tid-
5545972617923283648-8df12144-4222-4882-a799-2560c0b24ecc-247-1-
c000.csv', name='part-00000-tid-5545972617923283648-8df12144-4222-
4882-a799-2560c0b24ecc-247-1-c000.csv', size=24,
modificationTime=1713418280000)]
```

```
for filename in fn:
    if filename.name.endswith('.csv'):
        name = filename.name
dbutils.fs.cp('/FileStore/personTemp/' + name,
'FileStore/personSingleFile/persons.csv')
```



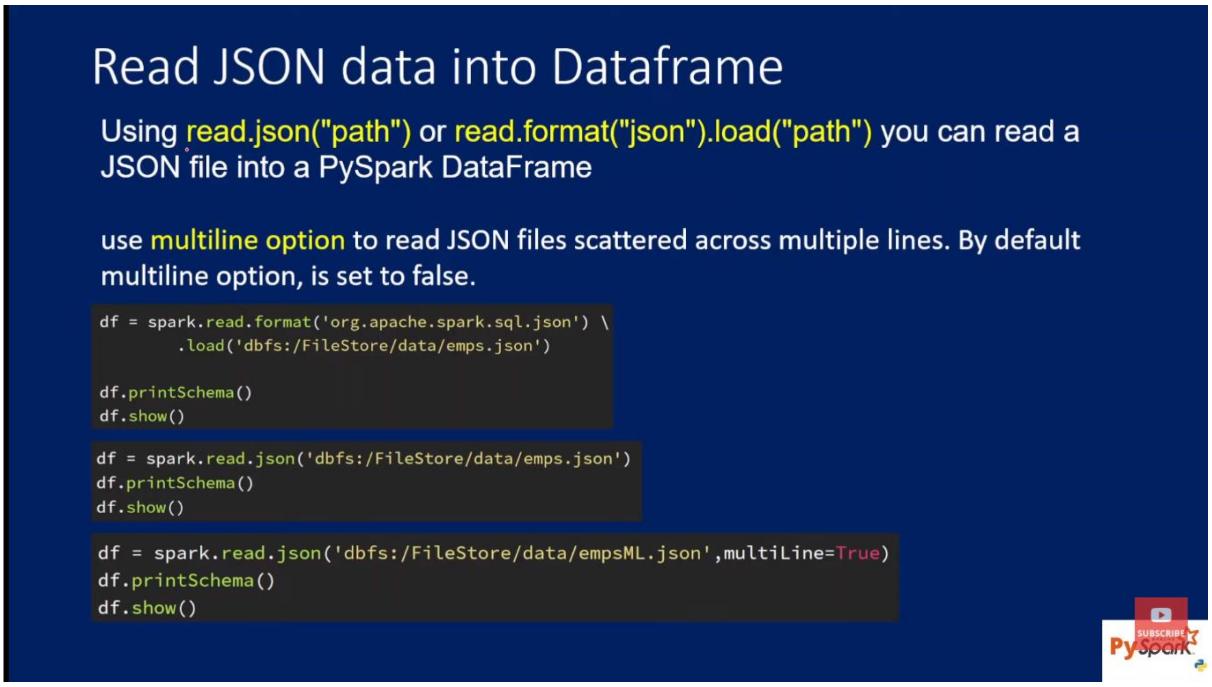
```
, size=0, modificationTime=1713418281000), FileInfo(path='db
itted_5545972617923283648', size=113, modificationTime=17134
617923283648', name='_started_5545972617923283648', size=0,
nTemp/part-00000-tid-5545972617923283648-8df12144-4222-4882-
283648-8df12144-4222-4882-a799-2560c0b24ecc-247-1-c000.csv',
```

```
gleFile/persons.csv')
```

```
e).show()
```

```
spark.read.csv('/FileStore/personSingleFile/persons.csv',header=True
).show()
+---+-----+

| id| name|

+---+-----+

|  1|veena|
|  2|lochu|

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

5. Read json file into DataFrame using Pyspark



Read JSON data into Dataframe

Using read.json("path") or read.format("json").load("path") you can read a JSON file into a PySpark DataFrame

use multiline option to read JSON files scattered across multiple lines. By default multiline option, is set to false.

```
df = spark.read.format('org.apache.spark.sql.json') \
        .load('dbfs:/FileStore/data/emps.json')

df.printSchema()
df.show()
```

```
df = spark.read.json('dbfs:/FileStore/data/emps.json')
df.printSchema()
df.show()
```

```
df = spark.read.json('dbfs:/FileStore/data/empsML.json',multiLine=True)
df.printSchema()
df.show()
```

```
→Reading a single line json
Emp.json:

{'id':1,'name':'veena','salary':2300}
{'id':2,'name':'lochu','salary':4300}
{'id':3,'name':'vara','salary':6300}

df = spark.read.json(path='dbfs:/FileStore/tables/emp.json')
display(df)
df.printSchema()
```

```
id    name  salary

1     veena 2300

2     lochu 4300

3     vara  6300

root

|-- id: long (nullable = true)

|-- name: string (nullable = true)

|-- salary: long (nullable = true)
```

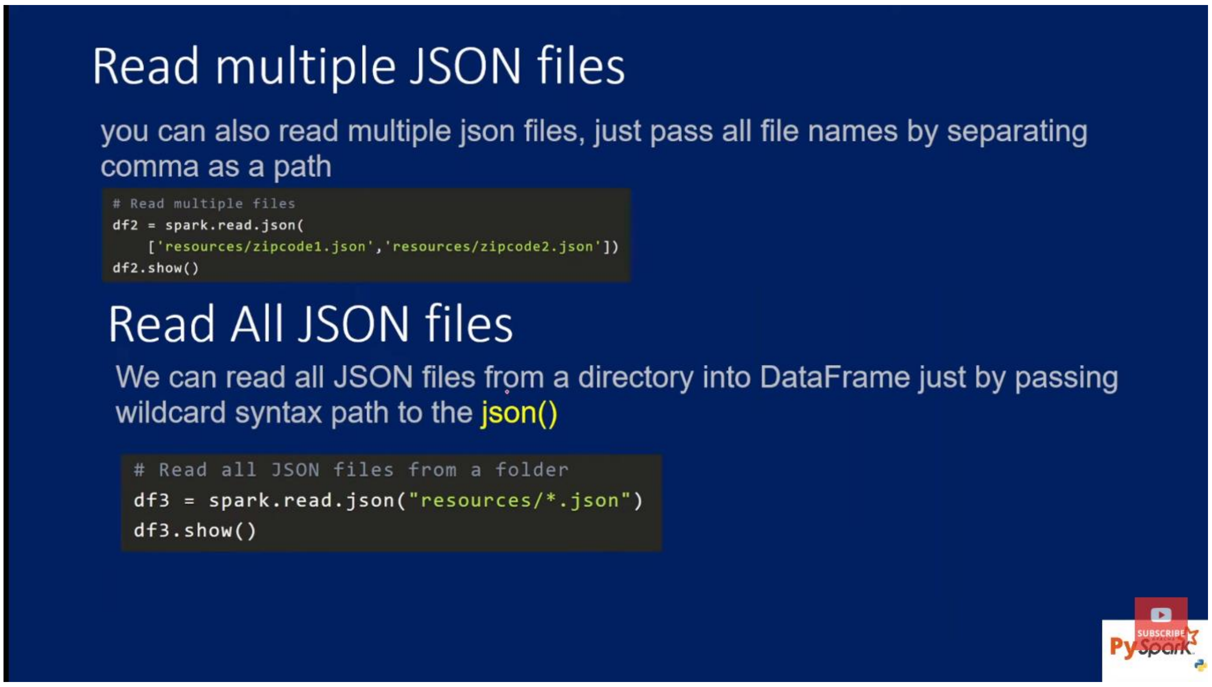
→ Reading a multiline json

empML.json:

```
[
      {
            'id':1,
            'name':'veena',
            'salary':2300
      },
      {
            'id':2,
            'name':'lochu',
            'salary':4300
      },
      {
            'id':3,
            'name':'vara',
            'salary':6300
      }
]
```

```
df =
spark.read.json(path='dbfs:/FileStore/tables/empML.json',multiLine=True)
display(df)
df.printSchema()
```

```
id    name   salary
1     veena  2300
2     lochu  4300
3     vara   6300
root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
|-- salary: long (nullable = true)
```



Read multiple JSON files

you can also read multiple json files, just pass all file names by separating comma as a path

```
# Read multiple files
df2 = spark.read.json(
    ['resources/zipcode1.json','resources/zipcode2.json'])
df2.show()
```

Read All JSON files

We can read all JSON files from a directory into DataFrame just by passing wildcard syntax path to the json()

```
# Read all JSON files from a folder
df3 = spark.read.json("resources/*.json")
df3.show()
```

```
from pyspark.sql.types import *

struct = StructType().add(field = 'id',data_type=IntegerType())\
                     .add(field='name',data_type=StringType())\
                     .add(field='salary',data_type=IntegerType())

df = spark.read.json(path='dbfs:/FileStore/tables/emp.json',schema=
struct)

display(df)
df.printSchema()
```

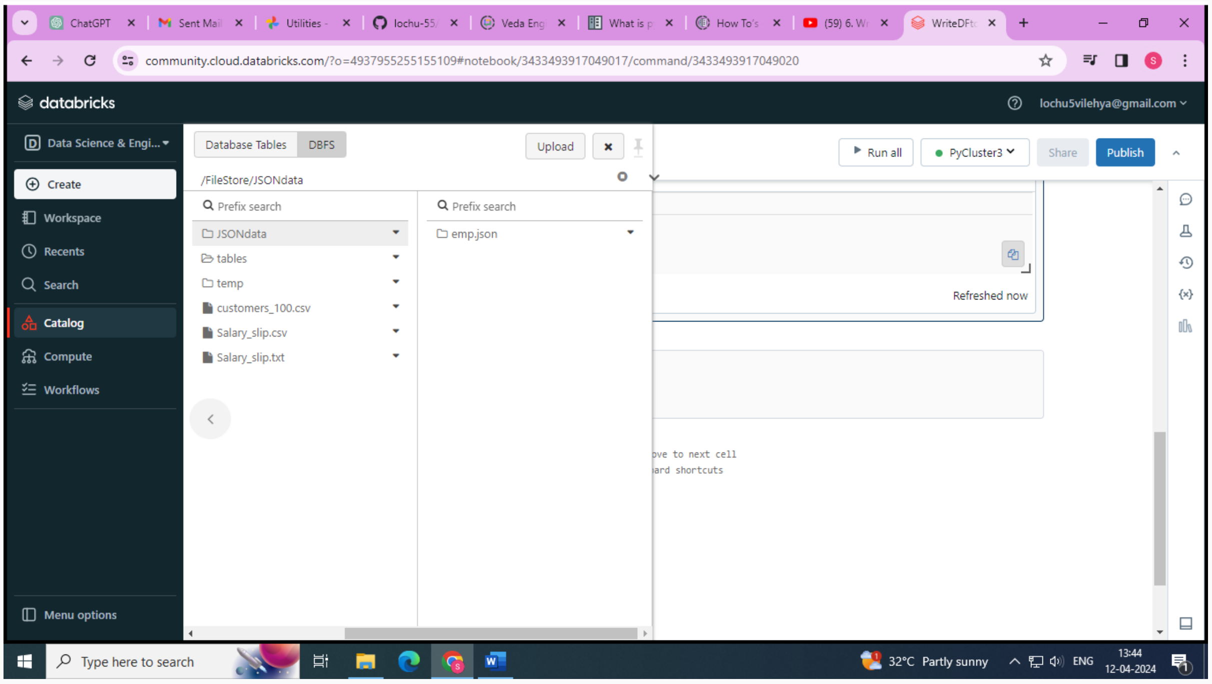
```
id    name  salary

1     veena 2300

2     lochu 4300

3     vara  6300

root

|-- id: integer (nullable = true)

|-- name: string (nullable = true)

|-- salary: integer (nullable = true)
```

6. Write DataFrame into json file using PySpark

```
d = [(1,'veena'),(2,'lochu')]
schema = ['id','name']
df = spark.createDataFrame(data = d,schema=schema)
df.display()
```

```
id    name

1     veena

2     lochu
```

```
df.write.json(path='dbfs:/FileStore/JSONdata/emp.json')
```



```
data = spark.read.json(path='dbfs:/FileStore/JSONdata/emp.json')
display(data)
```

```
id    name
```

```
1     veena

2     lochu
```

7. show() in Pyspark to display Dataframe contents in Table

```
d=[(1,'jhvfuguydjhfvsdhvfdherewewfrfgfvjh'),(2,'bdhjbjfbjhbfjrhfgjer
gewdewdwed'),(3,'kwjdjnefnekjbefgrfguyfguyrfgufgruyfgerufg')]
schema = ['id','name']

df = spark.createDataFrame(data = d,schema = schema)
df.show()
```

```
+---+--------------------+
| id|                name|
+---+--------------------+
| 1 |jhvfuguydjhfvsdhv...|
| 2 |bdhjbjfbjhbfjrhfg...|
| 3 |kwjdjnefnekjbefgr...|
+---+--------------------+
```

```
df.show(truncate=False)
```

```
+---+-----------------------------------------+
|id |                                     name |
+---+-----------------------------------------+
|1  |jhvfuguydjhfvsdhvfdherewewfrfgfvjh       |
|2  |bdhjbjfbjhbfjrhfgjergewdewdwed           |
|3  |kwjdjnefnekjbefgrfguyfguyrfgufgruyfgerufg|
+---+-----------------------------------------+
```

```
df.show(truncate = 8)
```

```
+---+--------+
| id|    name|
+---+--------+
| 1 |jhvfu...|
| 2 |bdhjb...|
| 3 |kwjdj...|
+---+--------+
```

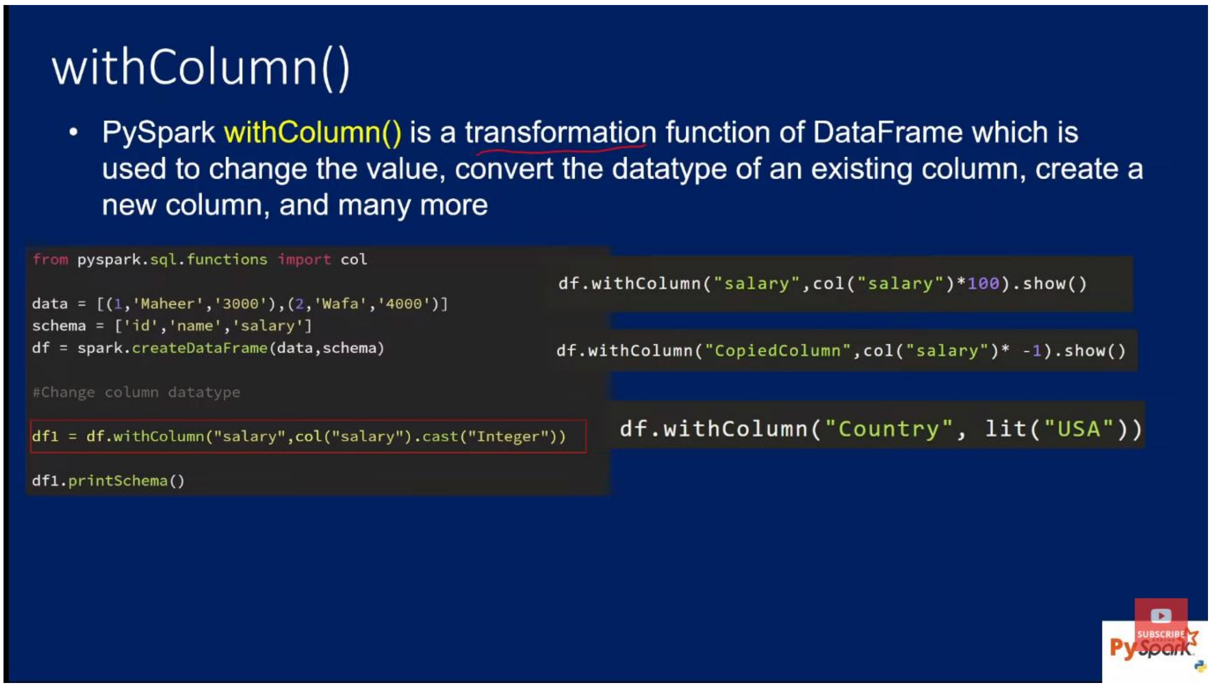
```
df.show(n=2,truncate = False)
```

```
+---+----------------------------------+
|id |                              name |
+---+----------------------------------+
|1  |jhvfuguydjhfvsdhvfdherewewfrfgfvjh|
|2  |   bdhjbjfbjhbfjrhfgjergewdewdwed |
+---+----------------------------------+
only showing top 2 rows
```

```
df.show(truncate = False,vertical=True)
```

```
-RECORD 0------------------------------------------
id | 1 name | jhvfuguydjhfvsdhvfdherewewfrfgfvjh
-RECORD 1------------------------------------------
id | 2 name | bdhjbjfbjhbfjrhfgjergewdewdwed
-RECORD 2------------------------------------------
id | 3 name | kwjdjnefnekjbefgrfguyfguyrfgufgruyfgerufg
```

8. withColumn() in PySpark | Add new column or Change existing column data or type in DataFrame



withColumn()

- PySpark withColumn() is a transformation function of DataFrame which is used to change the value, convert the datatype of an existing column, create a new column, and many more

```
from pyspark.sql.functions import col

data = [(1,'Maheer','3000'),(2,'Wafa','4000')]
schema = ['id','name','salary']
df = spark.createDataFrame(data,schema)

#Change column datatype

df1 = df.withColumn("salary",col("salary").cast("Integer"))

df1.printSchema()
```

```
df.withColumn("salary",col("salary")*100).show()
```

```
df.withColumn("CopiedColumn",col("salary")* -1).show()
```

```
df.withColumn("Country", lit("USA"))
```

```
from pyspark.sql.functions import col
d = [(1,'veena',353455),(2,'lochu',234234)]
schema = ['id','name','salary']
df = spark.createDataFrame(data = d,schema=schema)
df1 =
df.withColumn(colName='salary',col=col('salary').cast('Integer'))
df1.printSchema()
df1.show()

df2 = df1.withColumn('salary',col('salary')+5)
df2.show()
df3 = df2.withColumn('country',lit('india'))
df3.show()
df4 = df3.withColumn('copiedSalary',col('salary'))
df4.show()
```

```
root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
|-- salary: integer (nullable = true)
+---+----+------+
| id| name|salary|
+---+----+------+
| 1|veena |353455|
| 2|lochu |234234|
+---+----+------+

+---+----+------+
| id| name|salary|
+---+----+------+
| 1|veena |353460|
| 2|lochu |234239|
+---+----+------+

+---+----+-----+-------+
| id| name|salary|country|
+---+----+-----+-------+
| 1|veena|353460 | india |
| 2|lochu|234239 | india |
+---+----+-----+-------+

+---+-----+-----+-------+-----------+
| id| name|salary|country|copiedSalary|
+---+----+-----+-------+-----------+
| 1 |veena|353460| india |      353460|
| 2 |lochu|234239| india |      234239|
+---+-----+------+-------+------------+
```

9. withColumnRenamed() usage in PySpark

```python
df5 = df4.withColumnRenamed('salary','salary_amt')
df5.show()
```

```
+---+-----+----------+-------+------------+
| id| name|salary_amt|country|copiedSalary|
+---+-----+----------+-------+------------+
| 1 |veena|    353460| india |      353460|
| 2 |lochu|    234239| india |      234239|
+---+-----+----------+-------+------------+
```

10. StructType() & StructField() in PySpark

```python
from pyspark.sql.functions import col
from pyspark.sql.types import *

d =
[(1,('veena','tammina'),353455),(2,('lochu','surisetti'),234234)]
structName = StructType([\
    StructField('firstName',StringType()),\
    StructField('lastName',StringType())])

schema = StructType([\
    StructField('id',IntegerType()),\
        StructField('name',structName),\
            StructField('salary',IntegerType())])
df = spark.createDataFrame(d ,schema)
```

```
df.display()
df.printSchema()
```

```
id    name                                               salary
1     {"firstName":"veena","lastName":"tammina"}          353455
2     {"firstName":"lochu","lastName":"surisetti"}       234234
```

```
root
|-- id: integer (nullable = true)
|-- name: struct (nullable = true)
| |-- firstName: string (nullable = true)
| |-- lastName: string (nullable = true)
|-- salary: integer (nullable = true)
```

11. ArrayType Columns in PySpark

```
from pyspark.sql.types import *

d = [('veena',[35,34,55]),('lochu',[23,42,34])]
structName = StructType([\
    StructField('firstName',StringType()),\
    StructField('Numbers',ArrayType(IntegerType()))])

df = spark.createDataFrame(data=d ,schema=structName)
df.display()
df.printSchema()
df.withColumn('firstNumber',df.Numbers[0]).show()
```

```
firstName  Numbers
veena [35,34,55]
lochu [23,42,34]
```

```
root
|-- firstName: string (nullable = true)
|-- Numbers: array (nullable = true)
| |-- element: integer (containsNull = true)
+---------+-----------+-----------+
|firstName| Numbers    |firstNumber|
+---------+-----------+-----------+
| veena   |[35, 34, 55]|         35|
| lochu   |[23, 42, 34]|         23|
+---------+-----------+-----------+
```

12. explode(), split(), array() & array_contains() functions in PySpark

➔ explode() function used to create a new row for each element in the given array column

```
d= [(1,'maheer',['dotnet','azure']),(2,'lochu',['python','java'])]
schema = ['id','name','skills']

df=spark.createDataFrame(d,schema)
df.display()
df.printSchema()
```

```
id    name        skills
1     maheer     ["dotnet","azure"]
2     lochu       ["python","java"]
```

```
root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
|-- skills: array (nullable = true)
```

```
| |-- element: string (containsNull = true)
```

```
from pyspark.sql.functions import col,explode
df.show()
df1 = df.withColumn('skill',explode(col('skills')))
df1.show()
```

```
+---+------+---------------+
| id|  name|         skills|
+---+------+---------------+
| 1|maheer |[dotnet, azure]|
| 2| lochu | [python, java]|
+---+------+---------------+
```

```
+---+------+---------------+------+
| id|  name|         skills| skill|
+---+------+---------------+------+
| 1| maheer|[dotnet, azure]|dotnet|
| 1| maheer|[dotnet, azure]| azure|
| 2|  lochu| [python, java]|python|
| 2|  lochu| [python, java]|  java|
+---+------+---------------+------+
```

➔ split() function returns an array type after splitting the string column by delimiter

```
d= [(1,'maheer','dotnet,azure'),(2,'lochu','python,java')]
schema = ['id','name','skills']
```

```
df=spark.createDataFrame(d,schema)
df.display()
df.printSchema()
```

```
id    name        skills

1     maheer     dotnet,azure

2     lochu      python,java

root

|-- id: long (nullable = true)

|-- name: string (nullable = true)

|-- skills: string (nullable = true)
```

```
from pyspark.sql.functions import col,split
df.show()
df1 = df.withColumn('skillarray',split('skills',','))
df1.show()
```

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

| id|  name|      skills|

+---+------+------------+

|  1|maheer|dotnet,azure|

|  2| lochu| python,java|

+---+------+------------+




+---+------+------------+---------------+

| id|  name|      skills|     skillarray|

+---+------+------------+---------------+

|  1|maheer|dotnet,azure|[dotnet, azure]|

|  2| lochu| python,java| [python, java]|

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

➔ array() function is used to create a new array column by merging the data from multiple columns

```
d= [(1,'maheer','dotnet','azure'),(2,'lochu','python','java')]
schema = ['id','name','primaryskill','secondaryskill']

df=spark.createDataFrame(d,schema)
df.display()
df.printSchema()
```

```
id    name    primaryskill   secondaryskill

1     maheer      dotnet      azure

2     lochu      python      java
```

```
root

|-- id: long (nullable = true)

|-- name: string (nullable = true)

|-- primaryskill: string (nullable = true)

|-- secondaryskill: string (nullable = true)
```

```
from pyspark.sql.functions import col,array
df.show()
df1 = df.withColumn('skills',array('primaryskill','secondaryskill'))
df1.show()
```

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

| id|  name|primaryskill|secondaryskill|

+---+------+------------+--------------+

|  1|maheer|      dotnet|         azure|

|  2| lochu|      python|          java|

+---+------+------------+--------------+
+---+------+------------+--------------+---------------+
| id|  name|primaryskill|secondaryskill|         skills|
+---+------+------------+--------------+---------------+
|  1| maheer|      dotnet|         azure|[dotnet, azure]|
|  2|  lochu|      python|          java| [python, java]|
+---+------+------------+--------------+---------------+
```

➔ **array_contains()** sql function is used to check of array column contains a value.Returns null if the array is null,true if the array contains the value and false otherwise

```
d= [(1,'maheer',['dotnet','azure']),(2,'lochu',['python','java'])]
schema = ['id','name','primaryskill']

df=spark.createDataFrame(d,schema)
df.display()
df.printSchema()
```

```
id     name        primaryskill
1      maheer     ["dotnet","azure"]
2      lochu      ["python","java"]
root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
|-- primaryskill: array (nullable = true)
| |-- element: string (containsNull = true)
```

```
from pyspark.sql.functions import col,array_contains
df.show()
df =
df.withColumn('skilltest',array_contains('primaryskill','azure'))
df.show()
```

```
+---+------+---------------+
| id| name|    primaryskill|
+---+------+---------------+
|  1|maheer| [dotnet, azure]|
|  2| lochu|  [python, java]|
+---+------+---------------+
```

```
+---+------+---------------+---------+
| id|  name| primaryskill|  skilltest|
+---+------+---------------+---------+
|  1| maheer|[dotnet, azure]|     true|
|  2|  lochu| [python, java]|    false|
+---+------+---------------+---------+
```

13. MapType Column in PySpark

➔ PySpark MapType is used to represent map-key value pair similar to python dictionary(dict)

```
from pyspark.sql.types import *

data =
[('lochu',{'hair':'black','eye':'brown'}),('veena',{'hair':'brown','
eye':'blue'})]
schema = StructType([\
        StructField('name',StringType()),\
        StructField('properties',MapType(StringType(),StringType()))
])
df = spark.createDataFrame(data,schema)
df.show(truncate = False)
df.printSchema()
```

```
+-----+---------------------------+
|name |                     properties |
+-----+-----------------------------+
|lochu|{eye -> brown, hair -> black}|
|veena|{eye -> blue, hair -> brown} |
+-----+-----------------------------+

root
|-- name: string (nullable = true)
|-- properties: map (nullable = true)
| |-- key: string
| |-- value: string (valueContainsNull = true)
```

```
df1 = df.withColumn('hair',df.properties['hair'])
df1.show(truncate=False)
```

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

|name |                     properties |hair |

+-----+-----------------------------+-----+

|lochu|{eye -> brown, hair -> black}|black|

|veena|{eye -> blue, hair -> brown} |brown|

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

```
df2 = df1.withColumn('eye',df.properties.getItem('eye'))
df2.show(truncate=False)
```

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

|name |properties                   |hair | eye |

+-----+-----------------------------+-----+-----+

|lochu|{eye -> brown, hair -> black}|black|brown|

|veena|{eye -> blue, hair -> brown} |brown|blue |

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

14. map_keys(), map_values() & explode() functions to work with MapType Columns in PySpark

➔ explode()

```
from pyspark.sql.types import *
from pyspark.sql.functions import explode

data =
[('lochu',{'hair':'black','eye':'brown'}),('veena',{'hair':'brown','
eye':'blue'})]
schema = StructType([\
        StructField('name',StringType()),\
        StructField('properties',MapType(StringType(),StringType()))
])
df = spark.createDataFrame(data,schema)

df.select('name','properties',explode(df.properties)).show(truncate=
False)
```

```
+-----+------------------------------+----+-----+
|name |                    properties|key |value|
+-----+------------------------------+----+-----+
|lochu|{eye -> brown, hair -> black}|eye |brown|
|lochu|{eye -> brown, hair -> black}|hair|black|
|veena|{eye -> blue, hair -> brown} |eye |blue |
|veena|{eye -> blue, hair -> brown} |hair|brown|
+-----+------------------------------+----+-----+
```

→map_keys(),map_values()

```
from pyspark.sql.functions import map_keys,map_values
df1 = df.withColumn('keys',map_keys(df.properties))
df2 = df1.withColumn('values',map_values(df.properties))
df2.show(truncate=False)
```

```
+-----+-----------------------------+----------+-------------+
|name |                   properties |      keys |       values |
+-----+-----------------------------+----------+-------------+
|lochu|{eye -> brown, hair -> black}|[eye, hair]|[brown, black]|
|veena|{eye -> blue, hair -> brown} |[eye, hair]|[blue, brown] |
+-----+-----------------------------+----------+-------------+
```

15. Row() class in PySpark

➔ Pyspark.sql.Row which is represented as a record/row in DataFrame, one can create a Row object by using named argumnets or create a custom row like class

```
from pyspark.sql import Row

row = Row(name='lochu',salary=20000)
print(row[0] + ' ' + str(row[1]))
```

```
lochu 20000
```

```
from pyspark.sql import Row

row = Row(name='lochu',salary=20000)
print(row.name + ' ' + str(row.salary))
```

```
lochu 20000
```

```
from pyspark.sql import Row

row1 = Row(name='lochu',salary=20000)
row2 = Row(name='veena',salary=80000)
data = [row1,row2]
```

```
df = spark.createDataFrame(data)
df.show()
df.printSchema()
```

```
+-----+------+
| name|salary|
+-----+------+
|lochu| 20000|
|veena| 80000|
+-----+------+
root
|-- name: string (nullable = true)
|-- salary: long (nullable = true)
```

```
Person = Row('name','age')
person1 = Person('lochu',22)
person2 = Person('veena',21)
print(person1.name,person1.age)
```

```
lochu 22
```

```
Person = Row('name','age')
person1 = Person('lochu',22)
person2 = Person('veena',21)
df = spark.createDataFrame([person1,person2])
df.show()
```

```
+-----+---+
| name|age|
+-----+---+
|lochu| 22|
|veena| 21|
+-----+---+
data =
[Row(name='lochu',prop=Row(age=20,gender='female')),Row(name='chandu
',prop=Row(age=22,gender='male'))]
df = spark.createDataFrame(data)
df.show()
df.printSchema()
```

```
+------+------------+
| name|        prop|
+------+------------+
| lochu|{20, female}|
|chandu|  {22, male}|
+------+------------+
root
|-- name: string (nullable = true)
|-- prop: struct (nullable = true)
| |-- age: long (nullable = true)
| |-- gender: string (nullable = true)
```

16. Column class in PySpark

- ➔ Pyspark column class represents a single column in a dataframe
- ➔ Pyspark.sql.column class provides several functions to work with dataframe to manipulate the column values, evaluate the Boolean expression to filter rows, retrieve a value or part of a value from a dataframe column
- ➔ One of the simplest ways to create a column class object is using Pyspark lit() SQL function

```
from pyspark.sql.functions import lit
col1 = lit('abcd')
print(type(col1))
```

```
<class 'pyspark.sql.column.Column'>
```

```
from pyspark.sql.functions import lit
data = [('lochu','female',22),('veena','female',21)]
schema = ['name','gender','age']
df = spark.createDataFrame(data,schema)
df1 = df.withColumn('newcol',lit('newColVal'))
df1.show()
df1.printSchema()
```

```
+-----+------+---+---------+
| name|gender|age|   newcol|
+-----+------+---+---------+
|lochu|female| 22|newColVal|
|veena|female| 21|newColVal|
+-----+------+---+---------+
root
|-- name: string (nullable = true)
|-- gender: string (nullable = true)
|-- age: long (nullable = true)
|-- newcol: string (nullable = false)
```

```
df1.select(df1.name).show()
```

(or)

```
df1.select(df1['name']).show()
```

(or)

```
from pyspark.sql.functions import col
df1.select(col('name')).show()
```

```
+-----+
| name|
+-----+
|lochu|
|veena|
+-----+
```

```
from pyspark.sql.functions import lit
from pyspark.sql.types import *

data =
[('lochu','female',22,('black','brown')),('veena','female',21,('blac
k','brown'))]
propstype = StructType([\
    StructField('hair',StringType()),\
    StructField('eye',StringType())])

schema = StructType([
    StructField('name',StringType()),\
    StructField('gender',StringType()),\
    StructField('age',IntegerType()),\
    StructField('props',propstype)])
df = spark.createDataFrame(data,schema)

df.show()
df.printSchema()
```

```
+-----+------+---+--------------+
| name|gender|age|  props|
+-----+------+---+--------------+
|lochu|female| 22|{black, brown}|
|veena|female| 21|{black, brown}|
+-----+------+---+--------------+
```

```
root
|-- name: string (nullable = true)
|-- gender: string (nullable = true)
|-- age: integer (nullable = true)
|-- props: struct (nullable = true)
| |-- hair: string (nullable = true)
| |-- eye: string (nullable = true)
```

```
df.select(df.props.hair).show()
```

```
+----------+
|props.hair|
+----------+
|     black|
|     black|
+----------+
```

```
df.select(df['props.hair']).show()
```

```
+----------+
|      hair|
+----------+
|     black|
|     black|
+----------+
```

```
from pyspark.sql.functions import col
df.select(col('props.eye')).show()
```

```
+-----+
|  eye|
+-----+
|brown|
|brown|
+-----+
```

17. when() & otherwise() functions in PySpark

➔ It is similar to SQL Case When,executes sequence of expressions until matches the condition and returns a value when match

```
data =
[(1,'lochu','F',2000),(2,'chandu','M',5600),(3,'abcd','',6780)]
schema = ['id','name','gender','salary']
df = spark.createDataFrame(data,schema)
df.show()
```

```
+---+------+------+------+
| id|  name|gender|salary|
+---+------+------+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3|  abcd|      |  6780|
+---+------+------+------+
```

```
from pyspark.sql.functions import when

df1 =
df.select(df.id,df.name,when(df.gender=='M','male').when(df.gender==
'F','female').otherwise('unknown'))
df1.show()
```

```
+---+------+-------------------------------------------------------
-----------------------+
| id|  name|CASE WHEN (gender = M) THEN male WHEN (gender = F) THEN
female ELSE unknown END|
+---+------+------------------------------------------------------------
-----------------------+

| 1| lochu| female|

| 2|chandu| male|

| 3| abcd| unknown|

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

```python
from pyspark.sql.functions import when

df1 = df.select(df.id,\
    df.name,\
        when(df.gender=='M','male').\
            when(df.gender=='F','female').\
                otherwise('unknown').\
                    alias('gender'))
df1.show()
```

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

| id|  name| gender|

+---+-----+-------+

|  1| lochu| female|

|  2|chandu|   male|

|  3|  abcd|unknown|

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

18. alias(), asc(), desc(), cast() & like() functions on Columns of dataframe in PySpark

➔ alias() : provides alias to the column

```
data = [(1,'lochu',2000),(2,'chandu',5600),(3,'veena',6780)]
schema = ['id','name','salary']
df = spark.createDataFrame(data,schema)
df.select(df.id.alias('emp_id'),df.name.alias('emp_name'),df.salary.
alias('emp_salary')).show()
```

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

|emp_id|emp_name|emp_salary|

+------+--------+----------+

|     1|   lochu|      2000|

|     2|  chandu|      5600|

|     3|   veena|      6780|

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

➔ asc() , desc() : sorts the columns in ascending or descending order

```
df.sort(df.name.asc()).show()
df.sort(df.salary.desc()).show()
```

```
+---+------+------+
| id|  name|salary|
+---+------+------+
| 2 |chandu|  5600|
| 1 | lochu|  2000|
| 3 | veena|  6780|
+---+------+------+




+---+------+------+
| id| name| salary|
+---+-----+------+
|  3| veena|  6780|
|  2|chandu|  5600|
|  1| lochu|  2000|
+---+-----+------+
```

➔ cast() : convert the datatype

```
df1 = df.select(df.name,df.salary.cast('int'))
df1.show()
df1.printSchema()
+------+------+
|  name|salary|
+------+------+
| lochu|  2000|
|chandu|  5600|
| veena|  6780|
+------+------+

root
|-- name: string (nullable = true)
|-- salary: integer (nullable = true)
```

➔ like(): similar to SQL LIKE expression

```
data =
[(1,'lochu',2000),(2,'chandu',5600),(3,'veena',6780),(4,'lakshmi',23
21)]
schema = ['id','name','salary']
df = spark.createDataFrame(data,schema)
df.filter(df.name.like('l%')).show()
```

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

| id|   name|salary|

+---+-------+------+

|  1|  lochu|  2000|

|  4|lakshmi|  2321|

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

19. filter() & where() in PySpark

- ➔ PySpark filter() function is used to filter the rows from database based the given condition or SQL expression
- ➔ We can also use where() clause instead of the filter If you are coming from SQL background, both these functions operate exactly same

```
data =
[(1,'lochu','F',2000),(2,'chandu','M',5600),(3,'veena','F',6780),(4,
'lakshmi','F',2321)]
schema = ['id','name','gender','salary']
df=spark.createDataFrame(data,schema)
df.where(df.gender=='F').show()
```

```
+---+-------+-----+------+
| id|   name|gender|salary|
+---+-------+-----+------+
|  1|  lochu|     F|  2000|
|  3|  veena|     F|  6780|
|  4|lakshmi|     F|  2321|
+---+-------+-----+------+
```

```
df.filter(df.gender=='M').show()
```

```
+---+------+-----+------+
| id|  name|gender|salary|
+---+------+-----+------+
|  2|chandu|     M|  5600|
+---+------+-----+------+
```

20. distinct() & dropDuplicates() in PySpark

- ➔ PySpark distincht() function is used to remove the diplicates rows(all columns)
- ➔ dropDuplicates() is used to drop rows based on selected (one or multiple) columns
- ➔ So basically , using these functions we can get distinct rows

```
data =
[(1,'lochu','F',2000),(2,'chandu','M',5600),(3,'veena','F',6780),(1,
'lochu','F',2000)]
schema = ['id','name','gender','salary']
df=spark.createDataFrame(data,schema)
df.show()
df.distinct().show()
df.distinct().count()

df.dropDuplicates().show()
df.dropDuplicates(['gender']).show()
```

```
+---+------+------+------+
| id|  name|gender|salary|
+---+------+------+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|  6780|
|  1| lochu|     F|  2000|
+---+------+------+------+
+---+-----+-----+------+
| id|  name|gender|salary|
+---+-----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|  6780|
+---+-----+-----+------+

Out[13]: 3

+---+-----+-----+------+
| id|  name|gender|salary|
+---+-----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|  6780|
+---+-----+-----+------+


+---+-----+-----+------+
| id|  name|gender|salary|
+---+-----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
+---+-----+-----+------+
```

21. orderBy() & sort() in PySpark

- ➔ sort() or orderBy(0 function of Pyspark DataFrame to sort dataframe by ascending or descending order based on single or multiple columns
- ➔ By default , sorting will happenin ascending order.We can explicitly mention ascending or descending using asc() , desc() functions

```
data =
[(1,'lochu','F',2000),(2,'chandu','M',5600),(3,'veena','F',6780),(4,
'lakshmi','F',2000)]
schema = ['id','name','gender','salary']
df=spark.createDataFrame(data,schema)
df.sort('salary','name').show()
```

```
+---+-------+-----+------+
| id|   name|gender|salary|
+---+-------+-----+------+
|  4|lakshmi|     F|  2000|
|  1|  lochu|     F|  2000|
|  2| chandu|     M|  5600|
|  3|  veena|     F|  6780|
+---+-------+-----+------+
```

```
df.sort(df.salary,df.name.desc()).show()
```

```
+---+-------+-----+------+
| id|   name|gender|salary|
+---+-------+-----+------+
|  1|  lochu|     F|  2000|
|  4|lakshmi|     F|  2000|
|  2| chandu|     M|  5600|
|  3|  veena|     F|  6780|
+---+------+-----+------+
```

```
df.sort(df.salary.desc(),df.name.desc()).show()
```

```
+---+------+-----+------+
| id|   name|gender|salary|
+---+------+-----+------+
|  3|  veena|     F|  6780|
|  2| chandu|     M|  5600|
|  1|  lochu|     F|  2000|
|  4|lakshmi|     F|  2000|
+---+------+-----+------+
```

```
df.orderBy(df.salary.asc(),df.name.desc()).show()
```

```
+---+------+-----+------+
| id|   name|gender|salary|
+---+------+-----+------+
|  1|  lochu|     F|  2000|
|  4|lakshmi|     F|  2000|
|  2| chandu|     M|  5600|
|  3|  veena|     F|  6780|
+---+------+-----+------+
```

22. union() & unionAll() in PySpark

- ➔ union() and unionAll() transformations are used to merge two or more dataframes of the same schema or structure
- ➔ these methods merges two dataframes and returns the new dataframe with all rows from two dataframes regardless of duplicate data
- ➔ to remove duplicates use distinct() function

```
d1 = [(1,'lochu','F',2000),(2,'chandu','M',5600)]
d2 =[(3,'veena','F',6780),(1,'lochu','F',2000)]
schema = ['id','name','gender','salary']
df1=spark.createDataFrame(d1,schema)
df2=spark.createDataFrame(d2,schema)
df1.show()
df2.show()
newdf = df1.union(df2)  (or)  df1.unionAll(df2)
newdf.show()
newdf.distinct().show()
```

```
+---+------+------+------+
| id|  name|gender|salary|
+---+------+------+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
+---+------+------+------+


+---+-----+------+------+
| id| name|gender|salary|
+---+-----+------+------+
|  3|veena|     F|  6780|
|  1|lochu|     F|  2000|
+---+-----+------+------+
+---+-----+-----+------+
| id|  name|gender|salary|
+---+-----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|  6780|
|  1| lochu|     F|  2000|
+---+-----+-----+------+
```

```
+---+-----+-----+------+
| id | name|gender|salary|
+---+-----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|  6780|
+---+-----+-----+------+
```

23. groupBy() in PySpark

➔ Similar to SQL GROUP BY clause, PySpark groupBy() function is used to collect the identical data into groups on dataframe and perform count, sum, avg, min, max functions on grouped data

```
d1 = [(1,'lochu','F',2000,'HR'),(2,'chandu','M',5600,'IT'),\
    (3,'veena','F',6780,'HR'),(1,'lochu','F',2000,'IT'),\
    (5,'kalyan','M',2312,'IT')]
schema = ['id','name','gender','salary','dept']
df = spark.createDataFrame(d1,schema)
df2 = df.groupBy('dept').count()
df2.show()
```

```
+----+-----+
|dept|count|
+----+-----+
|  HR|    2|
|  IT|    3|
+----+-----+
```

```
df2 = df.groupBy('dept').max('salary')
df2.show()
```

```
+----+-----------+
|dept|max(salary)|
+----+-----------+
|  HR|       6780|
|  IT|       5600|
+----+-----------+
```

```
df2 = df.groupBy('dept').min('salary')
df2.show()
```

```
+----+-----------+
|dept|min(salary)|
+----+-----------+
|  HR|       2000|
|  IT|       2000|
+----+-----------+
```

```
df2 = df.groupBy('dept').avg('salary')
df2.show()
```

```
+----+-----------+
|dept|avg(salary)|
+----+-----------+
|  HR|     4390.0|
|  IT|     3304.0|
+----+-----------+
df2 = df.groupBy('dept','gender').count()
df2.show()
```

```
+----+-----+-----+
|dept|gender|count|
+----+-----+-----+
|  HR|     F|    2|
|  IT|     M|    2|
|  IT|     F|    1|
+----+-----+-----+
```

```
df2 = df.groupBy('gender').sum('salary')
df2.show()
```

```
+------+-----------+
|gender|sum(salary)|
+------+-----------+
|     F|      10780|
|     M|       7912|
+------+-----------+
```

24. GroupBy agg() function in PySpark

➔ groupBy agg() is used to calculate more than one aggregate at a time on grouped dataframe

```
from pyspark.sql.functions import min,max,count
d1 = [(1,'lochu','F',2000,'HR'),(2,'chandu','M',5600,'IT'),\
    (3,'veena','F',6780,'HR'),(1,'lochu','F',2000,'IT'),\
    (5,'kalyan','M',2312,'IT')]
schema = ['id','name','gender','salary','dept']
df = spark.createDataFrame(d1,schema)
```

```
df2 =
df.groupBy('dept').agg(count('*').alias('countOfEmps'),min('salary')
.alias('min_salary'),max('salary').alias('max_salary'))
df2.show()
```

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

|dept|countOfEmps|min_salary|max_salary|

+----+-----------+----------+----------+

|  HR|          2|      2000|      6780|

|  IT|          3|      2000|      5600|

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

25. unionByName() function in PySpark

➔ unionByName() lets you to merge/union two DataFrames with a different number of columns (different schema) by passing allowMissingColumns with value true.

```
d1 = [(1,'lochu','F',2000),(2,'chandu','M',5600)]
d2 =[(3,'veena','F',22),(1,'lochu','F',20)]
schema1 = ['id','name','gender','salary']
schema2 = ['id','name','gender','age']
df1=spark.createDataFrame(d1,schema1)
df2=spark.createDataFrame(d2,schema2)
df1.show()
df2.show()
newdf = df1.unionAll(df2)
newdf.show()
newdf.distinct().show()
```

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

| id|  name|gender|salary|

+---+------+------+------+

|  1| lochu|     F|  2000|

|  2|chandu|     M|  5600|
+---+-----+-----+------+


+---+-----+-----+---+
| id| name|gender|age|
+---+----+-----+---+
|  3|veena|     F| 22|
|  1|lochu|     F| 20|
+---+----+-----+---+



+---+-----+-----+------+
| id|  name|gender|salary|
+---+----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|    22|
|  1| lochu|     F|    20|
+---+-----+-----+------+



+---+-----+-----+------+
| id|  name|gender|salary|
+---+----+-----+------+
|  1| lochu|     F|  2000|
|  2|chandu|     M|  5600|
|  3| veena|     F|    22|
|  1| lochu|     F|    20|
+---+-----+-----+------+
df1.unionByName(allowMissingColumns=True,other=df2).show()
```

```
+---+------+------+------+----+
| id|  name|gender|salary| age|
+---+------+------+------+----+
|  1| lochu|     F|  2000|null|
|  2|chandu|     M|  5600|null|
|  3| veena|     F|  null|  22|
|  1| lochu|     F|  null|  20|
+---+------+------+------+----+
```

26. select() function in PySpark

➔ select() function is used to select single, multiple, column by index, all columns from the list and the nested columns from a dataframe

```
d1 = [(1,'lochu','F',2000,'HR'),(2,'chandu','M',5600,'IT'),\
    (3,'veena','F',6780,'HR'),(1,'lochu','F',2000,'IT'),\
    (5,'kalyan','M',2312,'IT')]
schema = ['id','name','gender','salary','dept']
df = spark.createDataFrame(d1,schema)
```

```
df.select(df.id,df.name,df.dept).show()
df.select(df['id'],df['name']).show()
df.select('id','name','salary').show()
```

```
+---+------+
| id|  name|
+---+------+
|  1| lochu|
|  2|chandu|
|  3| veena|
|  1| lochu|
|  5|kalyan|
+---+------+
```

```
+---+-----+------+
| id|  name|salary|
+---+-----+------+
|  1| lochu|  2000|
|  2|chandu|  5600|
|  3| veena|  6780|
|  1| lochu|  2000|
|  5|kalyan|  2312|
+---+-----+------+
```

```
from pyspark.sql.functions import col
df.select(col('id'),col('name')).show()
```

```
+---+------+
| id | name|
+---+------+
|  1| lochu|
|  2|chandu|
|  3| veena|
|  1| lochu|
|  5|kalyan|
+---+------+
```

```
df.select('*').show()
```

```
+---+------+------+------+----+
| id|  name|gender|salary|dept|
+---+------+------+------+----+
|  1| lochu|     F|  2000|  HR|
|  2|chandu|     M|  5600|  IT|
|  3| veena|     F|  6780|  HR|
|  1| lochu|     F|  2000|  IT|
|  5|kalyan|     M|  2312|  IT|
+---+------+------+------+----+
```

```
df.select([col for col in df.columns]).show()
```

```
+---+------+------+------+----+
| id|  name|gender|salary|dept|
+---+------+------+------+----+
|  1| lochu|     F|  2000|  HR|
|  2|chandu|     M|  5600|  IT|
|  3| veena|     F|  6780|  HR|
|  1| lochu|     F|  2000|  IT|
|  5|kalyan|     M|  2312|  IT|
+---+------+------+------+----+
```

27. join() function in PySpark | inner, left, right, full Join,Left semi, Left anti & self join

➔ join() is like SQL JOIN. We can combine columns from different dataframes based on the condition. It supports all basic join types as INNER, LEFT, OUTER,RIGHT OUTER, LEFT ANTI, LEFT SEMI, CROSS,SELF

```
d1 = [(1,'lochu',2000,2),(2,'veena',2001,1),(3,'vara',3000,4)]
s1 = ['id','name','salary','dep']

d2 = [(1,'IT'),(2,'HR'),(3,'Payroll')]
s2 = ['depId','depName']
empdf = spark.createDataFrame(d1,s1)
depdf = spark.createDataFrame(d2,s2)
empdf.show()
depdf.show()
```

```
+---+-----+------+---+
| id| name|salary|dep|
+---+-----+------+---+
|  1|lochu|  2000|  2|
|  2|veena|  2001|  1|
|  3| vara|  3000|  4|
+---+-----+------+---+
```

```
+-----+-------+
|depId|depName|
+-----+-------+
|    1|     IT|
|    2|     HR|
|    3|Payroll|
+-----+-------+
```

```
empdf.join(depdf,empdf.dep == depdf.depId,'inner').show()
```

```
+---+-----+------+---+-----+-------+
| id| name|salary|dep|depId|depName|
+---+-----+------+---+-----+-------+
|  2|veena|  2001|  1|    1|     IT|
|  1|lochu|  2000|  2|    2|     HR|
+---+-----+------+---+-----+-------+
```

```
empdf.join(depdf,empdf.dep == depdf.depId,'left').show()
```

```
+---+-----+------+---+-----+-------+
| id| name|salary|dep|depId|depName|
+---+-----+------+---+-----+-------+
|  1|lochu|  2000|  2|    2|     HR|
|  2|veena|  2001|  1|    1|     IT|
|  3| vara|  3000|  4| null|   null|
+---+-----+------+---+-----+-------+
```

```
empdf.join(depdf,empdf.dep == depdf.depId,'right').show()
```

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

|  id| name|salary| dep|depId|depName|

+----+-----+------+----+-----+-------+

|   2|veena|  2001|   1|    1|     IT|

|   1|lochu|  2000|   2|    2|     HR|

|null| null|  null|null|    3|Payroll|

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

```
empdf.join(depdf,empdf.dep == depdf.depId,'full').show()
```

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

|  id| name|salary| dep|depId|depName|

+----+-----+------+----+-----+-------+

|   2|veena|  2001|   1|    1|     IT|

|   1|lochu|  2000|   2|    2|     HR|

|null| null|  null|    3|Payroll|

|   3| vara|  3000|   4| null|   null|

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

➔ leftsemi() join similar to inner join but get columns only from left dataframe for matching rows
➔ leftanti() opposite to leftsemi(), it gets not matching rows from left dataframe
➔ self-join, joins data with same dataframe

```
empdf.join(depdf,empdf.dep == depdf.depId,'leftsemi').show()
+---+-----+------+---+
| id| name|salary|dep|
+---+-----+------+---+
|  2|veena|  2001|  1|
|  1|lochu|  2000|  2|
+---+-----+------+---+

empdf.join(depdf,empdf.dep == depdf.depId,'leftanti').show()
+---+----+------+---+
| id|name|salary|dep|
+---+----+------+---+
|  3|vara|  3000|  4|
+---+----+------+---+
```

```
from pyspark.sql.functions import col
df = spark.createDataFrame(d1,s1)
df.alias('empData').join(df.alias('mgrData'),\
    col('empData.dep')==col('mgrData.id'),\
        'left').show()
+---+-----+------+---+----+-----+------+----+
| id| name|salary|dep| id| name|salary| dep|
+---+-----+------+---+----+-----+------+----+
|  1|lochu|  2000|  2|   2|veena|  2001|   1|
|  2|veena|  2001|  1|   1|lochu|  2000|   2|
|  3| vara|  3000|  4|null| null|  null|null|
+---+-----+------+---+----+-----+------+----+
```

```
from pyspark.sql.functions import col
df.alias('empData').join(df.alias('mgrData'),\
    col('empData.dep')==col('mgrData.id'),\
        'left').select(col('empData.name').alias('empName'),col('mgr
Data.name').alias('mgrName')).show()
+-------+-------+

|empName|mgrName|

+-------+-------+

|  lochu|  veena|

|  veena|  lochu|

|  vara|    null|

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

28. pivot(),unpivot() function in PySpark

➔ it's used to rotate data in one column into multiple columns

➔ it is an aggregation where one of the grouping column values will be converted in individual columns

```
d1 = [\
    (1,'lochu','F','HR'),\
    (2,'veena','F','IT'),\
    (3,'chandu','M','HR'),\
    (4,'kalyan','M','IT'),\
    (5,'vara','F','IT'),\
    (6,'sai','M','HR'),\
    (7,'jyo','F','IT')]

schema = ['id','name','gender','dept']
df = spark.createDataFrame(d1,schema)
df.show()
+---+------+------+----+
| id|  name|gender|dept|
+---+------+------+----+
|  1| lochu|     F|  HR|
|  2| veena|     F|  IT|
|  3|chandu|     M|  HR|
|  4|kalyan|     M|  IT|
|  5|  vara|     F|  IT|
|  6|   sai|     M|  HR|
|  7|   jyo|      F|  IT|
+---+------+-----+-----+

df.groupBy('dept','gender').count().show()
+----+-----+-----+
|dept|gender|count|
+----+-----+-----+
|  HR|      F|    1|
|  IT|      F|    3|
|  HR|      M|    2|
|  IT|      M|    1|
+----+-----+-----+

df.groupBy('dept').pivot('gender').count().show()
+----+---+---+
|dept|  F|  M|
+----+---+---+
|  HR|  1|  2|
|  IT|  3|  1|
+----+---+---+

df.groupBy('dept').pivot('gender',['M']).count().show()
+----+---+
|dept|  M|
+----+---+
|  HR|  2|
|  IT|  1|
+----+---+

df.groupBy('dept').pivot('gender',['M','F']).count().show()
+----+---+---+
|dept|  M|  F|
+----+---+---+
|  HR|  2|  1|
|  IT|  1|  3|
+----+---+---+
```

➔ unpivot is rotating columns into rows. Pyspark SQL doesn't have unpivot function hence will use the stack() function

```
d1 = [\
    (1,'lochu','F','HR'),\
    (2,'veena','F','IT'),\
    (3,'chandu','M','HR'),\
    (4,'kalyan','M','IT'),\
    (5,'vara','F','IT'),\
    (6,'sai','M','HR'),\
    (7,'jyo','F','IT')]

schema = ['id','name','gender','dept']
df = spark.createDataFrame(d1,schema)
df2= df.groupBy('dept').pivot('gender',['M','F']).count()
df2.show()

from pyspark.sql.functions import expr
unpivotdf = df2.select('dept',expr("stack(2, 'M',M,'F',F)as
(gender,count)"))
unpivotdf.show()
```

```
+----+---+---+
|dept|  M|  F|
+----+---+---+
|  HR|  2|  1|
|  IT|  1|  3|
+----+---+---+


+----+------+-----+
|dept|gender|count|
+----+------+-----+
|  HR|     M|    2|
|  HR|     F|    1|
|  IT|     M|    1|
|  IT|     F|    3|
+----+------+-----+
```

29. fill() & fillna() functions in PySpark

```
d1 = [\
    (1,'lochu','F','HR'),\
    (2,'veena','F',None),\
    (3,'chandu','M','HR'),\
    (None,'kalyan','M','IT'),\
    (5,'vara','F','IT'),\
    (6,'sai',None,'HR'),\
    (7,'jyo','F','IT')]

schema = ['id','name','gender','dept']
df = spark.createDataFrame(d1,schema)
df.show()
```

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

|  id|  name|gender|dept|

+----+------+-----+----+

|   1| lochu|     F|  HR|

|   2| veena|     F|null|

|   3|chandu|     M|  HR|

|null|kalyan|     M|  IT|

|   5|  vara|     F|  IT|

|   6|   sai|  null|  HR|

|   7|   jyo|     F|  IT|

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

```
df2 = df.na.fill('unknown',['gender','dept']).fillna('nil',['id'])
df2.show()
```

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

|  id|  name| gender|   dept|

+----+------+-------+-------+

|   1| lochu|      F|     HR|

|   2| veena|      F|unknown|

|   3|chandu|      M|     HR|

|null|kalyan|      M|     IT|

|   5|  vara|      F|     IT|

|   6|   sai|unknown|     HR|
|   7|   jyo|      F|     IT|
+----+------+-------+-------+
```

30. sample() function in PySpark

- ➔ to get the random sampling subset from the large dataset
- ➔ use fraction to indicate what percentage of data to return and seed value t make sure every time to get same random sample

```
df = spark.range(start=1,end=101)
df1 = df.sample(fraction=0.1,seed=123)
df2 = df.sample(fraction=0.1)
df3 = df.sample(fraction=0.1)
display(df1)
display(df2)
display(df3)
```

id (fraction=0.1,seed=123)#to get fixed number of rows of numbers (8 rows)

36

39

42

46

72

85

88

100

Id (fraction = 0.1,13 rows)
5
7
10
12
15
16
40
48
68
77
79
81
85

Id (fraction = 0.1, 10 rows)
6
34
37
40

```
58

74

79

89

92

98
```

31. collect() function in PySpark

➔ collect() retrieves all the elements in a Dataframe as an array of row type to the driver node.

➔ collect() is an action hence it does not return a dataframe instead, it returns data in an array to the driver . Once the data is in an array, you can use python for loop to process it further.

➔ collect() use it with small dataframes. With big DataFrames it may result in out of memory error as its return entire data to single node(driver)

```
d1 = [\
    (1,'lochu','F','HR'),\
    (2,'veena','F',None),\
    (3,'chandu','M','HR'),\
    (None,'kalyan','M','IT'),\
    (5,'vara','F','IT'),\
    (6,'sai',None,'HR'),\
    (7,'jyo','F','IT')]

schema = ['id','name','gender','dept']
df = spark.createDataFrame(d1,schema)
```

```
listrow = df.collect()
print(listrow)
print(f"first row : {listrow[0]}")
print(f"dept : {listrow[0][3]}")
```

```
[Row(id=1, name='lochu', gender='F', dept='HR'), Row(id=2,
name='veena', gender='F', dept=None), Row(id=3, name='chandu',
gender='M', dept='HR'), Row(id=None, name='kalyan', gender='M',
dept='IT'), Row(id=5, name='vara', gender='F', dept='IT'), Row(id=6,
name='sai', gender=None, dept='HR'), Row(id=7, name='jyo',
gender='F', dept='IT')]

first row : Row(id=1, name='lochu', gender='F', dept='HR')

dept : HR
```

32. DataFrame.transform() function in PySpark

➔ it is used to chain the custom transformations and this function returns the new DataFrame after applying the specified transformations

```
d = [(1,'veena',2000),(2,'lochu',3000)]
schema = ['id','name','salary']

df = spark.createDataFrame(d,schema)
df.show()
```

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

| id| name|salary|

+---+-----+------+

|  1|veena|  2000|

|  2|lochu|  3000|

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

```
from pyspark.sql.functions import upper
```

```
df.withColumn('name',upper(df.name)).show()
+---+-----+------+

| id| name|salary|

+---+-----+------+

|  1|VEENA|  2000|

|  2|LOCHU|  3000|

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

```
from pyspark.sql.functions import upper
def convertToUpper(df):
    return df.withColumn('name',upper(df.name))
df1 = df.transform(convertToUpper)
df1.show()
+---+-----+------+

| id| name|salary|

+---+-----+------+

|  1|VEENA|  2000|

|  2|LOCHU|  3000|

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

```
def doubleSalary(df):
    return df.withColumn('salary',df.salary*2)
df1 = df.transform(doubleSalary)
df1.show()
+---+-----+------+

| id| name|salary|

+---+-----+------+

|  1|veena|  4000|

|  2|lochu|  6000|

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

```
df1 = df.transform(doubleSalary).transform(convertToUpper)
df1.show()
+---+-----+------+

| id| name|salary|
+---+-----+------+
|  1|VEENA|  4000|
|  2|LOCHU|  6000|
+---+-----+------+
```

33. pyspark.sql.functions.transform()

➔ It is used to apply the transformation on a column of type Array. This function applies the specified transformation on every element of the array and returns an object of ArrayType.

```
data = [(1,'veena',['dotnet','python']),(2,'lochu',['java','aws'])]
schema = ['id','name','skills']
df = spark.createDataFrame(data,schema)
df.show()
df.printSchema()
```

```
+---+-----+----------------+
| id| name|          skills|
+---+-----+----------------+
|  1|veena|[dotnet, python]|
|  2|lochu|     [java, aws]|
+---+-----+----------------+


root
|-- id: long (nullable = true)
|-- name: string (nullable = true)
|-- skills: array (nullable = true)
| |-- element: string (containsNull = true)
```

```
from pyspark.sql.functions import transform
```

```
df.select('id','name',transform('skills',lambda x:
upper(x)).alias('skills_upper')).show()
+---+-----+---------------+
| id| name|   skills_upper|
+---+-----+---------------+
|  1|veena|[DOTNET, PYTHON]|
|  2|lochu|     [JAVA, AWS]|
+---+-----+---------------+
```

```
from pyspark.sql.functions import transform
def convUpper(x):
    return upper(x)
df.select(transform('skills',convUpper).alias('upper_skills')).show(
)
+----------------+
|    upper_skills|
+----------------+
|[DOTNET, PYTHON]|
|     [JAVA, AWS]|
+----------------+
```

34. createOrReplaceTempView()

➔ Used to create temporary view on DataFrame to do selection and manipulation of data.
➔ Temporary views are session scoped and cannot be shared between the sessions

```
d = [(1,'veena',2000),(2,'lochu',3000)]
schema = ['id','name','salary']

df = spark.createDataFrame(d,schema)
```

```
df.createOrReplaceTempView('emps')
df1=spark.sql('SELECT id,name FROM emps')
df1.show()
+---+-----+

| id| name|

+---+-----+

|  1|veena|

|  2|lochu|

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

```
%sql
SELECT id,upper(name) as NAME FROM emps
```

id	NAME
1	VEENA
2	LOCHU

35. createOrReplaceGlobalTempView() function in PySpark

- ➔ It's used to create temp views or tables globally, when can be accessed across the sessions with in spark application
- ➔ To query these tables, we need append global_temp.<tablename>

Notebook1:

```
%scala
spark
res0: org.apache.spark.sql.SparkSession = org.apache.spark.sql.SparkSession@279c4543

d = [(1,'veena',2000),(2,'lochu',3000)]
```

```
schema = ['id','name','salary']

df = spark.createDataFrame(d,schema)
df.createOrReplaceTempView('emps')
```

Notebook2:

```
%scala
spark
res0: org.apache.spark.sql.SparkSession =
org.apache.spark.sql.SparkSession@16612d78
```

```
%sql
SELECT id,upper(name) as NAME FROM emps
AnalysisException: [TABLE_OR_VIEW_NOT_FOUND] The table or view
`emps` cannot be found. Verify the spelling and correctness of the
schema and catalog.
```

- ➔ If print the data in one notebook by selecting the required from data base created in the other notebook : it may give error "table not found"
- ➔ To overcome this problem we use createOrReplaceGlobalTempView()

Notebook1:

```
%scala
spark
res0: org.apache.spark.sql.SparkSession =
org.apache.spark.sql.SparkSession@279c4543

d = [(1,'veena',2000),(2,'lochu',3000)]
schema = ['id','name','salary']

df = spark.createDataFrame(d,schema)
df.createOrReplaceGlobalTempView('empGlobal')


spark.catalog.currentDatabase()
Out[3]: 'default'
```

```
spark.catalog.listTables('default')
Out[4]: []
```

```
spark.catalog.listTables('global_temp')
Out[5]: [Table(name='empGlobal', catalog=None, namespace=['global_te
mp'], description=None, tableType='TEMPORARY', isTemporary=True)]
```

Notebook2:

```
%scala
spark
res0: org.apache.spark.sql.SparkSession =
org.apache.spark.sql.SparkSession@16612d78
```

```
%sql
SELECT id,upper(name) as NAME FROM global_temp.empGlobal
```

id	NAME
1	VEENA
2	LOCHU

➔ spark.catalog.dropGlobalTempView('empGlobal') or spark.catalog.dropTempView('emps') used to drop the views created

36. UDF(user defined function)

➔ These are similar to function sin SQL. We define some logic in functions and store them in database and use them in queries

➔ Similar to that we can write our custom logic in python function and register it with PySpark using udf() function.

```
d = [(1,'lochu',3000,500),(2,'veena',2000,1000)]
schema = ['id','name','salary','bonus']

df = spark.createDataFrame(d,schema)

def total(s,b):
    return s+b
from pyspark.sql.functions import udf
from pyspark.sql.types import IntegerType
TotalPay = udf(lambda s,b:total(s,b),IntegerType())

df.withColumn('totPay',TotalPay(df.salary,df.bonus)).show()
```

```
+---+-----+------+-----+------+
| id| name|salary|bonus|totPay|
+---+-----+------+-----+------+
|  1|lochu|  3000|  500|  3500|
|  2|veena|  2000| 1000|  3000|
+---+-----+------+-----+------+
```

```
@udf(returnType=IntegerType())
def total(s,b):
    return s+b

df.select('*',total(df.salary,df.bonus).alias('totPay')).show()
```

```
+---+-----+------+-----+------+
| id| name|salary|bonus|totPay|
+---+-----+------+-----+------+
|  1|lochu|  3000|  500|  3500|
|  2|veena|  2000| 1000|  3000|
+---+-----+------+-----+------+
d = [(1,'lochu',3000,500),(2,'veena',2000,1000)]
schema = ['id','name','salary','bonus']

df = spark.createDataFrame(d,schema)
df.createOrReplaceTempView('emps')
def total(s,b):
    return s+b
spark.udf.register(name='TotalPay',f=total,returnType=IntegerType())
```

```
id:long
name:string
salary:long
bonus:long
Out[10]: <function __main__.total(s, b)>
```

```
%sql
SELECT *,TotalPay(salary,bonus) as totPay FROM emps
```

id	name	salary	bonus	totPay
1	lochu	3000	500	3500
2	veena	2000	1000	3000

37. Convert RDD to Dataframe

➔ RDD (Resilient Distributed Dataset)

➔ Its collection of objects similar to list in Python.Its immutable and in memory processing

➔ By using parallelize() function of SparkContext you create an RDD

```
d = [(1,'veena'),(2,'lochu')]
print(type(d))
rdd = spark.sparkContext.parallelize(d)
print(type(rdd))
print(rdd.collect())
<class 'list'>
```

```
<class 'pyspark.rdd.RDD'>

[(1, 'veena'), (2, 'lochu')]
```

```
df = rdd.toDF(schema=['id','name'])
df.show()
```

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

| id| name|

+---+-----+

|  1|veena|

|  2|lochu|

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

```
df = spark.createDataFrame(rdd,schema=['id','name'])
df.show()
```

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

| id| name|

+---+-----+

|  1|veena|

|  2|lochu|

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

38. map() transformation

➔ It's RDD transformation used to apply function(lambda) on every element of RDD and returns new RDD

➔ DataFrame doesn't have map() transformation to use with DataFrame you need to generate RDD first

```
d=[('lochani','vilehya'),('veenanjali','tammina')]
rdd = spark.sparkContext.parallelize(d)
rdd1 = rdd.map(lambda x: x + (x[0]+' '+x[1],))
print(rdd1.collect())
```

```
[('lochani', 'vilehya', 'lochani vilehya'), ('veenanjali',
'tammina', 'veenanjali tammina')]
```

```
d=[('lochani','vilehya'),('veenanjali','tammina')]
df = spark.createDataFrame(d,['fn','ln'])

rdd1 = df.rdd.map(lambda x: x + (x[0]+' '+x[1],))
df1 = rdd1.toDF(['fn','ln','fullname'])
df1.show()
```

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

|        fn|     ln|          fullname|

+----------+-------+------------------+

|   lochani|vilehya|   lochani vilehya|

|veenanjali|tammina|veenanjali tammina|

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

```
def fullname(x):
    x=x+(x[0]+' '+x[1],)
    return x
d=[('lochani','vilehya'),('veenanjali','tammina')]
df = spark.createDataFrame(d,['fn','ln'])

rdd1 = df.rdd.map(lambda x: fullname(x))
df1 = rdd1.toDF(['fn','ln','fullname'])
df1.show()
```

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

|        fn|     ln|          fullname|

+----------+-------+------------------+

|   lochani|vilehya|   lochani vilehya|

|veenanjali|tammina|veenanjali tammina|

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

39. flatMap() transformation

- ➔ flatMap() is a transformation operation that flattens the RDD (array/map DataFrame columns) after applying the function on every element and returns a new PySpark RDD.
- ➔ Its not available in dataframes.Explode() functions can be used in dataframes to flatten arrays

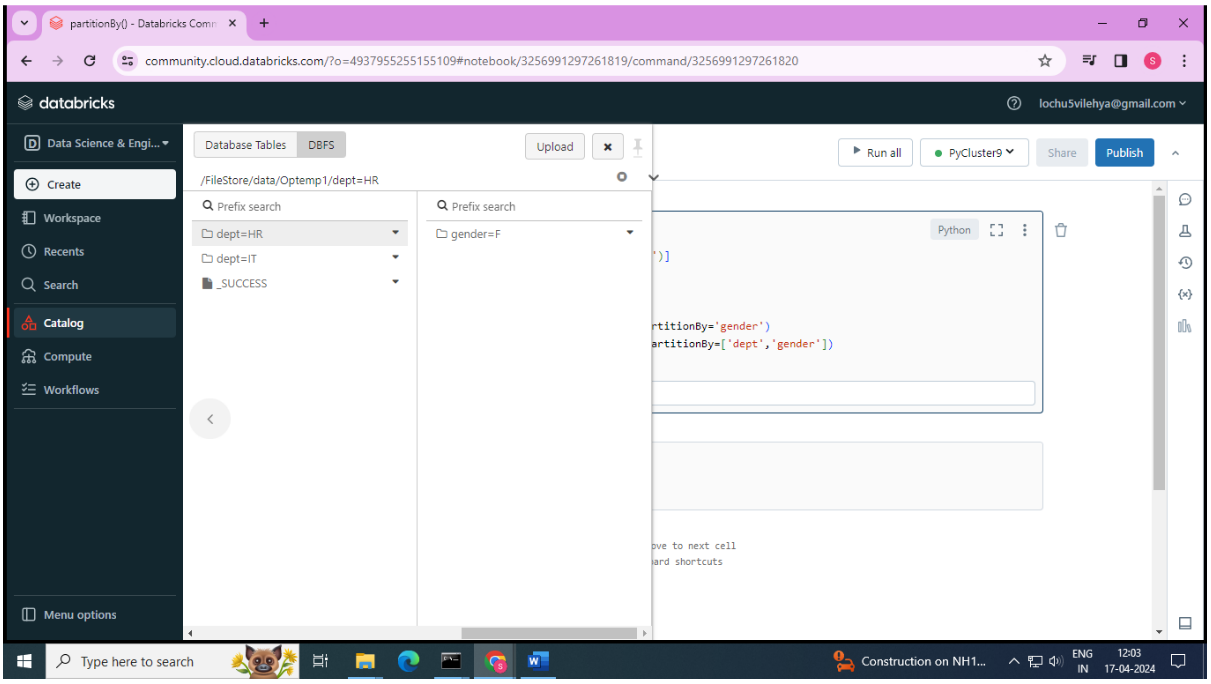
```
d=[('lochani vilehya'),('veenanjali tammina')]
rdd = spark.sparkContext.parallelize(d)

print("rdd - fullnames")
for i in rdd.collect():
    print(i)
print('\n')
rdd1 = rdd.flatMap(lambda x: x.split(' '))
print("rdd - splitnames")
for i in rdd1.collect():
    print(i)
```

```
rdd - fullnames
lochani vilehya
veenanjali tammina


rdd - splitnames
lochani
vilehya
veenanjali
```

40. partitionBy function in PySpark

➔ It's used to partition large dataset into smaller files based on one or multiple columns

```
 d =
[(1,'lochu','F','IT'),(2,'veena','F','HR'),(3,'chandu','M','IT')]
schema = ['id','name','gender','dept']

df = spark.createDataFrame(d,schema)
df.write.parquet(path='/FileStore/data/Optemp/',mode='overwrite',par
titionBy='gender')
df.write.parquet(path='/FileStore/data/Optemp1/',mode='overwrite',pa
rtitionBy=['dept','gender'])

spark.read.parquet('/FileStore/data/Optemp/').show()
+---+------+----+------+
| id|  name|dept|gender|
+---+------+----+------+
|  3|chandu|  IT|     M|
|  1| lochu|  IT|     F|
|  2| veena|  HR|     F|
+---+------+----+------+

spark.read.parquet('/FileStore/data/Optemp1/').show()
+---+------+----+------+
| id|  name|dept|gender|
+---+------+----+------+
|  3|chandu|  IT|     M|
|  2| veena|  HR|     F|
|  1| lochu|  IT|     F|
+---+------+----+------+
```



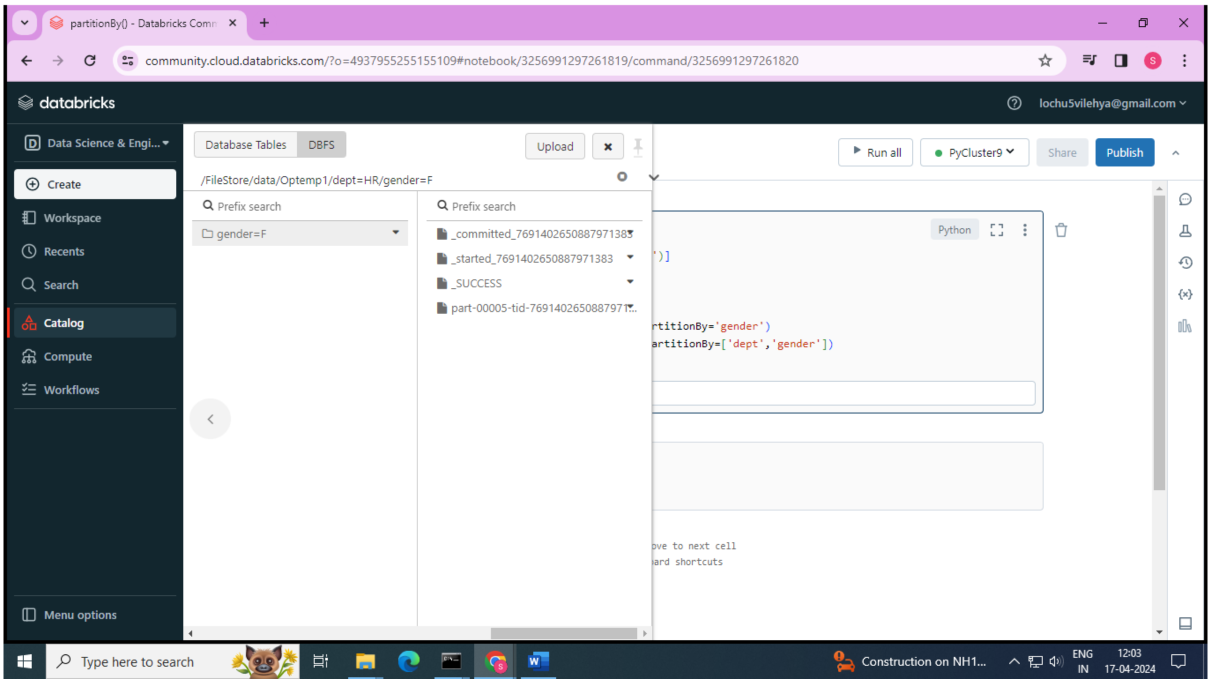
community.cloud.databricks.com/?o=4937955255155109#notebook/3256991297261819/command/3256991297261820

/FileStore/data/Optemp1/dept=HR

```
dept=HR
dept=IT
_SUCCESS
```

```
gender=F
```

```
')]
rtitionBy='gender')
artitionBy=['dept','gender'])
```



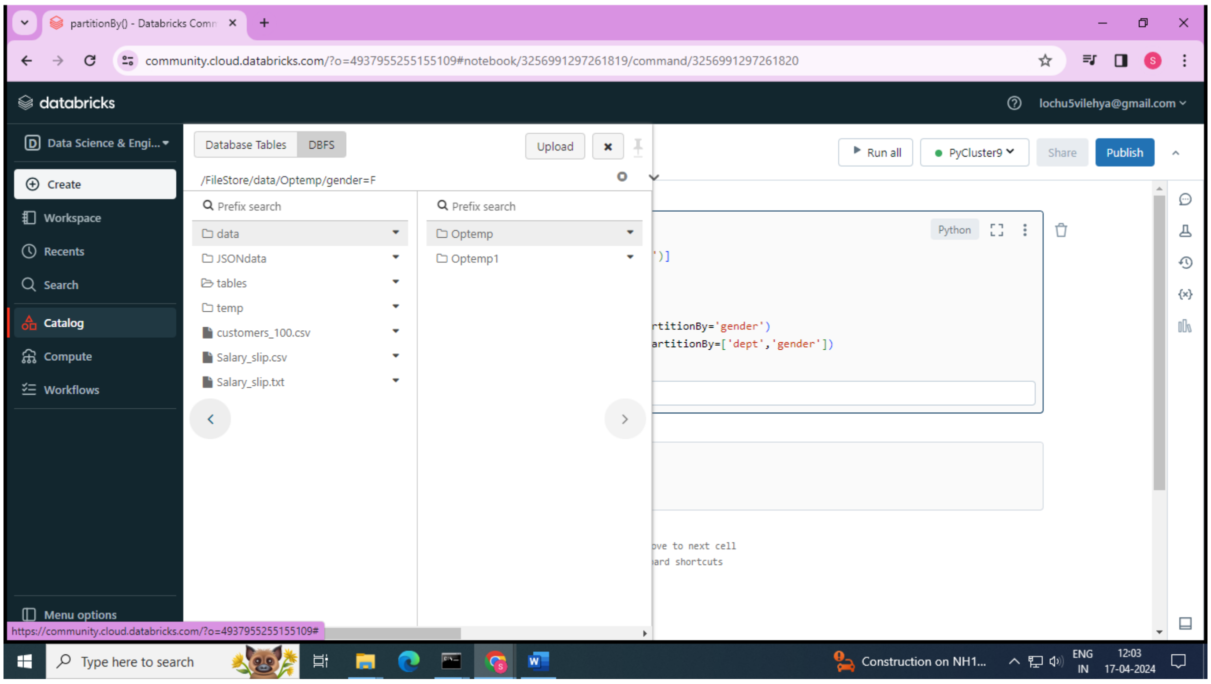
community.cloud.databricks.com/?o=4937955255155109#notebook/3256991297261819/command/3256991297261820

/FileStore/data/Optemp1/dept=HR/gender=F

```
gender=F
```

```
_committed_7691402650887971383
_started_7691402650887971383
_SUCCESS
part-00005-tid-769140265088797138...
```

```
')]
rtitionBy='gender')
artitionBy=['dept','gender'])
```



/FileStore/data/Optemp/gender=F

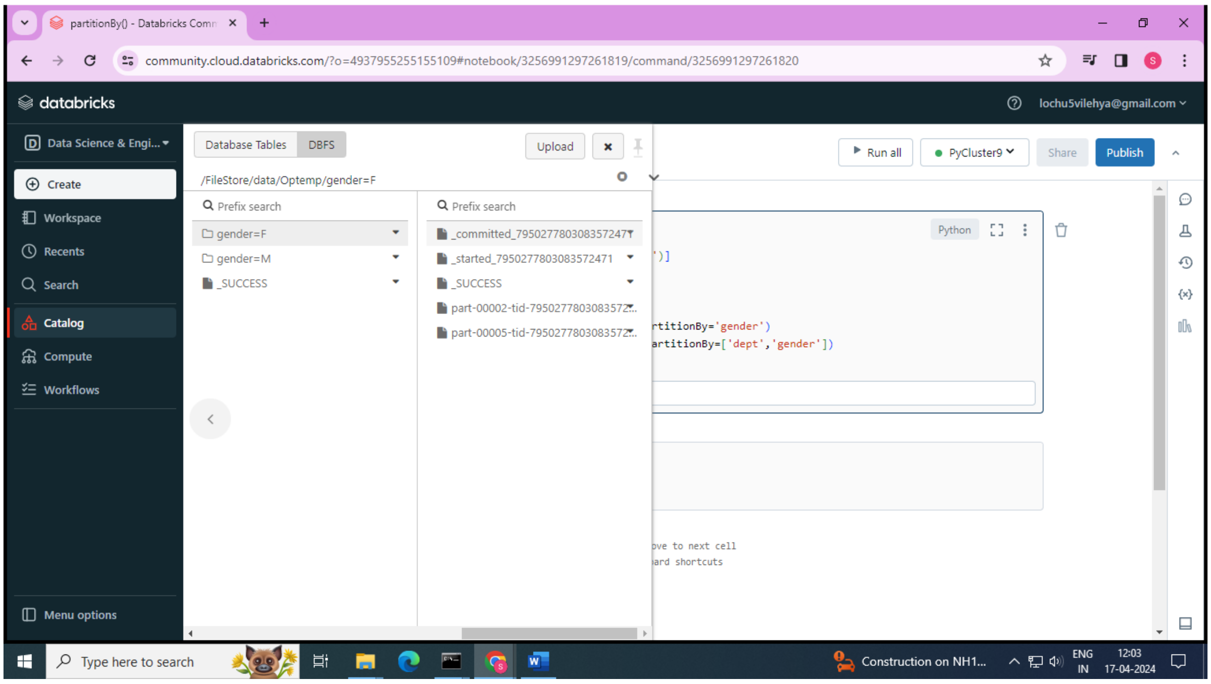
```
data
JSONdata
tables
temp
customers_100.csv
Salary_slip.csv
Salary_slip.txt
```

```
Optemp
Optemp1
```

```
')]
rtitionBy='gender')
artitionBy=['dept','gender'])
```

```
ove to next cell
ard shortcuts
```

https://community.cloud.databricks.com/?o=4937955255155109#



/FileStore/data/Optemp/gender=F

```
gender=F
gender=M
_SUCCESS
```

```
_committed_7950277803083572471
_started_7950277803083572471
_SUCCESS
part-00002-tid-7950277803083572...
part-00005-tid-7950277803083572...
```

```
')]
rtitionBy='gender')
artitionBy=['dept','gender'])
```

```
ove to next cell
ard shortcuts
```

41. from_json() function to convert json string into MapType and StructType

➔ its used to convert json string into MapType or structType

```
d = [('veena','{"hair":"black","eye":"brown"}')]
schema = ['name','props']
df = spark.createDataFrame(d,schema)
df.show(truncate = False)
df.printSchema()
```

```
name:string
props:string
```

```
+-----+------------------------------+
|name |props                         |
+-----+------------------------------+
|veena|{"hair":"black","eye":"brown"}|
+-----+------------------------------+
```

```
root
|-- name: string (nullable = true)
|-- props: string (nullable = true)
```

```
from pyspark.sql.functions import from_json
from pyspark.sql.types import MapType,StringType
mapSchema = MapType(StringType(),StringType())
df1 = df.withColumn('propsMap',from_json(df.props,mapSchema))
df1.show(truncate=False)
df1.printSchema()
```

```
+-----+------------------------------+-----------------------------+
|name |props                         |propsMap                     |
+-----+------------------------------+-----------------------------+
|veena|{"hair":"black","eye":"brown"}|{hair -> black, eye -> brown}|
+-----+------------------------------+-----------------------------+
root

|-- name: string (nullable = true)

|-- props: string (nullable = true)

|-- propsMap: map (nullable = true)

| |-- key: string

| |-- value: string (valueContainsNull = true)
```

```
df2 = df1.withColumn('hair',df1.propsMap.hair)\
    .withColumn('eye',df1.propsMap.eye)
df2.show(truncate=False)
```

```
+-----+-----------------------------+-----------------------------+-----+-----+
|name |                        props |                     propsMap |hair | eye |

+-----+-----------------------------+-----------------------------+-----+-----+
|veena|{"hair":"black","eye":"brown"}|{hair -> black, eye -> brown}|black|brown|
+-----+-----------------------------+-----------------------------+-----+-----+
```

```
from pyspark.sql.functions import from_json
from pyspark.sql.types import StructType,StructField,StringType
structSchema = StructType([\
    StructField('hair',StringType()),\
    StructField('eye',StringType())])
df1 = df.withColumn('propsStruct',from_json(df.props,structSchema))
df1.show(truncate=False)
df1.printSchema()
```

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

|name |                        props |  propsStruct |

+-----+-----------------------------+--------------+
|veena|{"hair":"black","eye":"brown"}|{black, brown}|

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

```
root

|-- name: string (nullable = true)

|-- props: string (nullable = true)

|-- propsStruct: struct (nullable = true)

| |-- hair: string (nullable = true)

| |-- eye: string (nullable = true)
```

```
df2 = df1.withColumn('hair',df1.propsStruct.hair)\
    .withColumn('eye',df1.propsStruct.eye)
df2.show(truncate=False)
```

```
+-----+-------------------------------+--------------+-----+-----+
|name |                          props |  propsStruct |hair | eye |
+-----+-------------------------------+--------------+-----+-----+
|veena|{"hair":"black","eye":"brown"}|{black, brown}|black|brown|
+-----+-------------------------------+--------------+-----+-----+
```

42. to_json() function in PySpark

➔ to_json() is used to convert DataFrame column MapType or StructType to JSON string

```
from pyspark.sql.functions import to_json
from pyspark.sql.types import StructType,StructField,StringType

d = [('veena',{"hair":"black","eye":"brown"})]
schema = ['name','props']
df = spark.createDataFrame(d,schema)
df.show(truncate = False)
df.printSchema()
```

```
+-----+-----------------------------+
|name |                        props |
+-----+-----------------------------+
|veena|{eye -> brown, hair -> black}|
+-----+-----------------------------+


root
|-- name: string (nullable = true)
|-- props: map (nullable = true)

| |-- key: string

| |-- value: string (valueContainsNull = true)
```

```
df1 = df.withColumn('prop',to_json(df.props))
df1.show(truncate=False)
df1.printSchema()
```

```
+-----+---------------------------+-----------------------------+
|name |props |prop |

+-----+---------------------------+-----------------------------+
|veena|{eye -> brown, hair -> black}|{"eye":"brown","hair":"black"}|
+-----+---------------------------+-----------------------------+

root

|-- name: string (nullable = true)

|-- props: map (nullable = true)

| |-- key: string

| |-- value: string (valueContainsNull = true)

|-- prop: string (nullable = true from pyspark.sql.functions import to_json
```

```
from pyspark.sql.types import StructType,StructField,StringType
d = [('veena',("black","brown"))]
structSchema = StructType([\
    StructField('name',StringType()),\
    StructField('props',StructType([StructField('hair',StringType())
,StructField('eye',StringType())]))])
df = spark.createDataFrame(d,structSchema)
df1 = df.withColumn('propsStruct',to_json(df.props))
df1.show(truncate=False)
df1.printSchema()
```

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

|name |props |propsStruct |

+-----+--------------+------------------------------+

|veena|{black, brown}|{"hair":"black","eye":"brown"}|

+-----+--------------+------------------------------+
root

|-- name: string (nullable = true)

|-- props: struct (nullable = true)

| |-- hair: string (nullable = true)

| |-- eye: string (nullable = true)

|-- propsStruct: string (nullable = true)
```

43. json_tuple() function in PySpark

➔ json_tuple() function is used to query or extract elements from json string column and create as new columns

```
d =
[('veena','{"hair":"black","eye":"brown","skin":"brown"}'),('lochu',
'{"hair":"brown","eye":"blue","skin":"white"}')]
schema = ['name','props']
df = spark.createDataFrame(d,schema)
df.show(truncate = False)
df.printSchema()
```

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

|name |props |

+-----+---------------------------------------------+
|veena|{"hair":"black","eye":"brown","skin":"brown"}|
|lochu|{"hair":"brown","eye":"blue","skin":"white"} |

+-----+---------------------------------------------+


root

|-- name: string (nullable = true)

|-- props: string (nullable = true)
```

```
from pyspark.sql.functions import json_tuple
df2 =
df.select(df.name,json_tuple(df.props,'hair','skin').alias('hair','s
kin'))
df2.show()
```

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

| name| hair| skin|

+-----+-----+-----+

|veena|black|brown|

|lochu|brown|white|

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

44. get_ json_object() function in PySpark

➔ its used to extract the json string based on path from JSON column

➔ here , $ means the root node

```
d =
[('veena','{"genes":{"hair":"black","eye":"brown","skin":"brown"},"g
ender":"F"}'),\
    ('lochu','{"genes":{"hair":"brown","eye":"blue","skin":"white"},
"gender":"F"}')]
schema = ['name','props']
df = spark.createDataFrame(d,schema)
df.show(truncate = False)
```

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

|name |                                                            props |

+-----+-----------------------------------------------------------------+
|veena|{"genes":{"hair":"black","eye":"brown","skin":"brown"},"gender":"F"}|
|lochu|{"genes":{"hair":"brown","eye":"blue","skin":"white"},"gender":"F"} |

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

```
from pyspark.sql.functions import get_json_object
```

```
df.select('name',get_json_object('props','$.gender').alias('gender')
).show()
```

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

| name|gender|

+-----+------+

|veena|     F|

|lochu|     F|

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

```
from pyspark.sql.functions import get_json_object
df.select('name',get_json_object('props','$.genes.hair').alias('hair
colour')).show()
```

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

| name|hair colour|

+-----+-----------+

|veena|      black|

|lochu|      brown|

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

```
from pyspark.sql.functions import get_json_object
df.select('name',get_json_object('props','$.genes.hair').alias('hair
colour'),get_json_object('props','$.genes.skin').alias('skin
colour')).show()
```

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

| name|hair colour|skin colour|

+-----+-----------+-----------+

|veena|      black|      brown|

|lochu|      brown|      white|

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

45. Date functions in PySpark | current_date(), to_date(), date_format(), datediff(), months_between(), add_months(), date_add(), month(), year() functions

- ➔ DateType default format is **yyyy-MM-dd**
- ➔ **current_date()** get the current system date. By default , the data will be returned in yyyy-dd-MM format
- ➔ **date_format()** to parses the date and converts from yyyy-MM-dd to specified format.
- ➔ **to_date()** converts date string into datetype. We need to specify format of date in the string in the function

```
from pyspark.sql.functions import
current_date,date_format,lit,to_date

df = spark.range(1)
df1 = df.withColumn('todays_Date',current_date())
df1.show()
df2 =
df1.withColumn('newFormat',date_format(lit(df1.todays_Date),'MM.dd.y
yyy'))
df2.show()
df3 =
df2.withColumn('newDatecol',to_date(lit(df2.newFormat),'MM.dd.yyyy')
)
df3.show()
df3.printSchema()
```

```
df:pyspark.sql.dataframe.DataFrame = [id: long]
df1:pyspark.sql.dataframe.DataFrame = [id: long, todays_Date: date]
df2:pyspark.sql.dataframe.DataFrame = [id: long, todays_Date: date ... 1 more field]
df3:pyspark.sql.dataframe.DataFrame = [id: long, todays_Date: date ... 2 more fields]
```

```
+---+-----------+
| id|todays_Date|
+---+-----------+
|  0| 2024-04-17|
+---+-----------+

+---+-----------+----------+
| id|todays_Date| newFormat|
+---+-----------+----------+
|  0| 2024-04-17|04.17.2024|
+---+-----------+----------+

+---+-----------+----------+----------+
| id|todays_Date| newFormat|newDatecol|
+---+-----------+----------+----------+
|  0| 2024-04-17|04.17.2024|2024-04-17|
+---+-----------+----------+----------+

root
|-- id: long (nullable = false)
|-- todays_Date: date (nullable = false)
|-- newFormat: string (nullable = false)
|-- newDatecol: date (nullable = true)
```

```
from pyspark.sql.functions import
datediff,months_between,add_months,date_add,year,month

df = spark.createDataFrame([('2015-04-18','2015-05-
08')],['d1','d2'])
df1 = df.withColumn('diff',datediff(df.d2,df.d1))
df2 = df1.withColumn('monthsBetween',months_between(df.d2,df.d1))
df3 = df2.withColumn('addmonth',add_months(df.d2,4))
df4 = df3.withColumn('submonth',add_months(df.d2,-4))
df4.show()
```

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

|        d1|        d2|diff|monthsBetween|  addmonth|  submonth|

+----------+----------+----+-------------+----------+----------+

|2015-04-18|2015-05-08|  20|   0.67741935|2015-09-08|2015-01-08|

+----------+----------+----+-------------+----------+----------+
df1 = df.withColumn('addDate',date_add(df.d2,4))
df2 = df1.withColumn('subdate',date_add(df.d2,-4))
df3 = df2.withColumn('year',year(df.d1))
df4 = df3.withColumn('month',month(df.d2))
df4.show()
+----------+----------+----------+----------+----+-----+

|        d1|        d2|   addDate|   subdate|year|month|

+----------+----------+----------+----------+----+-----+

|2015-04-18|2015-05-08|2015-05-12|2015-05-04|2015|    5|

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

46. Timestamp Functions

➔ timestampType default format **is yyyy-MM-dd HH:mm:ss.SS**

➔ **current_timestamp()** get the current timestamp . By default , the data will in default format

➔ **to_timestamp()** converts timestamp string into Timestamptype . We need format of timestamp in the string the function

➔ **hour(),minute(),second()** functions

```
from pyspark.sql.functions import
current_timestamp,to_timestamp,lit,hour,minute,second

df = spark.range(1)
df1 = df.withColumn('timestamp',current_timestamp())
df1.show(truncate=False)
df1.printSchema()

df2 = df1.withColumn('toTimestamp',lit('25.12.2022 06.10.13.45'))
df3 =
df2.withColumn('toTimestamp',to_timestamp(df2.toTimestamp,'dd.MM.yyy
y HH.mm.ss.SSS'))
df3.show(truncate=False)
```

```
df3.printSchema()
```

```
+---+-----------------------+
|id |              timestamp |
+---+-----------------------+
| 0 |2024-04-17 11:33:24.026|
+---+-----------------------+

root
|-- id: long (nullable = false)
|-- timestamp: timestamp (nullable = false)

+---+-----------------------+----------------------+
|id |              timestamp |          toTimestamp |
+---+-----------------------+----------------------+
| 0 |2024-04-17 11:33:24.331|2022-12-25 06:10:13.45|
+---+-----------------------+----------------------+
root
|-- id: long (nullable = false)
|-- timestamp: timestamp (nullable = false)
|-- toTimestamp: timestamp (nullable = true)
```

```
df1.select('*',hour(df1.timestamp).alias('hour'),\
    minute(df1.timestamp).alias('minute'),\
    second(df1.timestamp).alias('second')).show(truncate=False)
```

```
+---+-----------------------+----+------+------+
|id |              timestamp |hour|minute|second|
+---+-----------------------+----+------+------+
| 0 |2024-04-17 11:34:57.659| 11 |   34 |   57 |
+---+-----------------------+----+------+------+
```

47. Aggregate functions : approx_count_distinct(), avg(), collect_list(), collect_set(), countDistinct(), count()

- ➔ Aggregate functions operate on a group of rows and calculate a single return value for every group
- ➔ Approx_count_distinct() = returns the count of distinct items in a group of rpws
- ➔ Avg() = returns average of values in agroup of rows
- ➔ Collect_list() = returns all values from input column as list with duplicates
- ➔ Collect_set() = returns all values from input column as list without duplicates
- ➔ CountDistinct() = returns number od distinct elements in input column
- ➔ Count() = return number of elements in a column

```
from pyspark.sql.functions import approx_count_distinct,avg
data = [('lochu','HR',1500),('veena','IT',3000),('hiii','HR',1500)]
schema = ['name','dept','salary']
df = spark.createDataFrame(data,schema)
df.show()
df.select(approx_count_distinct('salary')).show()
df.select(avg('salary')).show()
```

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

| name|dept|salary|

+-----+----+------+

|lochu|  HR|  1500|

|veena|  IT|  3000|

| hiii|  HR|  1500|

+-----+----+------+
+----------------------------+
|approx_count_distinct(salary)|
+----------------------------+
|                           2|
+----------------------------+

+-----------+
|avg(salary)|
+-----------+
|     2000.0|
+-----------+
```

```
from pyspark.sql.functions import *
df.select(collect_list('salary')).show()
df.select(collect_set('salary')).show()
df.select(countDistinct('dept')).show()
df.select(count('salary')).show()
```

```
+--------------------+
|collect_list(salary)|
+--------------------+
|  [1500, 3000, 1500]|
+--------------------+

+-------------------+
|collect_set(salary)|
+-------------------+
|       [3000, 1500]|
+-------------------+

+--------------------+
|count(DISTINCT dept)|
+--------------------+
|                   2|
+--------------------+

+-------------+
|count(salary)|
+-------------+
|            3|
+-------------+
```

48. row_number(), rank(), dense_rank() functions

- ➔ we need to partition the data using Window. partitionBy() , and for row number and rank function we need to additionally order by on partition data using orderBy clause
- ➔ row_number() window function is used to give the sequential row number starting from 1 to the result of each window partition
- ➔ rank() window function is used to provide a rank to the result within a window partition. This function leaves gaps in the rank when there are ties.
- ➔ Dense_rank() : window function is used to get the result with rank of rows within a window partition without any gaps. This is similar to rank() function difference being rank function leaves gaps in rank when there are ties

```
from pyspark.sql.functions import row_number,rank,dense_rank
from pyspark.sql.window import Window
data =
[('lochu','HR',1500),('veena','IT',3000),('hiii','HR',1500),('chandu
','IT',8500),('vara','HR',4500),('sai','HR',5500),('jyo','IT',7500)]
schema = ['name','dept','salary']
df = spark.createDataFrame(data,schema)
df.show()
```

```
+------+----+------+
| name|dept|salary|
+------+----+------+
| lochu|  HR|  1500|
| veena|  IT|  3000|
|  hiii|  HR|  1500|
|chandu|  IT|  8500|
|  vara|  HR|  4500|
|   sai|  HR|  5500|
|   jyo|  IT|  7500|
+------+----+------+
```

```
df.sort('dept').show()
win = Window.partitionBy('dept').orderBy('salary')
df.withColumn('rowno.',row_number().over(win)).\
    withColumn('rank',rank().over(win)).\
        withColumn('denseRank',dense_rank().over(win)).show()
```

```
+------+----+------+
| name|dept|salary|
+------+----+------+
|  vara|  HR|  4500|
| lochu|  HR|  1500|
|   sai|  HR|  5500|
|  hiii|  HR|  1500|
| veena|  IT|  3000|
|   jyo|  IT|  7500|
|chandu|  IT|  8500|
+------+----+------+

+------+----+------+------+----+---------+
| name|dept|salary|rowno.|rank|denseRank|
+------+----+------+------+----+---------+
| lochu|  HR|  1500|     1|   1|        1|
|  hiii|  HR|  1500|     2|   1|        1|
|  vara|  HR|  4500|     3|   3|        2|
|   sai|  HR|  5500|     4|   4|        3|
| veena|  IT|  3000|     1|   1|        1|
|   jyo|  IT|  7500|     2|   2|        2|
|chandu|  IT|  8500|     3|   3|        3|
+------+----+------+------+----+---------+
```