In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
tel_data=pd.read_csv(r"C:\Users\HP\Downloads\telco.csv")
tel_data.head()
```

Out[1]:

| | customerID | gender | SeniorCitizen | Partner | Dependents | tenure | PhoneService | MultipleLines |
|---|---|---|---|---|---|---|---|---|
| **0** | 7590-VHVEG | Female | 0 | Yes | No | 1 | No | No phone service |
| **1** | 5575-GNVDE | Male | 0 | No | No | 34 | Yes | No |
| **2** | 3668-QPYBK | Male | 0 | No | No | 2 | Yes | No |
| **3** | 7795-CFOCW | Male | 0 | No | No | 45 | No | No phone service |
| **4** | 9237-HQITU | Female | 0 | No | No | 2 | Yes | No |

5 rows × 21 columns

In [2]:
```
#dropping nulls if there any and viewing the data
tel_data.dropna()
tel_data.info()
#the total charge column is object althought it should be float
```

```
<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 [3]:
```
tel_data=tel_data.drop(columns="customerID")
```

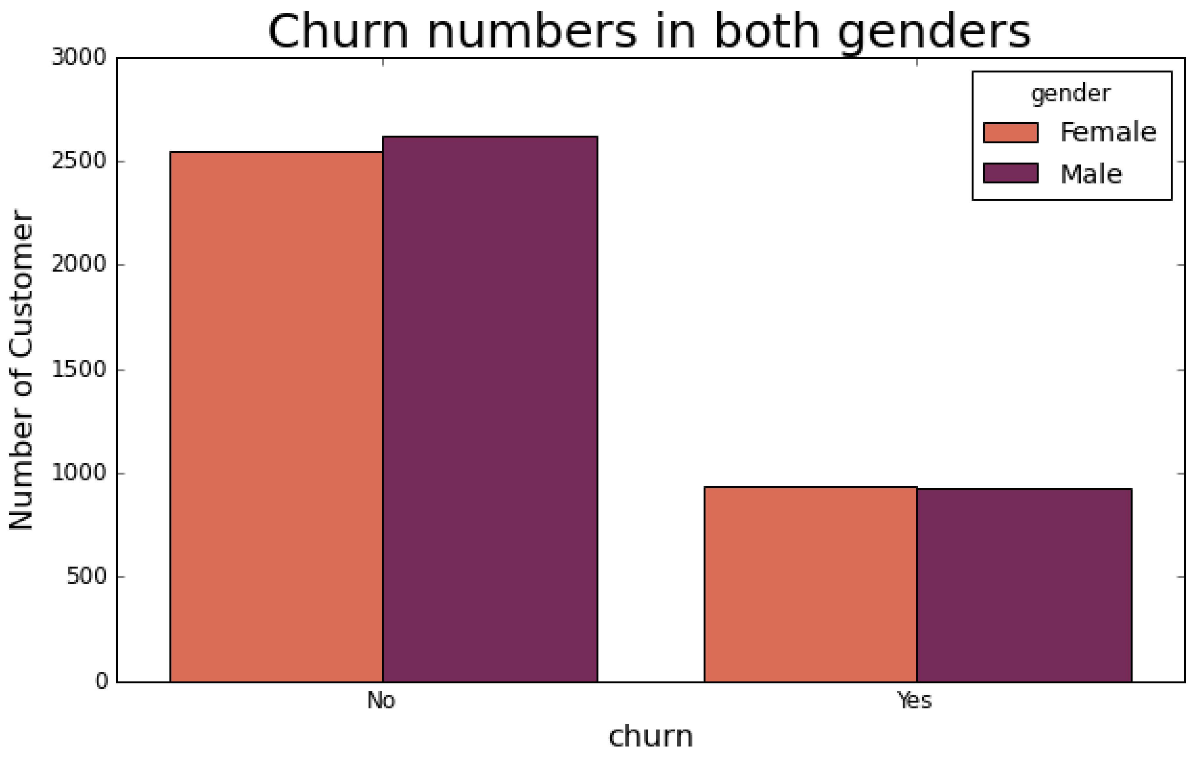
In [4]:
```
#these rows contain empty total charges so i will drop them so i can cast the c
print(tel_data["TotalCharges"][tel_data["TotalCharges"]==' '])
tel_data.drop([488,753,936,1082,1340,3331,3826,4380,5218,6670,6754], axis=0, ir
```

```
488     
753     
936     
1082    
1340    
3331    
3826    
4380    
5218    
6670    
6754    
Name: TotalCharges, dtype: object
```

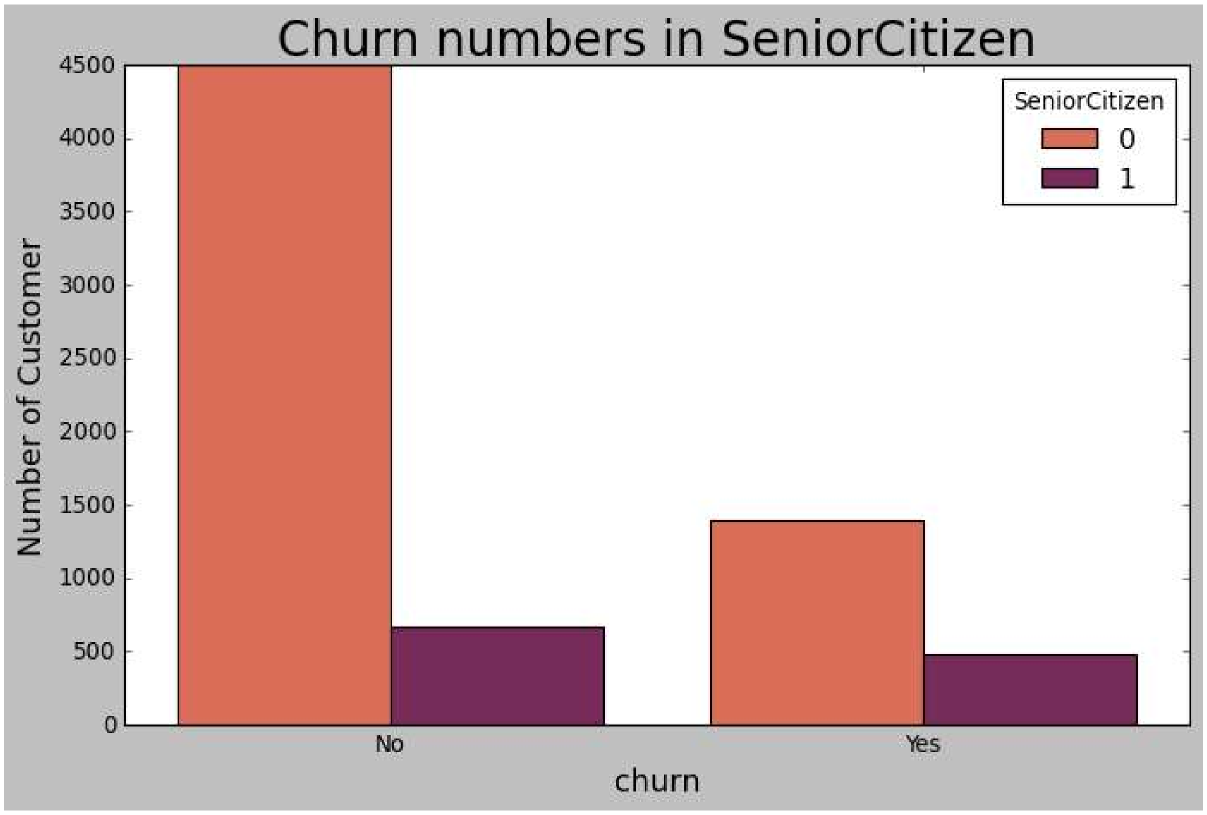
In [5]:
```
tel_data["TotalCharges"] = tel_data["TotalCharges"].astype(float)
tel_data.info()
#casting done
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7032 entries, 0 to 7042
Data columns (total 20 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   gender            7032 non-null   object 
 1   SeniorCitizen     7032 non-null   int64  
 2   Partner           7032 non-null   object 
 3   Dependents        7032 non-null   object 
 4   tenure            7032 non-null   int64  
 5   PhoneService      7032 non-null   object 
 6   MultipleLines     7032 non-null   object 
 7   InternetService   7032 non-null   object 
 8   OnlineSecurity    7032 non-null   object 
 9   OnlineBackup      7032 non-null   object 
 10  DeviceProtection  7032 non-null   object 
 11  TechSupport       7032 non-null   object 
 12  StreamingTV       7032 non-null   object 
 13  StreamingMovies   7032 non-null   object 
 14  Contract          7032 non-null   object 
 15  PaperlessBilling  7032 non-null   object 
 16  PaymentMethod     7032 non-null   object 
 17  MonthlyCharges    7032 non-null   float64
 18  TotalCharges      7032 non-null   float64
 19  Churn             7032 non-null   object 
dtypes: float64(2), int64(2), object(16)
memory usage: 1.1+ MB
```

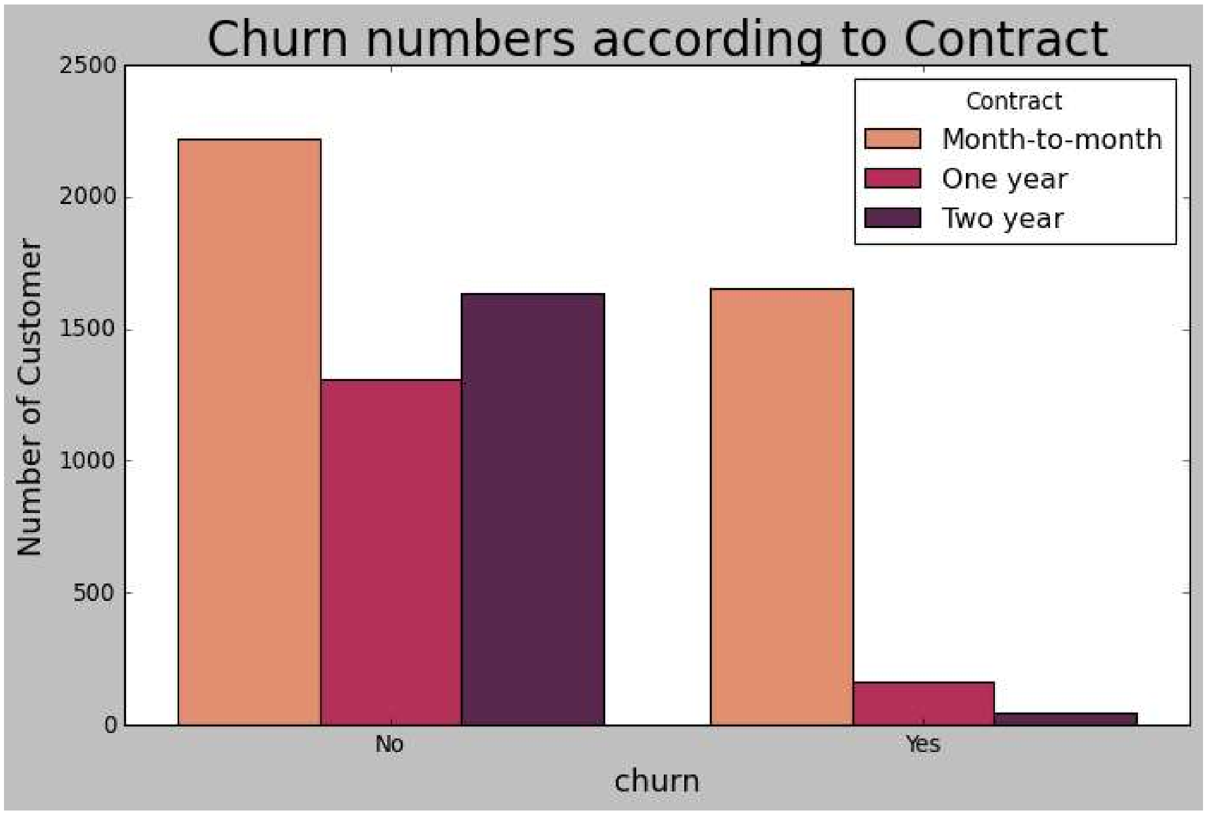
```
In [6]: #visualizing the data to know relationships between them
        plt.figure(figsize = (10,6))
        plt.style.use('classic')
        ax = sns.countplot(x = "Churn", hue = "gender", data = tel_data, palette= "rock
        ax.set_title(label = "Churn numbers in both genders", fontsize = 25)
        ax.set_xlabel(xlabel = "churn", fontsize = 16)
        ax.set_ylabel(ylabel = "Number of Customer", fontsize = 16);
        #churn is equal in both genders
```



In [7]:
```
plt.figure(figsize = (10,6))
plt.style.use('classic')
ax = sns.countplot(x = "Churn", hue = "SeniorCitizen", data = tel_data, palette
ax.set_title(label = "Churn numbers in SeniorCitizen", fontsize = 25)
ax.set_xlabel(xlabel = "churn", fontsize = 16)
ax.set_ylabel(ylabel = "Number of Customer", fontsize = 16);
#churn is high in non senior citizens
```



In [8]:
```
plt.figure(figsize = (10,6))
plt.style.use('classic')
ax = sns.countplot(x = "Churn", hue = "Contract", data = tel_data, palette= "rc
ax.set_title(label = "Churn numbers according to Contract", fontsize = 25)
ax.set_xlabel(xlabel = "churn", fontsize = 16)
ax.set_ylabel(ylabel = "Number of Customer", fontsize = 16);
#churn is high for people with month to month contract
```



In [9]:
```
tel_data
```

Out[9]:

| | gender | SeniorCitizen | Partner | Dependents | tenure | PhoneService | MultipleLines | InternetSe |
|---|---|---|---|---|---|---|---|---|
| **0** | Female | 0 | Yes | No | 1 | No | No phone service | |
| **1** | Male | 0 | No | No | 34 | Yes | No | |
| **2** | Male | 0 | No | No | 2 | Yes | No | |
| **3** | Male | 0 | No | No | 45 | No | No phone service | |
| **4** | Female | 0 | No | No | 2 | Yes | No | Fibe |
| **...** | ... | ... | ... | ... | ... | ... | ... | |
| **7038** | Male | 0 | Yes | Yes | 24 | Yes | Yes | |
| **7039** | Female | 0 | Yes | Yes | 72 | Yes | Yes | Fibe |
| **7040** | Female | 0 | Yes | Yes | 11 | No | No phone service | |
| **7041** | Male | 1 | Yes | No | 4 | Yes | Yes | Fibe |
| **7042** | Male | 0 | No | No | 66 | Yes | No | Fibe |

7032 rows × 20 columns

In [10]:
```
#turning the object (string)columns into numeric(0,1) to be able to perform log
tel_data=pd.get_dummies(tel_data,drop_first=True)
tel_data
```

Out[10]:

| | SeniorCitizen | tenure | MonthlyCharges | TotalCharges | gender_Male | Partner_Yes | Dependent |
|---|---|---|---|---|---|---|---|
| **0** | 0 | 1 | 29.85 | 29.85 | 0 | 1 | |
| **1** | 0 | 34 | 56.95 | 1889.50 | 1 | 0 | |
| **2** | 0 | 2 | 53.85 | 108.15 | 1 | 0 | |
| **3** | 0 | 45 | 42.30 | 1840.75 | 1 | 0 | |
| **4** | 0 | 2 | 70.70 | 151.65 | 0 | 0 | |
| **...** | ... | ... | ... | ... | ... | ... | |
| **7038** | 0 | 24 | 84.80 | 1990.50 | 1 | 1 | |
| **7039** | 0 | 72 | 103.20 | 7362.90 | 0 | 1 | |
| **7040** | 0 | 11 | 29.60 | 346.45 | 0 | 1 | |
| **7041** | 1 | 4 | 74.40 | 306.60 | 1 | 1 | |
| **7042** | 0 | 66 | 105.65 | 6844.50 | 1 | 0 | |

7032 rows × 31 columns

In [11]:
```
#putting all the data except for churn (the one to predict) into x and churn ir
from sklearn.model_selection import train_test_split
x=tel_data.drop("Churn_Yes",axis=1)
y=tel_data["Churn_Yes"]
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, randon
```

In [12]:
```
from sklearn.linear_model import LogisticRegression
```

In [13]:
```
#training the model
churn_model=LogisticRegression().fit(x_train,y_train);
```

```
C:\Users\HP\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:44
4: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html (https://sciki
t-learn.org/stable/modules/preprocessing.html)
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
sion (https://scikit-learn.org/stable/modules/linear_model.html#logistic-regr
ession)
  n_iter_i = _check_optimize_result(
```

In [14]:
```
#predicting the churn for the data in x-test
churn_model_prediction = churn_model.predict(x_test)
churn_model_prediction
```

Out[14]:
```
array([0, 0, 0, ..., 1, 0, 1], dtype=uint8)
```

In [15]:
```
#holding accuracy of the model prediction by comparing the model prediction wit
import sklearn.metrics as sm
churn_model_accuracy_score=sm.accuracy_score(y_test, churn_model_prediction)*10
print("%",churn_model_accuracy_score)
```

```
% 80.38379530916845
```

In [16]:
```
#making confusion matrix of the model
from sklearn.metrics import confusion_matrix as cm
cm(y_test, churn_model_prediction)
```

Out[16]:
```
array([[928, 110],
       [166, 203]], dtype=int64)
```

In [ ]:
```

```