In [ ]:

```
# 📊 Telco Customer Churn Analysis

This project explores and analyzes a telecom company's customer base to understand churn patterns, customer behavior,
```

In [5]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

%matplotlib inline
sns.set(style="whitegrid")
plt.rcParams["figure.figsize"] = (7, 4)
```

In [4]:

```
df = pd.read_csv("telco_customer_churn.csv")
df.head()
```

Out[4]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurit
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	N
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Ye
2	3668-QPYBK	Male	0	No	No	2	Yes	No	DSL	Ye
3	7795-CFOCW	Male	0	No	No	45	No	No phone service	DSL	Ye
4	9237-HQITU	Female	0	No	No	2	Yes	No	Fiber optic	N

5 rows × 21 columns

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

Out[6]:
```
(7043, 21)
```

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   customerID        7043 non-null   object 
 1   gender            7043 non-null   object 
 2   SeniorCitizen     7043 non-null   int64  
 3   Partner           7043 non-null   object 
 4   Dependents        7043 non-null   object 
 5   tenure            7043 non-null   int64  
 6   PhoneService      7043 non-null   object 
 7   MultipleLines     7043 non-null   object 
 8   InternetService   7043 non-null   object 
 9   OnlineSecurity    7043 non-null   object 
 10  OnlineBackup      7043 non-null   object 
 11  DeviceProtection  7043 non-null   object 
 12  TechSupport       7043 non-null   object 
 13  StreamingTV       7043 non-null   object 
 14  StreamingMovies   7043 non-null   object 
 15  Contract          7043 non-null   object 
 16  PaperlessBilling  7043 non-null   object 
 17  PaymentMethod     7043 non-null   object 
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7043 non-null   object 
 20  Churn             7043 non-null   object 
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB
```

In [8]:
```
df.describe()
```

Out[8]:

	SeniorCitizen	tenure	MonthlyCharges
count	7043.000000	7043.000000	7043.000000
mean	0.162147	32.371149	64.761692
std	0.368612	24.559481	30.090047
min	0.000000	0.000000	18.250000
25%	0.000000	9.000000	35.500000
50%	0.000000	29.000000	70.350000
75%	0.000000	55.000000	89.850000
max	1.000000	72.000000	118.750000

In [9]:

```
df.nunique()
```

Out[9]:

```
customerID          7043
gender                 2
SeniorCitizen          2
Partner                2
Dependents             2
tenure                73
PhoneService           2
MultipleLines          3
InternetService        3
OnlineSecurity         3
OnlineBackup           3
DeviceProtection       3
TechSupport            3
StreamingTV            3
StreamingMovies        3
Contract               3
PaperlessBilling       2
PaymentMethod          4
MonthlyCharges      1585
TotalCharges        6531
Churn                  2
dtype: int64
```

In [10]:
```
df["TotalCharges"].unique()[:10]
```

Out[10]:
```
array(['29.85', '1889.5', '108.15', '1840.75', '151.65', '820.5',
       '1949.4', '301.9', '3046.05', '3487.95'], dtype=object)
```

In [11]:
```
df["TotalCharges"] = pd.to_numeric(df["TotalCharges"], errors="coerce")
```

In [12]:
```
df.dropna(subset=["TotalCharges"], inplace=True)
```

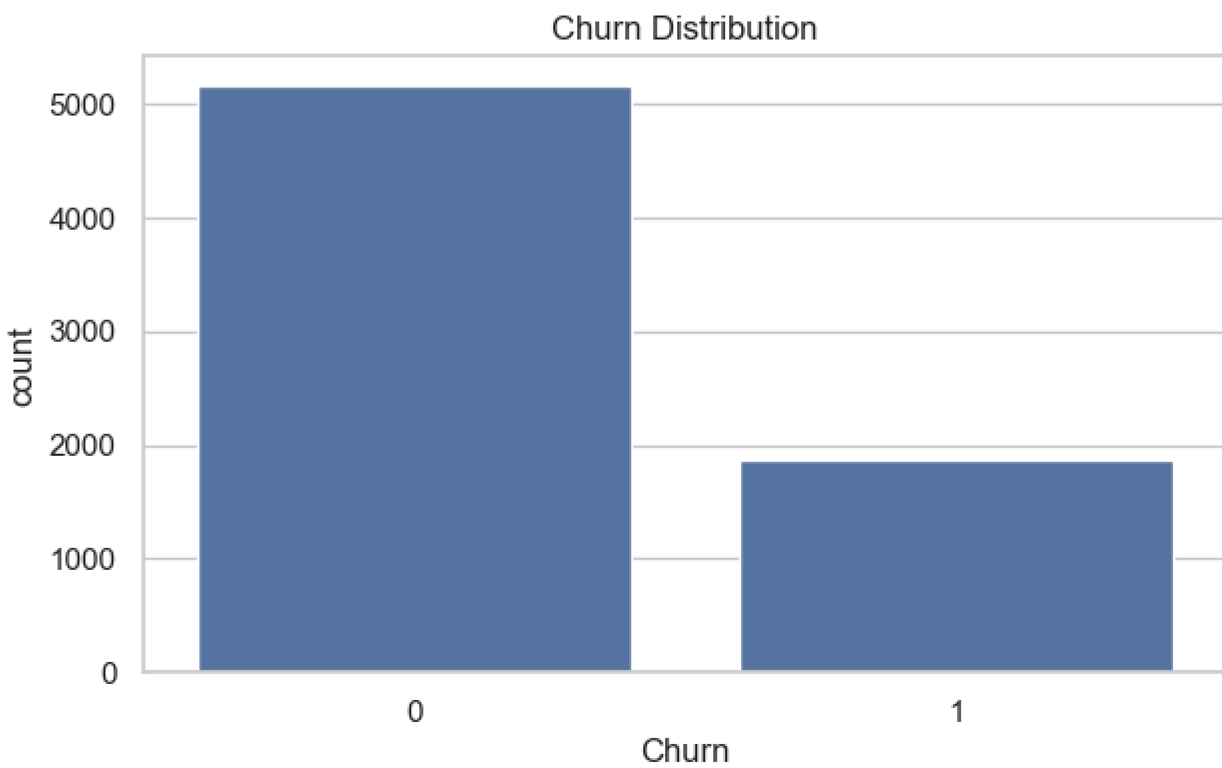
In [13]:
```
df["SeniorCitizen"] = df["SeniorCitizen"].astype("category")
```

In [14]:
```
df["Churn"].value_counts()
```

Out[14]:
```
Churn
No     5163
Yes    1869
Name: count, dtype: int64
```

In [15]:
```
df["Churn"] = df["Churn"].map({"Yes": 1, "No": 0})
```

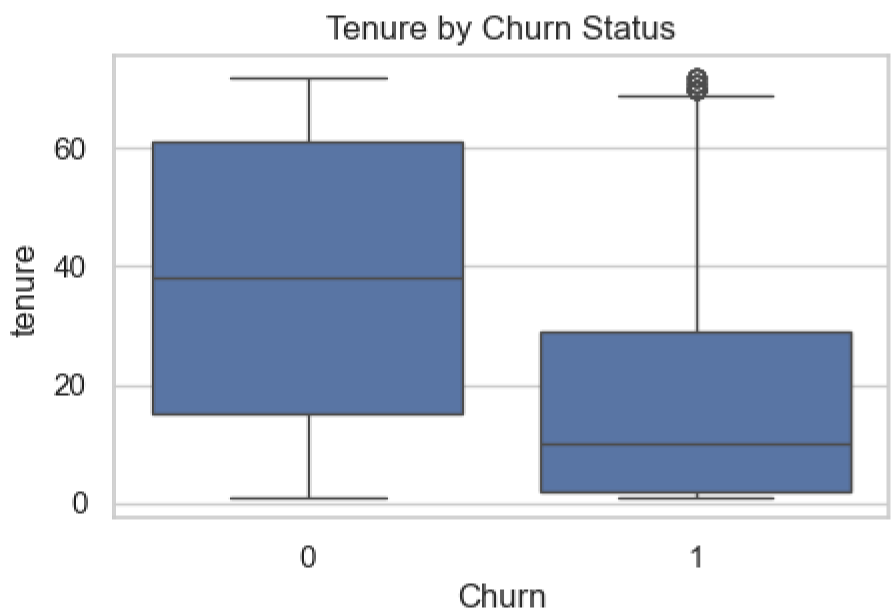
In [16]:
```
sns.countplot(x="Churn", data=df)
plt.title("Churn Distribution")
plt.show()
```



In [17]:
```
df.groupby("Churn")["tenure"].mean()
```

Out[17]:
```
Churn
0    37.650010
1    17.979133
Name: tenure, dtype: float64
```

In [30]:
```
plt.figure(figsize=(5, 3))
sns.boxplot(x="Churn", y="tenure", data=df)
plt.title("Tenure by Churn Status")
plt.show()
```

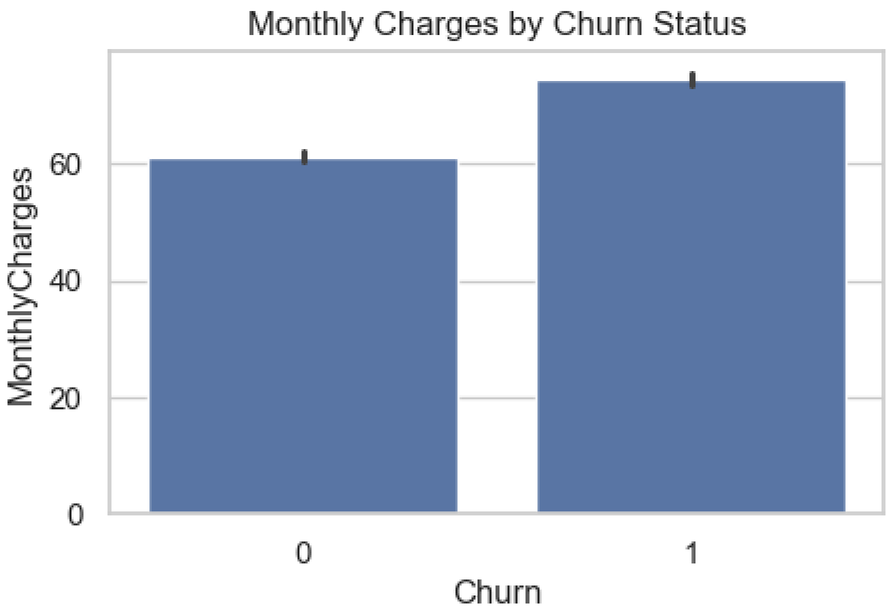


In [19]:
```
df.groupby("Churn")[["MonthlyCharges", "TotalCharges"]].mean()
```

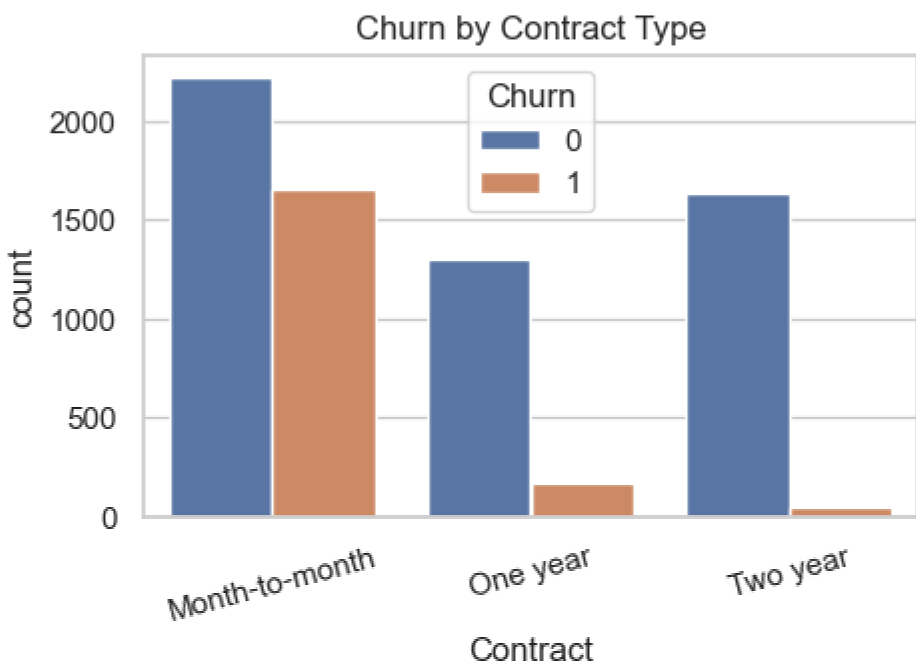
Out[19]:

	MonthlyCharges	TotalCharges
Churn		
0	61.307408	2555.344141
1	74.441332	1531.796094

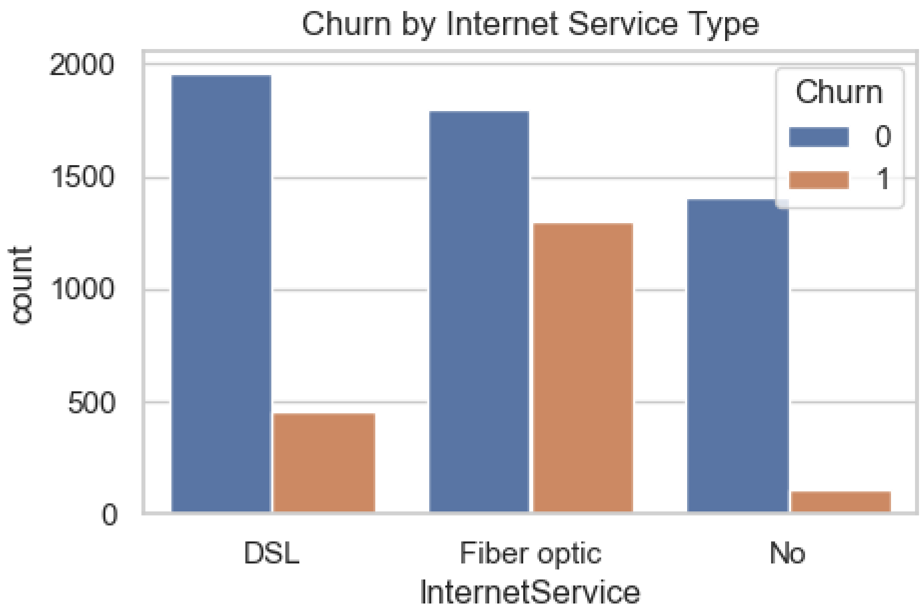
In [29]:
```
plt.figure(figsize=(5,3))
sns.barplot(x="Churn", y="MonthlyCharges", data=df)
plt.title("Monthly Charges by Churn Status")
plt.show()
```



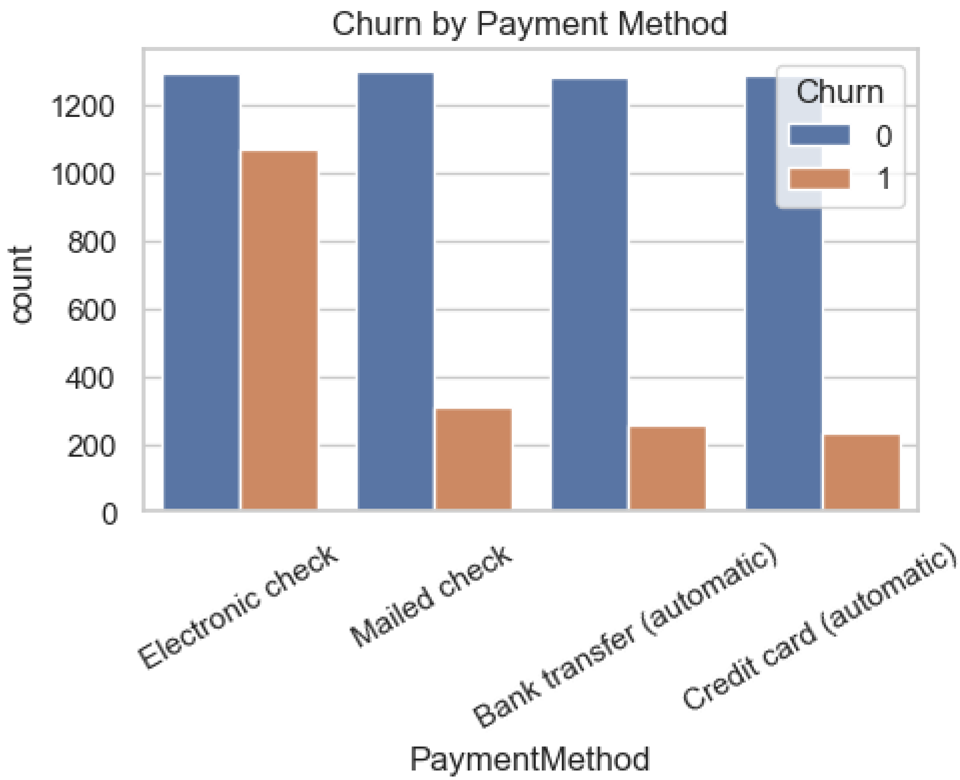
In [28]:
```
plt.figure(figsize=(5, 3))
sns.countplot(x="Contract", hue="Churn", data=df)
plt.title("Churn by Contract Type")
plt.xticks(rotation=15)
plt.show()
```



In [31]:
```
plt.figure(figsize=(5,3))
sns.countplot(x="InternetService", hue="Churn", data=df)
plt.title("Churn by Internet Service Type")
plt.show()
```

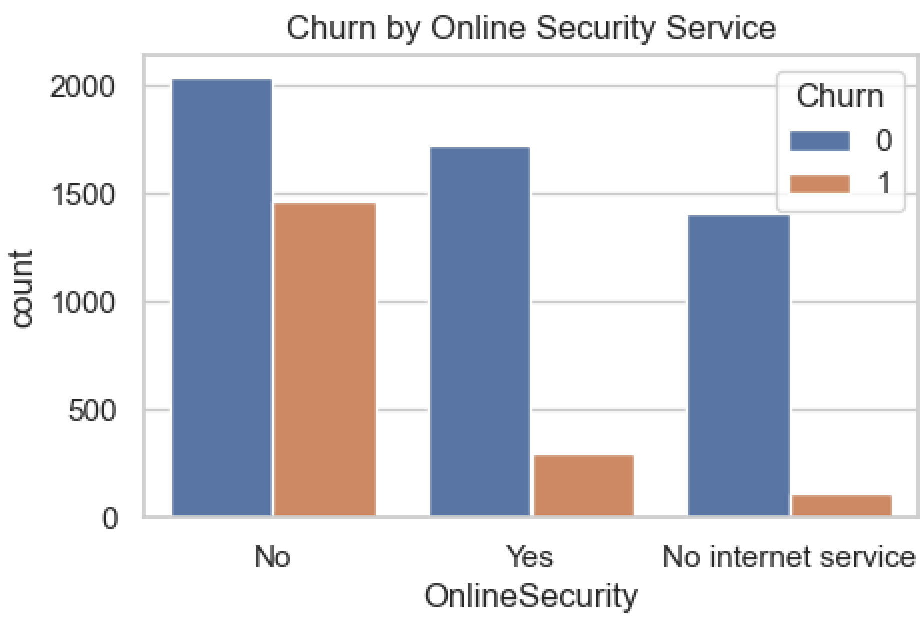


In [32]:
```
plt.figure(figsize=(5,3))
sns.countplot(x="PaymentMethod", hue="Churn", data=df)
plt.title("Churn by Payment Method")
plt.xticks(rotation=30)
plt.show()
```



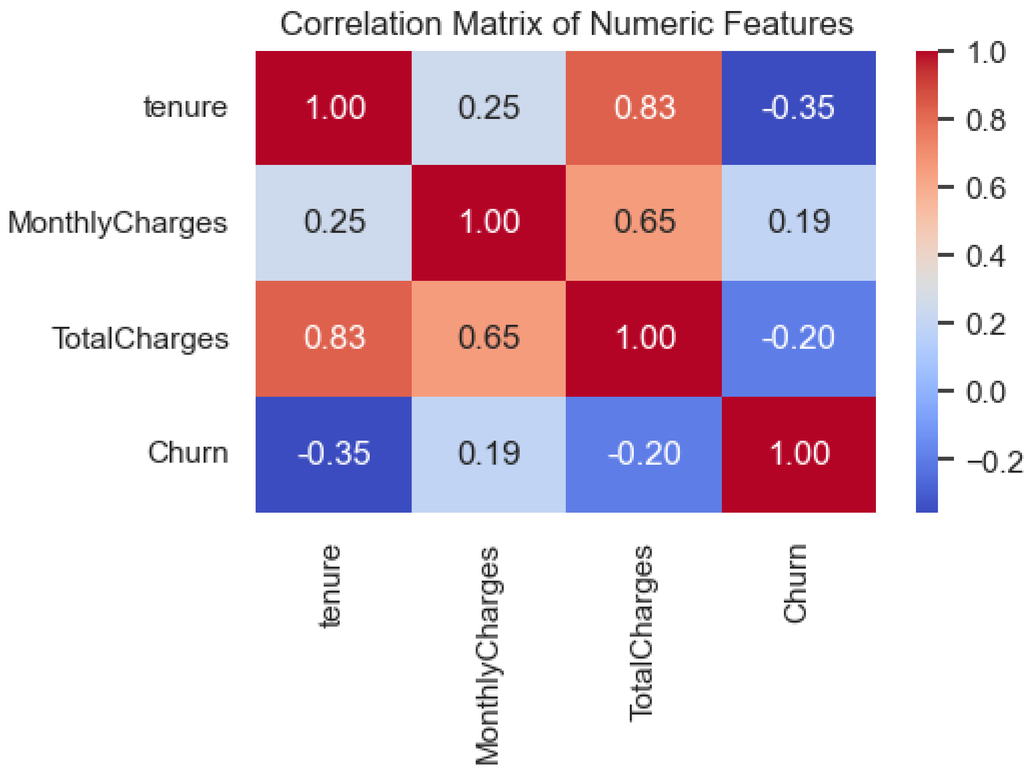
In [33]:

```
plt.figure(figsize=(5,3))
sns.countplot(x="OnlineSecurity", hue="Churn", data=df)
plt.title("Churn by Online Security Service")
plt.show()
```



In [25]:
```
numeric_df = df.select_dtypes(include=["float64", "int64"])
```

In [34]:
```
plt.figure(figsize=(5, 3))
sns.heatmap(numeric_df.corr(), annot=True, cmap="coolwarm", fmt=".2f")
plt.title("Correlation Matrix of Numeric Features")
plt.show()
```



In [ ]:

```
### Key Takeaways

- Customers on month-to-month contracts show the highest churn rates.
- Those without online security or tech support are more likely to leave.
- Higher monthly charges and shorter tenure both correlate with churn.
- Long-term customers on yearly contracts rarely churn, even with high total charges.

### Business Recommendations

- Encourage long-term contracts with loyalty discounts.
- Bundle online security or tech support as retention incentives.
- Identify high-risk groups early based on billing and service patterns.
```