```
pip install pyspark
```

```
Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: pyspark in
/usr/local/lib/python3.10/dist-packages (3.4.0)
Requirement already satisfied: py4j==0.10.9.7 in
/usr/local/lib/python3.10/dist-packages (from pyspark) (0.10.9.7)
```

```
from google.colab import drive
drive.mount('/content/drive')
# Import Sparksession
from pyspark.sql import SparkSession
spark=SparkSession.builder.appName("Project").getOrCreate()
```

```
Drive already mounted at /content/drive; to attempt to forcibly
remount, call drive.mount("/content/drive", force_remount=True).
```

```
# Read data
file_location = "/content/drive/MyDrive/BDA/DataSet/OnlineRetail.csv"
file_type = "csv"
infer_schema = "true"
first_row_is_header = "true"
delimiter = ","

df = spark.read.format(file_type)\
.option("inferSchema", infer_schema)\
.option("header", first_row_is_header)\
.option("sep", delimiter)\
.load(file_location)

# Print Metadata
df.printSchema()
```

```
root
 |-- InvoiceNo: string (nullable = true)
 |-- StockCode: string (nullable = true)
 |-- Description: string (nullable = true)
 |-- Quantity: integer (nullable = true)
 |-- InvoiceDate: string (nullable = true)
 |-- UnitPrice: double (nullable = true)
 |-- CustomerID: integer (nullable = true)
 |-- Country: string (nullable = true)
```

```
#  Count data
df.count()
print('The total number of records '+str(df.count()))
```

The total number of records 541909

df.show()

```
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+
|InvoiceNo|StockCode|         Description|Quantity|   InvoiceDate|
UnitPrice|CustomerID|       Country|
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+
|   536365|   85123A|WHITE HANGING HEA...|       6|12/1/2010 8:26|
2.55|     17850|United Kingdom|
|   536365|    71053| WHITE METAL LANTERN|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|
|   536365|   84406B|CREAM CUPID HEART...|       8|12/1/2010 8:26|
2.75|     17850|United Kingdom|
|   536365|   84029G|KNITTED UNION FLA...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|
|   536365|   84029E|RED WOOLLY HOTTIE...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|
|   536365|    22752|SET 7 BABUSHKA NE...|       2|12/1/2010 8:26|
7.65|     17850|United Kingdom|
|   536365|    21730|GLASS STAR FROSTE...|       6|12/1/2010 8:26|
4.25|     17850|United Kingdom|
|   536366|    22633|HAND WARMER UNION...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|
|   536366|    22632|HAND WARMER RED P...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|
|   536367|    84879|ASSORTED COLOUR B...|      32|12/1/2010 8:34|
1.69|     13047|United Kingdom|
|   536367|    22745|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|
|   536367|    22748|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|
|   536367|    22749|FELTCRAFT PRINCES...|       8|12/1/2010 8:34|
3.75|     13047|United Kingdom|
|   536367|    22310|IVORY KNITTED MUG...|       6|12/1/2010 8:34|
1.65|     13047|United Kingdom|
|   536367|    84969|BOX OF 6 ASSORTED...|       6|12/1/2010 8:34|
4.25|     13047|United Kingdom|
|   536367|    22623|BOX OF VINTAGE JI...|       3|12/1/2010 8:34|
4.95|     13047|United Kingdom|
|   536367|    22622|BOX OF VINTAGE AL...|       2|12/1/2010 8:34|
9.95|     13047|United Kingdom|
|   536367|    21754|HOME BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|
|   536367|    21755|LOVE BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|
|   536367|    21777|RECIPE BOX WITH M...|       4|12/1/2010 8:34|
7.95|     13047|United Kingdom|
+---------+---------+--------------------+--------+--------------
```

```
+---------+----------+--------------+
only showing top 20 rows
```

```
from pyspark.sql.functions import to_date, split, col


# Separate date and time components
df = df.withColumn("OrderDate", split(col("InvoiceDate"), " ")[0])
df = df.withColumn("OrderTime", split(col("InvoiceDate"), " ")[1])

# Alternatively, if you want to keep the date and time together as a
string
df = df.withColumn("OrderDateTime", col("InvoiceDate").cast("string"))

df.show()
```

```
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+---------+---------
+--------------+
|InvoiceNo|StockCode|         Description|Quantity|   InvoiceDate|
UnitPrice|CustomerID|       Country|OrderDate|OrderTime|
OrderDateTime|
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+---------+---------
+--------------+
|   536365|   85123A|WHITE HANGING HEA...|       6|12/1/2010 8:26|
2.55|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|    71053| WHITE METAL LANTERN|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|   84406B|CREAM CUPID HEART...|       8|12/1/2010 8:26|
2.75|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|   84029G|KNITTED UNION FLA...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|   84029E|RED WOOLLY HOTTIE...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|    22752|SET 7 BABUSHKA NE...|       2|12/1/2010 8:26|
7.65|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536365|    21730|GLASS STAR FROSTE...|       6|12/1/2010 8:26|
4.25|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
|   536366|    22633|HAND WARMER UNION...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|12/1/2010|     8:28|12/1/2010 8:28|
|   536366|    22632|HAND WARMER RED P...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|12/1/2010|     8:28|12/1/2010 8:28|
|   536367|    84879|ASSORTED COLOUR B...|      32|12/1/2010 8:34|
1.69|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    22745|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    22748|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
```

```
|   536367|    22749|FELTCRAFT PRINCES...|       8|12/1/2010 8:34|
3.75|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    22310|IVORY KNITTED MUG...|       6|12/1/2010 8:34|
1.65|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    84969|BOX OF 6 ASSORTED...|       6|12/1/2010 8:34|
4.25|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    22623|BOX OF VINTAGE JI...|       3|12/1/2010 8:34|
4.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    22622|BOX OF VINTAGE AL...|       2|12/1/2010 8:34|
9.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    21754|HOME BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    21755|LOVE BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
|   536367|    21777|RECIPE BOX WITH M...|       4|12/1/2010 8:34|
7.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+---------+---------
+--------------+
only showing top 20 rows
```

```
df.printSchema() # Prints Schema of the dataframe attributes in a tree
format
```

```
root
 |-- InvoiceNo: string (nullable = true)
 |-- StockCode: string (nullable = true)
 |-- Description: string (nullable = true)
 |-- Quantity: integer (nullable = true)
 |-- InvoiceDate: string (nullable = true)
 |-- UnitPrice: double (nullable = true)
 |-- CustomerID: integer (nullable = true)
 |-- Country: string (nullable = true)
 |-- OrderDate: string (nullable = true)
 |-- OrderTime: string (nullable = true)
 |-- OrderDateTime: string (nullable = true)
```

```
df = df.dropna()
```

```
import pyspark.sql.functions as F


# Calculate the new column "Value"
df = df.withColumn("Value", F.round(col("Quantity") *
col("UnitPrice"),2))

# Show the dataframe
df.show()
```

```
+---------+---------+--------------------+--------+-------------
+---------+----------+-------------+---------+---------
+--------------+-----+
|InvoiceNo|StockCode|         Description|Quantity|   InvoiceDate|
UnitPrice|CustomerID|       Country|OrderDate|OrderTime|
OrderDateTime|Value|
+---------+---------+--------------------+--------+-------------
+---------+----------+-------------+---------+---------
+--------------+-----+
|   536365|   85123A|WHITE HANGING HEA...|       6|12/1/2010 8:26|
2.55|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
15.3|
|   536365|    71053| WHITE METAL LANTERN|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
20.34|
|   536365|   84406B|CREAM CUPID HEART...|       8|12/1/2010 8:26|
2.75|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
22.0|
|   536365|   84029G|KNITTED UNION FLA...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
20.34|
|   536365|   84029E|RED WOOLLY HOTTIE...|       6|12/1/2010 8:26|
3.39|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
20.34|
|   536365|    22752|SET 7 BABUSHKA NE...|       2|12/1/2010 8:26|
7.65|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
15.3|
|   536365|    21730|GLASS STAR FROSTE...|       6|12/1/2010 8:26|
4.25|     17850|United Kingdom|12/1/2010|     8:26|12/1/2010 8:26|
25.5|
|   536366|    22633|HAND WARMER UNION...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|12/1/2010|     8:28|12/1/2010 8:28|
11.1|
|   536366|    22632|HAND WARMER RED P...|       6|12/1/2010 8:28|
1.85|     17850|United Kingdom|12/1/2010|     8:28|12/1/2010 8:28|
11.1|
|   536367|    84879|ASSORTED COLOUR B...|      32|12/1/2010 8:34|
1.69|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
54.08|
|   536367|    22745|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
12.6|
|   536367|    22748|POPPY'S PLAYHOUSE...|       6|12/1/2010 8:34|
2.1|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
12.6|
|   536367|    22749|FELTCRAFT PRINCES...|       8|12/1/2010 8:34|
3.75|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
30.0|
|   536367|    22310|IVORY KNITTED MUG...|       6|12/1/2010 8:34|
1.65|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
```

```
9.9|
|   536367|    84969|BOX OF 6 ASSORTED...|       6|12/1/2010 8:34|
4.25|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
25.5|
|   536367|    22623|BOX OF VINTAGE JI...|       3|12/1/2010 8:34|
4.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
14.85|
|   536367|    22622|BOX OF VINTAGE AL...|       2|12/1/2010 8:34|
9.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
19.9|
|   536367|    21754|HOME BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
17.85|
|   536367|    21755|LOVE BUILDING BLO...|       3|12/1/2010 8:34|
5.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
17.85|
|   536367|    21777|RECIPE BOX WITH M...|       4|12/1/2010 8:34|
7.95|     13047|United Kingdom|12/1/2010|     8:34|12/1/2010 8:34|
31.8|
+---------+---------+--------------------+--------+--------------
+---------+----------+--------------+---------+---------
+--------------+-----+
only showing top 20 rows
```

```
from pyspark.sql import SparkSession
from pyspark.sql.functions import col, max, min, count, sum
from pyspark.sql.window import Window

rfm = df.groupBy("CustomerID").agg(
    max(col("InvoiceDate")).alias("Recent_date"),
    count(col("InvoiceNo")).alias("Frequency"),
    F.round(sum(col("Value")).alias("Monetary"),2)
)

rfm = rfm.withColumnRenamed("round(sum(Value) AS Monetary, 2)",
"Monetary")

rfm.show()
```

```
+----------+---------------+---------+--------+
|CustomerID|    Recent_date|Frequency|Monetary|
+----------+---------------+---------+--------+
|     12346|1/18/2011 10:17|        2|     0.0|
|     12347|  8/2/2011 8:48|      182|  4310.0|
|     12348|9/25/2011 13:13|       31| 1797.24|
|     12349|11/21/2011 9:51|       73| 1757.55|
|     12350| 2/2/2011 16:01|       17|   334.4|
|     12352|9/28/2011 14:58|       95| 1545.41|
|     12353|5/19/2011 17:47|        4|    89.0|
|     12354|4/21/2011 13:11|       58|  1079.4|
```

```
|     12355| 5/9/2011 13:49|       13|   459.4|
|     12356| 4/8/2011 12:33|       59| 2811.43|
|     12357|11/6/2011 16:07|      131| 6207.67|
|     12358|7/12/2011 10:04|       19| 1168.06|
|     12359| 6/3/2011 12:26|      254| 6245.53|
|     12360|8/19/2011 10:10|      129| 2662.06|
|     12361|2/25/2011 13:51|       10|   189.9|
|     12362|9/28/2011 12:04|      274| 5154.58|
|     12363|8/22/2011 10:18|       23|   552.0|
|     12364|9/22/2011 16:07|       85|  1313.1|
|     12365|2/21/2011 14:04|       23|  320.69|
|     12367|12/5/2011 16:48|       11|   168.9|
+----------+---------------+---------+--------+
only showing top 20 rows
```

```
rfm_d = rfm.toPandas()
from pyspark.sql.functions import current_date
current_date_value = current_date()
```

```
import pandas as pd

# Assuming you have a pandas DataFrame named rfm
rfm_d['Recent_date'] = pd.to_datetime(rfm_d['Recent_date'])  # Convert
column to datetime if not already
rfm_d['Recency'] = (pd.to_datetime('2012-01-01') -
rfm_d['Recent_date']).dt.days
rfm_d.head(5)
```

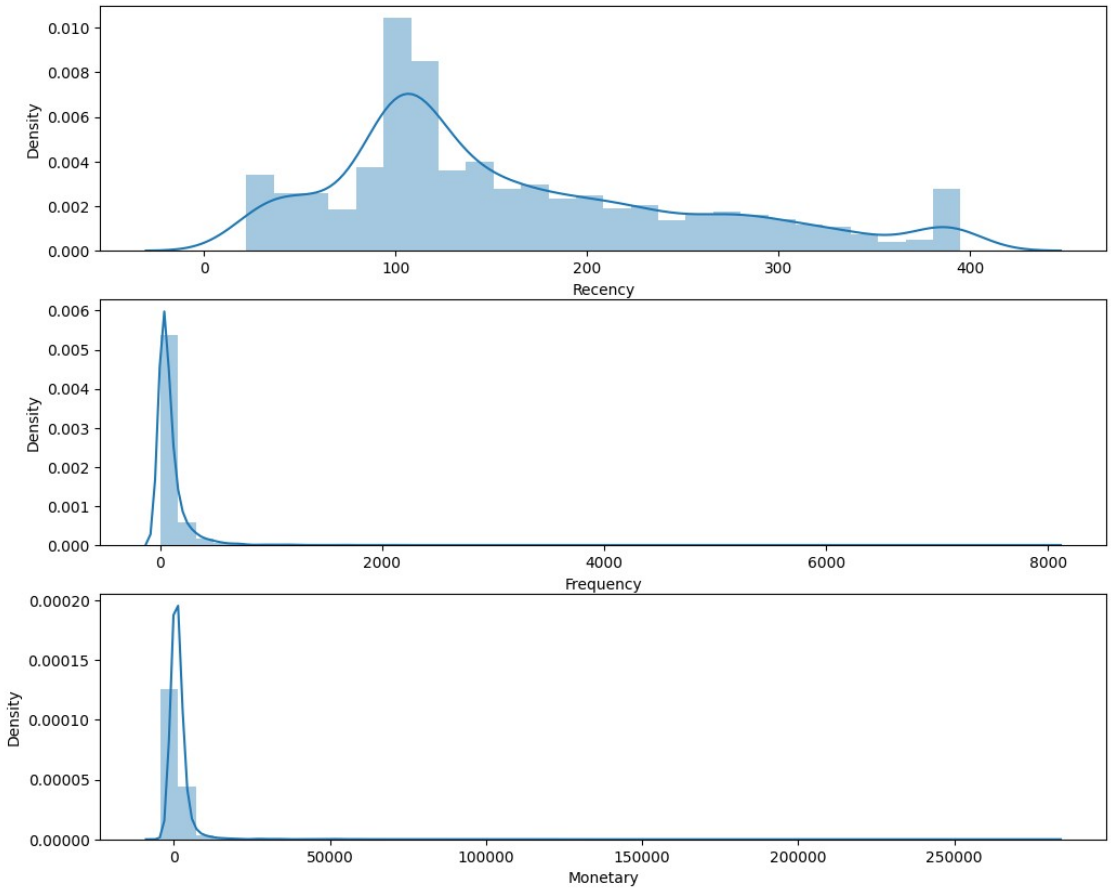
```
   CustomerID         Recent_date  Frequency  Monetary  Recency
0       12346 2011-01-18 10:17:00          2      0.00      347
1       12347 2011-08-02 08:48:00        182   4310.00      151
2       12348 2011-09-25 13:13:00         31   1797.24       97
3       12349 2011-11-21 09:51:00         73   1757.55       40
4       12350 2011-02-02 16:01:00         17    334.40      332
```

```
import matplotlib.pyplot as plt

from pyspark.sql import SparkSession


import seaborn as sns
plt.figure(figsize=(12,10))
# Plot distribution of recency
plt.subplot(3, 1, 1)
sns.distplot(rfm_d['Recency'])
# Plot distribution of frequency
plt.subplot(3, 1, 2)
sns.distplot(rfm_d['Frequency'])
# Plot distribution of monetary
```

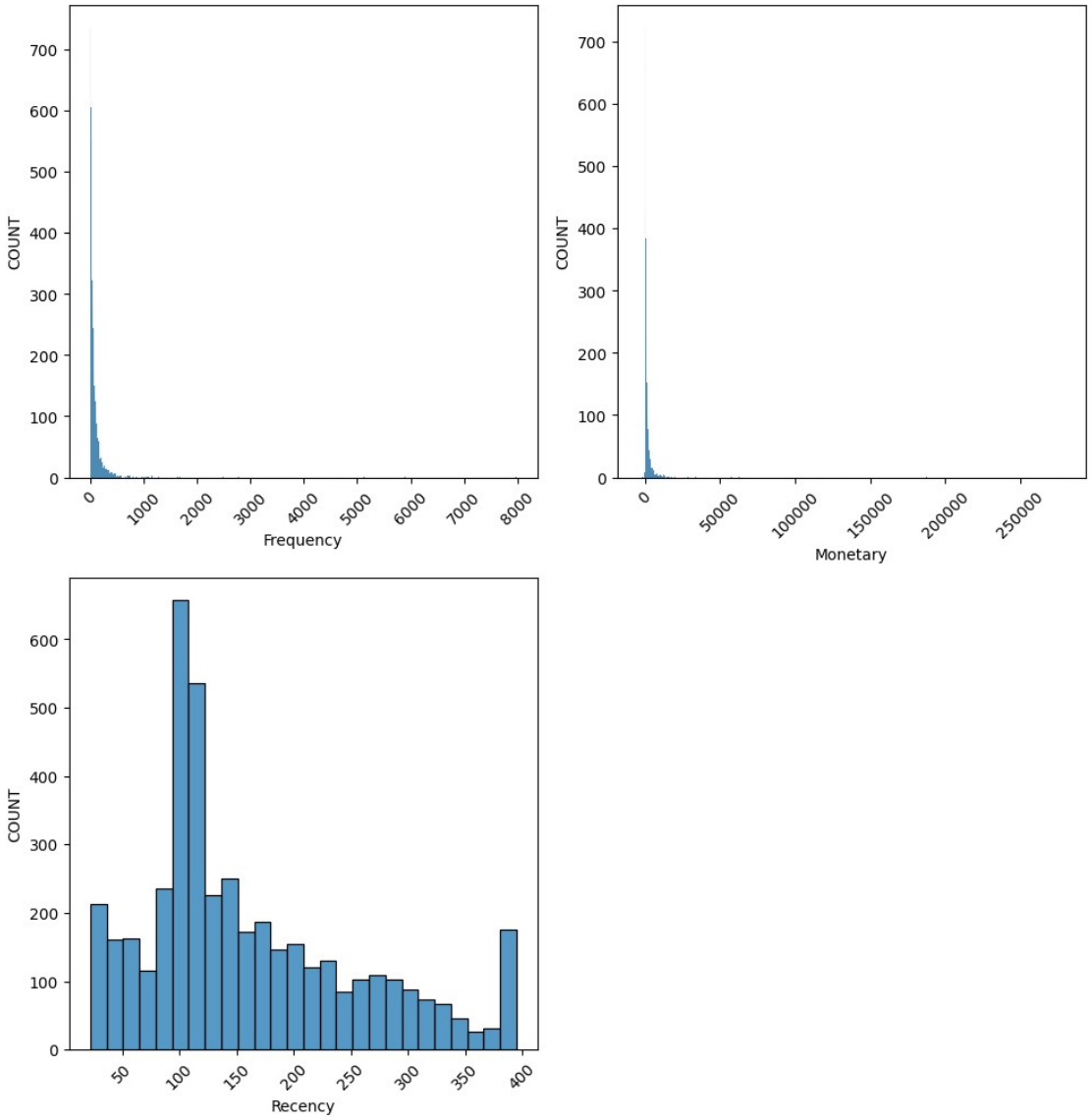
```
plt.subplot(3, 1, 3)
sns.distplot(rfm_d['Monetary'])
```

```
<ipython-input-18-f1e6c074a878>:10: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(rfm_d['Recency'])
<ipython-input-18-f1e6c074a878>:13: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(rfm_d['Frequency'])
<ipython-input-18-f1e6c074a878>:16: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(rfm_d['Monetary'])
```

```
<Axes: xlabel='Monetary', ylabel='Density'>
```

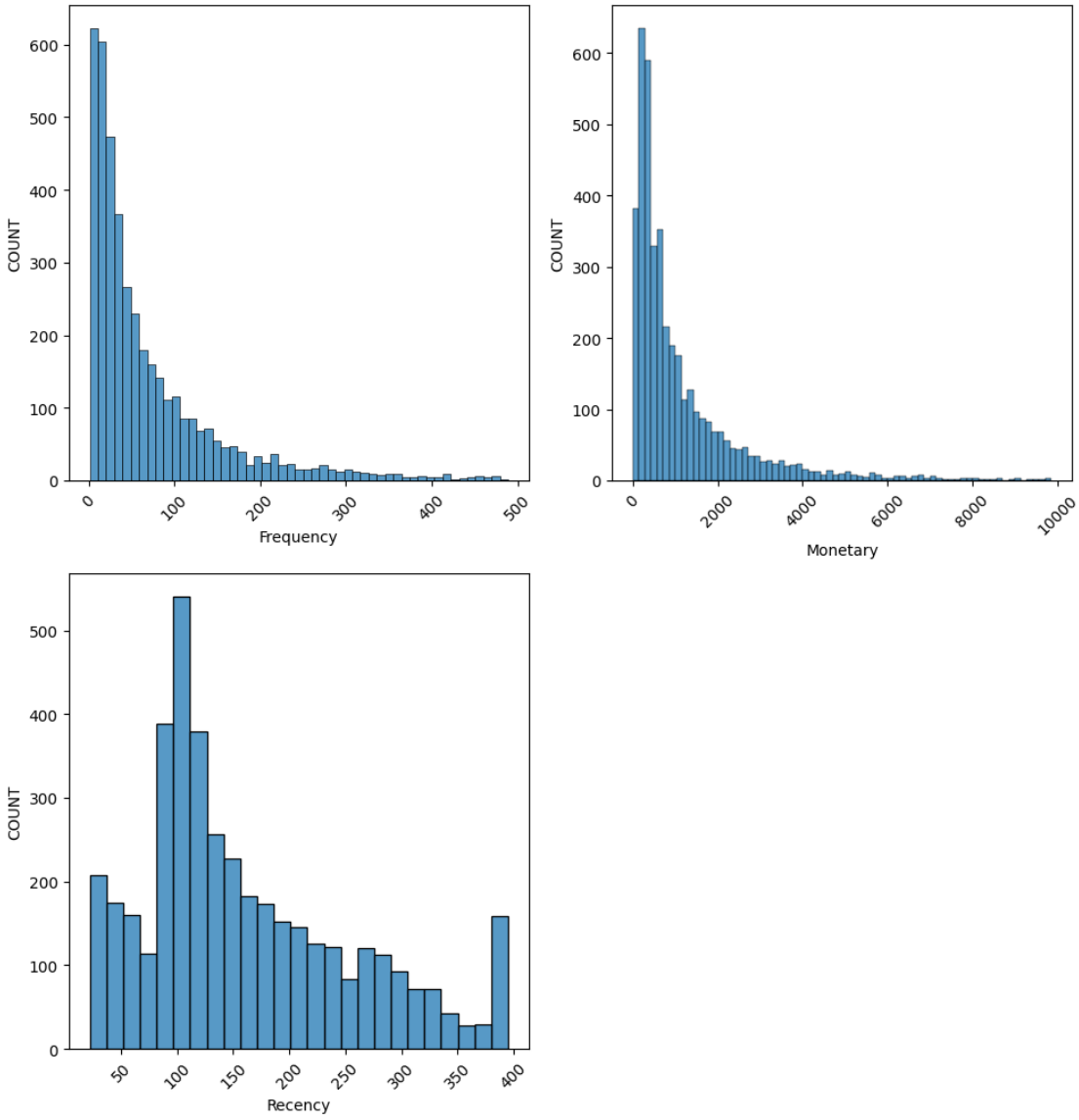



```
fig = plt.figure(figsize=(10,20))
num_vars = rfm_d.select_dtypes(['int64', 'float64']).columns.tolist()
#num_vars.remove('Id')
for index, col in enumerate(num_vars):
    plt.subplot(4,2,index+1)
    sns.histplot(x=col, data=rfm_d)
    plt.ylabel('COUNT', size = 10)
    plt.xlabel(col, fontsize = 10)
    plt.xticks(size = 10, rotation = 45 )
    plt.yticks(size = 10)
fig.tight_layout(pad=1.0)
```




```
rfm_d.drop(rfm_d[rfm_d['Frequency'] >= 500].index, inplace = True)

rfm_d.drop(rfm_d[rfm_d['Monetary'] >= 10000].index, inplace = True)

rfm_d.drop(rfm_d[rfm_d['Monetary'] <= 0].index, inplace = True)

fig = plt.figure(figsize=(10,20))
num_vars = rfm_d.select_dtypes(['int64', 'float64']).columns.tolist()
#num_vars.remove('Id')
for index, col in enumerate(num_vars):
    plt.subplot(4,2,index+1)
    sns.histplot(x=col, data=rfm_d)
    plt.ylabel('COUNT', size = 10)
    plt.xlabel(col, fontsize = 10)
    plt.xticks(size = 10, rotation = 45 )
```

```
    plt.yticks(size = 10)
fig.tight_layout(pad=1.0)
```




```
from pyspark.ml.clustering import KMeans
from pyspark.ml.feature import VectorAssembler
from pyspark.ml.feature import StandardScaler
from pyspark.ml.evaluation import ClusteringEvaluator

rfmd=rfm_d
rfmd.dropna()
```

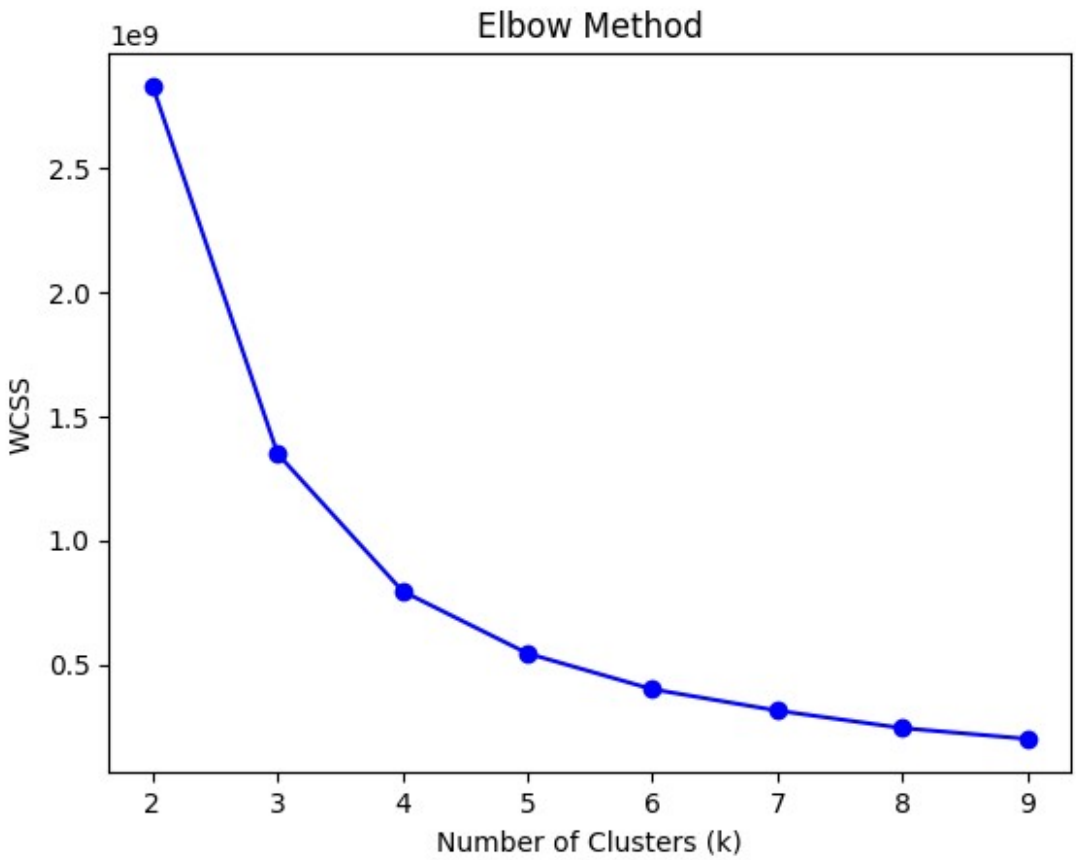
	CustomerID	Recent_date	Frequency	Monetary	Recency
1	12347	2011-08-02 08:48:00	182	4310.00	151
2	12348	2011-09-25 13:13:00	31	1797.24	97
3	12349	2011-11-21 09:51:00	73	1757.55	40

```
4          12350 2011-02-02 16:01:00         17    334.40      332
5          12352 2011-09-28 14:58:00         95   1545.41       94
...          ...                 ...        ...       ...      ...
4366       18278 2011-09-27 11:58:00          9    173.90       95
4367       18280 2011-03-07 09:52:00         10    180.60      299
4368       18281 2011-06-12 10:53:00          7     80.82      202
4369       18282 2011-08-09 15:10:00         13    176.60      144
4371       18287 2011-05-22 10:39:00         70   1837.28      223

[4163 rows x 5 columns]
```

```
rfm_col = ["Recency", "Frequency", "Monetary"]
assembler =
VectorAssembler().setHandleInvalid("skip").setInputCols(rfm_col).setOu
tputCol("unscaled_features")
scaler =
StandardScaler().setInputCol("unscaled_features").setOutputCol("featur
es")
```

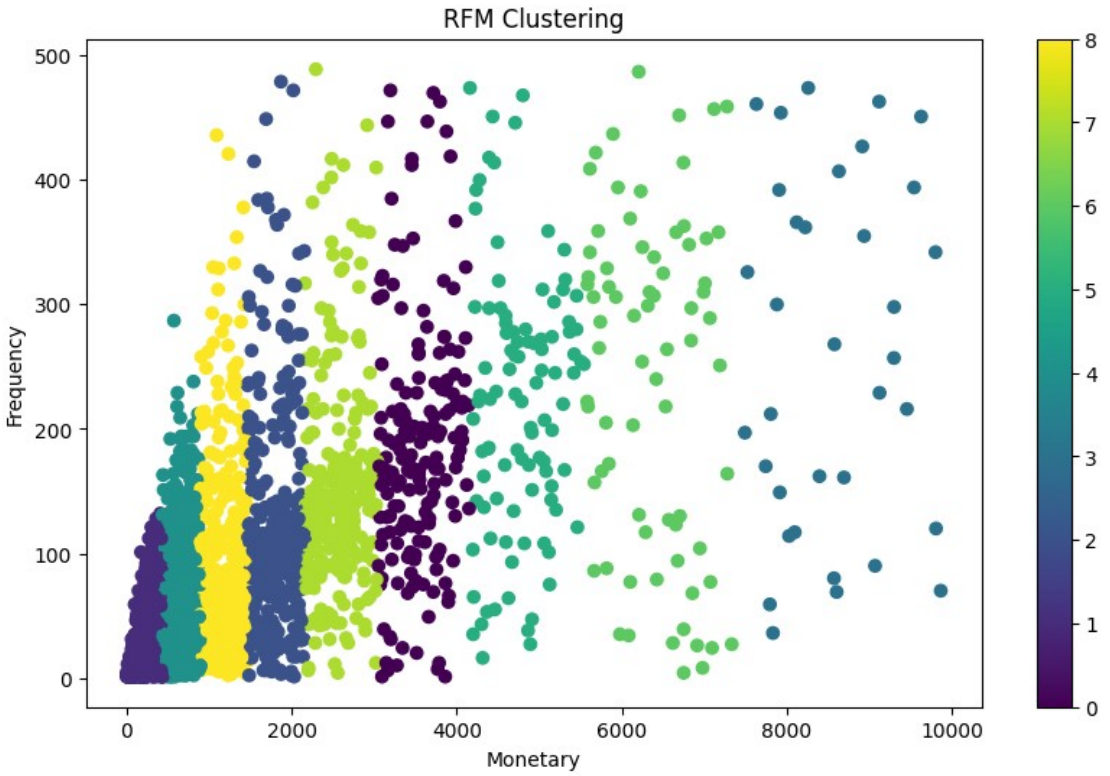
```
import pyspark.sql.functions as F
from pyspark.ml.feature import VectorAssembler, StandardScaler
from pyspark.ml import Pipeline
from pyspark.ml.clustering import KMeans
from pyspark.ml.evaluation import ClusteringEvaluator


# Assuming you have a DataFrame with RFM data
# rfmdf = spark.read.csv("rfm_data.csv", header=True,
inferSchema=True)
# Convert the Pandas DataFrame to PySpark DataFrame
rfmdf = spark.createDataFrame(rfmd)
# Preprocess RFM data and create feature vector
rfmdf = rfmdf.withColumn("Recency", rfmdf["Recency"].cast("double"))
rfmdf = rfmdf.withColumn("Frequency",
rfmdf["Frequency"].cast("double"))
rfmdf = rfmdf.withColumn("Monetary", rfmdf["Monetary"].cast("double"))
assembler = VectorAssembler(
    inputCols=["Recency", "Frequency", "Monetary"],
    outputCol="features"
)
rfmdf = assembler.transform(rfmdf)

# Standardize the features
scaler = StandardScaler(inputCol="features",
outputCol="scaledFeatures")
scalerModel = scaler.fit(rfmdf)
scaledData = scalerModel.transform(rfmdf)

k_values = range(2, 10)
```

```
wcss = []

for k in k_values:
    kmeans = KMeans(k=k, seed=42)
    model = kmeans.fit(scaledData)
    cost = model.summary.trainingCost
    wcss.append(cost)

# Plot the WCSS values
plt.plot(k_values, wcss, 'bo-')
plt.xlabel('Number of Clusters (k)')
plt.ylabel('WCSS')
plt.title('Elbow Method')
plt.show()


# # Apply k-means clustering
# k = 4  # Number of clusters
# kmeans = KMeans(k=k, seed=42)
# model = kmeans.fit(scaledData)


# Assign cluster labels to the data
predictions = model.transform(scaledData)

# View the cluster assignments
predictions.select("Recency", "Frequency", "Monetary",
"prediction").show()

# Get the cluster centers
centers = model.clusterCenters()
for center in centers:
    print(center)
```

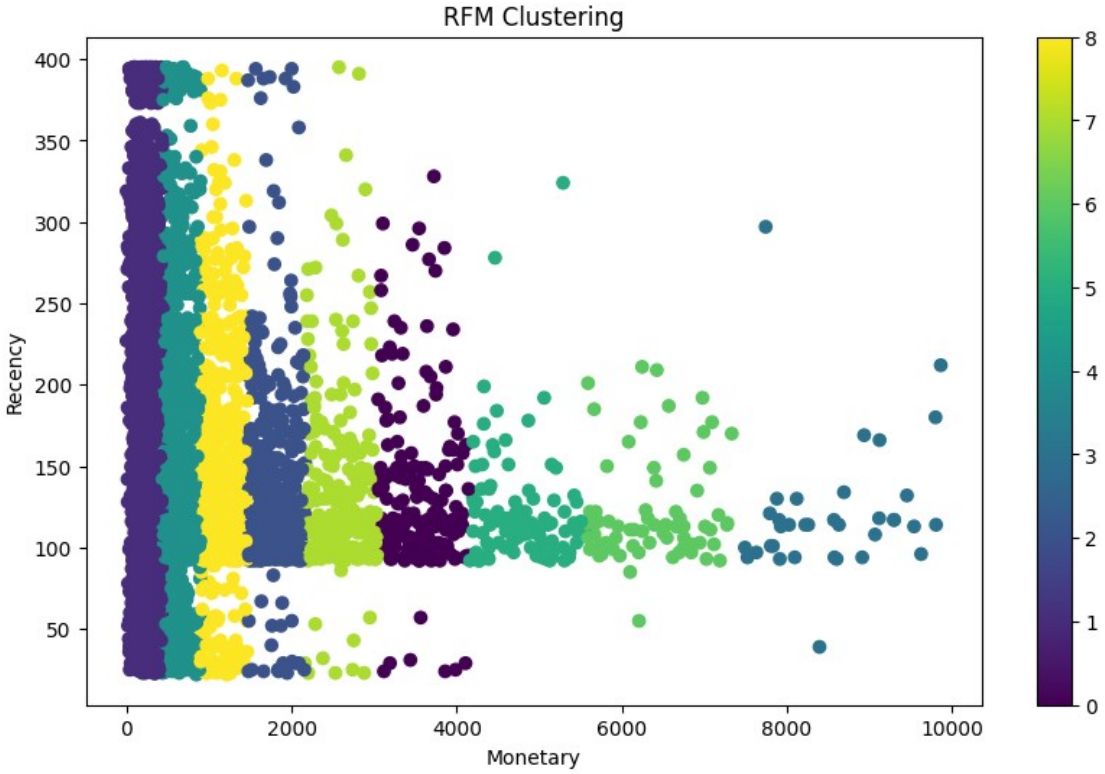


Recency	Frequency	Monetary	prediction
151.0	182.0	4310.0	5
97.0	31.0	1797.24	2
40.0	73.0	1757.55	2
332.0	17.0	334.4	1
94.0	95.0	1545.41	2
226.0	4.0	89.0	1
254.0	58.0	1079.4	8
236.0	13.0	459.4	4
267.0	59.0	2811.43	7
55.0	131.0	6207.67	6
172.0	19.0	1168.06	8
211.0	254.0	6245.53	6
134.0	129.0	2662.06	7
309.0	10.0	189.9	1
94.0	274.0	5154.58	5
131.0	23.0	552.0	4
100.0	85.0	1313.1	8
313.0	23.0	320.69	1
26.0	11.0	168.9	1
296.0	167.0	3545.69	0

```
only showing top 20 rows

[ 134.12021858  184.49180328 3548.43027322]
[181.71463867  21.72699197 238.66590488]
[ 138.5038961   117.4        1785.87963636]
[ 121.62857143  258.51428571 8554.49314286]
[165.28158458  51.89828694 640.9096788 ]
[ 122.30612245  221.87755102 4775.43673469]
[ 121.39726027  240.76712329 6373.4930137 ]
[ 132.55598456  151.3011583  2552.90648649]
[ 145.82322357   80.98093588 1150.60951473]



# Convert PySpark DataFrame to Pandas DataFrame
pandas_df = predictions.select("Recency", "Frequency", "Monetary",
"prediction").toPandas()

# Plotting the clusters
plt.figure(figsize=(10, 6))
scatter = plt.scatter(pandas_df["Monetary"], pandas_df["Frequency"],
c=pandas_df["prediction"], cmap="viridis")
plt.xlabel("Monetary")
plt.ylabel("Frequency")
plt.title("RFM Clustering")
plt.colorbar(scatter)
plt.show()
```




```
# Convert PySpark DataFrame to Pandas DataFrame
pandas_df = predictions.select("Recency", "Frequency", "Monetary",
"prediction").toPandas()

# Plotting the clusters
plt.figure(figsize=(10, 6))
scatter = plt.scatter(pandas_df["Monetary"], pandas_df["Recency"],
c=pandas_df["prediction"], cmap="viridis")
plt.xlabel("Monetary")
plt.ylabel("Recency")
plt.title("RFM Clustering")
plt.colorbar(scatter)
plt.show()
```


RFM Clustering
Recency
Monetary
400
350
300
250
200
150
100
50
0
2000
4000
6000
8000
10000
8
7
6
5
4
3
2
1
0