```
# Importing libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
print('Libraries loaded ...')
Libraries loaded ...
# load dataset
df= pd.read csv(r'D:\Learnig Environment\Python\Work\Customer
Churn.csv')
# read csv() for reading csv data
print('Data loaded...')
Data loaded...
df.shape # return size of data
(7043, 21)
df.head() # returns first 5 rows
   customerID gender SeniorCitizen Partner Dependents tenure
PhoneService \
  7590-VHVEG Female
                                                              1
                                        Yes
                                                     No
                                 no
No
1 5575-GNVDE
                 Male
                                         No
                                                     No
                                                             34
                                 no
Yes
2 3668-QPYBK
                                                              2
                 Male
                                 no
                                         No
                                                     No
Yes
3 7795-CF0CW
                 Male
                                         No
                                                     No
                                                             45
                                 no
No
4 9237-HQITU
               Female
                                 no
                                         No
                                                     No
                                                              2
Yes
      MultipleLines InternetService OnlineSecurity ...
DeviceProtection
0 No phone service
                                DSL
                                                 No
No
1
                 No
                                DSL
                                                Yes ...
Yes
                                DSL
2
                 No
                                                Yes ...
No
3 No phone service
                                DSL
                                                Yes ...
Yes
4
                 No
                        Fiber optic
                                                 No ...
No
```

Tech	nSupport Stre	aminaTV Str	eamingMov	ies	Contract		
	essBilling.	\	camining 10 v	103	contract		
0	No	No		No Mor	th-to-month	1	
Yes							
1	No	No		No	One year	•	
No					•		
2	No	No		No Mor	th-to-month	1	
Yes							
3	Yes	No		No	One year	•	
No							
4	No	No		No Mor	th-to-month	1	
Yes							
	D		4 113 61	-	161	CI	
0		mentMethod I			otalCharges		
0		onic check		29.85	29.85		
1 2		iled check		56.95	1889.50		
		iled check		53.85	108.15 1840.75		
3 Dall	nk transfer (	onic check		42.30 70.70	151.65		
4	Etecti	Ollic Clieck		70.70	151.05	res	
[5 row	vs x 21 colum	ins]					
df.tai	ll() # return	s last 5 ro	ws of date	а			
	customerID	gender Seni	orCitizen	Partner	Dependents	tenure	\
7038	6840-RESVB	Male	no	Yes			-
7039	2234-XADUH	Female	no	Yes	Yes	72	
7040	4801-JZAZL	Female	no	Yes	Yes	11	
7041	8361-LTMKD	Male	yes	Yes	S No	4	
7042	3186-AJIEK	Male	no	No	No.	66	
	PhoneService	Multiple	eLines In	ternetSe	ervice		
	eSecurity	. \	.,		5.51		
7038	Yes		Yes		DSL		
	Van		V	Tába.			
7039	Yes		Yes	Fiber	optic		
No 7040	No.	No phone se	arvi co		DSL		
		No phone so	ervice		νSL		
Voc			Yes	Fiber	ontic		
	VAC		163	ITDEI	optic		
7041	Yes						
7041 No					ontic		
7041 No 7042	Yes		No	Fiber	optic		
7041 No 7042					optic		
7041 No 7042 Yes .	Yes	ion TechSup	No	Fiber		ovies	
7041 No 7042 Yes .	Yes  DeviceProtect		No oort Stre	Fiber amingTV		ovies	
7041 No 7042 Yes . Contra 7038	Yes  DeviceProtect	ion TechSup <sub>l</sub> Yes	No	Fiber		ovies Yes	
7041 No 7042 Yes Contra 7038 One ye	Yes  DeviceProtect	Yes	No port Stre Yes	Fiber amingTV Yes		Yes	
7041 No 7042 Yes . Contra 7038	Yes  DeviceProtect		No oort Stre	Fiber amingTV			

0				
One year 7040	No	No	No	No Month-
to-month	NO	IVO	INO	NO MOTICIT-
7041	No	No	No	No Month-
to-month	NO	NO	NO	NO HOHEH-
7042	Yes	Yes	Yes	Yes
Two year	. 05	. 00	. 00	. 65
, ,				
Paperles	sBilling	Pay	mentMethod Mon	nthlyCharges
TotalCharges	\			
7038	Yes	Ma	iled check	84.80
1990.50	V C	and't mad (		102.20
7039	Yes C	redit card (	automatic)	103.20
7362.90 7040	Yes	Floctr	onic check	29.60
346.45	163	Ltecti	OHIC CHECK	29.00
7041	Yes	Ma	iled check	74.40
306.60				
7042	Yes Ban	k transfer (	automatic)	105.65
6844.50				
7039 No 7040 No 7041 Yes 7042 No [5 rows x 21	columnsl			
df.info()	co camii 5 j			
d111110()				
<pre><class #="" 'panda="" 7="" column<="" columns="" data="" pre="" rangeindex:=""></class></pre>	043 entries, (total 21 col	0 to 7042	Dtype	
0 customer	TD 704	3 non-null	object	
1 gender		3 non-null	object	
2 SeniorCi		3 non-null	int64	
3 Partner		3 non-null	object	
4 Dependen		3 non-null	object	
5 tenure		3 non-null	int64	
6 PhoneSer		3 non-null	object	
<ul><li>7 Multiple</li><li>8 Internet</li></ul>		3 non-null 3 non-null	object object	
9 OnlineSe		3 non-null	object	
	-	J Hon Hace		
10 UnlineBa	ckup 704	3 non-null	_	
<pre>10 OnlineBa 11 DevicePr</pre>	-	3 non-null 3 non-null	object object	
	otection 704		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
                                     object
                     7043 non-null
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
```

## replacing the value below

```
df['TotalCharges']=df['TotalCharges'].replace(" ","0")
```

## Changing the datatype below from string to float

```
df['TotalCharges']=df['TotalCharges'].astype("float")
```

## **Checking Null**

df.is	null() # <i>ret</i>	urns Tru	e/false cell wi	se		
tenur	customerID e \	gender	SeniorCitizen	Partner	Dependents	
0	False	False	False	False	False	False
1	False	False	False	False	False	False
2	False	False	False	False	False	False
3	False	False	False	False	False	False
4	False	False	False	False	False	False
7038	False	False	False	False	False	False
7039	False	False	False	False	False	False
7040	False	False	False	False	False	False

7041	F	alse	False		False	False	False	False
7042	F	alse	False		False	False	False	False
Online	Phones Securi	Service ity	Multip . \	leLines	Inter	netServic	е	
0		False	,	False		Fals	е	
False 1 False		False		False		Fals	e	
2		False		False		Fals	е	
False		False		False		Fals	е	
False 4 False		False		False		Fals	e	
7038		False		False		Fals	е	
False 7039		False		False		Fals	е	
False 7040		False		False		Fals	е	
False 7041		False		False		Fals	е	
False 7042		False		False		Fals	e	
False								
Contra		eProtect	tion Te	chSuppo	rt Str	reamingTV	StreamingMo	ovies
0 False	(	Fa	alse	Fal	se	False	F	alse
1		Fa	alse	Fal	se	False	F	alse
False 2		Fa	alse	Fal	se	False	F	alse
False 3		Fa	alse	Fal	se	False	F	alse
False 4		Fa	alse	Fal	se	False	F	alse
False 								
 7038		Fa	alse	Fal	se	False	f	alse
False 7039		Fa	alse	Fal	se	False	F	alse
False 7040 False			alse	Fal		False		alse

7041	False	False	False	False
False 7042	False	False	False	False
False				
	PaperlessBilling	PaymentMethod	MonthlyCharges	TotalCharges
Churn				
0	False	False	False	False
False 1	False	False	False	False
False	14130	14150	14150	1 4 6 5 6
2	False	False	False	False
False				
3	False	False	False	False
False 4	False	False	False	False
False		1 4 1 5 6	1 4 15 5	. 4.50
7000	- 1	- 1	- 1	- 1
7038 False	False	False	False	False
7039	False	False	False	False
False				
7040	False	False	False	False
False	F-1	F-1	F.1	F.1
7041 False	False	False	False	False
7042	False	False	False	False
False				
[7043	rows x 21 columns	]		

df.isnull().sum() # summing column wise total null values

customerID	0
gender	0
SeniorCitizen	0
Partner	0
Dependents	0
tenure	0
PhoneService	0
MultipleLines	0
InternetService	0
OnlineSecurity	0
OnlineBackup	0
DeviceProtection	0
TechSupport	0
StreamingTV	0
StreamingMovies	0
Contract	0

```
PaperlessBilling 0
PaymentMethod 0
MonthlyCharges 0
TotalCharges 0
Churn 0
dtype: int64
```

#### checking the information

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

#### **Basic Statistics**

```
df.describe()

SeniorCitizen tenure MonthlyCharges TotalCharges
count 7043.000000 7043.000000 7043.000000
```

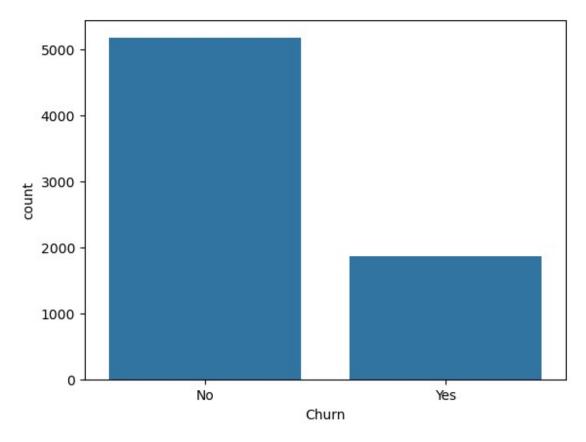
min 0.000000 0.000000 18.250000 0.000000 25% 0.000000 9.000000 35.500000 398.550000 50% 0.000000 29.000000 70.350000 1394.550000

## Check Duplicate in data

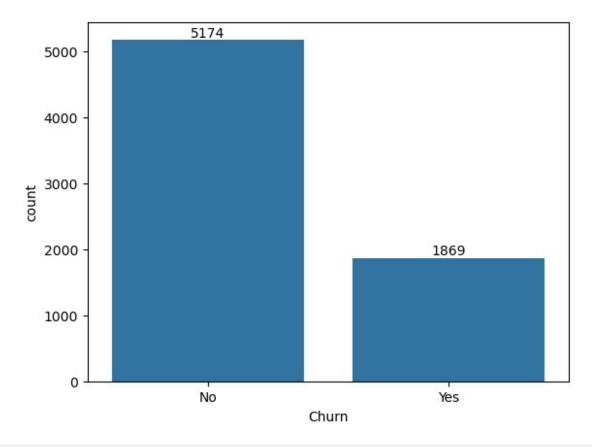
```
df.duplicated() # Returnds True or False
0
        False
1
        False
2
        False
3
        False
        False
7038
        False
7039
        False
7040
        False
7041
        False
7042
        False
Length: 7043, dtype: bool
# Summing Total Duplicate value
df.duplicated().sum()
0
# converting the Senior Citizen Yes No
def conv(value):
    if value==1:
        return "yes"
    else:
        return "no"
df['SeniorCitizen']=df['SeniorCitizen'].apply(conv)
df.head(10)
   customerID gender SeniorCitizen Partner Dependents tenure
PhoneService \
  7590-VHVEG Female
                                  no
                                         Yes
                                                      No
                                                               1
No
1 5575-GNVDE
                 Male
                                          No
                                                      No
                                                              34
                                  no
Yes
```

Yes 3 7795-CFOCW Male no No No 45 No								
3		68-QPYBK	Male	ı	no N	lo	No	2
4         9237-HQITU         Female         no         No         No         2           Yes         5         9305-CDSKC         Female         no         No         No         8           Yes         6         1452-KIOVK         Male         no         No         No         10           No         No         No         No         10         No         10           No         No         No         No         10         No         10           No         No         No         No         28         Yes         7892-P00KP         Female         no         No         10         No         28         Yes         78         62         Yes         62         Yes         62         Yes         78         62         Yes         78         78         62         Yes         78 <t< td=""><td></td><td>95-CF0CW</td><td>Male</td><td>i</td><td>10 N</td><td>lo</td><td>No</td><td>45</td></t<>		95-CF0CW	Male	i	10 N	lo	No	45
Yes 5 9305-CDSKC Female	No 4 923	37-HOTTII	Female	,	no N	Jo	No	2
Yes 6 1452-KIOVK Male	Yes							
6 1452-KIOVK Male no No Yes 22 Yes Yes 7 6713-0KOMC Female no No No No 10 No 8 7892-POOKP Female no Yes No 28 Yes 9 6388-TABGU Male no No Yes 62 Yes  MultipleLines InternetService OnlineSecurity DeviceProtection \ 0 No phone service DSL No No 1 No DSL Yes Yes 2 No DSL Yes Yes 2 No DSL Yes Yes 4 No Fiber optic No No 3 No phone service DSL No Yes 4 No Fiber optic No Yes 6 Yes Fiber optic No Yes 7 No phone service DSL Yes Yes 9 No DSL Yes No 7 No phone service DSL Yes No 7 TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No No Month-to-month Yes 1 No No No No No Month-to-month Yes		95 - CDSKC	Female	ľ	10 1	lo	No	8
7 6713-0KOMC Female	6 145	52-KIOVK	Male	ı	no N	lo	Yes	22
8 7892-POOKP Female       no       Yes       No       28         Yes       9 6388-TABGU       Male       no       No       Yes       62         Yes        MultipleLines InternetService OnlineSecurity           DeviceProtection \ 0 No phone service       DSL       No          No       DSL       Yes          No       DSL       Yes          Yes       2       No       DSL       Yes          No       3 No phone service       DSL       Yes        Yes          Yes       4       No       Fiber optic       No        Yes          No       7 Yes       Fiber optic       No        No          No       No       DSL       Yes        No          No       No       No       No        No          No       No       No       No       No       No       No       No       No       No       No       No       No       No       No       No       No       No       No		13-0K0MC	Female	ı	10 N	lo	No	10
Yes 9 6388-TABGU Male no No Yes 62 Yes  MultipleLines InternetService OnlineSecurity DeviceProtection \ 0 No phone service DSL No No 1 No DSL Yes Yes 2 No DSL Yes No 3 No phone service DSL Yes Yes 4 No Fiber optic No Yes 4 No Fiber optic No Yes 6 Yes Fiber optic No Yes 6 Yes Fiber optic No Yes 7 No phone service DSL Yes No No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 2 No No No No Month-to-month Yes	No 780	02 - PNNKP	Female	,	no Y6	<b>7</b> C	No	28
MultipleLines InternetService OnlineSecurity  DeviceProtection \ 0 No phone service DSL No  No 1 No DSL Yes  Yes 2 No DSL Yes  No 3 No phone service DSL Yes  No 3 No phone service DSL Yes  Yes 4 No Fiber optic No  No 5 Yes Fiber optic No  Yes 6 Yes Fiber optic No  No 7 No phone service DSL Yes  No 8 Yes Fiber optic No  No 7 No phone service DSL Yes  No 8 Yes Fiber optic No  TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 2 No No No No Month-to-month Yes	Yes							
MultipleLines InternetService OnlineSecurity  DeviceProtection \ 0 No phone service DSL No  No 1 No DSL Yes  Yes 2 No DSL Yes  No 3 No phone service DSL Yes  Yes  Yes 4 No Fiber optic No  No 5 Yes Fiber optic No  Yes 6 Yes Fiber optic No  Yes 6 Yes Fiber optic No  No 7 No phone service DSL Yes  No 8 Yes Fiber optic No  No 7 No phone service DSL Yes  No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 2 No No No No Month-to-month Yes		88-TABGU	Male	ľ	10 1	lo	Yes	62
DeviceProtection \ 0 No phone service DSL No No 1 No DSL Yes Yes 2 No DSL Yes No 3 No phone service DSL Yes Yes 4 No Fiber optic No Yes 4 No Fiber optic No Yes 6 Yes Fiber optic No Yes 6 Yes Fiber optic No Yes 8 Yes Fiber optic No No No DSL Yes No No DSL Yes No No Priber optic No Yes 9 No DSL Yes No No No No Month-to-month Yes 1 No No No No Month-to-month Yes 1 No No No No Month-to-month Yes		Multiplo	lings Int	arnetServi	ce Online	Security		
No		eProtecti	on \			_		
1 No DSL Yes Yes 2 No DSL Yes No 3 No phone service DSL Yes Yes 4 No Fiber optic No No 5 Yes Fiber optic No Yes 6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No Month-to-month Yes		phone se	rvice	DS	SL	No		
2 No DSL Yes No 3 No phone service DSL Yes Yes 4 No Fiber optic No No 5 Yes Fiber optic No Yes 6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No No Month-to-month Yes 1 No No No No No Month-to-month Yes 2 No No No No Month-to-month Yes	1		No	DS	SL	Yes		
No 3 No phone service DSL Yes Yes 4 No Fiber optic No No 5 Yes Fiber optic No Yes 6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No No Month-to-month Yes 1 No No No No One year No 2 No No No No Month-to-month Yes	Yes 2		No	DS	SL	Yes		
Yes 4 No Fiber optic No No 5 Yes Fiber optic No Yes 6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No One year No 2 No No No No Month-to-month Yes	No No	nhono so	rui co					
No 5 Yes Fiber optic No Yes 6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No One year No 2 No No No No Month-to-month Yes	Yes	phone se	rvice	υ	)L	res		
Yes  Yes  Yes  Yes  Yes  Yes  Yes  No	4 No.		No	Fiber opt:	LC	No		
6 Yes Fiber optic No No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No  TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No One year No 2 No No No Month-to-month Yes	5		Yes	Fiber opt:	ic	No		
No 7 No phone service DSL Yes No 8 Yes Fiber optic No Yes 9 No DSL Yes No  TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No No One year No 2 No No No No Month-to-month Yes			Yes	Fiber opt:	ic	No		
No  8 Yes Fiber optic No  Yes  9 No DSL Yes  No  TechSupport StreamingTV StreamingMovies Contract  PaperlessBilling \ 0 No No No Month-to-month  Yes  1 No No No No One year  No 2 No No No Month-to-month  Yes	No	1		•				
Yes 9 No DSL Yes No  TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No One year No 2 No No No Month-to-month Yes	/ No	pnone se	rvice	D:	)L	Yes		
9 No DSL Yes No TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0 No No No Month-to-month Yes 1 No No No One year No 2 No No No Month-to-month Yes	8 Vac		Yes	Fiber opt:	LC	No		
TechSupport StreamingTV StreamingMovies Contract PaperlessBilling \ 0    No    No    No    Month-to-month Yes 1    No    No    No    One year No 2    No    No    No    Month-to-month Yes	9		No	DS	SL .	Yes		
PaperlessBilling \ 0    No    No    No Month-to-month Yes 1    No    No    No    One year No 2    No    No    No    Month-to-month Yes	No							
0 No No No Month-to-month Yes 1 No No No No One year No 2 No No No Month-to-month Yes				TV Streami	ngMovies	С	ontract	
1 No No No One year No 2 No No No Month-to-month Yes	0		iig (	No	No	Month-t	o-month	
No 2 No No No Month-to-month Yes	Yes 1	No		No	No	n	ne vear	
Yes	No						•	
		No		No	No	Month-t	o-month	
	3	Yes		No	No	0	ne year	

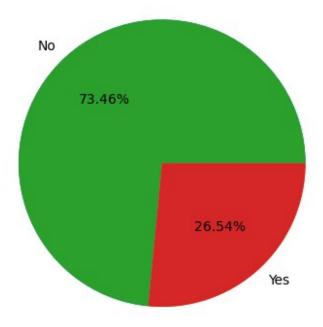
No					
4	No	No	No	Month-to-month	
Yes	No	Yes	Yes	Month-to-month	
5 Yes		res	res	Month-to-month	
6	No	Yes	No	Month-to-month	
Yes					
7 No.	No	No	No	Month-to-month	
No 8	Yes	Yes	Yes	Month-to-month	
Yes		103	103	Horren co morren	
9	No	No	No	One year	
No					
	Pā	aymentMethod Mo	nthlyCharge	s TotalCharges	Churn
0	Elect	ronic check	29.8	5 29.85	No
1 2 3 4		Mailed check	56.9		No
2		Mailed check	53.8		Yes
3	Bank transfer	•	42.3		No
4		ronic check	70.7		Yes
5		ronic check	99.6 89.1		Yes No
5 6 7	Credit card	(automatic) Mailed check	29.7		No
8		ronic check	104.8		Yes
	Bank transfer		56.1		No
	2	(3.3.2011.0.220)	3311	3.0.103	
[10	rows x 21 col	umns]			
sns	countal at (v='	Churn', data=d	f)		
	.show()	charif , data-d	,		



```
ax=sns.countplot(x='Churn', data=df)
ax.bar_label(ax.containers[0])
plt.show()
```

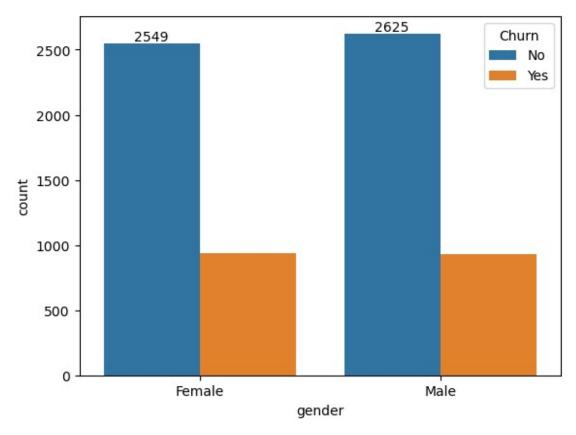


```
gb = df.groupby('Churn').agg({'Churn':'count'})
plt.pie(gb['Churn'],labels=gb.index, autopct='%1.2f%%')
plt.pie(gb['Churn'])
plt.show()
```



## Gender wise Churn Analysis

```
ax= sns.countplot(x='gender', data=df, hue='Churn')
ax.bar_label(ax.containers[0])
plt.show()
```

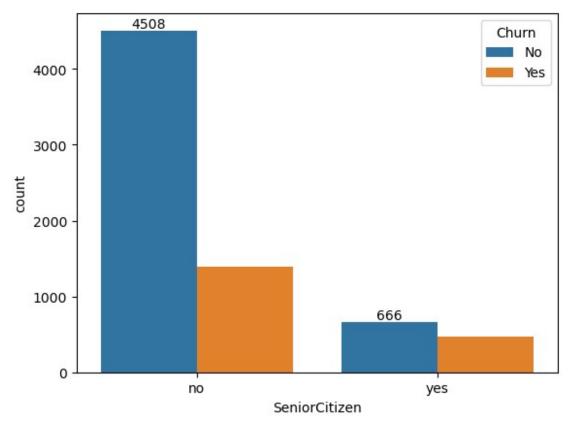


```
df.columns

Index(['customerID', 'gender', 'SeniorCitizen', 'Partner',
    'Dependents',
        'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
        'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
    'TechSupport',
        'StreamingTV', 'StreamingMovies', 'Contract',
    'PaperlessBilling',
        'PaymentMethod', 'MonthlyCharges', 'TotalCharges', 'Churn'],
        dtype='object')
```

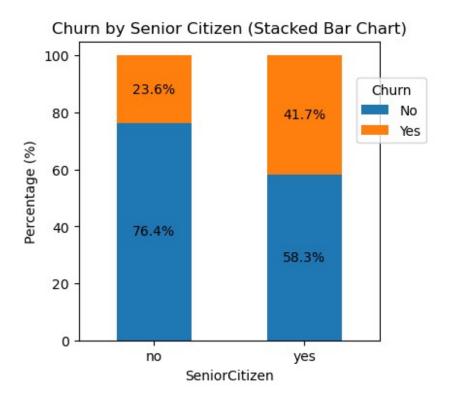
## Senior Citizen Churn Analysis

```
ax= sns.countplot(x='SeniorCitizen', data=df, hue='Churn')
ax.bar_label(ax.containers[0])
plt.show()
```



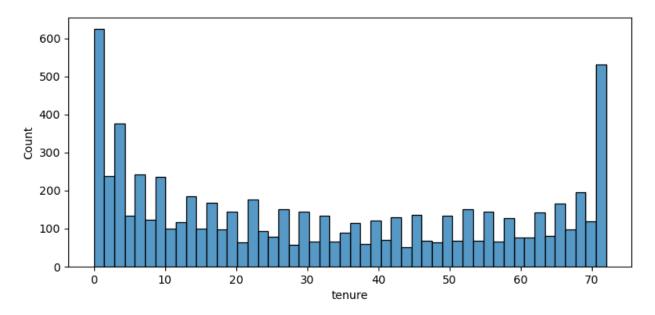
```
total_counts = df.groupby('SeniorCitizen')
['Churn'].value counts(normalize=True).unstack() * 100
# Plot
fig, ax = plt.subplots(figsize=(4, 4)) # Adjust figsize for better
visualization
# Plot the bars
total counts.plot(kind='bar', stacked=True, ax=ax, color=['#1f77b4',
'#ff7f0e'l) # Customize colors if desired
# Add percentage labels on the bars
for p in ax.patches:
    width, height = p.get width(), p.get height()
    x, y = p.get xy()
    ax.text(x + width / 2, y + height / 2, f'{height:..1f}%',
ha='center', va='center')
plt.title('Churn by Senior Citizen (Stacked Bar Chart)')
plt.xlabel('SeniorCitizen')
plt.ylabel('Percentage (%)')
plt.xticks(rotation=0)
plt.legend(title='Churn', bbox to anchor = (0.9,0.9)) # Customize
legend location
```

plt.show()

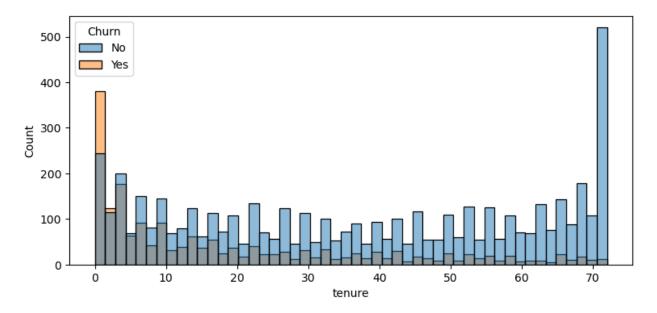


## Tenure Based Churn analysis

```
plt.figure(figsize=(9,4))
sns.histplot(x='tenure', data=df, bins=50)
plt.show()
```

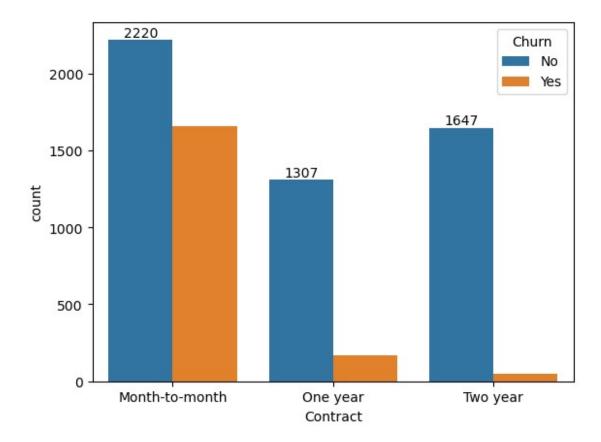


```
# Churn Status
plt.figure(figsize=(9,4))
sns.histplot(x='tenure', data=df, bins=50, hue='Churn')
plt.show()
```



## contract Based Churn Analysis

```
ax=sns.countplot(x='Contract', data=df, hue ='Churn')
ax.bar_label(ax.containers[0])
plt.show()
```



Above we can see that month to month contract customer has high churn number.

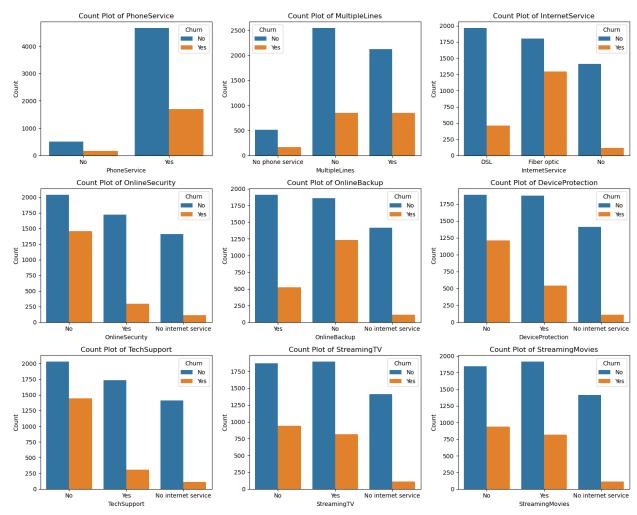
```
df.columns.values
array(['customerID', 'gender', 'SeniorCitizen', 'Partner',
'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
columns = ['PhoneService', 'MultipleLines', 'InternetService',
'OnlineSecurity',
           'OnlineBackup', 'DeviceProtection', 'TechSupport',
'StreamingTV', 'StreamingMovies']
# Number of columns for the subplot grid (you can change this)
n cols = 3
n rows = (len(columns) + n cols - 1) // n cols # Calculate number of
rows needed
# Create subplots
fig, axes = plt.subplots(n rows, n cols, figsize=(15, n rows * 4)) #
Adjust figsize as needed
```

```
# Flatten the axes array for easy iteration (handles both 1D and 2D
arrays)
axes = axes.flatten()

# Iterate over columns and plot count plots
for i, col in enumerate(columns):
    sns.countplot(x=col, data=df, ax=axes[i], hue = df["Churn"])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].set_xlabel(col)
    axes[i].set_ylabel('Count')

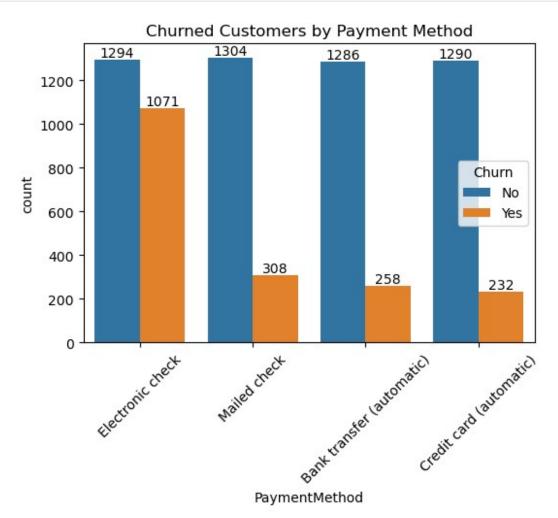
# Remove empty subplots (if any)
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

plt.tight_layout()
plt.show()
```



The majority of customers who do not churn tend to have services like PhoneService, InternetService (particularly DSL), and OnlineSecurity enabled. For services like OnlineBackup, TechSupport, and StreamingTV, churn rates are noticeably higher when these services are not used or are unavailable.

```
plt.figure(figsize = (6,4))
ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churned Customers by Payment Method")
plt.xticks(rotation = 45)
plt.show()
```



# customer is likely to churn when he is using electronic check as a payment method.

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