CUSTOMER SEGMENTATION IN PYTHON

Introduction to RFM segmentation

Karolis Urbonas
Head of Data Science, Amazon

What is RFM segmentation?

Behavioral customer segmentation based on three metrics:

- Recency (R)
- Frequency (F)
- Monetary Value (M)

Grouping RFM values

The RFM values can be grouped in several ways:

- Percentiles e.g. quantiles
- Pareto 80/20 cut
- Custom - based on business knowledge

We are going to implement percentile-based grouping.

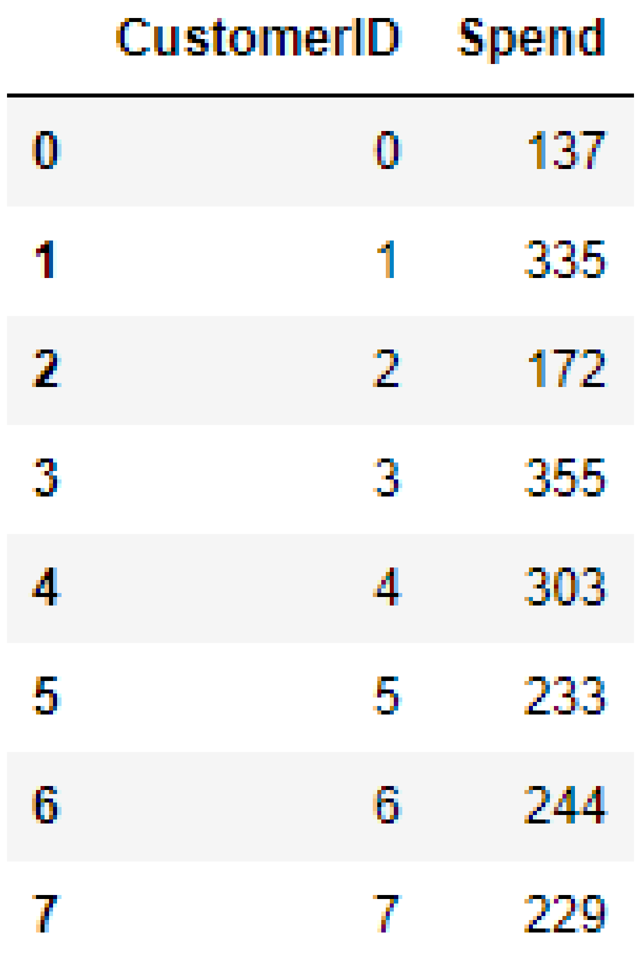
Short review of percentiles

Process of calculating percentiles:

1. Sort customers based on that metric
2. Break customers into a pre-defined number of groups of equal size
3. Assign a label to each group

Calculate percentiles with Python

Data with eight `CustomerID` and a randomly calculated `Spend` values.



	CustomerID	Spend
0	0	137
1	1	335
2	2	172
3	3	355
4	4	303
5	5	233
6	6	244
7	7	229

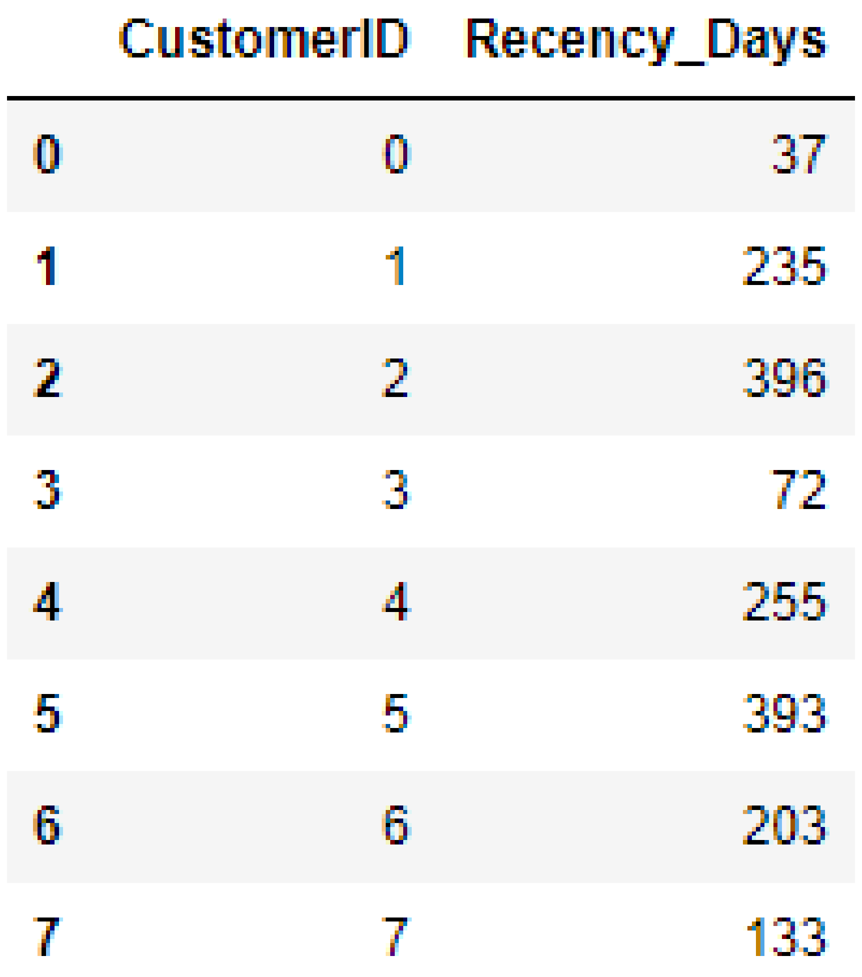
Calculate percentiles with Python

```
spend_quartiles = pd.qcut(data['Spend'], q=4, labels=range(1,5))

data['Spend_Quartile'] = spend_quartiles

data.sort_values('Spend')
```

	CustomerID	Spend	Spend_Quartile
0	0	137	1
2	2	172	1
7	7	229	2
5	5	233	2
6	6	244	3
4	4	303	3
1	1	335	4
3	3	355	4

Assigning labels

- Highest score to the best metric - best is not always highest e.g. recency
- In this case, the label is inverse - the more recent the customer, the better



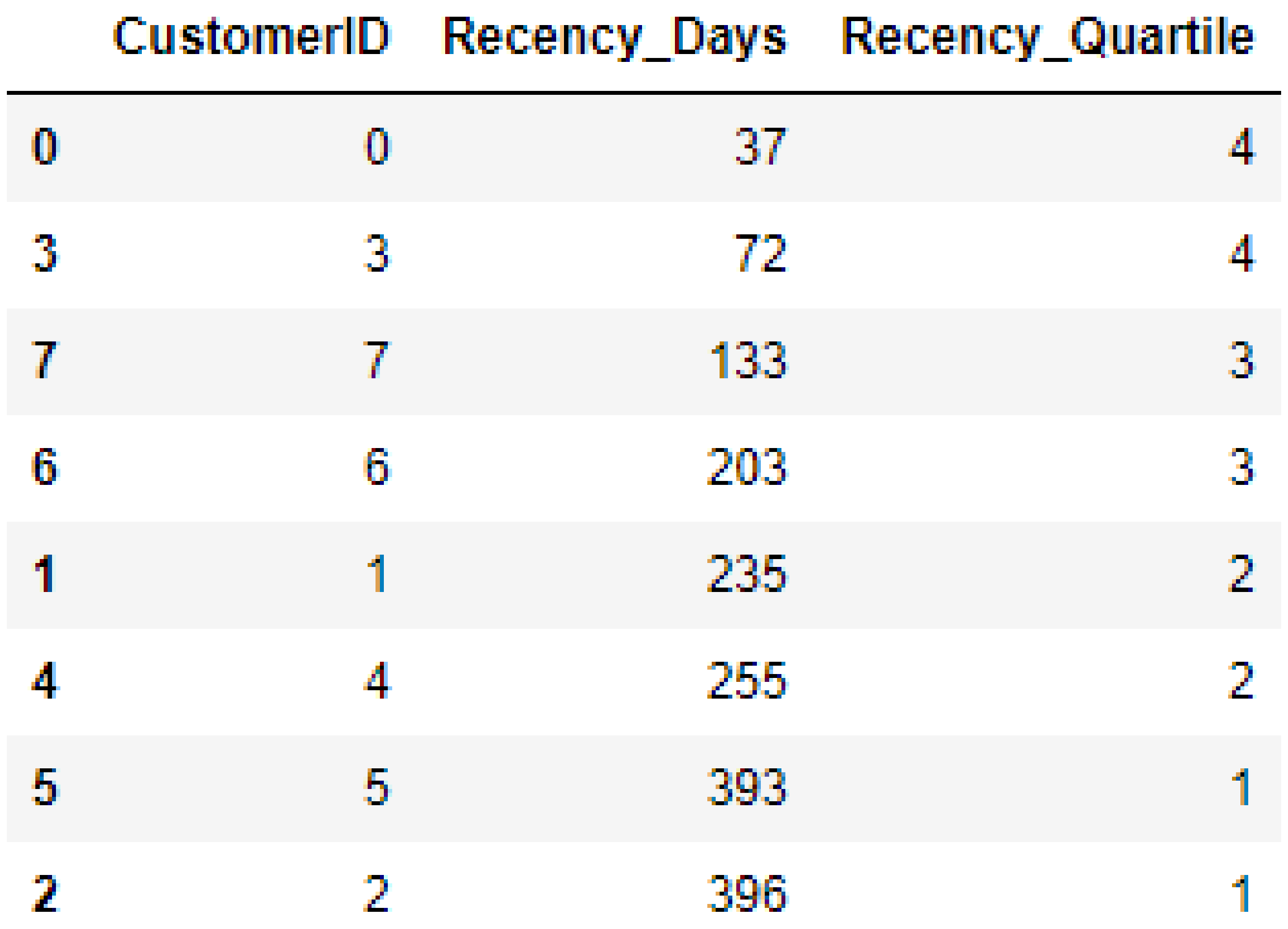
	CustomerID	Recency_Days
0	0	37
1	1	235
2	2	396
3	3	72
4	4	255
5	5	393
6	6	203
7	7	133

Assigning labels

```
# Create numbered labels
r_labels = list(range(4, 0, -1))

# Divide into groups based on quartiles
recency_quartiles = pd.qcut(data['Recency_Days'], q=4, labels=r_labels)

# Create new column
data['Recency_Quartile'] = recency_quartiles

# Sort recency values from lowest to highest
data.sort_values('Recency_Days')
```

Assigning labels

As you can see, the quartile labels are reversed, since the more recent customers are more valuable.



	CustomerID	Recency_Days	Recency_Quartile
0	0	37	4
3	3	72	4
7	7	133	3
6	6	203	3
1	1	235	2
4	4	255	2
5	5	393	1
2	2	396	1

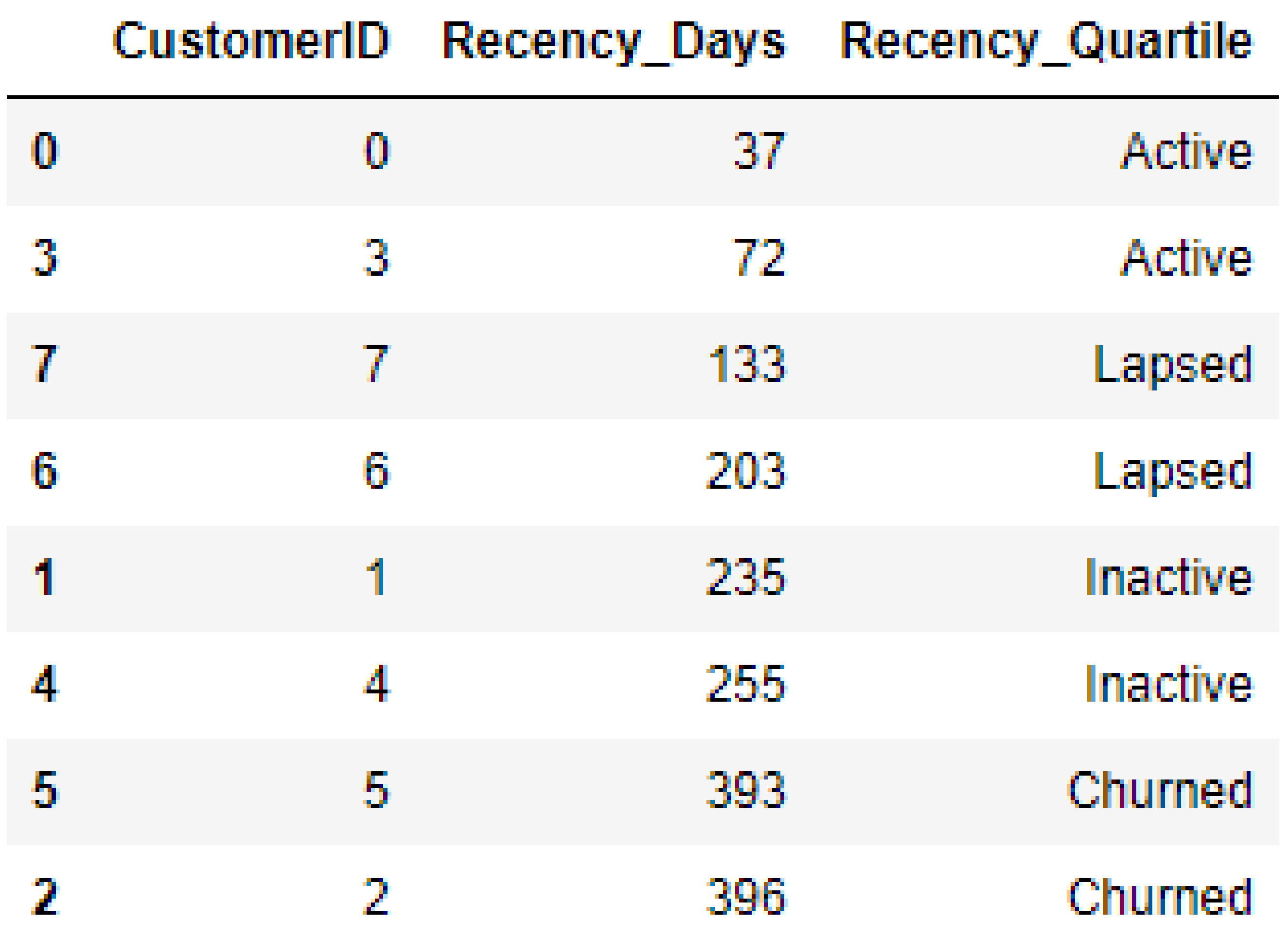
Custom labels

We can define a list with string or any other values, depending on the use case.

```
# Create string labels
r_labels = ['Active', 'Lapsed', 'Inactive', 'Churned']

# Divide into groups based on quartiles
recency_quartiles = pd.qcut(data['Recency_Days'], q=4, labels=r_labels)

# Create new column
data['Recency_Quartile'] = recency_quartiles

# Sort values from lowest to highest
data.sort_values('Recency_Days')
```

Custom labels

Custom labels assigned to each quartile



	CustomerID	Recency_Days	Recency_Quartile
0	0	37	Active
3	3	72	Active
7	7	133	Lapsed
6	6	203	Lapsed
1	1	235	Inactive
4	4	255	Inactive
5	5	393	Churned
2	2	396	Churned

CUSTOMER SEGMENTATION IN PYTHON

Let's practice with percentiles!

CUSTOMER SEGMENTATION IN PYTHON

Recency, Frequency, Monetary Value calculation

Karolis Urbonas
Head of Data Science, Amazon

Definitions

- Recency - days since last customer transaction
- Frequency - number of transactions in the last 12 months
- Monetary Value - total spend in the last 12 months

Dataset and preparations

- Same `online` dataset like in the previous lessons
- Need to do some data preparation
- New `TotalSum` column = `Quantity` x `UnitPrice`.

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	TotalSum
416792	572558	22745	POPPY'S PLAYHOUSE BEDROOM	6	2011-10-25	2.10	14286	United Kingdom	12.60
482904	577485	23196	VINTAGE LEAF MAGNETIC NOTEPAD	1	2011-11-20	1.45	16360	United Kingdom	1.45
263743	560034	23299	FOOD COVER WITH BEADS SET 2	6	2011-07-14	3.75	13933	United Kingdom	22.50
495549	578307	72349B	SET/6 PURPLE BUTTERFLY T-LIGHTS	1	2011-11-23	2.10	17290	United Kingdom	2.10
204384	554656	21756	BATH BUILDING BLOCK WORD	3	2011-05-25	5.95	17663	United Kingdom	17.85

Data preparation steps

We're starting with a pre-processed `online` DataFrame with only the latest 12 months of data:

```
print('Min:{}; Max:{}'.format(min(online.InvoiceDate),
                              max(online.InvoiceDate)))

Min:2010-12-10; Max:2011-12-09
```

Let's create a hypothetical **snapshot_day** data as if we're doing analysis recently.

```
snapshot_date = max(online.InvoiceDate) + datetime.timedelta(days=1)
```

Calculate RFM metrics

```
# Aggregate data on a customer level
datamart = online.groupby(['CustomerID']).agg({
    'InvoiceDate': lambda x: (snapshot_date - x.max()).days,
    'InvoiceNo': 'count',
    'TotalSum': 'sum'})

# Rename columns for easier interpretation
datamart.rename(columns = {'InvoiceDate': 'Recency',
                           'InvoiceNo': 'Frequency',
                           'TotalSum': 'MonetaryValue'}, inplace=True)

# Check the first rows
datamart.head()
```

Final RFM values

Our table for RFM segmentation is completed!

	Recency	Frequency	MonetaryValue
CustomerID			
12747	3	25	948.70
12748	1	888	7046.16
12749	4	37	813.45
12820	4	17	268.02
12822	71	9	146.15

CUSTOMER SEGMENTATION IN PYTHON

Let's practice calculating RFM values!

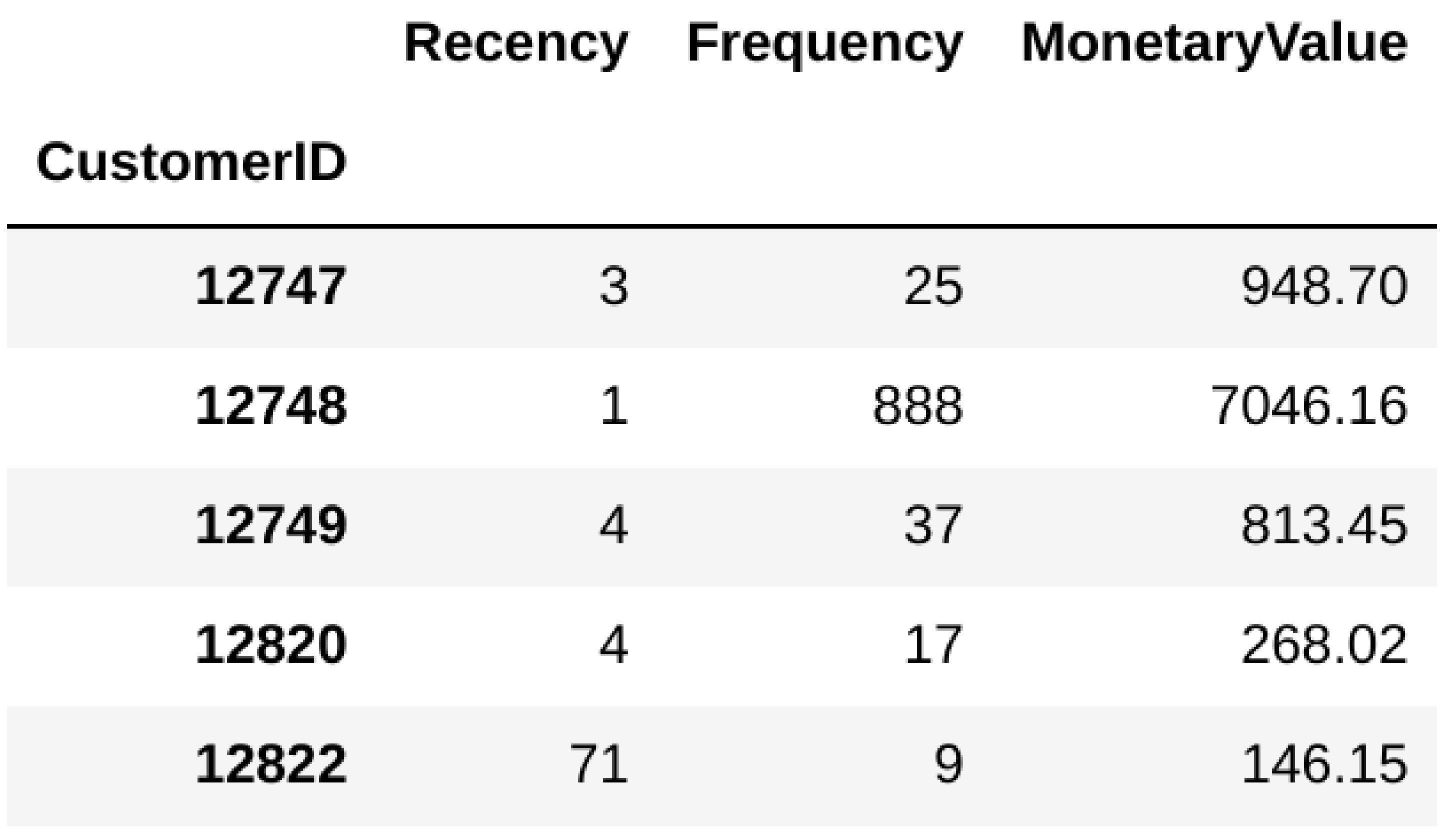
CUSTOMER SEGMENTATION IN PYTHON

Building RFM segments

Karolis Urbonas
Head of Data Science, Amazon

Data

- Dataset we created previously
- Will calculate quartile value for each column and name then `R`, `F`, `M`



	Recency	Frequency	MonetaryValue
CustomerID			
12747	3	25	948.70
12748	1	888	7046.16
12749	4	37	813.45
12820	4	17	268.02
12822	71	9	146.15

Recency quartile

```
r_labels = range(4, 1, -1)
r_quartiles = pd.qcut(datamart['Recency'], 4, labels = r_labels)
datamart = datamart.assign(R = r_quartiles.values)
```

	Recency	Frequency	MonetaryValue	R
CustomerID				
12747	3	25	948.70	4
12748	1	888	7046.16	4
12749	4	37	813.45	4
12820	4	17	268.02	4
12822	71	9	146.15	2

Frequency and Monetary quartiles

```
f_labels = range(1,5)
m_labels = range(1,5)

f_quartiles = pd.qcut(datamart['Frequency'], 4, labels = f_labels)
m_quartiles = pd.qcut(datamart['MonetaryValue'], 4, labels = m_labels)

datamart = datamart.assign(F = f_quartiles.values)
datamart = datamart.assign(M = m_quartiles.values)
```

	Recency	Frequency	MonetaryValue	R	F	M
CustomerID						
12747	3	25	948.70	4	4	4
12748	1	888	7046.16	4	4	4
12749	4	37	813.45	4	4	4
12820	4	17	268.02	4	3	3
12822	71	9	146.15	2	2	3

Build RFM Segment and RFM Score

- Concatenate RFM quartile values to `RFM_Segment`
- Sum RFM quartiles values to `RFM_Score`

```
def join_rfm(x): return str(x['R']) + str(x['F']) + str(x['M'])
datamart['RFM_Segment'] = datamart.apply(join_rfm, axis=1)
datamart['RFM_Score'] = datamart[['R','F','M']].sum(axis=1)
```

Final result

CustomerID	Recency	Frequency	MonetaryValue	R	F	M	RFM_Segment	RFM_Score
18108	255	4	58.60	1	1	1	111	3.0
13803	256	3	57.70	1	1	1	111	3.0
12922	162	4	57.24	1	1	1	111	3.0
13304	352	4	57.21	1	1	1	111	3.0
17496	359	2	57.15	1	1	1	111	3.0
16063	261	4	57.10	1	1	1	111	3.0
17531	191	2	57.00	1	1	1	111	3.0
14206	240	3	57.00	1	1	1	111	3.0
13784	219	2	55.80	1	1	1	111	3.0
14476	258	4	55.75	1	1	1	111	3.0

CUSTOMER SEGMENTATION IN PYTHON

Let's practice building RFM segments

CUSTOMER SEGMENTATION IN PYTHON

Analyzing RFM segments

Karolis Urbonas
Head of Data Science, Amazon

Largest RFM segments

```
datamart.groupby('RFM_Segment').size().sort_values(ascending=False)[:10]
```

```
RFM_Segment
444      372
111      345
211      169
344      156
233      129
222      128
333      120
122      117
311      114
433      113
dtype: int64
```

Filtering on RFM segments

- Select bottom RFM segment "111" and view top 5 rows

```
datamart[datamart['RFM_Segment']=='111'][:5]
```

CustomerID	Recency	Frequency	MonetaryValue	R	F	M	RFM_Segment	RFM_Score
12837	174	2	10.55	1	1	1	111	3.0
12852	295	2	32.55	1	1	1	111	3.0
12902	265	4	42.03	1	1	1	111	3.0
12915	149	2	35.90	1	1	1	111	3.0
12922	162	4	57.24	1	1	1	111	3.0

Summary metrics per RFM Score

```
datamart.groupby('RFM_Score').agg({
    'Recency': 'mean',
    'Frequency': 'mean',
    'MonetaryValue': ['mean', 'count'] }).round(1)
```

	Recency	Frequency	MonetaryValue	
	mean	mean	mean	count
RFM_Score				
3.0	246.9	2.1	28.4	345
4.0	162.2	3.1	47.8	337
5.0	138.9	4.3	78.2	393
6.0	101.0	6.3	146.3	444
7.0	78.0	8.5	160.2	382
8.0	62.6	12.8	196.3	376
9.0	46.8	16.7	330.3	345
10.0	31.9	24.0	443.1	355
11.0	21.8	38.9	705.3	294
12.0	8.0	75.6	1653.9	372

Grouping into named segments

Use RFM score to group customers into **Gold**, **Silver** and **Bronze** segments.

```
def segment_me(df):
    if df['RFM_Score'] >= 9:
        return 'Gold'
    elif (df['RFM_Score'] >= 5) and (df['RFM_Score'] < 9):
        return 'Silver'
    else:
        return 'Bronze'
```

```
datamart['General_Segment'] = datamart.apply(segment_me, axis=1)
```

```
datamart.groupby('General_Segment').agg({
    'Recency': 'mean',
    'Frequency': 'mean',
    'MonetaryValue': ['mean', 'count']
}).round(1)
```

New segments and their values

	Recency	Frequency	MonetaryValue	
	mean	mean	mean	count
General_Segment				
1. Gold	27.0	39.4	800.8	1366
2. Silver	95.8	7.9	144.6	1595
3. Bronze	205.0	2.6	38.0	682

CUSTOMER SEGMENTATION IN PYTHON

Practice building custom segments