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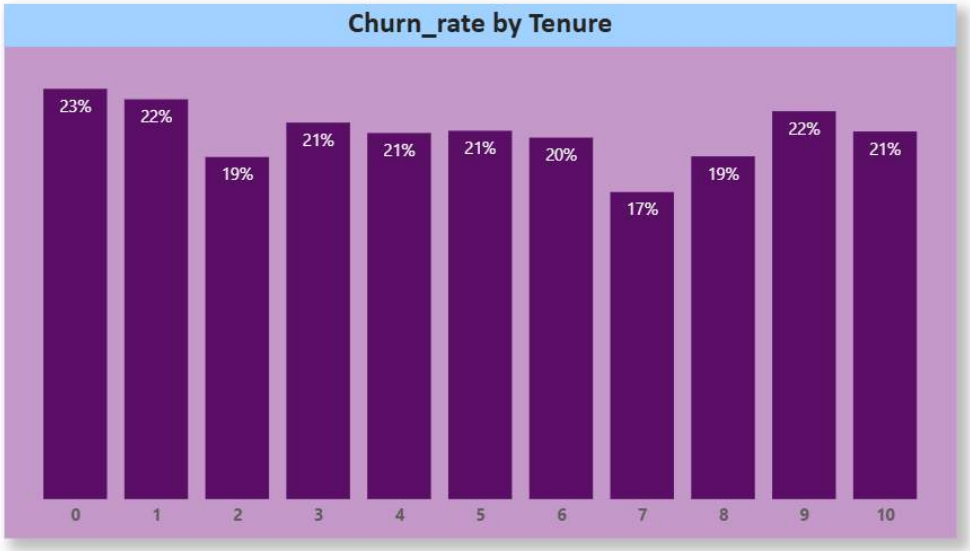
1. What is the overall churn rate, and how does it trend over time (if applicable)?

Churn Rate

20%



Filters

Data

Search

Customer-Churn-Reco...

- Age
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- IsActiveMember
- NumOfProducts
- Point Earned
- RowNumber
- Satisfaction Sco...
- Surname
- Tenure

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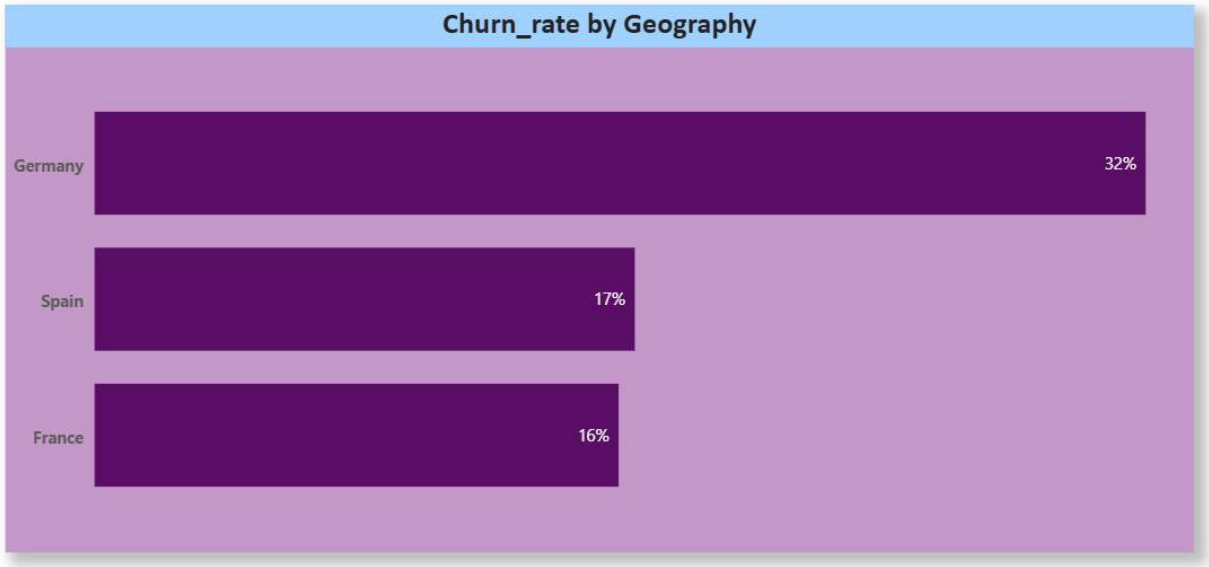
2. How does churn vary by geography (France, Germany, Spain)?



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Customer-Churn-Reco...

- Age
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- EstimatedSalary
- Exited
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- Geography
- HasCrCard
- IsActiveMember
- NumOfProducts
- Point Earned
- RowNumber
- Satisfaction Sco...
- Surname
- Tenure

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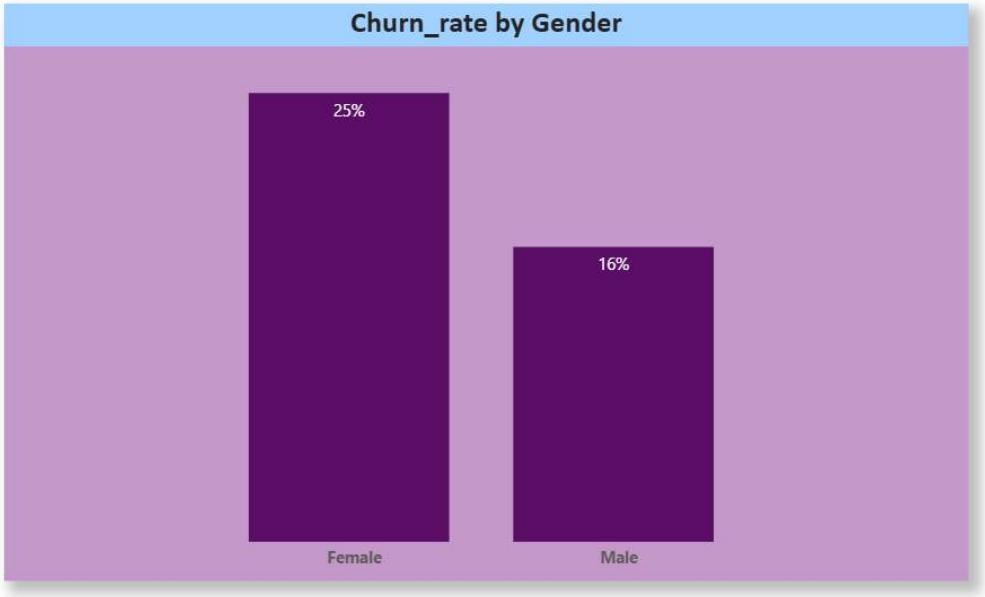
3. What are the differences in churn rates between male and female customers?



Filters

Data

Search

Customer-Churn-Reco...

- Age
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- IsActiveMember
- NumOfProducts
- Point Earned
- RowNumber
- Satisfaction Sco...
- Surname
- Tenure

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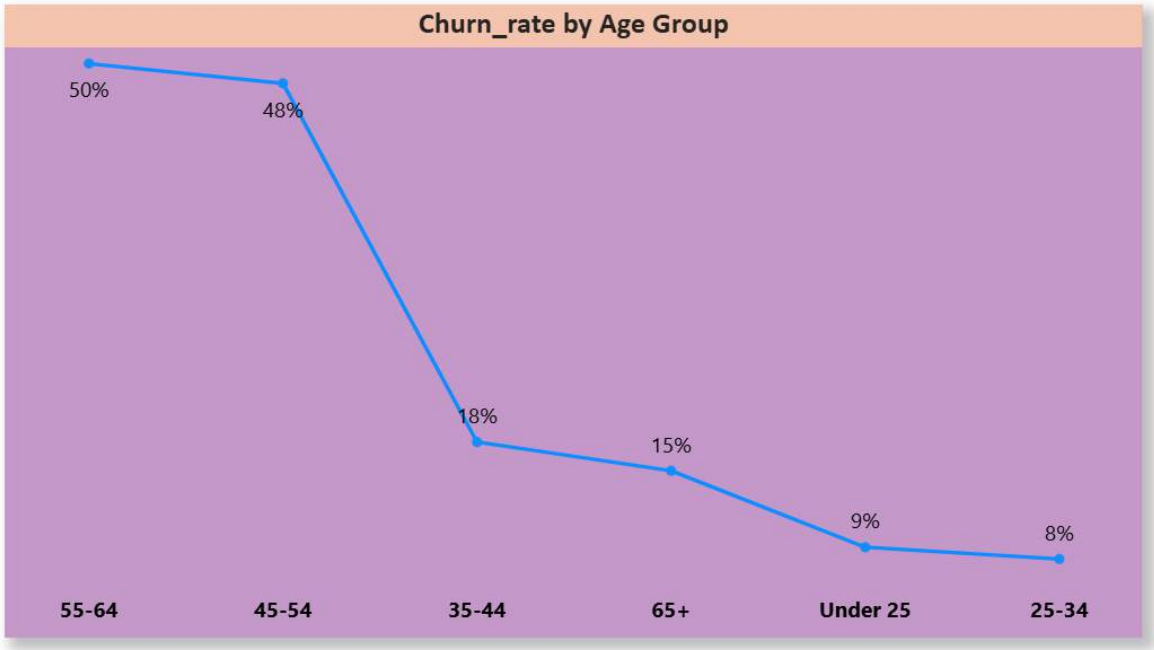
4. What is the churn rate distribution across different age groups?



Filters

Data

Search

Customer-Churn-Re...
- Age
- Age Group
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- IsActiveMemb...
- NumOfProdu...
- Point Earned
- RowNumber
- Satisfaction Sc...
- Surname

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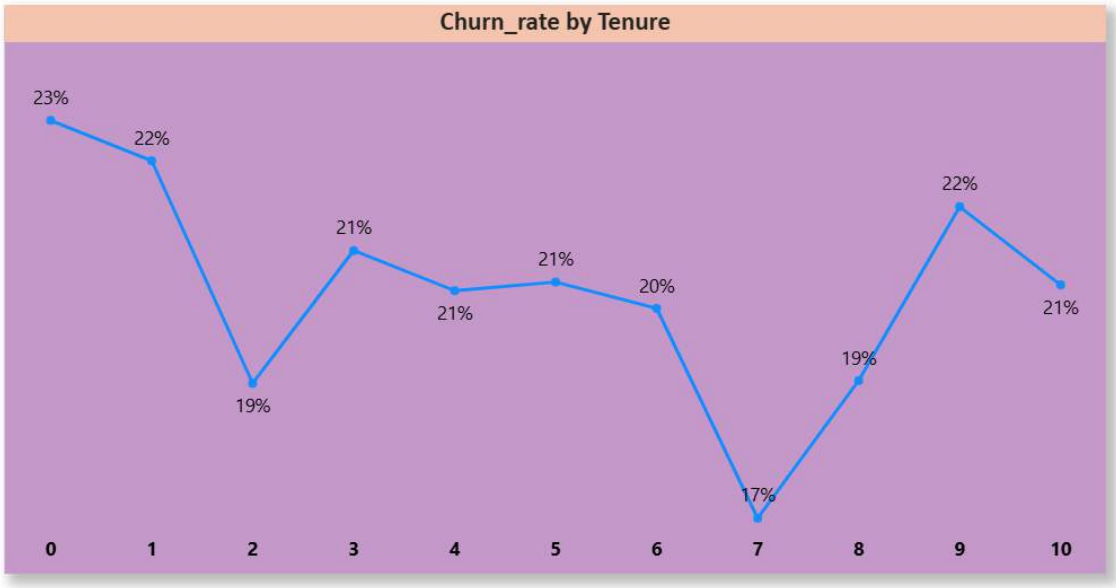
5. How does churn behavior change with tenure?



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Data

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Customer-Churn-Re...

- Age
- Age Group
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- IsActiveMemb...
- NumOfProdu...
- Point Earned
- RowNumber
- Satisfaction Sc...
- Surname

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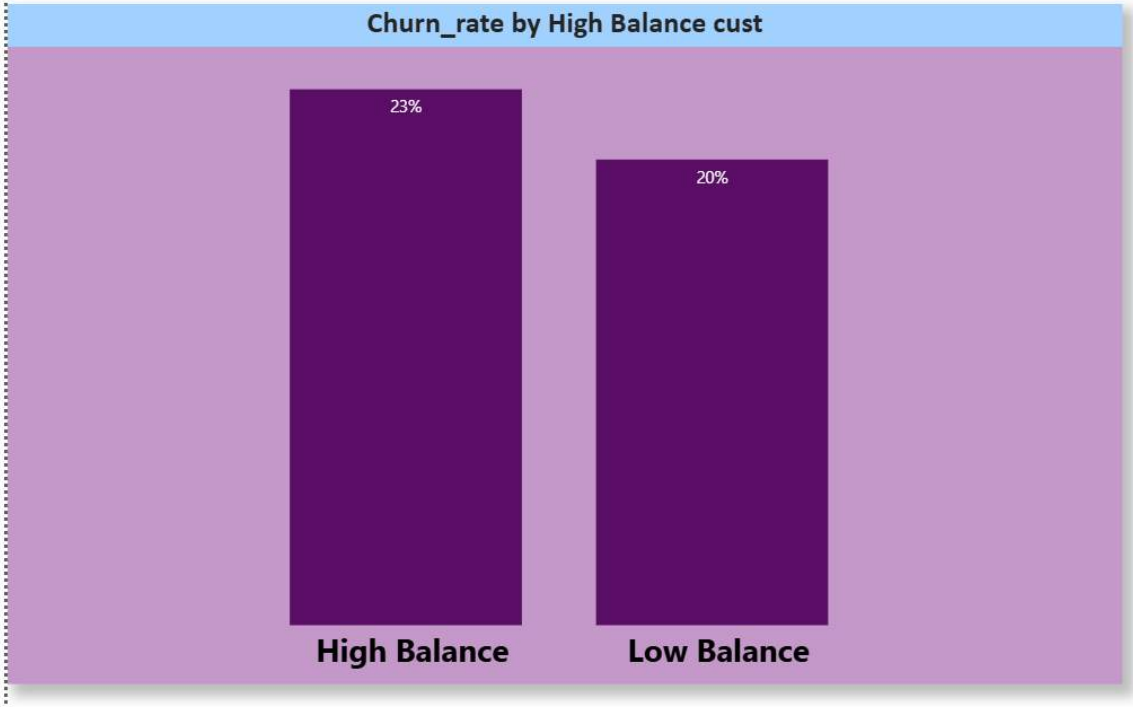
6. What percentage of high-balance customers (e.g., >$100K) have churned?



High Balance churn(%)

23.12

Filters

Data

Search

Customer-Churn-Re...
- Age
- Age Group
- Avg_Balance
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- High balance ...
- High Balance ...
- IsActiveMemb...
- NumOfProdu...
- Point Earned

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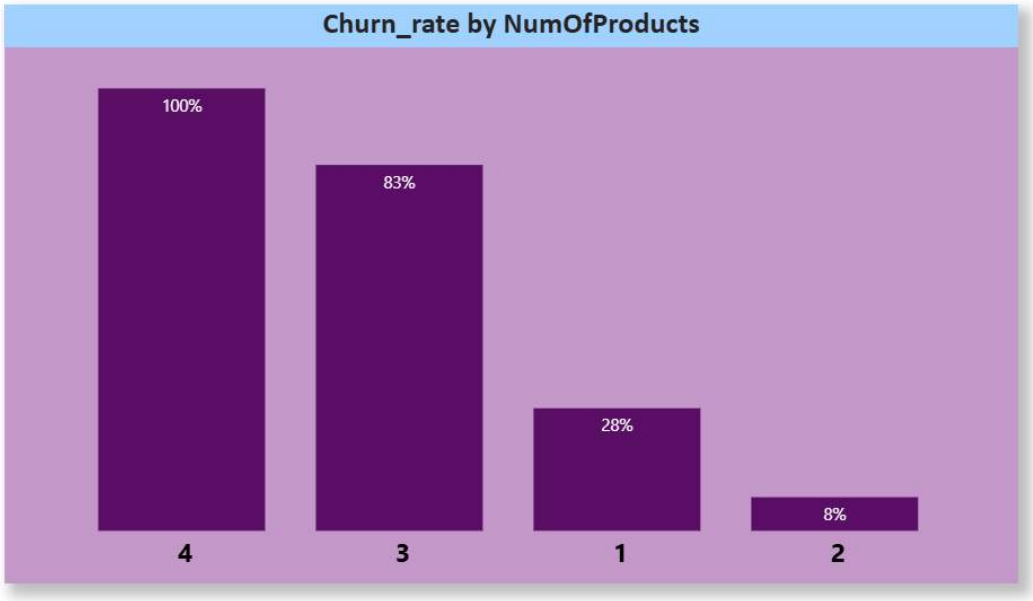
7. How do churn rates compare across different NumOfProducts?



Filters

Data

Search

Customer-Churn-Re...
- Age
- Age Group
- Avg_Balance
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- High balance ...
- High Balance ...
- IsActiveMemb...
- NumOfProdu...
- Point Earned

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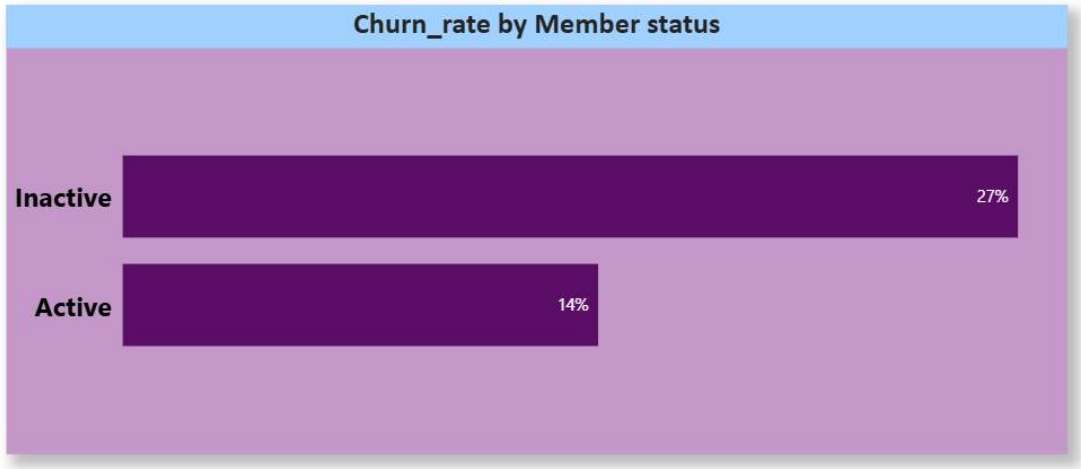
8. Are inactive members (IsActiveMember = 0) more likely to churn?

Member status	Churn_rate
Active	14%
Inactive	27%
Total	**20%**



Filters

Data

Search

Customer-Churn-Re...
- Age
- Age Group
- Avg_Balance
- Balance
- Card Type
- Churn_rate
- Complain
- CreditScore
- CustomerId
- EstimatedSalary
- Exited
- Gender
- Geography
- HasCrCard
- High balance ...
- High Balance ...
- IsActiveMemb...
- Member status
- NumOfProdu...

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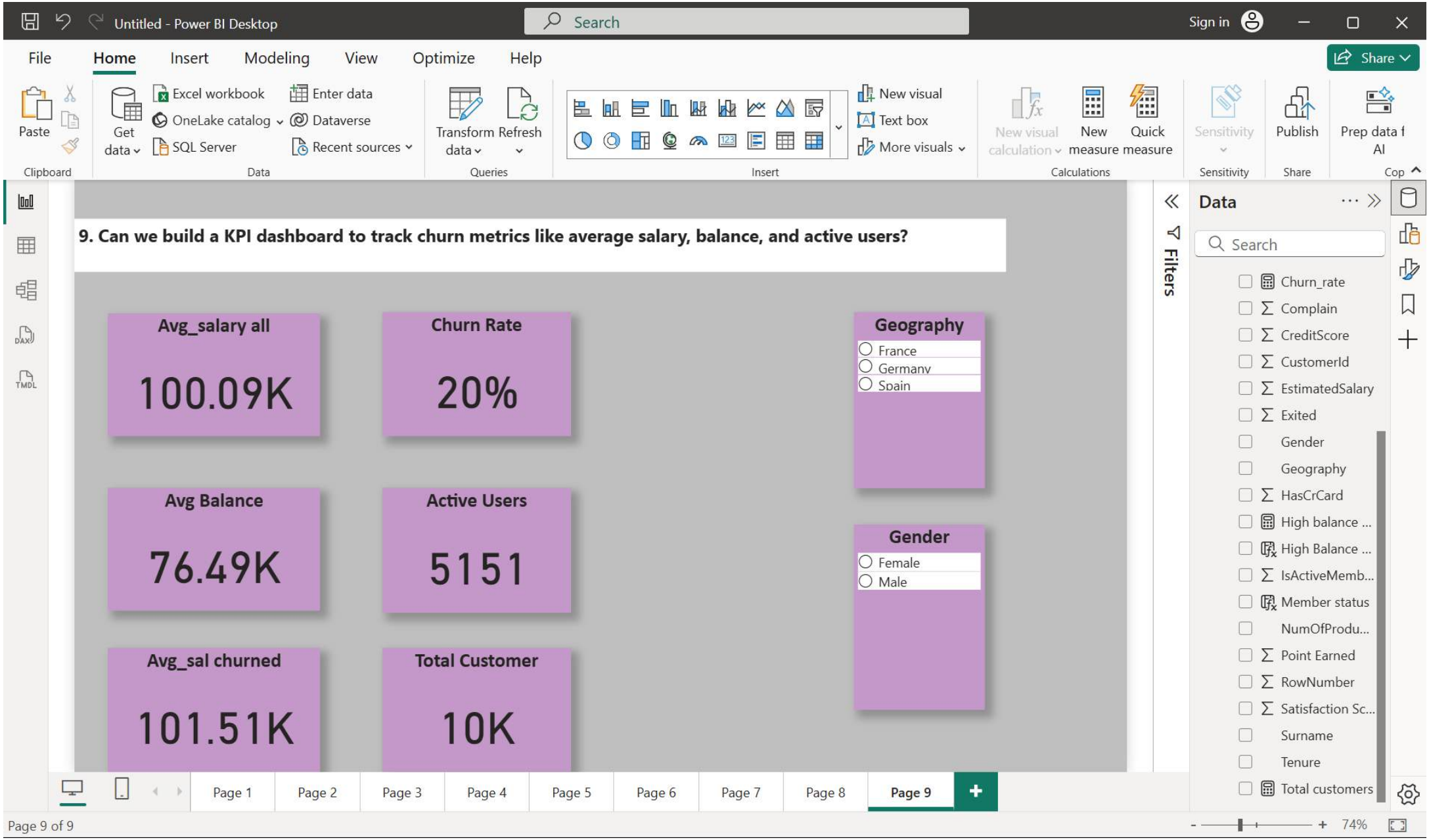
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More visuals
New visual calculation
New measure
Quick measure
Sensitivity
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Data
Queries
Insert
Calculations
Sensitivity
Share
Cop
9. Can we build a KPI dashboard to track churn metrics like average salary, balance, and active users?
Avg_salary all
100.09K
Churn Rate
20%
Avg Balance
76.49K
Active Users
5151
Avg_sal churned
101.51K
Total Customer
10K
Geography
France
Germany
Spain
Gender
Female
Male
Filters
Data
Search
Churn_rate
Complain
CreditScore
CustomerId
EstimatedSalary
Exited
Gender
Geography
HasCrCard
High balance ...
High Balance ...
IsActiveMemb...
Member status
NumOfProdu...
Point Earned
RowNumber
Satisfaction Sc...
Surname
Tenure
Total customers
Page 1
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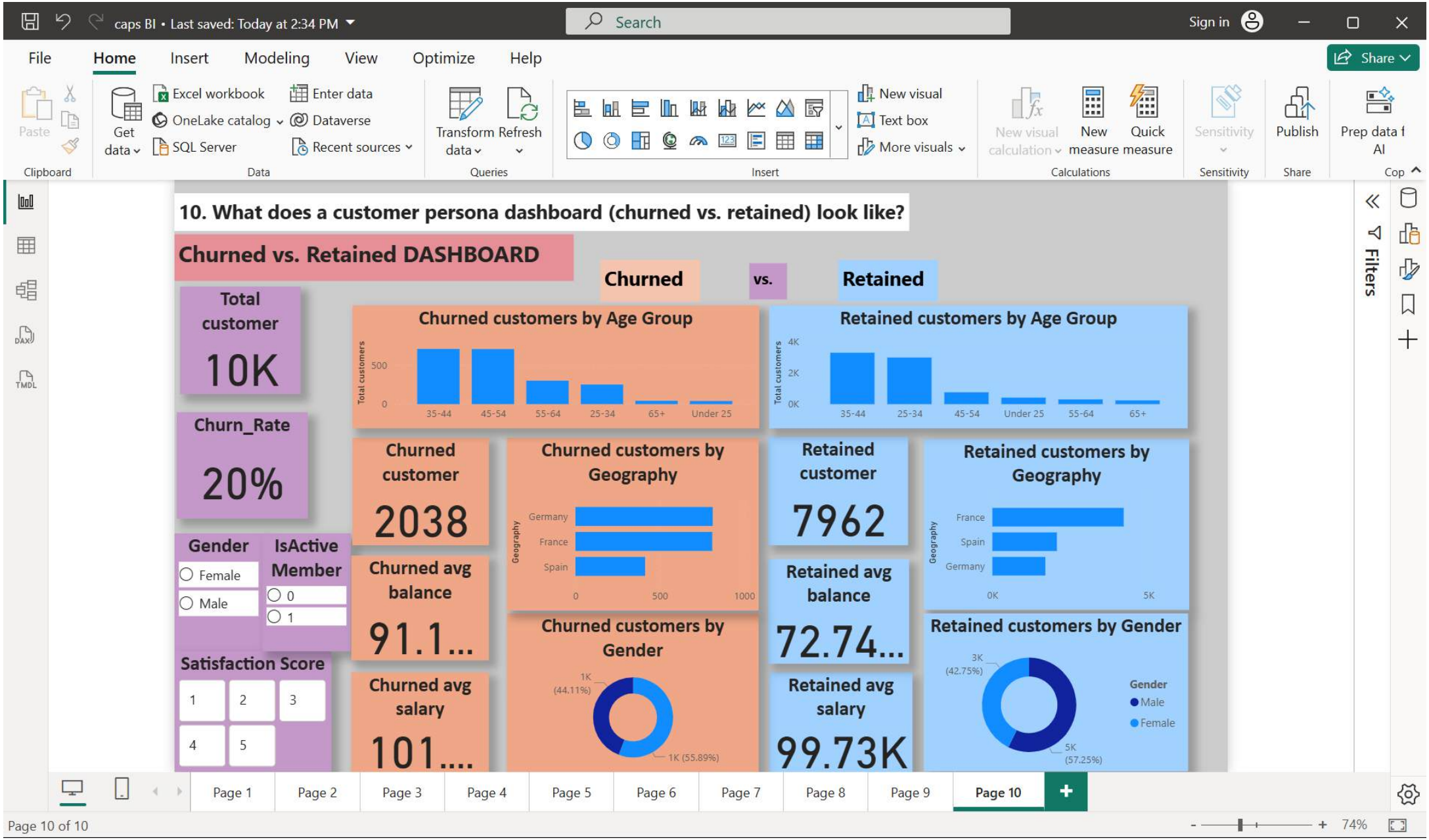
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SQL Server
Enter data
Dataverse
Recent sources
Transform data
Refresh
New visual
Text box
More visuals
New visual calculation
New measure
Quick measure
Sensitivity
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Queries
Insert
Calculations
Sensitivity
Share
Cop
10. What does a customer persona dashboard (churned vs. retained) look like?
Churned vs. Retained DASHBOARD
Churned
vs.
Retained
Total customer
10K
Churn_Rate
20%
Churned customer
2038
Churned avg balance
91.1...
Churned avg salary
101....
Churned customers by Age Group
Total customers
500
0
35-44
45-54
55-64
25-34
65+
Under 25
Churned customers by Geography
Germany
France
Spain
Geography
0
500
1000
Churned customers by Gender
1K (44.11%)
1K (55.89%)
Retained customer
7962
Retained avg balance
72.74...
Retained avg salary
99.73K
Retained customers by Age Group
4K
2K
0K
35-44
25-34
45-54
Under 25
55-64
65+
Retained customers by Geography
France
Spain
Germany
0K
5K
Retained customers by Gender
3K (42.75%)
5K (57.25%)
Gender
Male
Female
Gender
Female
Male
IsActive Member
0
1
Satisfaction Score
1
2
3
4
5
Filters
Page 1
Page 2
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Page 4
Page 5
Page 6
Page 7
Page 8
Page 9
Page 10
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74%

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[3]:
```
df=pd.read_csv("Customer-churn-Records.csv")
```

[5]:
```
df.head()
```

[5]:

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0

[6]:
```
df.shape
```

[6]:
```
(10000, 18)
```

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 18 columns):
```

memory usage: 1.4+ MB

[ ]:

[ ]:
```
# 11. Check the percentage of missing data and handle accordingly.
```

[8]:
```
df.isnull().sum()
```

[8]:
```
RowNumber            0
CustomerId           0
Surname              0
CreditScore          0
Geography            0
Gender               0
Age                  0
Tenure               0
Balance              0
NumOfProducts        0
HasCrCard            0
IsActiveMember       0
EstimatedSalary      0
Exited               0
Complain             0
Satisfaction Score   0
Card Type            0
Point Earned         0
dtype: int64
```

[ ]:

Code

JupyterLab

Python [conda env:base] *

```
Balance              0
NumOfProducts        0
HasCrCard            0
IsActiveMember       0
EstimatedSalary      0
Exited               0
Complain             0
Satisfaction Score   0
Card Type            0
Point Earned         0
dtype: int64
```

[ ]:

[ ]:
```
# 12. How many rows and columns are there in the dataset?
```

[10]:
```
df.shape
```

[10]:
```
(10000, 18)
```

[13]:
```
rows, cols =df.shape
print(f"The dataset has {rows} rows and {cols} columns.")
```

```
The dataset has 10000 rows and 18 columns.
```

[ ]:

[ ]:

[ ]:

[ ]:
```
#13. What is the distribution of churned vs. non-churned customers?
```

[14]:
```
df['Exited'].value_counts()
```

[14]:
```
Exited
0    7962
1    2038
Name: count, dtype: int64
```

[15]:
```
df['Exited'].value_counts(normalize=True)*100
```

[15]:
```
Exited
0    79.62
1    20.38
Name: proportion, dtype: float64
```

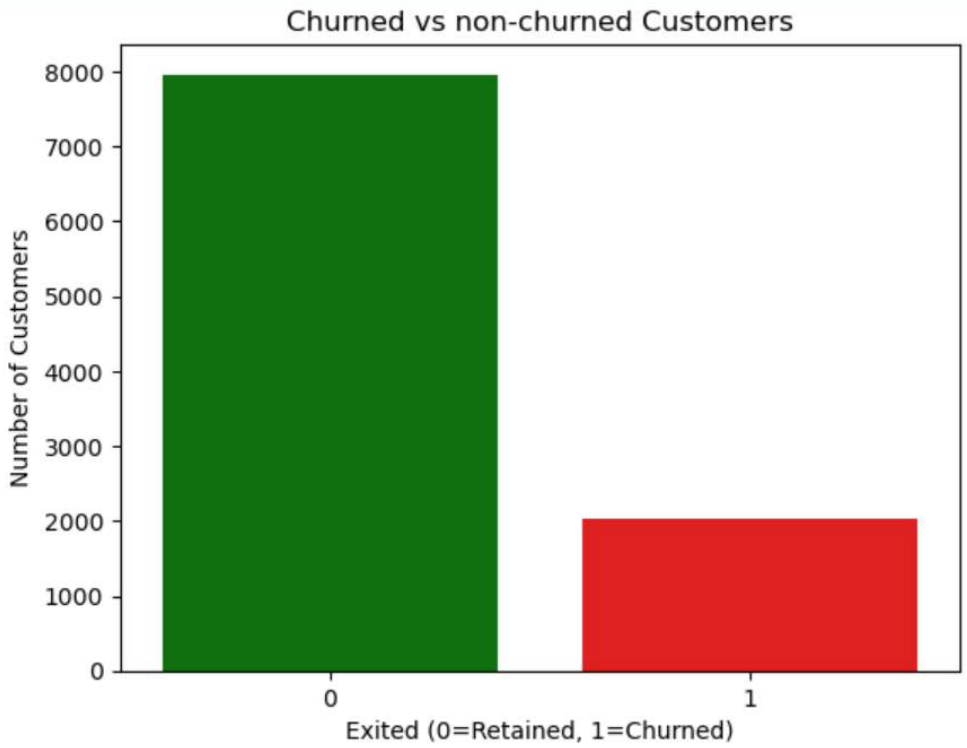
[23]:
```
sns.countplot(x='Exited',data=df,palette=['green','red'])
plt.title('Churned vs non-churned Customers')
plt.xlabel('Exited (0=Retained, 1=Churned)')
plt.ylabel('Number of Customers')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_19932\3929842554.py:1: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.countplot(x='Exited',data=df,palette=['green','red'])
```

```
sns.countplot(x='Exited',data=df,palette=['green','red'])
```




```
# About 20% customers have Churned , While 80% remain with Bank.
```

[ ]:
```
#14. What is the distribution of EstimatedSalary of churned and retained Customers?
```

[ ]:

[25]:
```
df.groupby('Exited')['EstimatedSalary'].describe()
```

[25]:

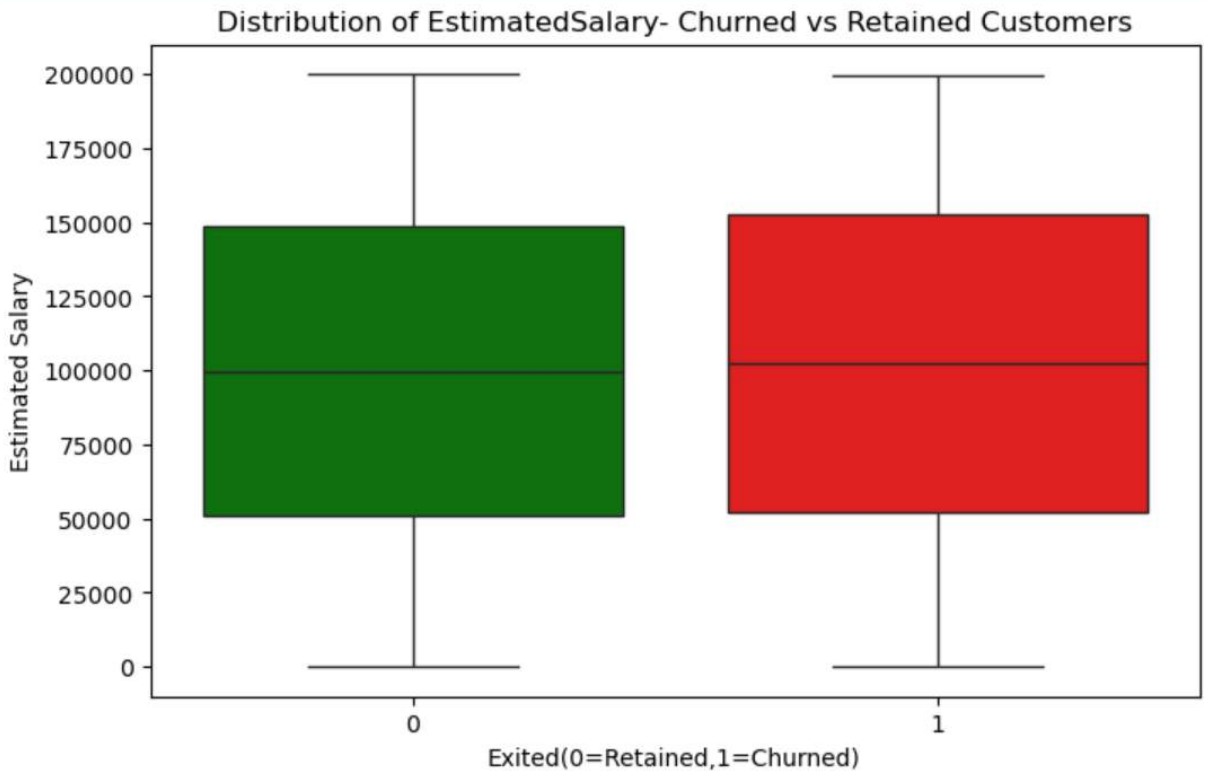
Exited	count	mean	std	min	25%	50%	75%	max
0	7962.0	99726.853141	57399.956717	90.07	50783.295	99620.355	148602.4450	199992.48
1	2038.0	101509.908783	57932.623392	11.58	51924.020	102489.335	152443.8575	199808.10

[26]:
```
plt.figure(figsize=(8,5))
sns.boxplot(x='Exited',y='EstimatedSalary',data=df,palette=['green','red'])
plt.title('Distribution of EstimatedSalary- Churned vs Retained Customers')
plt.xlabel('Exited(0=Retained,1=Churned)')
plt.ylabel('Estimated Salary')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_19932\3890800965.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.boxplot(x='Exited',y='EstimatedSalary',data=df,palette=['green','red'])
```



[ ]: `# Both Churned and Retained customers have similar salary distributions,So estimated salary is not a major factor in customer churn for data.`

[ ]:

[ ]:

```
[ ]:
```

```
[20]: # 15. How do churn rates vary by Gender, Geography, and IsActiveMember?
```

```
[21]: #churn rate vary by Genger
```

```
[22]: churn_gender=df.groupby('Gender')['Exited'].mean()*100
      print(churn_gender)
```

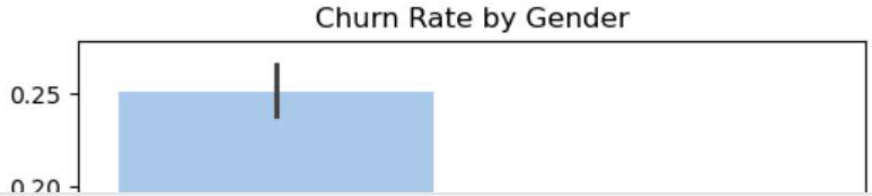
```
Gender
Female    25.071539
Male      16.474253
Name: Exited, dtype: float64
```

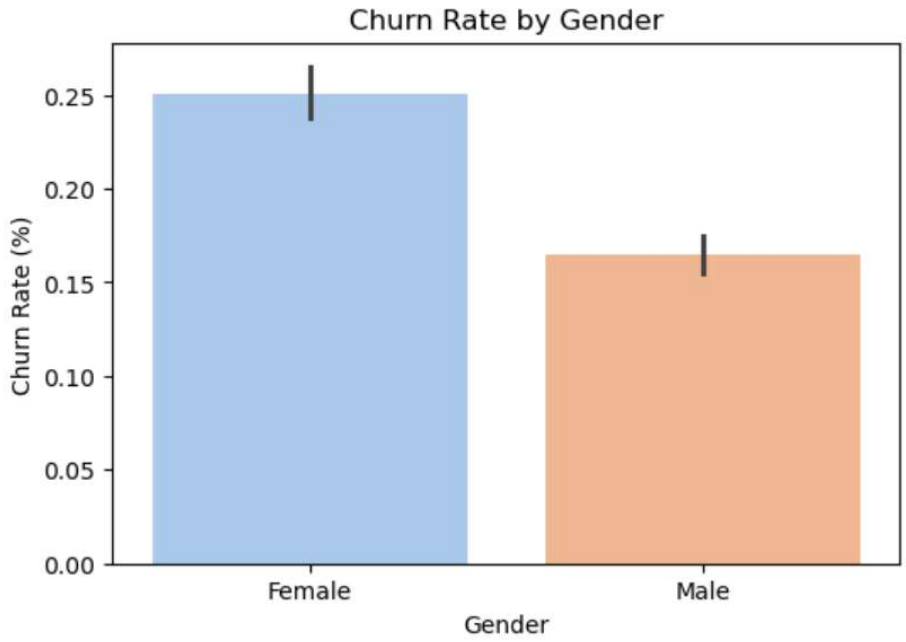
```
[23]: plt.figure(figsize=(6,4))
      sns.barplot(x='Gender',y='Exited',data=df,estimator='mean',palette='pastel')
      plt.title('Churn Rate by Gender')
      plt.ylabel('Churn Rate (%)')
      plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2934609559.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.barplot(x='Gender',y='Exited',data=df,estimator='mean',palette='pastel')
```





[24]:
```
#Female Customers have a higher churn Rate.
```

[25]:
```
 #churn rate vary by Geography
```

[30]:
```
churn_geography=df.groupby('Geography')['Exited'].mean()*100
print(churn_geography)
```

```
Geography
France     16.174711
Germany    32.443204
```

Code JupyterLab Python [conda env:base] *

[25]:
```
#churn rate vary by Geography
```

[30]:
```
churn_geography=df.groupby('Geography')['Exited'].mean()*100
print(churn_geography)
```

```
Geography
France     16.174711
Germany    32.443204
Spain      16.673395
Name: Exited, dtype: float64
```

[26]:
```
plt.figure(figsize=(6,4))
sns.barplot(x='Geography',y='Exited',data=df,estimator='mean',palette='muted')
plt.title('Churn Rate by Geography')
plt.ylabel('Churn Rate (%)')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\707093323.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.barplot(x='Geography',y='Exited',data=df,estimator='mean',palette='muted')
```

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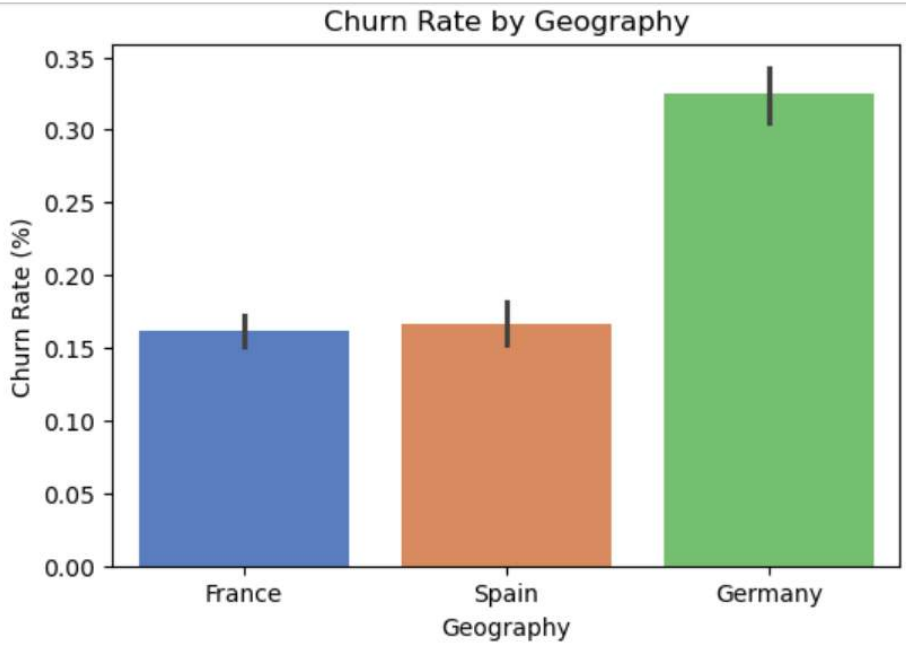
Code JupyterLab Python [conda env:base] *



[27]:
```
#Churn rate is highest among German Customers.
```

[28]:
```
 #churn Rate by Active Membership
```

[31]:
```
churn_Activemembership=df.groupby('IsActiveMember')['Exited'].mean()*100
print(churn_Activemembership)
```

```
IsActiveMember
0    26.871520
1    14.269074
```

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Code JupyterLab Python [conda env:base] *

[28]:
```
#churn Rate by Active Membership
```

[31]:
```
churn_Activemembership=df.groupby('IsActiveMember')['Exited'].mean()*100
print(churn_Activemembership)
```

```
IsActiveMember
0    26.871520
1    14.269074
Name: Exited, dtype: float64
```

[29]:
```
plt.figure(figsize=(6,4))
sns.barplot(x='IsActiveMember',y='Exited',data=df,estimator='mean',palette='coolwarm')
plt.title('Churn Rate by Active Membership')
plt.ylabel('Churn Rate (%)')
plt.xticks([0,1],['Inactive','Active'])
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2505570173.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.barplot(x='IsActiveMember',y='Exited',data=df,estimator='mean',palette='coolwarm')
```

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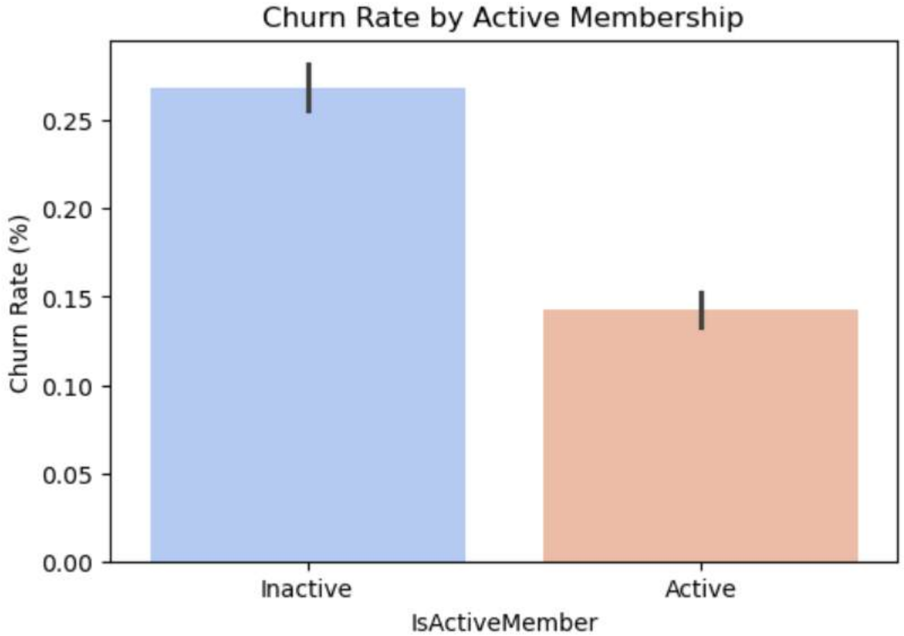
Code JupyterLab Python [conda env:base] *

```
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2505570173.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.barplot(x='IsActiveMember',y='Exited',data=df,estimator='mean',palette='coolwarm')
```



[ ]:

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Code JupyterLab Python [conda env:base] *

[ ]:

[ ]:
```
# 16. What is the average CreditScore, Balance, and EstimatedSalary of churned vs. retained customers?
```

[33]:
```
df.head()
```

[33]:

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0

[34]:
```
avg_values=df.groupby('Exited')[['CreditScore','Balance','EstimatedSalary']].mean()
print(avg_values)
```

```
        CreditScore       Balance  EstimatedSalary
Exited
0        651.837855  72742.750663     99726.853141
1        645.414622  91109.476006    101509.908783
```

[ ]:
```
# Note: 0 is for retained and 1 is for Churned
```

[ ]:

[ ]:
```
17. #How does Age impact churn? Plot histograms and boxplots for churned and non-churned groups.
```

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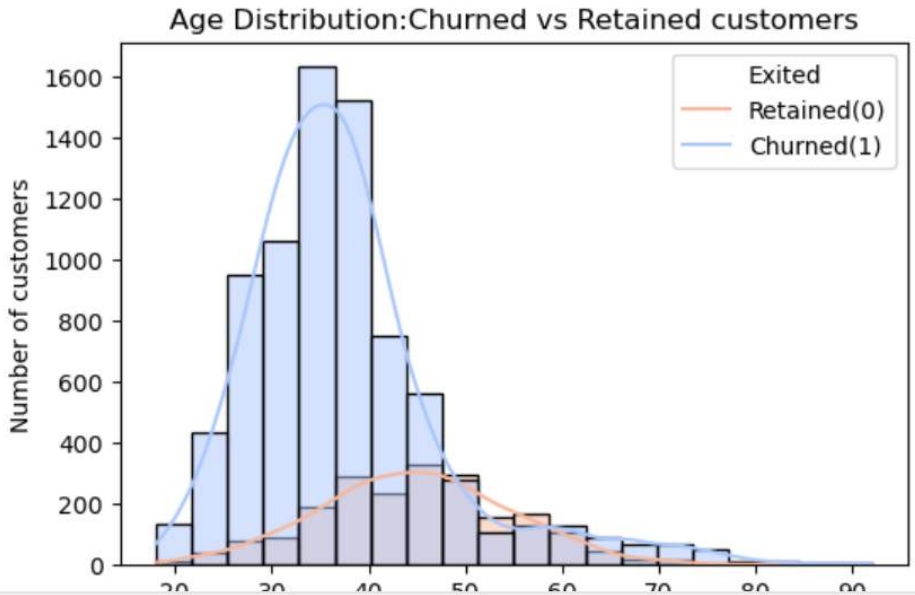
Code JupyterLab Python [conda env:base] *

[ ]: 17. #How does Age impact churn? Plot histograms and boxplots for churned and non-churned groups.

•[35]:
```
#Histogram
plt.figure(figsize=(6,4))
sns.histplot(data=df,x='Age',hue='Exited',kde=True,bins=20,palette='coolwarm')
plt.title('Age Distribution:Churned vs Retained customers')
plt.xlabel('Age')
plt.ylabel('Number of customers')
plt.legend(title='Exited',labels=['Retained(0)','Churned(1)'])
plt.show()
```



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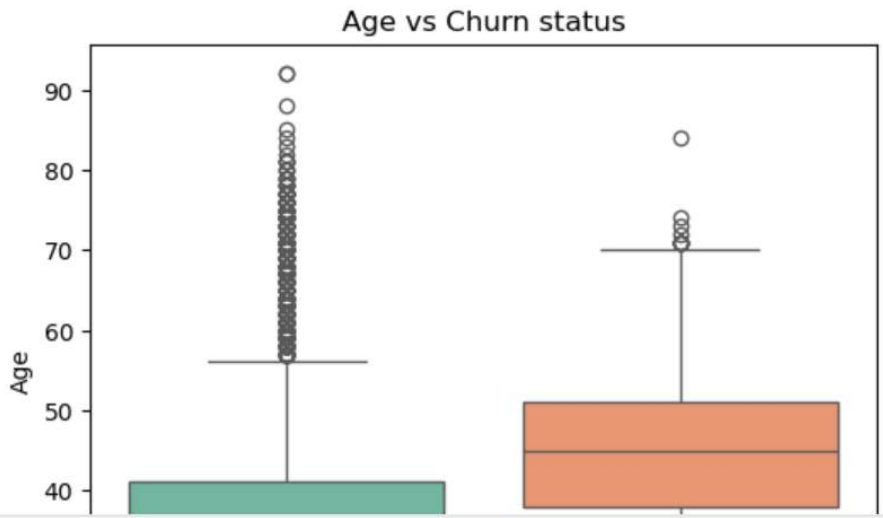
Code JupyterLab Python [conda env:base] *

[37]:
```
#Boxplot
plt.figure(figsize=(6,5))
sns.boxplot(x='Exited',y='Age',data=df,palette='Set2')
plt.title('Age vs Churn status')
plt.xlabel('Exited(0=Retained,1=Churned)')
plt.ylabel('Age')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2785628990.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.boxplot(x='Exited',y='Age',data=df,palette='Set2')
```



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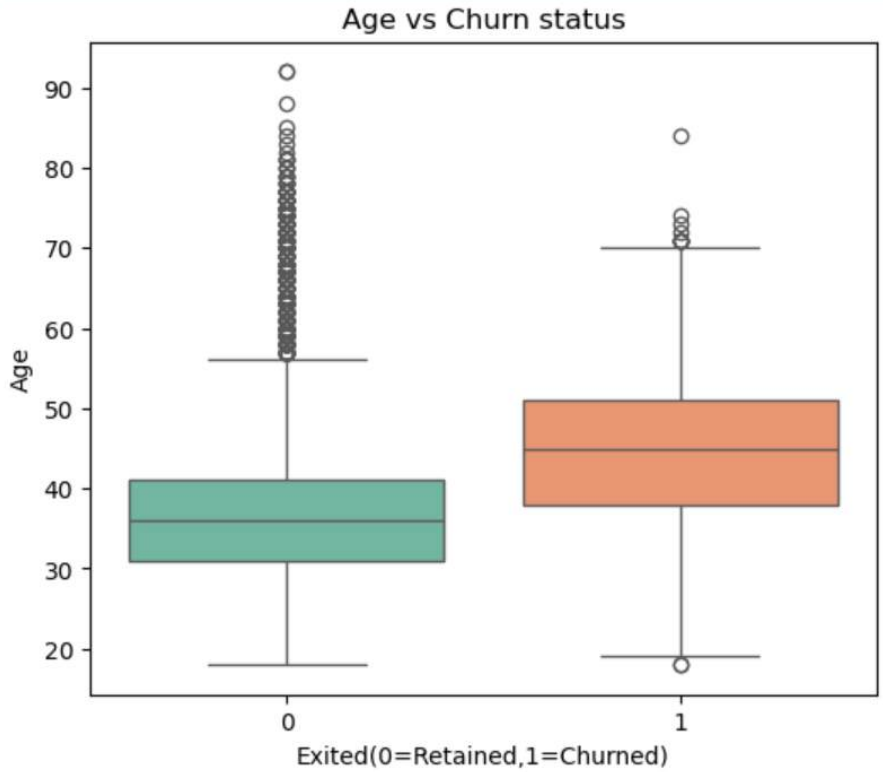
Code JupyterLab Python [conda env:base] *



[39]:
```
df.groupby('Exited')['Age'].mean()
```

[39]:
```
Exited
0    37.408063
1    44.835623
```

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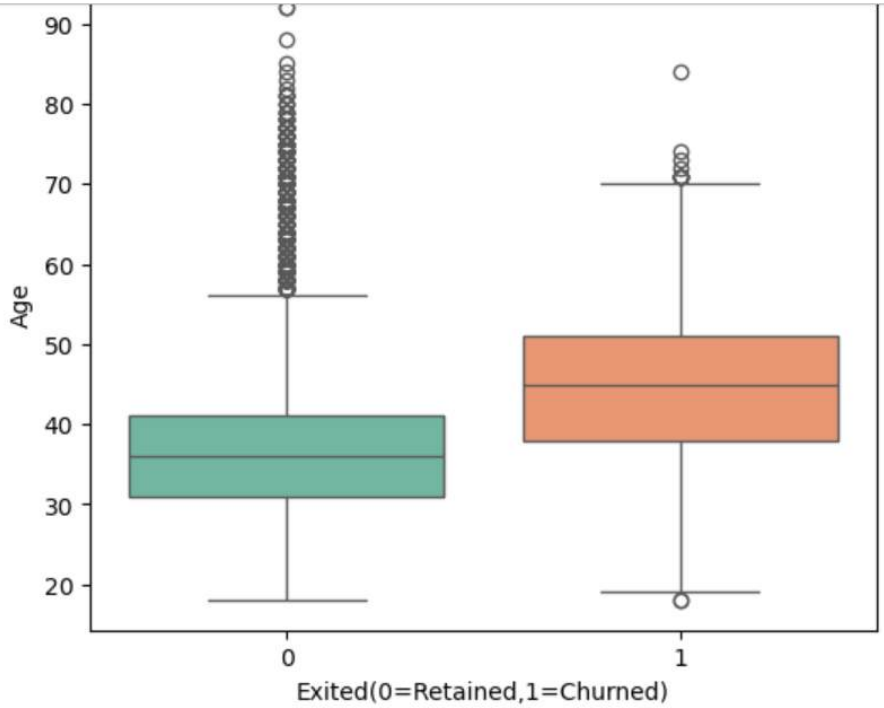
Code JupyterLab Python [conda env:base] *



[39]:
```
df.groupby('Exited')['Age'].mean()
```

[39]:
```
Exited
0    37.408063
1    44.835623
Name: Age, dtype: float64
```

[ ]:
```
#Churned customers have a average age og 44.8 compared to 37.4 for Retained.Older Customers are more likely to churn.
```

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Code JupyterLab Python [conda env:base] *

```
1    44.835623
Name: Age, dtype: float64
```

[ ]:
```
#Churned customers have a average age og 44.8 compared to 37.4 for Retained.Older Customers are more likely to churn.
```

[ ]:

[ ]:
```
#18. Is there any correlation among numeric features like CreditScore, Balance, and EstimatedSalary?
```

[43]:
```
#select numeric columns
num_cols=['CreditScore','Balance','EstimatedSalary']
#calculate correlation matrix
corr_matrix=df[num_cols].corr()
print(corr_matrix)
```

```
                CreditScore   Balance  EstimatedSalary
CreditScore        1.000000  0.006268        -0.001384
Balance            0.006268  1.000000         0.012797
EstimatedSalary   -0.001384  0.012797         1.000000
```

[ ]:

[44]:
```
plt.figure(figsize=(6,5))
sns.heatmap(corr_matrix,annot=True,cmap='coolwarm',fmt='.2f')
plt.title('correlation among CreditScore, Balance, and EstimatedSalary')
plt.show()
```

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Code JupyterLab Python [conda env:base] *

[44]:
```
plt.figure(figsize=(6,5))
sns.heatmap(corr_matrix,annot=True,cmap='coolwarm',fmt='.2f')
plt.title('correlation among CreditScore, Balance, and EstimatedSalary')
plt.show()
```

Code JupyterLab Python [conda env:base] *

[ ]:
```
#19. What does a heatmap reveal about feature interactions with churn?
```

[49]:
```
Num_cols=['CreditScore','Age','Tenure','Balance','NumOfProducts','HasCrCard','IsActiveMember','EstimatedSalary','Exited']

corr=df[Num_cols].corr()
print(corr)
```

```
                 CreditScore       Age    Tenure   Balance  NumOfProducts  \
CreditScore         1.000000 -0.003965  0.000842  0.006268       0.012238
Age                -0.003965  1.000000 -0.009997  0.028308      -0.030680
Tenure              0.000842 -0.009997  1.000000 -0.012254       0.013444
Balance             0.006268  0.028308 -0.012254  1.000000      -0.304180
NumOfProducts       0.012238 -0.030680  0.013444 -0.304180       1.000000
HasCrCard          -0.005458 -0.011721  0.022583 -0.014858       0.003183
IsActiveMember      0.025651  0.085472 -0.028362 -0.010084       0.009612
EstimatedSalary    -0.001384 -0.007201  0.007784  0.012797       0.014204
Exited             -0.026771  0.285296 -0.013656  0.118577      -0.047611

                 HasCrCard  IsActiveMember  EstimatedSalary    Exited
CreditScore      -0.005458        0.025651        -0.001384 -0.026771
Age              -0.011721        0.085472        -0.007201  0.285296
Tenure            0.022583       -0.028362         0.007784 -0.013656
Balance          -0.014858       -0.010084         0.012797  0.118577
NumOfProducts     0.003183        0.009612         0.014204 -0.047611
HasCrCard         1.000000       -0.011866        -0.009933 -0.006976
IsActiveMember   -0.011866        1.000000        -0.011421 -0.156356
EstimatedSalary  -0.009933       -0.011421         1.000000  0.012490
Exited           -0.006976       -0.156356         0.012490  1.000000
```

[52]:
```
plt.figure(figsize=(6,5))
sns.heatmap(corr,annot=True,cmap='coolwarm',fmt='.2f')
plt.title('Correlation Heatmap:Feature interaction with Churn')
```

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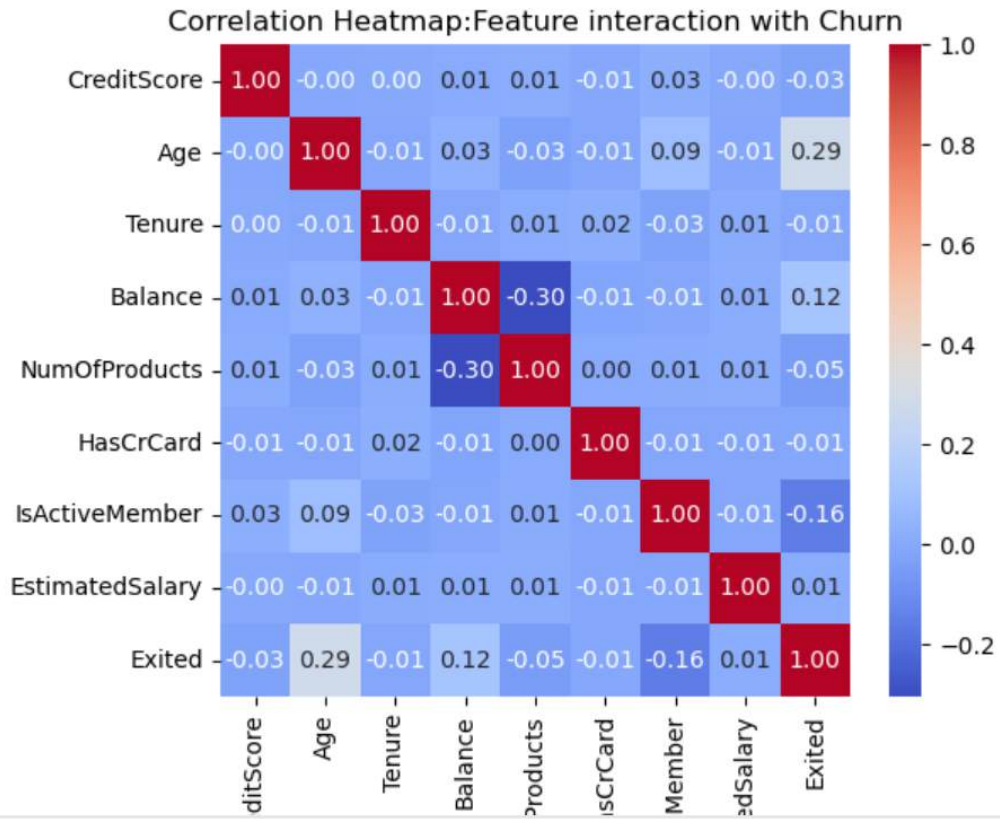
Code JupyterLab Python [conda env:base] *

[52]:
```
plt.figure(figsize=(6,5))
sns.heatmap(corr,annot=True,cmap='coolwarm',fmt='.2f')
plt.title('Correlation Heatmap:Feature interaction with Churn')
plt.show()
```



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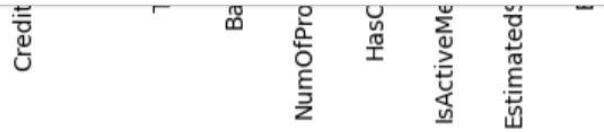
Code JupyterLab Python [conda env:base] *



[ ]:
```
'''Age and Balance show a positive correlation with Churn, indicating that older customers and with higher account balance are more likely to leave the B
IsActivemember and Numofproducts have a negative correlation with churn, means customers who are active are less likely to Churn.
EstimatedSalary and Tenure show almost no correlation with churn,meaning they have minimal influence on wheather a customer stay or leave.'''
```

[ ]:

[ ]:
```
#20. Are there outliers in Balance, CreditScore, or Age that are mostly associated with churn?
```

[54]:
```
numeric_cols=['CreditScore','Age','Balance']
plt.figure(figsize=(15,5))
for i, col in enumerate(numeric_cols,1):
    plt.subplot(1,3,i)
    sns.boxplot(x='Exited',y=col,data=df,palette='Set2')
    plt.title(f'cols vs Churn')
plt.tight_layout()
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2120548627.py:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.boxplot(x='Exited',y=col,data=df,palette='Set2')
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2120548627.py:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
```

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Code

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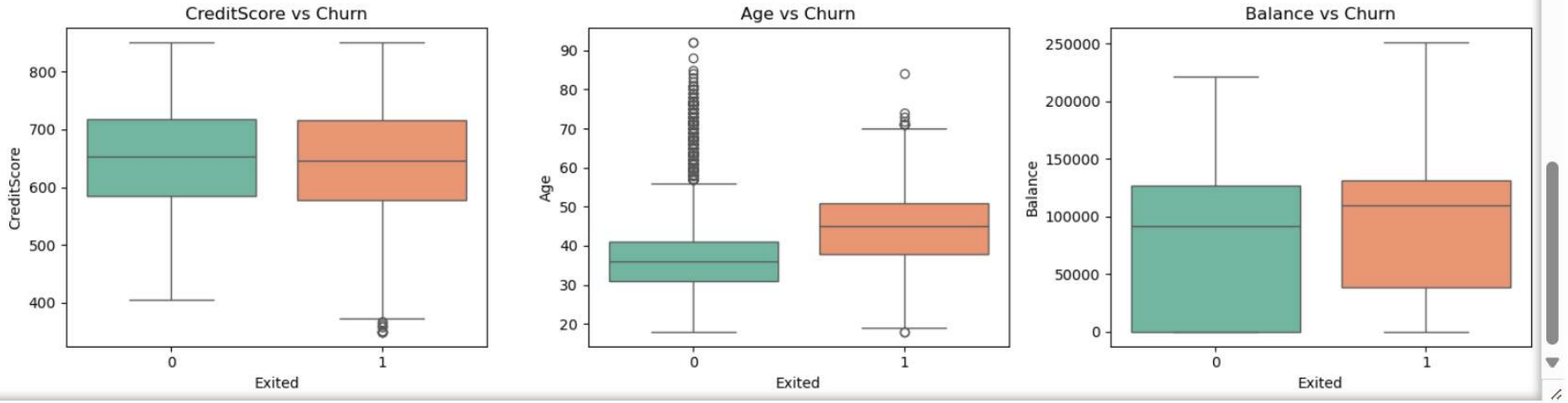
Python [conda env:base] *

[114]:
```
#20. Are there outliers in Balance, CreditScore, or Age that are mostly associated with churn?
```

[122]:
```
numeric_cols=['CreditScore','Age','Balance']
plt.figure(figsize=(15,4))
for i, col in enumerate(numeric_cols,1):
    plt.subplot(1,3,i)
    sns.boxplot(x='Exited',y=col,data=df,palette='Set2')
    plt.title(f'{col} vs Churn')
plt.tight_layout()
plt.show()
```

```
sns.boxplot(x='Exited',y=col,data=df,palette='Set2')
```



[ ]:

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Code

JupyterLab

Python [conda env:base] *

[173]:
```
#21. Group customers into age brackets (e.g.,18-30 as Adults, 30-50 as middle age and 50-100 as seniors.). How does churn rate change across them?
```

[174]:
```
bins=[18,30,50,100]
labels=['Adult(18-30)','Middle Age(30-50)','Senior(50-100)']
df['AgeGroups']=pd.cut(df['Age'],bins=bins,labels=labels,right=False)
```

[175]:
```
df.head()
```

[175]:

ıgraphy	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Complain	Satisfaction Score	Card Type	Point Earned	AgeGroups
France	Female	42	2	0.00	1	1	1	101348.88	1	1	2	DIAMOND	464	Middle Age(30-50)
Spain	Female	41	1	83807.86	1	0	1	112542.58	0	1	3	DIAMOND	456	Middle Age(30-50)
France	Female	42	8	159660.80	3	1	0	113931.57	1	1	3	DIAMOND	377	Middle Age(30-50)
France	Female	39	1	0.00	2	0	0	93826.63	0	0	5	GOLD	350	Middle Age(30-50)
Spain	Female	43	2	125510.82	1	1	1	79084.10	0	0	5	GOLD	425	Middle Age(30-50)

[176]:
```
Churn_by_agegroup=df.groupby('AgeGroups')['Exited'].mean()*100
print(Churn_by_agegroup)
```

```
AgeGroups
Adult(18-30)          7.556368
Middle Age(30-50)    18.380241
```

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Code JupyterLab Python [conda env:base] *

Age(30-50)

[176]:
```
Churn_by_agegroup=df.groupby('AgeGroups')['Exited'].mean()*100
print(Churn_by_agegroup)
```

```
AgeGroups
Adult(18-30)          7.556368
Middle Age(30-50)    18.380241
Senior(50-100)       45.448029
Name: Exited, dtype: float64
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2116857766.py:1: FutureWarning: The default of observed=False is deprecated and will be changed to True in a future version of pandas. Pass observed=False to retain current behavior or observed=True to adopt the future default and silence this warning.
  Churn_by_agegroup=df.groupby('AgeGroups')['Exited'].mean()*100
```

[177]:
```
#Visulize churn rate by Age groups
```

[178]:
```
plt.figure(figsize=(6,4))
sns.barplot(x=Churn_by_agegroup.index,y=Churn_by_agegroup.values,palette='Set2')
plt.title('Churn Rate by AgeGroup')
plt.ylabel('Churn Rate(%)')
plt.xlabel('Age Group')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\1509556778.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x=Churn_by_agegroup.index,y=Churn_by_agegroup.values,palette='Set2')
```

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Code

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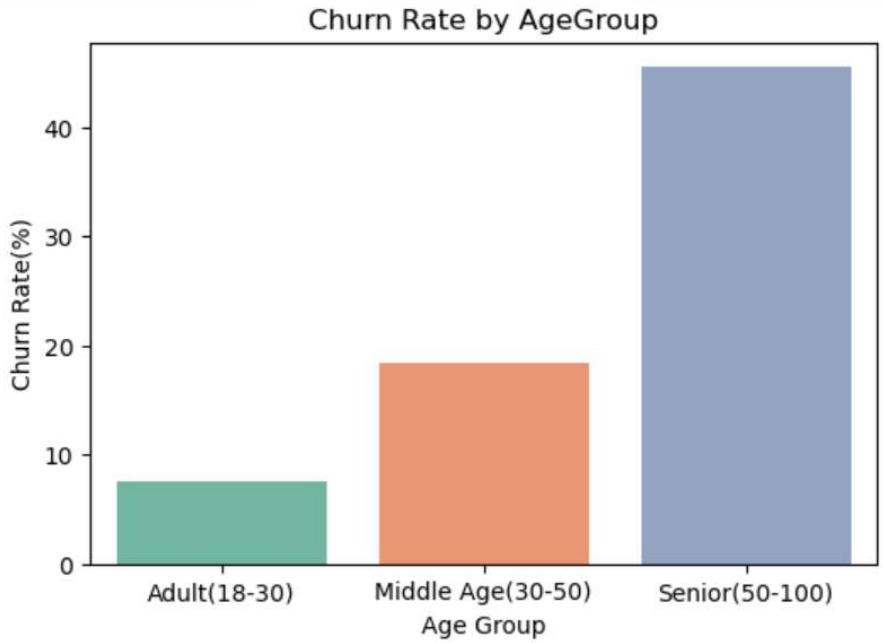
Python [conda env:base] *

```
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\1509556778.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x=Churn_by_agegroup.index,y=Churn_by_agegroup.values,palette='Set2')
```



[ ]:

Code JupyterLab Python [conda env:base] *

[ ]:

[179]:
```
#22. Are customers with only one product (NumOfProducts = 1) more likely to churn than those with multiple?
```

[180]:
```
Churn_by_products=df.groupby('NumOfProducts')['Exited'].mean()*100
print(Churn_by_products)
```

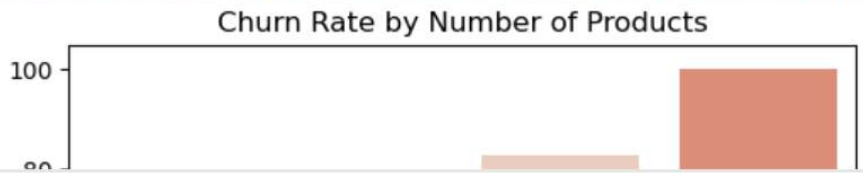
```
NumOfProducts
1     27.714398
2      7.603486
3     82.706767
4    100.000000
Name: Exited, dtype: float64
```

[181]:
```
plt.figure(figsize=(6,4))
sns.barplot(x=Churn_by_products.index,y=Churn_by_products.values,palette='coolwarm')
plt.title('Churn Rate by Number of Products')
plt.xlabel('Number of Products')
plt.xlabel('Churn Rate(%)')
plt.show()
```

```
C:\Users\nayak\AppData\Local\Temp\ipykernel_6884\2976775891.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the s
ame effect.

  sns.barplot(x=Churn_by_products.index,y=Churn_by_products.values,palette='coolwarm')
```



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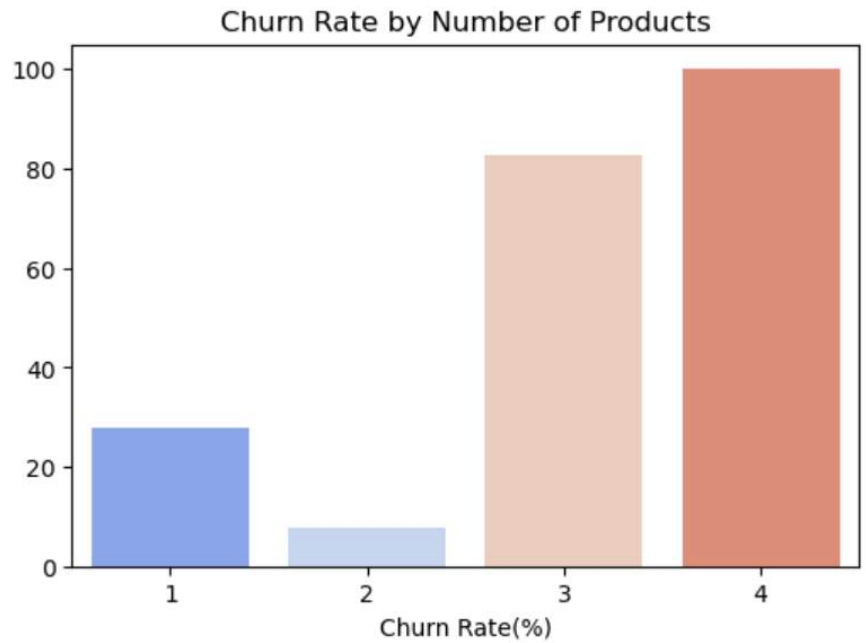
Code JupyterLab Python [conda env:base] *

```
sns.barplot(x=Churn_by_products.index,y=Churn_by_products.values,palette='coolwarm')
```



[182]:
```
df['NumOfProducts'].value_counts()
```

[182]:
```
NumOfProducts
1    5084
2    4590
3     266
4      60
Name: count, dtype: int64
```

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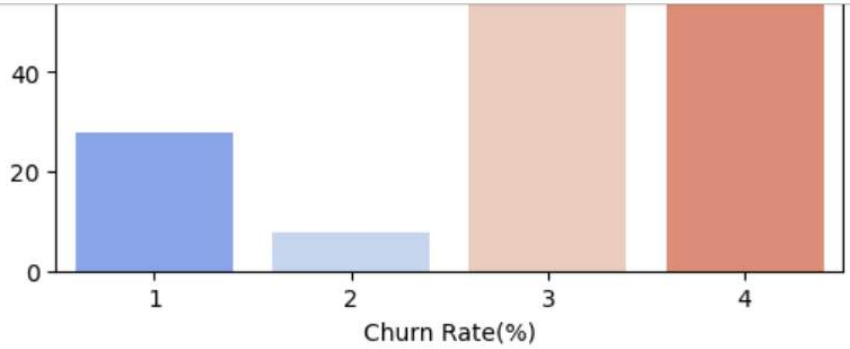
Code JupyterLab Python [conda env:base] *



[182]:
```
df['NumOfProducts'].value_counts()
```

[182]:
```
NumOfProducts
1    5084
2    4590
3     266
4      60
Name: count, dtype: int64
```

[184]:
```
'''ChurnRate decreases from 1 to 2 products but spikes sharply for 3 and 4 products.That means moderate engagement(2 products) promotes loyalty.
and under-engagement(1 product)and over-engagement(3 and 4 products)may lead to customer dissatisfaction.'''
```

[184]:
```
'ChurnRate decreases from 1 to 2 products but spikes sharply for 3 and 4 products.That means moderate engagement(2 products) promotes loyalty.\nand under
-engagement(1 product)and over-engagement(3 and 4 products)may lead to customer dissatisfaction.'
```

[ ]:

[ ]:

[ ]: