```
import pandas as pd
import numpy as np
pip install matplotlib
Requirement already satisfied: matplotlib in c:\users\piyush\
anaconda3\lib\site-packages (3.8.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (4.25.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (1.4.4)
Requirement already satisfied: numpy<2,>=1.21 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (23.1)
Requirement already satisfied: pillow>=6.2.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (10.2.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\
piyush\anaconda3\lib\site-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in c:\users\piyush\anaconda3\
lib\site-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
pip install seaborn
Requirement already satisfied: seaborn in c:\users\piyush\anaconda3\
lib\site-packages (0.12.2)
Requirement already satisfied: numpy!=1.24.0,>=1.17 in c:\users\
piyush\anaconda3\lib\site-packages (from seaborn) (1.26.4)
Requirement already satisfied: pandas>=0.25 in c:\users\piyush\
anaconda3\lib\site-packages (from seaborn) (2.1.4)
Requirement already satisfied: matplotlib!=3.6.1,>=3.1 in c:\users\
piyush\anaconda3\lib\site-packages (from seaborn) (3.8.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
Requirement already satisfied: cycler>=0.10 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(4.25.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\piyush\
```

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anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(1.4.4)
Requirement already satisfied: packaging>=20.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(23.1)
Requirement already satisfied: pillow>=6.2.0 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(10.2.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\
piyush\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1-
>seaborn) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\users\piyush\
anaconda3\lib\site-packages (from pandas>=0.25->seaborn)
(2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in c:\users\piyush\
anaconda3\lib\site-packages (from pandas>=0.25->seaborn) (2023.3)
Requirement already satisfied: six>=1.5 in c:\users\pivush\anaconda3\
lib\site-packages (from python-dateutil>=2.7->matplotlib!=3.6.1,>=3.1-
>seaborn) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
import matplotlib.pyplot as plt
import seaborn as sns
df = pd.read csv('Customer Churn.csv')
df
                                          Traceback (most recent call
FileNotFoundError
last)
Cell In[7], line 1
----> 1 df = pd.read csv('Customer Churn.csv')
     2 df
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:948,
in read csv(filepath or buffer, sep, delimiter, header, names,
index col, usecols, dtype, engine, converters, true values,
false values, skipinitialspace, skiprows, skipfooter, nrows,
na values, keep default na, na filter, verbose, skip blank lines,
parse dates, infer datetime format, keep date col, date parser,
date format, dayfirst, cache dates, iterator, chunksize, compression,
thousands, decimal, lineterminator, quotechar, quoting, doublequote,
escapechar, comment, encoding, encoding errors, dialect, on bad lines,
delim_whitespace, low_memory, memory_map, float_precision,
storage options, dtype backend)
```

```
935 kwds defaults = refine defaults read(
    936
            dialect,
    937
            delimiter,
   (\ldots)
    944
            dtype backend=dtype backend,
    945 )
    946 kwds.update(kwds defaults)
--> 948 return read(filepath or buffer, kwds)
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:611,
in read(filepath or buffer, kwds)
    608 validate names(kwds.get("names", None))
    610 \ \overline{\#} Create the parser.
--> 611 parser = TextFileReader(filepath or buffer, **kwds)
    613 if chunksize or iterator:
    614
            return parser
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:1448,
in TextFileReader.__init__(self, f, engine, **kwds)
            self.options["has index names"] = kwds["has index names"]
   1445
   1447 self.handles: IOHandles | None = None
-> 1448 self. engine = self. make engine(f, self.engine)
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:1705,
in TextFileReader. make engine(self, f, engine)
            if "b" not in mode:
   1703
                mode += "b"
   1704
-> 1705 self.handles = get handle(
   1706
            f,
   1707
            mode.
            encoding=self.options.get("encoding", None),
   1708
   1709
            compression=self.options.get("compression", None),
   1710
            memory map=self.options.get("memory map", False),
   1711
            is text=is text,
   1712
            errors=self.options.get("encoding errors", "strict"),
            storage options=self.options.get("storage options", None),
   1713
   1714 )
   1715 assert self.handles is not None
   1716 f = self.handles.handle
File ~\anaconda3\Lib\site-packages\pandas\io\common.py:863, in
get handle(path or buf, mode, encoding, compression, memory map,
is text, errors, storage options)
    858 elif isinstance(handle, str):
    859
            # Check whether the filename is to be opened in binary
mode.
    860
            # Binary mode does not support 'encoding' and 'newline'.
            if ioargs.encoding and "b" not in ioargs.mode:
    861
                # Encoding
    862
--> 863
                handle = open(
```

```
864
                    handle,
                    ioargs.mode,
    865
    866
                    encoding=ioargs.encoding,
    867
                    errors=errors,
    868
                    newline="",
    869
            else:
    870
                # Binary mode
    871
                handle = open(handle, ioargs.mode)
    872
FileNotFoundError: [Errno 2] No such file or directory: 'Customer
Churn.csv'
df = pd.read csv('Customer Churn.csv')
FileNotFoundError
                                          Traceback (most recent call
last)
Cell In[8], line 1
----> 1 df = pd.read csv('Customer Churn.csv')
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:948,
in read csv(filepath or buffer, sep, delimiter, header, names,
index col, usecols, dtype, engine, converters, true values,
false_values, skipinitialspace, skiprows, skipfooter, nrows,
na values, keep default na, na filter, verbose, skip blank lines,
parse dates, infer datetime format, keep date col, date parser,
date format, dayfirst, cache dates, iterator, chunksize, compression,
thousands, decimal, lineterminator, quotechar, quoting, doublequote,
escapechar, comment, encoding, encoding errors, dialect, on bad lines,
delim whitespace, low memory, memory_map, float_precision,
storage_options, dtype backend)
    935 kwds defaults = refine_defaults_read(
    936
            dialect,
    937
            delimiter,
   (\ldots)
    944
            dtype backend=dtype backend,
    945 )
    946 kwds.update(kwds defaults)
--> 948 return read(filepath or buffer, kwds)
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:611,
in read(filepath or buffer, kwds)
    608 validate names(kwds.get("names", None))
    610 # Create the parser.
--> 611 parser = TextFileReader(filepath or buffer, **kwds)
    613 if chunksize or iterator:
    614 return parser
```

```
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:1448,
in TextFileReader. init (self, f, engine, **kwds)
            self.options["has index names"] = kwds["has index names"]
   1447 self.handles: IOHandles | None = None
-> 1448 self. engine = self. make engine(f, self.engine)
File ~\anaconda3\Lib\site-packages\pandas\io\parsers\readers.py:1705,
in TextFileReader. make engine(self, f, engine)
            if "b" not in mode:
   1703
                mode += "b"
   1704
-> 1705 self.handles = get handle(
   1706
            f,
   1707
            mode.
            encoding=self.options.get("encoding", None),
   1708
   1709
            compression=self.options.get("compression", None),
   1710
            memory map=self.options.get("memory map", False),
   1711
            is text=is text.
            errors=self.options.get("encoding errors", "strict"),
   1712
   1713
            storage options=self.options.get("storage options", None),
   1714 )
   1715 assert self.handles is not None
   1716 f = self.handles.handle
File ~\anaconda3\Lib\site-packages\pandas\io\common.py:863, in
get handle(path or buf, mode, encoding, compression, memory map,
is text, errors, storage options)
    858 elif isinstance(handle, str):
           # Check whether the filename is to be opened in binary
    859
mode.
            # Binary mode does not support 'encoding' and 'newline'.
    860
            if ioargs.encoding and "b" not in ioargs.mode:
    861
                # Encoding
    862
                handle = open(
--> 863
    864
                    handle,
    865
                    ioargs.mode,
    866
                    encoding=ioargs.encoding,
    867
                    errors=errors,
    868
                    newline="",
    869
    870
            else:
    871
                # Binary mode
                handle = open(handle, ioargs.mode)
    872
FileNotFoundError: [Errno 2] No such file or directory: 'Customer
Churn.csv'
df = pd.read_csv("C:\Users\PIYUSH\Downloads\Customer Churn.csv")
  Cell In[9], line 1
    df = pd.read csv("C:\Users\PIYUSH\Downloads\Customer Churn.csv")
```

```
SyntaxError: (unicode error) 'unicodeescape' codec can't decode bytes
in position 2-3: truncated \UXXXXXXXX escape
df = pd.read csv("C:\\Users\\PIYUSH\\Downloads\\Customer Churn.csv")
df
                            SeniorCitizen Partner Dependents
      customerID
                   gender
                                                                 tenure \
      7590 - VHVEG
0
                   Female
                                         0
                                                Yes
                                                             No
                                                                      1
1
      5575-GNVDE
                     Male
                                         0
                                                                     34
                                                 No
                                                             No
2
                                                                      2
      3668-QPYBK
                     Male
                                         0
                                                 No
                                                             No
3
      7795 - CF0CW
                     Male
                                         0
                                                 No
                                                             No
                                                                     45
4
                                         0
                                                                      2
      9237-HQITU
                  Female
                                                 No
                                                             No
                                                                     . . .
                     Male
7038
      6840-RESVB
                                         0
                                                                     24
                                                Yes
                                                            Yes
      2234-XADUH
                                                                     72
7039
                   Female
                                         0
                                                Yes
                                                            Yes
7040
      4801-JZAZL
                   Female
                                         0
                                                Yes
                                                                     11
                                                            Yes
7041
      8361-LTMKD
                                                                      4
                     Male
                                         1
                                                Yes
                                                             No
7042 3186-AJIEK
                     Male
                                         0
                                                 No
                                                             No
                                                                     66
     PhoneService
                       MultipleLines InternetService
OnlineSecurity
                No No phone service
                                                    DSL
No
               Yes
                                   No
                                                    DSL
1
Yes
2
               Yes
                                   No
                                                    DSL
Yes
                    No phone service
                                                    DSL
3
                No
Yes
     . . .
4
               Yes
                                   No
                                           Fiber optic
No
7038
               Yes
                                   Yes
                                                    DSL
Yes
7039
                                           Fiber optic
               Yes
                                  Yes
No
   . . .
                    No phone service
7040
                No
                                                    DSL
Yes
    . . .
7041
               Yes
                                   Yes
                                           Fiber optic
No
   . . .
7042
               Yes
                                   No
                                           Fiber optic
Yes ...
     DeviceProtection TechSupport StreamingTV StreamingMovies
Contract \
0
                    No
                                              No
                                                                No
                                                                    Month-
                                 No
```

to-month 1	Yes	No	No	No
One year	163	NO	NO	NO
2	No	No	No	No Month-
to-month	V	Vaa	NI -	Na
3 One year	Yes	Yes	No	No
4	No	No	No	No Month-
to-month	110	110	110	NO HOHEH
		.,		
7038	Yes	Yes	Yes	Yes
One year 7039	Yes	No	Yes	Yes
One year	165	NU	165	165
7040	No	No	No	No Month-
to-month				
7041	No	No	No	No Month-
to-month				
7042	Yes	Yes	Yes	Yes
Two year				
Paperless	sBillina	Pavi	mentMethod Mon	thlvCharges
TotalCharges		,		, J
0	Yes	Electro	onic check	29.85
29.85				F.C. 0.F
1 1889.5	No	Mai	iled check	56.95
2	Yes	Ma	iled check	53.85
108.15	103	Tid.	red eneck	33103
3	No	Bank transfer (a	automatic)	42.30
1840.75		_		
4	Yes	Electro	onic check	70.70
151.65				
• • •	• • •			
7038	Yes	Ma	iled check	84.80
1990.5				
7039	Yes	Credit card (automatic)	103.20
7362.9	.,	-1		20.50
7040	Yes	Electro	onic check	29.60
346.45 7041	Yes	Ma	iled check	74.40
306.6	163	ria.	rted check	74.40
7042	Yes	Bank transfer (a	automatic)	105.65
6844.5				
Characa				
Churn O No				
O NO				

```
1
        No
2
       Yes
3
        No
4
       Yes
7038
        No
7039
        No
7040
        No
7041
       Yes
7042
        No
[7043 rows x 21 columns]
df.head()
   customerID gender SeniorCitizen Partner Dependents tenure
PhoneService \
0 7590-VHVEG Female
                                     0
                                           Yes
                                                        No
                                                                 1
No
1 5575-GNVDE
                 Male
                                            No
                                                        No
                                                                34
Yes
2 3668-QPYBK
                 Male
                                            No
                                                        No
                                                                 2
Yes
3 7795-CF0CW
                 Male
                                                                45
                                            No
                                                        No
No
                                                                 2
4 9237-HQITU
              Female
                                            No
                                                        No
Yes
      MultipleLines InternetService OnlineSecurity ...
DeviceProtection \
0 No phone service
                                  DSL
                                                  No
No
                                 DSL
                                                 Yes
1
                  No
Yes
2
                  No
                                 DSL
                                                 Yes
No
3 No phone service
                                 DSL
                                                 Yes ...
Yes
                         Fiber optic
4
                  No
                                                  No
No
  TechSupport StreamingTV StreamingMovies
                                                   Contract
PaperlessBilling \
                                             Month-to-month
           No
                        No
                                         No
0
Yes
1
                                                   One year
           No
                        No
                                         No
No
2
           No
                                             Month-to-month
                        No
                                         No
Yes
3
          Yes
                        No
                                         No
                                                   One year
```

```
No
                                            Month-to-month
4
           No
                        No
                                        No
Yes
               PaymentMethod MonthlyCharges
                                              TotalCharges Churn
0
            Electronic check
                                       29.85
                                                      29.85
                                                               No
1
                Mailed check
                                       56.95
                                                     1889.5
                                                               No
2
                Mailed check
                                       53.85
                                                     108.15
                                                              Yes
3
   Bank transfer (automatic)
                                       42.30
                                                    1840.75
                                                               No
4
            Electronic check
                                       70.70
                                                     151.65
                                                              Yes
[5 rows x 21 columns]
df.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
#
     Column
                        Non-Null Count
                                        Dtype
 0
                        7043 non-null
     customerID
                                        object
 1
     gender
                       7043 non-null
                                        object
 2
     SeniorCitizen
                       7043 non-null
                                        int64
 3
     Partner
                        7043 non-null
                                        object
 4
                       7043 non-null
     Dependents
                                        object
 5
                        7043 non-null
     tenure
                                        int64
                                        object
 6
     PhoneService
                       7043 non-null
 7
                       7043 non-null
                                        object
     MultipleLines
 8
     InternetService
                       7043 non-null
                                        object
 9
     OnlineSecurity
                       7043 non-null
                                        object
                       7043 non-null
 10 OnlineBackup
                                        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
df["TotalCharges"] = df["TotalCharges"].replace(" ","0")
df["TotalCharges"] = df["TotalCharges"].astype("float")
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
     gender
                        7043 non-null
                                         object
 2
     SeniorCitizen
                        7043 non-null
                                         int64
 3
                        7043 non-null
                                         object
     Partner
 4
                        7043 non-null
                                         object
     Dependents
 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
                        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
                                         object
 14
     StreamingMovies
                        7043 non-null
                                         object
 15
                        7043 non-null
    Contract
                                         object
     PaperlessBilling
                        7043 non-null
 16
                                         obiect
                        7043 non-null
 17
     PaymentMethod
                                         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
df.isnull().sum().sum()
0
df.describe()
       SeniorCitizen
                            tenure
                                    MonthlyCharges
                                                      TotalCharges
         7043.000000
                       7043,000000
                                        7043.000000
                                                       7043.000000
count
mean
            0.162147
                         32.371149
                                          64.761692
                                                       2279.734304
            0.368612
                         24.559481
                                          30.090047
                                                       2266.794470
std
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
75%
            0.000000
                         55.000000
                                          89.850000
                                                       3786.600000
            1.000000
                         72.000000
                                         118.750000
                                                       8684.800000
max
df.duplicated().sum()
0
df["customerID"].duplicated().sum()
0
```

```
def conv(value):
    if value == 1:
        return "yes"
    else:
        return "no"
df['SeniorCitizen'] = df["SeniorCitizen"].apply(conv)
df.head()
   customerID gender SeniorCitizen Partner Dependents tenure
PhoneService \
0 7590-VHVEG Female
                                         Yes
                                                      No
                                                               1
                                  no
No
1 5575-GNVDE
                 Male
                                                      No
                                                              34
                                  no
                                          No
Yes
2 3668-QPYBK
                 Male
                                                               2
                                  no
                                          No
                                                      No
Yes
3 7795-CF0CW
                 Male
                                                      No
                                                              45
                                          No
                                  no
No
4 9237-HQITU Female
                                          No
                                                      No
                                                               2
                                  no
Yes
      MultipleLines InternetService OnlineSecurity ...
DeviceProtection \
                                 DSL
0 No phone service
                                                 No
No
                                 DSL
1
                 No
                                                 Yes ...
Yes
2
                 No
                                 DSL
                                                 Yes ...
No
3 No phone service
                                 DSL
                                                Yes ...
Yes
                        Fiber optic
                 No
                                                 No ...
No
  TechSupport StreamingTV StreamingMovies
                                                  Contract
PaperlessBilling \
                        No
                                            Month-to-month
           No
                                        No
Yes
1
           No
                        No
                                        No
                                                   One year
No
                                            Month-to-month
           No
                        No
2
                                        No
Yes
3
          Yes
                        No
                                                   One year
                                        No
No
           No
                                            Month-to-month
                        No
                                        No
Yes
               PaymentMethod MonthlyCharges TotalCharges Churn
```

0 1 2 3 Bank 4	transf		l check l check omatic)		29.85 56.95 53.85 42.30 70.70		29.8 1889.! 108.: 1840.:	50 No 15 Yes 75 No
[5 rows	v 21 c	olumns]						
[J TOWS	X 21 C	o cuiii15 j						
df.head(10)							
	merID	gender	SeniorC	itizen	Partner	Depende	ents	tenure
PhoneSer 0 7590-	vice VHVEG	\ Female		no	Yes		No	1
No 7390-	VIIVLG	i ellia te		110	165		NO	1
1 5575 - Yes	GNVDE	Male		no	No		No	34
	QPYBK	Male		no	No		No	2
3 7795-	CF0CW	Male		no	No		No	45
	HQITU	Female		no	No		No	2
Yes 5 9305-	CDSKC	Female		no	No		No	8
Yes	CDSIC	i ellia te		110	INO		NO	O
	KI0VK	Male		no	No		Yes	22
Yes		_						
7 6713-	OKOMC	Female		no	No		No	10
No 8 7892-	P00KP	Female		no	Yes		No	28
Yes	TOOK	i cilia ce		110	163		NO	20
9 6388-	TABGU	Male		no	No		Yes	62
Yes								
M	1+inla	linos In	tornotC	orvi co	OnlineCo	ourity		
Mu DevicePr	•		iternetse	ervice	OnlineSe	ecurity		
	one se	-		DSL		No		
No								
1		No		DSL		Yes		
Yes 2		No		DCI		Voc		
Z No		No		DSL		Yes		
	one se	rvice		DSL		Yes		
Yes								
4		No	Fiber	optic		No		
No		Vaa	Fiber	ontic		Ma		
5 Yes		Yes	riber	optic		No		
6		Yes	Fiber	optic		No		
No				•				
7 No ph	one se	rvice		DSL		Yes		

No							
8	Yes	Fiber opt:	ic	No			
Yes		D.	. .	V			
9 N -	No	D:	SL	Yes			
No							
TechSupp PaperlessB		ngTV Streami	ngMovies	Contrac	t		
0	No No	No	No	Month-to-mont	h		
Yes 1	No	No	No	One yes	r		
No	NO	IVO	NO	One yea	ı		
2	No	No	No	Month-to-mont	h		
Yes	110	110	110	TIOTICIT CO MOTIC			
	Yes	No	No	One yea	r		
No							
4	No	No	No	Month-to-mont	h		
Yes	NI -	W	V	Manda barana	L		
5 Yes	No	Yes	Yes	Month-to-mont	n		
6	No	Yes	No	Month-to-mont	h		
Yes	NO	163	NO	Homen-co-mone			
7	No	No	No	Month-to-mont	h		
No							
	Yes	Yes	Yes	Month-to-mont	h		
Yes	NI -	NI -	NI -	0			
9 No	No	No	No	One yea	r		
NO							
4 5 6 Credi 7 8	Electronic Mailec Mailec ansfer (auto Electronic Electronic t card (auto	d check d check omatic) c check c check omatic) d check c check	nlyCharge 29.8 56.9 53.8 42.3 70.7 99.6 89.1 29.7 104.8 56.1	5 29.8 5 1889.5 5 108.1 0 1840.7 0 151.6 5 820.5 0 1949.4 5 301.9 0 3046.0	 5 No 6 No 5 Yes 5 Yes 6 Yes 7 No 9 No 9 No 10 Yes 10 Yes 		
[10 rows x 21 columns]							
df.head(20)							
custom PhoneServi		SeniorCiti:	zen Partn	er Dependents	tenure		
0 7590-V	HVEG Female	9	no Y	es No	1		
No 1 5575-G	NVDE Male	9	no	No No	34		

Yes 2	3668-QPYBK	Male	no	No	No	2
Yes	JUUG-UPTEN		110	NO	INO	2
3 No	7795-CF0CW	Male	no	No	No	45
4	9237-HQITU	Female	no	No	No	2
Yes 5	9305-CDSKC	Female	no	No	No	8
Yes 6 Yes	1452-KI0VK	Male	no	No	Yes	22
7	6713-0K0MC	Female	no	No	No	10
No 8	7892-P00KP	Female	no	Yes	No	28
Yes 9	6388-TABGU	Male	no	No	Yes	62
Yes 10	9763-GRSKD	Male	no	Yes	Yes	13
Yes 11	7469-LKBCI	Male	no	No	No	16
Yes 12	8091-TTVAX	Male	no	Yes	No	58
Yes 13	0280-XJGEX	Male	no	No	No	49
Yes 14	5129-JLPIS	Male	no	No	No	25
Yes 15	3655-SNQYZ	Female	no	Yes	Yes	69
Yes 16	8191-XWSZG	Female	no	No	No	52
Yes 17	9959-W0FKT	Male	no	No	Yes	71
Yes 18	4190-MFLUW	Female	no	Yes	Yes	10
Yes						
19 Yes	4183-MYFRB	Female	no	No	No	21
0 1 2	Multiple No phone se		ernetService DSL DSL DSL	Onli	neSecurity No Yes Yes	\
0 1 2 3 4 5 6 7	No phone se	rvice No Yes Yes	DSL Fiber optic Fiber optic Fiber optic DSL		Yes No No No Yes	
8 9	No phone se	Yes No	Fiber optic DSL		No Yes	

```
10
                    No
                                     DSL
                                                             Yes
11
                    No
                                           No internet service
                                      No
12
                   Yes
                            Fiber optic
                                                              No
13
                            Fiber optic
                   Yes
                                                              No
14
                    No
                            Fiber optic
                                                             Yes
15
                   Yes
                            Fiber optic
                                                             Yes
16
                    No
                                           No internet service
                                      No
17
                   Yes
                            Fiber optic
                                                             Yes
18
                    No
                                     DSL
                                                              No
19
                    No
                            Fiber optic
                                                              No
                                                             StreamingTV
        DeviceProtection
                                     TechSupport
0
                       No
                                               No
                                                                       No
1
                      Yes
                                               No
                                                                       No
2
                                               No
                       No
                                                                       No
3
                      Yes
                                              Yes
                                                                       No
4
                       No
                                                                       No
                                               No
5
                      Yes
                                               No
                                                                      Yes
6
                       No
                                               No
                                                                      Yes
7
                       No
                                               No
                                                                       No
8
                      Yes
                                              Yes
                                                                      Yes
9
                       No
                                               No
                                                                       No
10
                       No
                                               No
                                                                       No
11
    No internet service
                            No internet service
                                                    No internet service
12
                      Yes
                                               No
                                                                      Yes
13
                      Yes
                                               No
                                                                      Yes
14
                      Yes
                                              Yes
                                                                      Yes
15
                      Yes
                                              Yes
                                                                      Yes
16
    No internet service
                            No internet service
                                                    No internet service
17
                      Yes
                                               No
                                                                      Yes
18
                      Yes
                                              Yes
                                                                       No
19
                      Yes
                                               No
                                                                       No
         StreamingMovies
                                   Contract PaperlessBilling \
0
                       No
                            Month-to-month
                                                            Yes
1
                       No
                                   One year
                                                             No
2
                       No
                            Month-to-month
                                                            Yes
3
                       No
                                   One year
                                                            No
4
                       No
                            Month-to-month
                                                            Yes
5
                            Month-to-month
                                                            Yes
                      Yes
6
                       No
                            Month-to-month
                                                            Yes
7
                       No
                            Month-to-month
                                                            No
8
                      Yes
                            Month-to-month
                                                            Yes
9
                       No
                                   One year
                                                            No
10
                            Month-to-month
                       No
                                                            Yes
11
    No internet service
                                   Two year
                                                            No
12
                      Yes
                                   One year
                                                            No
13
                      Yes
                            Month-to-month
                                                            Yes
14
                            Month-to-month
                      Yes
                                                            Yes
```

15 16 17 18 19	Yes No internet service Yes No Yes	Two year One year Two year Month-to-month Month-to-month	No No No No Yes	
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	PaymentM Electronic Mailed Mailed Bank transfer (autom Electronic Credit card (autom Mailed Electronic Bank transfer (autom Mailed Credit card (autom Credit card (autom Credit card (autom Electronic Credit card (autom Electronic Credit card (autom Electronic Credit card (autom Mailed Bank transfer (autom Credit card (autom Electronic Credit card (autom Electronic	check 56.9 check 53.8 matic) 42.3 check 70.7 check 99.6 matic) 89.1 check 29.7 check 104.8 matic) 56.1 check 49.9 matic) 100.3 matic) 103.7 check 105.5 matic) 113.2 check 20.6 matic) 55.2	35 29.85 35 1889.50 35 108.15 30 1840.75 70 151.65 35 820.50 40 1949.40 75 301.90 30 3046.05 45 326.80 35 5681.10 70 5036.30 30 2686.05 25 7895.15 35 1022.95 70 7382.25 20 528.35	Churn No No Yes No Yes No

[20 rows x 21 columns]

df.head(30)

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure
Phor	neService \					
0	7590-VHVEG	Female	no	Yes	No	1
No						
1	5575-GNVDE	Male	no	No	No	34
Yes						
2	3668-QPYBK	Male	no	No	No	2
Yes						
3	7795-CF0CW	Male	no	No	No	45
No						
4	9237-HQITU	Female	no	No	No	2
Yes						
5	9305-CDSKC	Female	no	No	No	8
Yes						
6	1452-KI0VK	Male	no	No	Yes	22
Yes						
7	6713-0K0MC	Female	no	No	No	10
No						

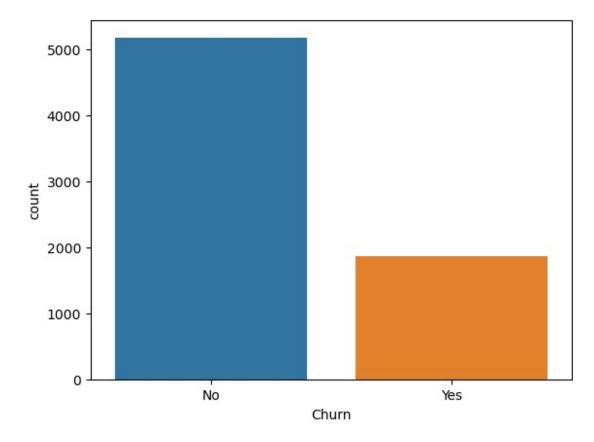
8	7892-P00KP	Female	no	Yes	No	28	
Yes							
9 Yes	6388-TABGU	Male	no	No	Yes	62	
10	9763-GRSKD	Male	no	Yes	Yes	13	
Yes	7469-LKBCI	Male	no	No	No	16	
Yes 12	8091-TTVAX	Male	no	Yes	No	58	
Yes	0280-XJGEX	Male	no	No	No	49	
Yes 14 Yes	5129-JLPIS	Male	no	No	No	25	
15 Yes	3655-SNQYZ	Female	no	Yes	Yes	69	
16 Yes	8191-XWSZG	Female	no	No	No	52	
17 Yes	9959-W0FKT	Male	no	No	Yes	71	
18 Yes	4190-MFLUW	Female	no	Yes	Yes	10	
19 Yes	4183-MYFRB	Female	no	No	No	21	
20	8779-QRDMV	Male	yes	No	No	1	
No 21	1680-VDCWW	Male	no	Yes	No	12	
Yes 22 Yes	1066-JKSGK	Male	no	No	No	1	
23 Yes	3638-WEABW	Female	no	Yes	No	58	
24	6322-HRPFA	Male	no	Yes	Yes	49	
Yes 25	6865-JZNK0	Female	no	No	No	30	
Yes 26	6467-CHFZW	Male	no	Yes	Yes	47	
Yes 27	8665-UTDHZ	Male	no	Yes	Yes	1	
No 28	5248-YGIJN	Male	no	Yes	No	72	
Yes 29 Yes	8773-HHU0Z	Female	no	No	Yes	17	
0 1 2	Multiple No phone se		ernetService DSL DSL DSL	Onlin	eSecurity No Yes Yes	\	

```
3
    No phone service
                                     DSL
                                                             Yes
4
                            Fiber optic
                    No
                                                              No
5
                   Yes
                            Fiber optic
                                                              No
6
                            Fiber optic
                   Yes
                                                              No
7
    No phone service
                                     DSL
                                                             Yes
8
                   Yes
                            Fiber optic
                                                              No
9
                    No
                                                             Yes
                                     DSL
10
                    No
                                     DSL
                                                             Yes
11
                    No
                                       No
                                           No internet service
12
                   Yes
                            Fiber optic
                                                               No
                            Fiber optic
13
                   Yes
                                                              No
                            Fiber optic
14
                    No
                                                             Yes
15
                            Fiber optic
                   Yes
                                                             Yes
16
                    No
                                           No internet service
                                       No
17
                   Yes
                            Fiber optic
                                                             Yes
18
                                     DSL
                    No
                                                               No
19
                    No
                            Fiber optic
                                                               No
20
                                     DSL
    No phone service
                                                               No
21
                                       No
                                           No internet service
                    No
22
                    No
                                      No
                                           No internet service
23
                   Yes
                                     DSL
                                                              No
24
                    No
                                     DSL
                                                             Yes
25
                    No
                                     DSL
                                                             Yes
26
                   Yes
                            Fiber optic
                                                              No
27
                                     DSL
                                                              No
    No phone service
28
                                     DSL
                   Yes
                                                             Yes
29
                    No
                                     DSL
                                                              No
                                                                   . . .
        DeviceProtection
                                     TechSupport
                                                             StreamingTV
0
                       No
                                                No
                                                                        No
1
                      Yes
                                               No
                                                                        No
2
                       No
                                                No
                                                                        No
3
                      Yes
                                              Yes
                                                                        No
4
                       No
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5
                      Yes
                                                No
                                                                      Yes
6
                       No
                                               No
                                                                      Yes
7
                       No
                                                No
                                                                        No
8
                      Yes
                                              Yes
                                                                      Yes
9
                       No
                                                No
                                                                        No
10
                       No
                                                No
                                                                        No
11
    No internet service
                            No internet service
                                                    No internet service
12
                      Yes
                                                No
                                                                      Yes
13
                      Yes
                                               No
                                                                      Yes
14
                      Yes
                                              Yes
                                                                      Yes
15
                      Yes
                                              Yes
                                                                      Yes
16
    No internet service
                            No internet service
                                                    No internet service
17
                      Yes
                                               No
                                                                      Yes
                      Yes
18
                                              Yes
                                                                        No
19
                      Yes
                                                No
                                                                        No
```

20 21 22 23 24 25 26 27 28 29	Yes No internet service No internet service No	No internet se No internet se		internet internet		
0 1 2 3 4 5 6 7 8 9 10 11 12 13	StreamingMovies No No No No No No Yes No No Yes No No Yes No Yes Yes Yes Yes Yes	Month-to-month One year Month-to-month One year Month-to-month Month-to-month Month-to-month Month-to-month One year Month-to-month Two year One year Month-to-month		Yes No Yes No Yes Yes No Yes No Yes No Yes No Yes		
14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	Yes Yes Yes No internet service Yes No Yes Yes No internet service No internet service No No No No No Yes Yes No Yes Yes No Yes Yes No Yes Yes	Month-to-month Two year One year Two year Month-to-month Month-to-month One year Month-to-month Two year Month-to-month Month-to-month Month-to-month Month-to-month Two year Month-to-month Month-to-month Two year Month-to-month		Yes No No No Yes Yes No Yes No Yes Yes Yes Yes Yes Yes		
0 1 2 3 4	PaymentM Electronic Mailed Mailed Bank transfer (autom Electronic	check check atic)	narges To 29.85 56.95 53.85 42.30 70.70	talCharges 29.85 1889.56 108.15 1840.75	No No Yes No	

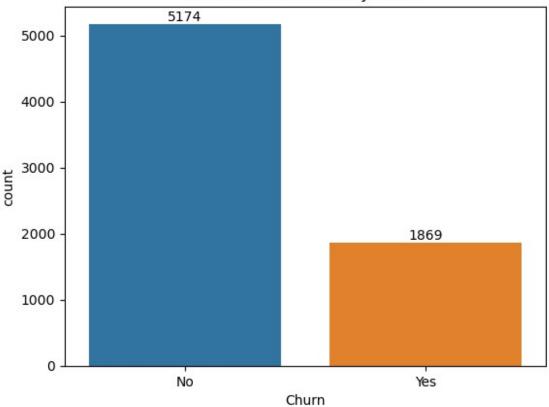
```
5
              Electronic check
                                          99.65
                                                        820.50
                                                                   Yes
6
      Credit card (automatic)
                                          89.10
                                                       1949.40
                                                                    No
7
                  Mailed check
                                          29.75
                                                         301.90
                                                                     No
8
              Electronic check
                                         104.80
                                                       3046.05
                                                                   Yes
    Bank transfer (automatic)
9
                                          56.15
                                                       3487.95
                                                                    No
10
                  Mailed check
                                          49.95
                                                         587.45
                                                                     No
11
      Credit card (automatic)
                                          18.95
                                                        326.80
                                                                    No
12
      Credit card (automatic)
                                         100.35
                                                       5681.10
                                                                     No
    Bank transfer (automatic)
                                                       5036.30
13
                                         103.70
                                                                   Yes
14
              Electronic check
                                         105.50
                                                       2686.05
                                                                    No
15
                                         113.25
                                                        7895.15
      Credit card (automatic)
                                                                     No
                                          20.65
16
                  Mailed check
                                                        1022.95
                                                                    No
17
    Bank transfer (automatic)
                                         106.70
                                                        7382.25
                                                                    No
      Credit card (automatic)
18
                                          55.20
                                                        528.35
                                                                   Yes
19
              Electronic check
                                          90.05
                                                        1862.90
                                                                    No
20
              Electronic check
                                          39.65
                                                          39.65
                                                                   Yes
21
    Bank transfer (automatic)
                                          19.80
                                                        202.25
                                                                    No
                                          20.15
22
                  Mailed check
                                                          20.15
                                                                   Yes
23
                                          59.90
      Credit card (automatic)
                                                       3505.10
                                                                    No
24
      Credit card (automatic)
                                          59.60
                                                       2970.30
                                                                     No
25
    Bank transfer (automatic)
                                          55.30
                                                       1530.60
                                                                    No
                                                       4749.15
26
              Electronic check
                                          99.35
                                                                   Yes
27
              Electronic check
                                          30.20
                                                          30.20
                                                                   Yes
28
      Credit card (automatic)
                                          90.25
                                                       6369.45
                                                                    No
29
                  Mailed check
                                          64.70
                                                       1093.10
                                                                   Yes
[30 rows x 21 columns]
sns.countplot(x = 'Churn', data = df)
```

plt.show()



```
ax = sns.countplot(x = 'Churn', data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of customers by Churn")
plt.show()
```

Count of customers by Churn

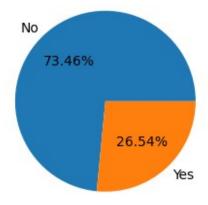


```
gb = df.groupby("Churn").agg({'Churn':"count"})
gb

Churn
Churn
No    5174
Yes    1869

plt.figure(figsize = (3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churned Customers")
plt.show()
gb
```

Percentage of Churned Customers



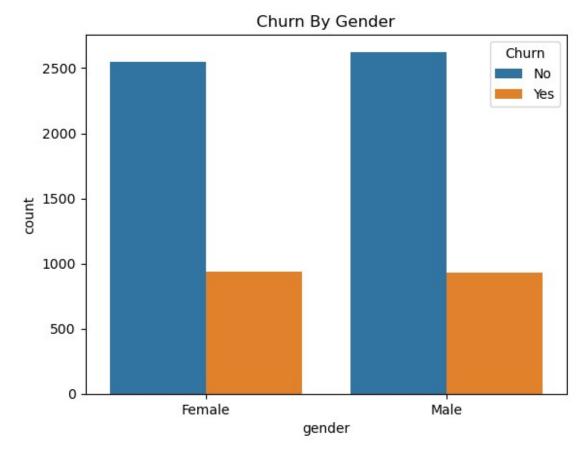
```
Churn

Churn

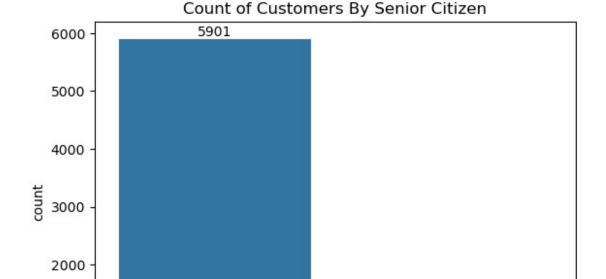
No 5174

Yes 1869

sns.countplot(x = "gender", data = df, hue = "Churn")
plt.title("Churn By Gender")
plt.show()
```



```
ax = sns.countplot(x = "SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers By Senior Citizen")
plt.show()
```



1000

0

no

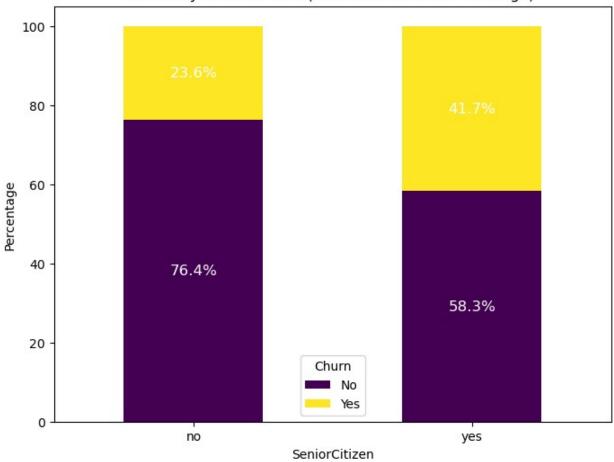
1142

yes

```
counts = df.groupby(["SeniorCitizen", "Churn"]).size().unstack()
# Convert to percentages
percentages = counts.div(counts.sum(axis=1), axis=0) * 100
# Plot stacked bar chart
ax = percentages.plot(kind="bar", stacked=True, colormap="viridis",
figsize=(8,6)
# Add labels (percentages)
for bars in ax.containers:
    ax.bar_label(bars, fmt="%.1f%", label_type="center",
color="white", fontsize=12)
plt.title("Churn by SeniorCitizen (Stacked Bar with Percentage)")
plt.xlabel("SeniorCitizen")
plt.ylabel("Percentage")
plt.legend(title="Churn")
plt.xticks(rotation=0)
plt.show()
```

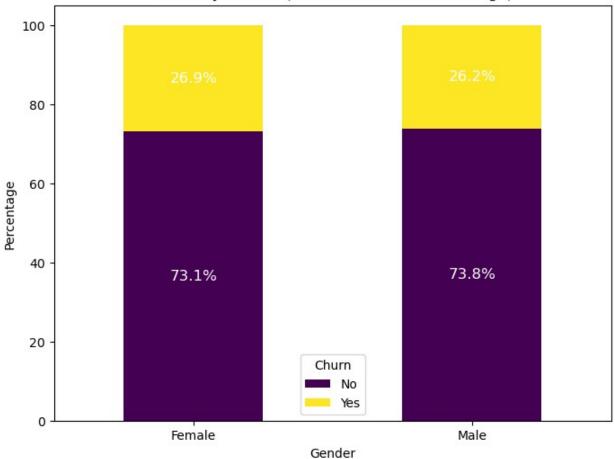
SeniorCitizen





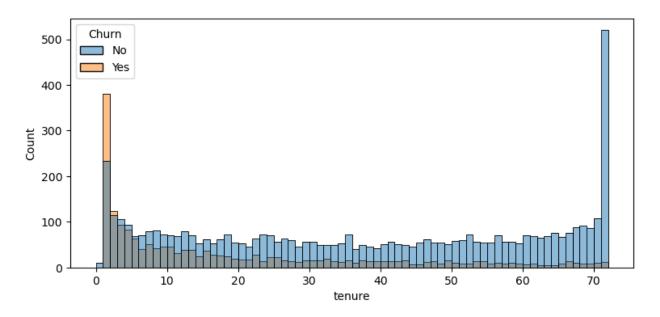
```
counts = df.groupby(["gender", "Churn"]).size().unstack()
# Convert to percentages
percentages = counts.div(counts.sum(axis=1), axis=0) * 100
# Plot stacked bar chart
ax = percentages.plot(kind="bar", stacked=True, colormap="viridis",
figsize=(8,6)
# Add labels (percentages)
for bars in ax.containers:
    ax.bar label(bars, fmt="%.1f%", label type="center",
color="white", fontsize=12)
plt.title("Churn by Gender (Stacked Bar with Percentage)")
plt.xlabel("Gender")
plt.ylabel("Percentage")
plt.legend(title="Churn")
plt.xticks(rotation=0)
plt.show()
```





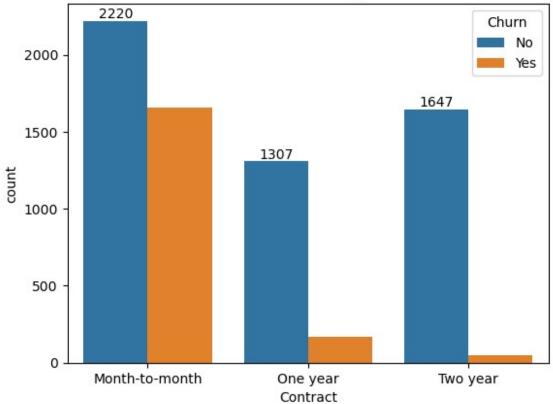
```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.show()

C:\Users\PIYUSH\anaconda3\Lib\site-packages\seaborn\_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed in a future version. Convert inf values to NaN before operating instead.
   with pd.option_context('mode.use_inf_as_na', True):
```



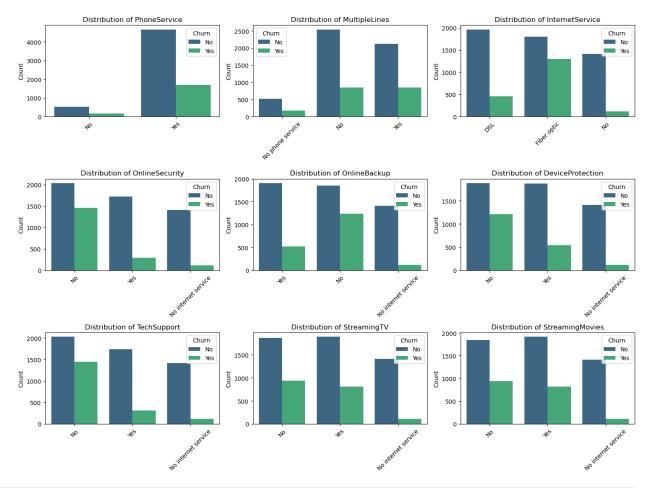
```
ax = sns.countplot(x = "Contract", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.title("Count Of Customers By Contract")
plt.show()
```





```
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)
'TechSupport', 'StreamingTV', 'StreamingMovies']
# Set up the figure and axes
fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(15, 12)) # 3x3
grid of subplots
fig.suptitle("Count Plots for Various Services", fontsize=16)
# Flatten axes array for easy iteration
axes = axes.flatten()
# Generate count plots for each column
for i, col in enumerate(columns):
   sns.countplot(x=df[col], hue=df["Churn"], ax=axes[i],
palette="viridis")
   axes[i].set title(f"Distribution of {col}")
   axes[i].set xlabel("")
   axes[i].set ylabel("Count")
   axes[i].tick params(axis='x', rotation=45) # Rotate x-axis labels
if needed
# Adiust lavout
plt.tight layout(rect=[0, 0, 1, 0.96]) # Leave space for the main
title
plt.show()
```

Count Plots for Various Services



```
plt.figure(figsize = (10,4))
ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.title("Churned Customers By Payment Method")
plt.show()
```

