```
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)
(1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\piyush\
anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1->seaborn)
(0.11.0)
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\
```

```
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\piyush\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
```

```
---------------------------------------------------------------------------
-----
FileNotFoundError                         Traceback (most recent call
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,
   (...)
    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)
   1445     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)
   1703     if "b" not in mode:
   1704         mode += "b"
-> 1705 self.handles = get_handle(
   1706     f,
   1707     mode,
   1708     encoding=self.options.get("encoding", None),
   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"),
   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):
    859     # Check whether the filename is to be opened in binary
mode.
    860     # Binary mode does not support 'encoding' and 'newline'.
    861     if ioargs.encoding and "b" not in ioargs.mode:
    862         # Encoding
--> 863         handle = open(
```

```
    864             handle,
    865             ioargs.mode,
    866             encoding=ioargs.encoding,
    867             errors=errors,
    868             newline="",
    869         )
    870     else:
    871         # Binary mode
    872         handle = open(handle, ioargs.mode)

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,
   (...)
    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)
   1445     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)
   1703     if "b" not in mode:
   1704         mode += "b"
-> 1705 self.handles = get_handle(
   1706     f,
   1707     mode,
   1708     encoding=self.options.get("encoding", None),
   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"),
   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):
    859     # Check whether the filename is to be opened in binary
mode.
    860     # Binary mode does not support 'encoding' and 'newline'.
    861     if ioargs.encoding and "b" not in ioargs.mode:
    862         # Encoding
--> 863         handle = open(
    864             handle,
    865             ioargs.mode,
    866             encoding=ioargs.encoding,
    867             errors=errors,
    868             newline="",
    869         )
    870     else:
    871         # Binary mode
    872         handle = open(handle, ioargs.mode)

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

      customerID  gender  SeniorCitizen Partner Dependents  tenure  \
0     7590-VHVEG  Female              0     Yes         No       1
1     5575-GNVDE    Male              0      No         No      34
2     3668-QPYBK    Male              0      No         No       2
3     7795-CFOCW    Male              0      No         No      45
4     9237-HQITU  Female              0      No         No       2
...          ...     ...            ...     ...        ...     ...
7038  6840-RESVB    Male              0     Yes        Yes      24
7039  2234-XADUH  Female              0     Yes        Yes      72
7040  4801-JZAZL  Female              0     Yes        Yes      11
7041  8361-LTMKD    Male              1     Yes         No       4
7042  3186-AJIEK    Male              0      No         No      66

     PhoneService     MultipleLines InternetService
OnlineSecurity  ...  \
0              No  No phone service             DSL
No  ...
1             Yes                No             DSL
Yes  ...
2             Yes                No             DSL
Yes  ...
3              No  No phone service             DSL
Yes  ...
4             Yes                No     Fiber optic
No  ...
...           ...               ...             ...             ...  ..
.
7038          Yes               Yes             DSL
Yes  ...
7039          Yes               Yes     Fiber optic
No  ...
7040           No  No phone service             DSL
Yes  ...
7041          Yes               Yes     Fiber optic
No  ...
7042          Yes                No     Fiber optic
Yes  ...

     DeviceProtection TechSupport StreamingTV StreamingMovies
Contract  \
0                  No          No          No              No  Month-
```

```
to-month
1                  Yes           No           No               No
One year
2                   No           No           No               No  Month-
to-month
3                  Yes          Yes           No               No
One year
4                   No           No           No               No  Month-
to-month
...                ...          ...          ...              ...
...
7038               Yes          Yes          Yes              Yes
One year
7039               Yes           No          Yes              Yes
One year
7040                No           No           No               No  Month-
to-month
7041                No           No           No               No  Month-
to-month
7042               Yes          Yes          Yes              Yes
Two year

     PaperlessBilling              PaymentMethod MonthlyCharges
TotalCharges  \
0                  Yes           Electronic check          29.85
29.85
1                   No               Mailed check          56.95
1889.5
2                  Yes               Mailed check          53.85
108.15
3                   No  Bank transfer (automatic)          42.30
1840.75
4                  Yes           Electronic check          70.70
151.65
...                ...                        ...            ...
...
7038               Yes               Mailed check          84.80
1990.5
7039               Yes    Credit card (automatic)         103.20
7362.9
7040               Yes           Electronic check          29.60
346.45
7041               Yes               Mailed check          74.40
306.6
7042               Yes  Bank transfer (automatic)         105.65
6844.5

     Churn
0       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              0      No         No      34
Yes
2  3668-QPYBK    Male              0      No         No       2
Yes
3  7795-CFOCW    Male              0      No         No      45
No
4  9237-HQITU  Female              0      No         No       2
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  ...
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
3         Yes          No              No        One year
```

```
No
4          No          No               No  Month-to-month
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   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
```

```
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):
 #   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   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
count    7043.000000  7043.000000     7043.000000   7043.000000
mean        0.162147    32.371149       64.761692   2279.734304
std         0.368612    24.559481       30.090047   2266.794470
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
max         1.000000    72.000000      118.750000   8684.800000
```

```
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            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-CFOCW    Male            no      No         No      45
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
2                No             DSL            Yes  ...
No
3  No phone service             DSL            Yes  ...
Yes
4                No     Fiber optic             No  ...
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
3         Yes          No              No        One year
No
4          No          No              No  Month-to-month
Yes

               PaymentMethod MonthlyCharges  TotalCharges  Churn
```

```
0           Electronic check          29.85         29.85     No
1               Mailed check          56.95       1889.50     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.head(10)
```

```
   customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
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-CFOCW    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-KIOVK    Male            no      No        Yes      22
Yes
7  6713-OKOMC  Female            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  ...
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        One year
No
2           No          No              No  Month-to-month
Yes
3          Yes          No              No        One year
No
4           No          No              No  Month-to-month
Yes
5           No         Yes             Yes  Month-to-month
Yes
6           No         Yes              No  Month-to-month
Yes
7           No          No              No  Month-to-month
No
8          Yes         Yes             Yes  Month-to-month
Yes
9           No          No              No        One year
No

                PaymentMethod MonthlyCharges  TotalCharges  Churn
0            Electronic check          29.85         29.85     No
1                Mailed check          56.95       1889.50     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            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
9  Bank transfer (automatic)          56.15       3487.95     No

[10 rows x 21 columns]

df.head(20)

    customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
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-CFOCW    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-KIOVK    Male            no       No         Yes       22
Yes
7   6713-OKOMC  Female            no       No          No       10
No
8   7892-POOKP  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-WOFKT    Male            no       No         Yes       71
Yes
18  4190-MFLUW  Female            no      Yes         Yes       10
Yes
19  4183-MYFRB  Female            no       No          No       21
Yes

       MultipleLines InternetService       OnlineSecurity  ...  \
0   No phone service             DSL                   No  ...
1                 No             DSL                  Yes  ...
2                 No             DSL                  Yes  ...
3   No phone service             DSL                  Yes  ...
4                 No     Fiber optic                   No  ...
5                Yes     Fiber optic                   No  ...
6                Yes     Fiber optic                   No  ...
7   No phone service             DSL                  Yes  ...
8                Yes     Fiber optic                   No  ...
9                 No             DSL                  Yes  ...
```

```
10                 No             DSL                   Yes  ...
11                 No              No  No internet service  ...
12                Yes     Fiber optic                    No  ...
13                Yes     Fiber optic                    No  ...
14                 No     Fiber optic                   Yes  ...
15                Yes     Fiber optic                   Yes  ...
16                 No              No  No internet service  ...
17                Yes     Fiber optic                   Yes  ...
18                 No             DSL                    No  ...
19                 No     Fiber optic                    No  ...

       DeviceProtection          TechSupport          StreamingTV  \
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                   Yes  Month-to-month              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                   No  Month-to-month              Yes
11  No internet service        Two year               No
12                  Yes        One year               No
13                  Yes  Month-to-month              Yes
14                  Yes  Month-to-month              Yes
```

```
15                  Yes        Two year               No
16  No internet service        One year               No
17                  Yes        Two year               No
18                   No  Month-to-month               No
19                  Yes  Month-to-month              Yes

                 PaymentMethod MonthlyCharges  TotalCharges  Churn
0            Electronic check          29.85         29.85     No
1                Mailed check          56.95       1889.50     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            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
9   Bank transfer (automatic)          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
13  Bank transfer (automatic)         103.70       5036.30    Yes
14           Electronic check         105.50       2686.05     No
15    Credit card (automatic)         113.25       7895.15     No
16               Mailed check          20.65       1022.95     No
17  Bank transfer (automatic)         106.70       7382.25     No
18    Credit card (automatic)          55.20        528.35    Yes
19           Electronic check          90.05       1862.90     No

[20 rows x 21 columns]

df.head(30)

    customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
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-CFOCW    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-KIOVK    Male            no      No        Yes      22
Yes
7   6713-OKOMC  Female            no      No         No      10
No
```

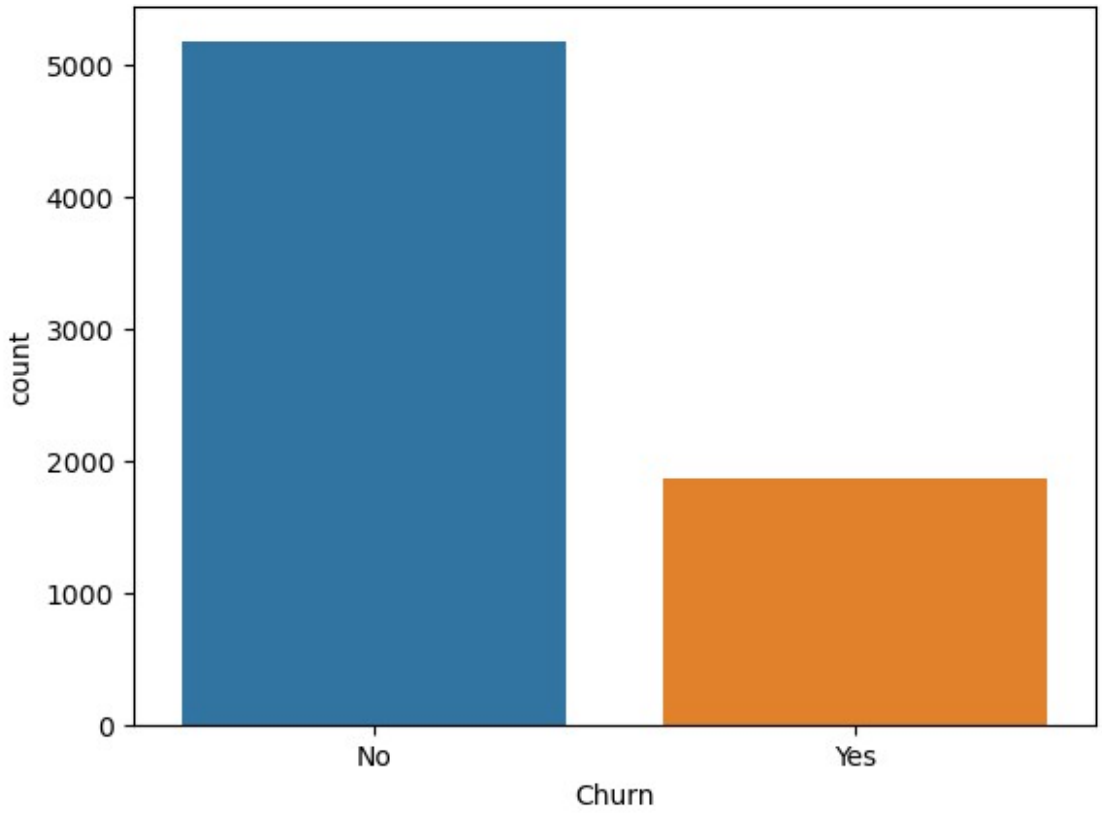
```
8   7892-POOKP  Female            no     Yes          No      28
Yes
9   6388-TABGU    Male            no      No         Yes      62
Yes
10  9763-GRSKD    Male            no     Yes         Yes      13
Yes
11  7469-LKBCI    Male            no      No          No      16
Yes
12  8091-TTVAX    Male            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-WOFKT    Male            no      No         Yes      71
Yes
18  4190-MFLUW  Female            no     Yes         Yes      10
Yes
19  4183-MYFRB  Female            no      No          No      21
Yes
20  8779-QRDMV    Male           yes      No          No       1
No
21  1680-VDCWW    Male            no     Yes          No      12
Yes
22  1066-JKSGK    Male            no      No          No       1
Yes
23  3638-WEABW  Female            no     Yes          No      58
Yes
24  6322-HRPFA    Male            no     Yes         Yes      49
Yes
25  6865-JZNKO  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  8773-HHUOZ  Female            no      No         Yes      17
Yes

       MultipleLines InternetService       OnlineSecurity  ...  \
0   No phone service             DSL                   No  ...
1                 No             DSL                  Yes  ...
2                 No             DSL                  Yes  ...
```

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

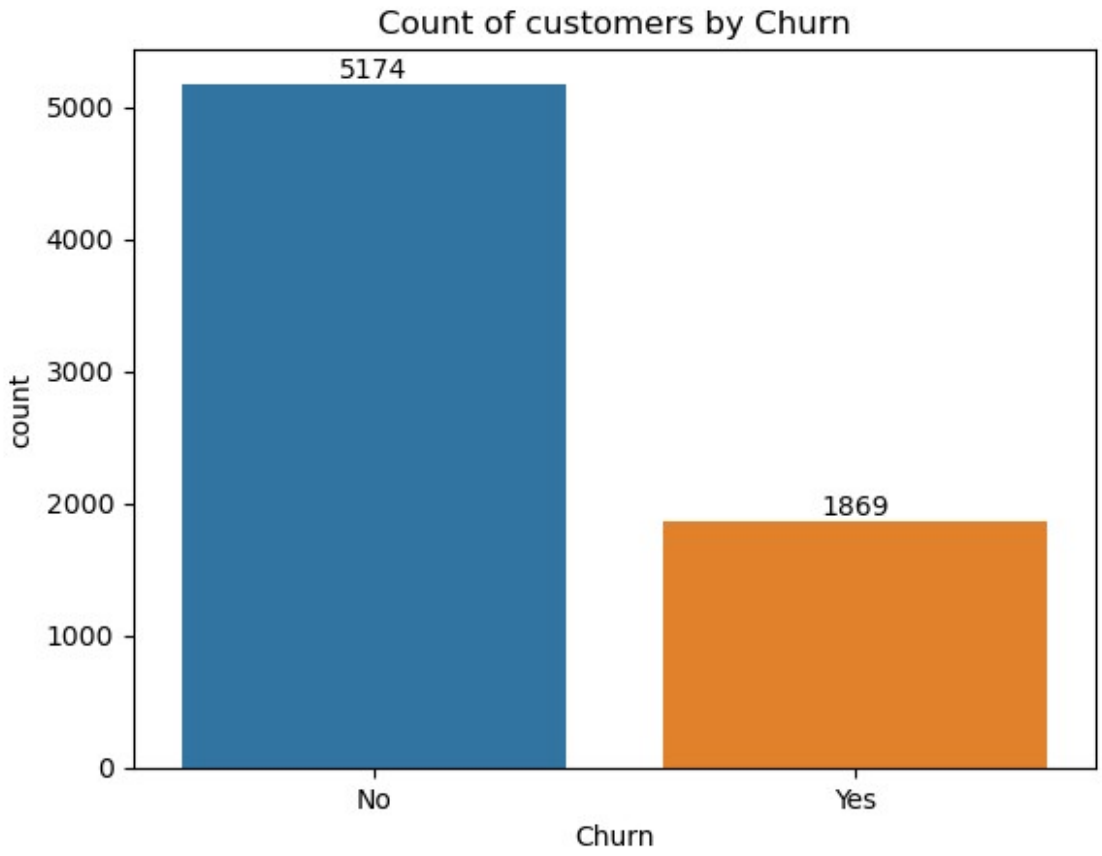
```
20                  Yes                    No                    No
21  No internet service  No internet service  No internet service
22  No internet service  No internet service  No internet service
23                   No                   Yes                    No
24                   No                   Yes                    No
25                   No                    No                    No
26                   No                    No                   Yes
27                   No                    No                    No
28                  Yes                   Yes                   Yes
29                   No                    No                   Yes

        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                   Yes  Month-to-month              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                   No  Month-to-month              Yes
11  No internet service        Two year               No
12                  Yes        One year               No
13                  Yes  Month-to-month              Yes
14                  Yes  Month-to-month              Yes
15                  Yes        Two year               No
16  No internet service        One year               No
17                  Yes        Two year               No
18                   No  Month-to-month               No
19                  Yes  Month-to-month              Yes
20                  Yes  Month-to-month              Yes
21  No internet service        One year               No
22  No internet service  Month-to-month               No
23                   No        Two year              Yes
24                   No  Month-to-month               No
25                   No  Month-to-month              Yes
26                  Yes  Month-to-month              Yes
27                   No  Month-to-month               No
28                  Yes        Two year              Yes
29                  Yes  Month-to-month              Yes

                PaymentMethod MonthlyCharges  TotalCharges  Churn
0            Electronic check          29.85         29.85     No
1                Mailed check          56.95       1889.50     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            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
9   Bank transfer (automatic)          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
13  Bank transfer (automatic)         103.70       5036.30    Yes
14           Electronic check         105.50       2686.05     No
15    Credit card (automatic)         113.25       7895.15     No
16               Mailed check          20.65       1022.95     No
17  Bank transfer (automatic)         106.70       7382.25     No
18    Credit card (automatic)          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
22               Mailed check          20.15         20.15    Yes
23    Credit card (automatic)          59.90       3505.10     No
24    Credit card (automatic)          59.60       2970.30     No
25  Bank transfer (automatic)          55.30       1530.60     No
26           Electronic check          99.35       4749.15    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()
```



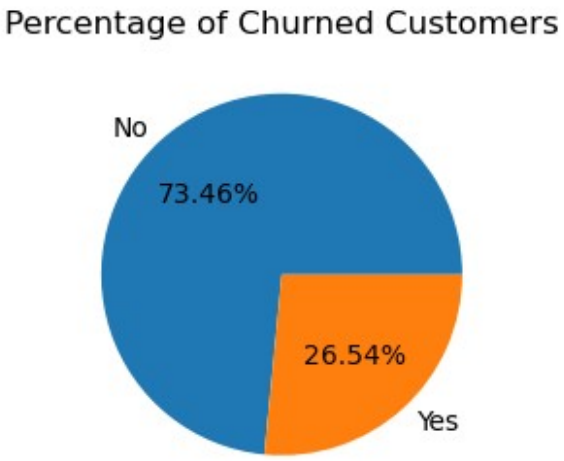

```
ax = sns.countplot(x = 'Churn', data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of customers by Churn")
plt.show()
```




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

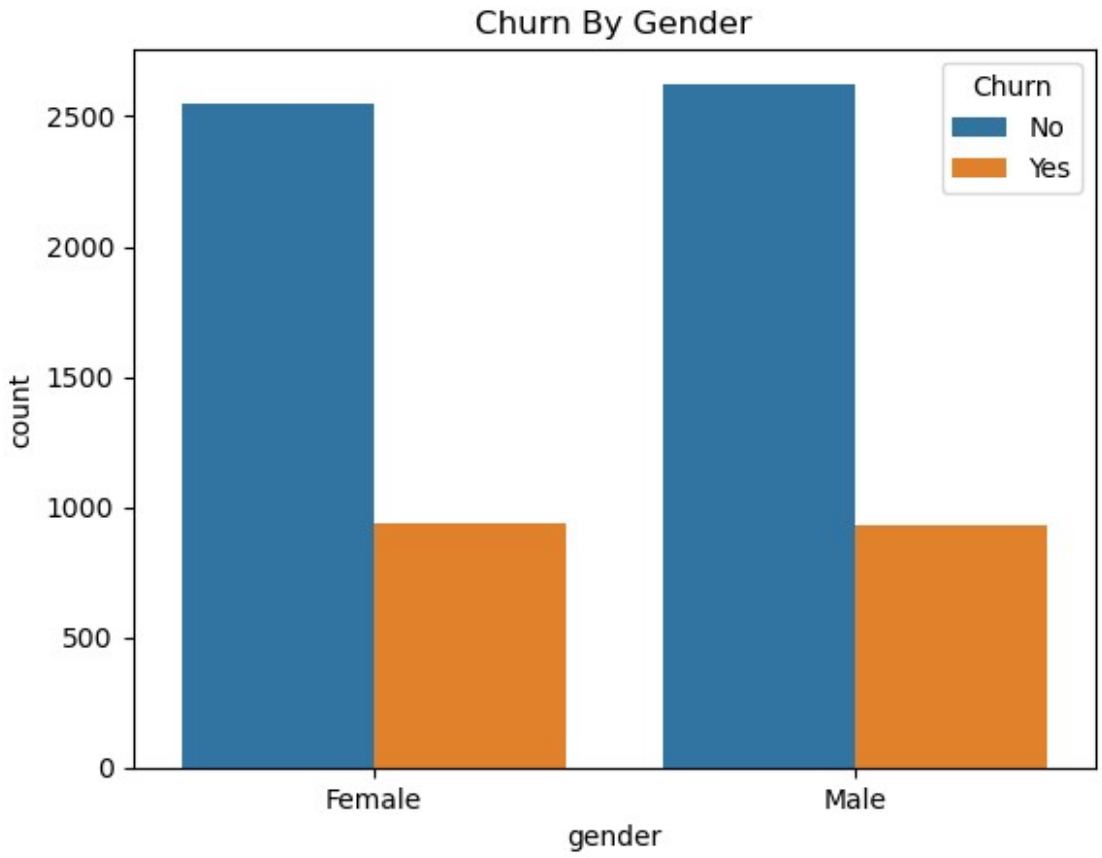
Churn	Churn
No	5174
Yes	1869

```
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
```

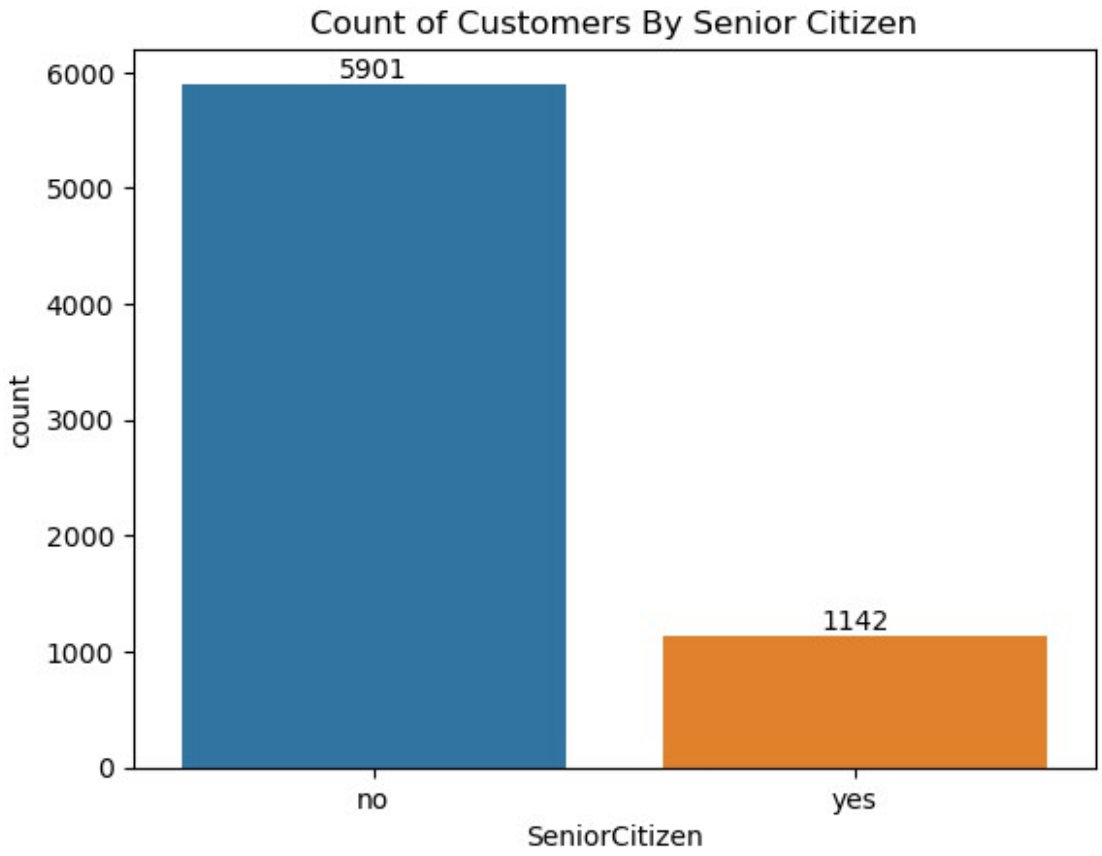



```
       Churn
Churn
No      5174
Yes     1869
```

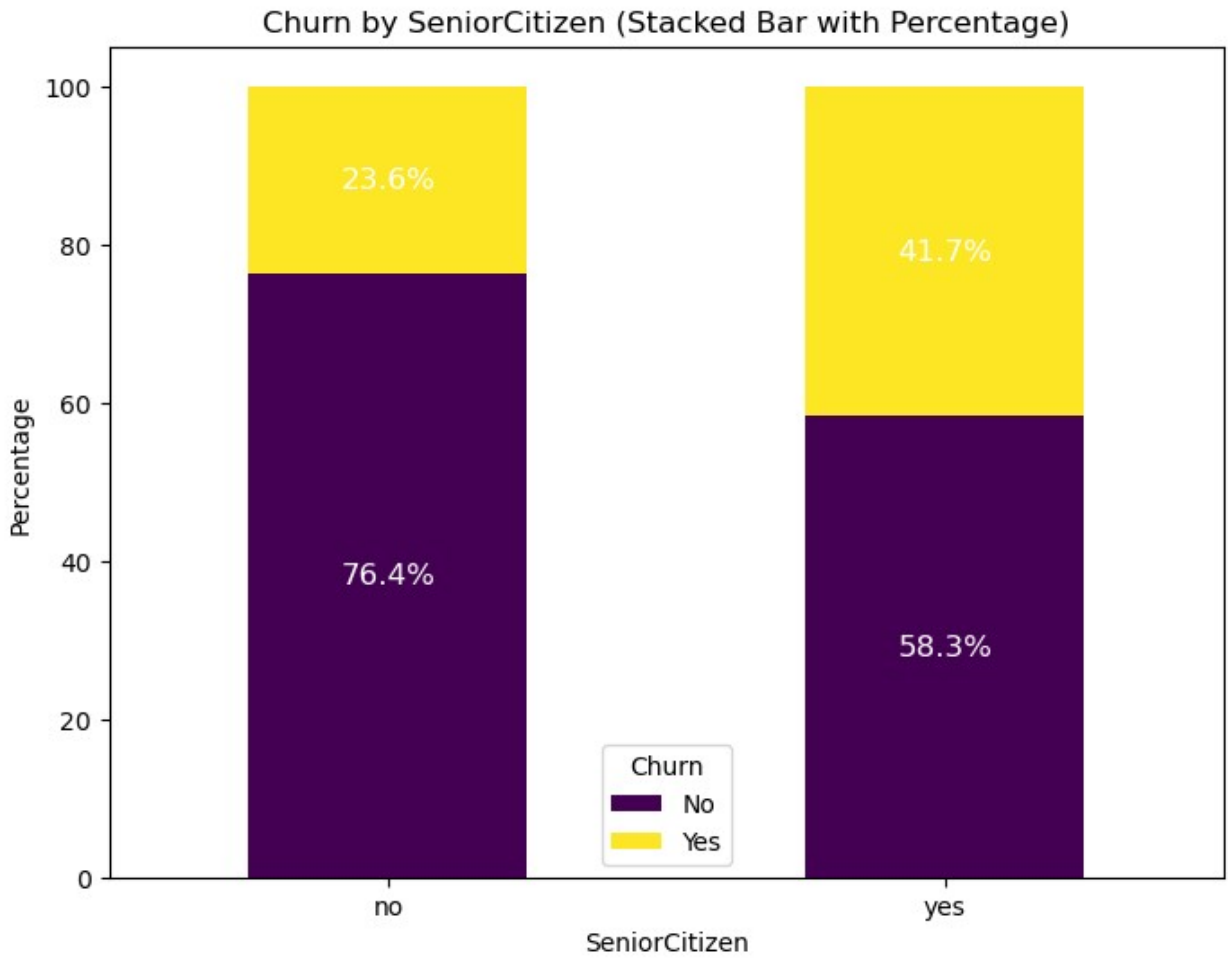
```
sns.countplot(x = "gender", data = df, hue = "Churn")
plt.title("Churn By Gender")
plt.show()
```



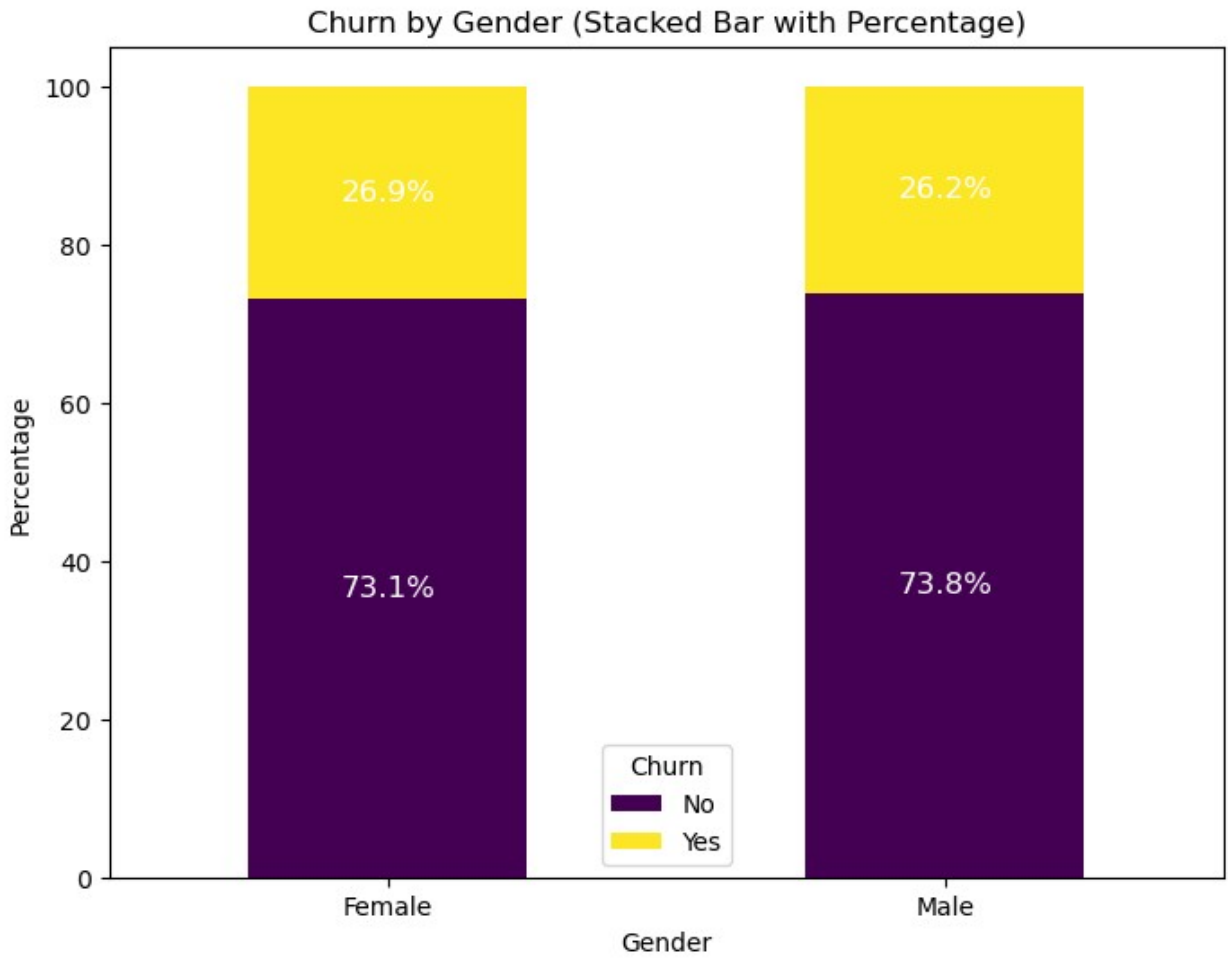

```
ax = sns.countplot(x = "SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers By Senior Citizen")
plt.show()
```




```
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()
```

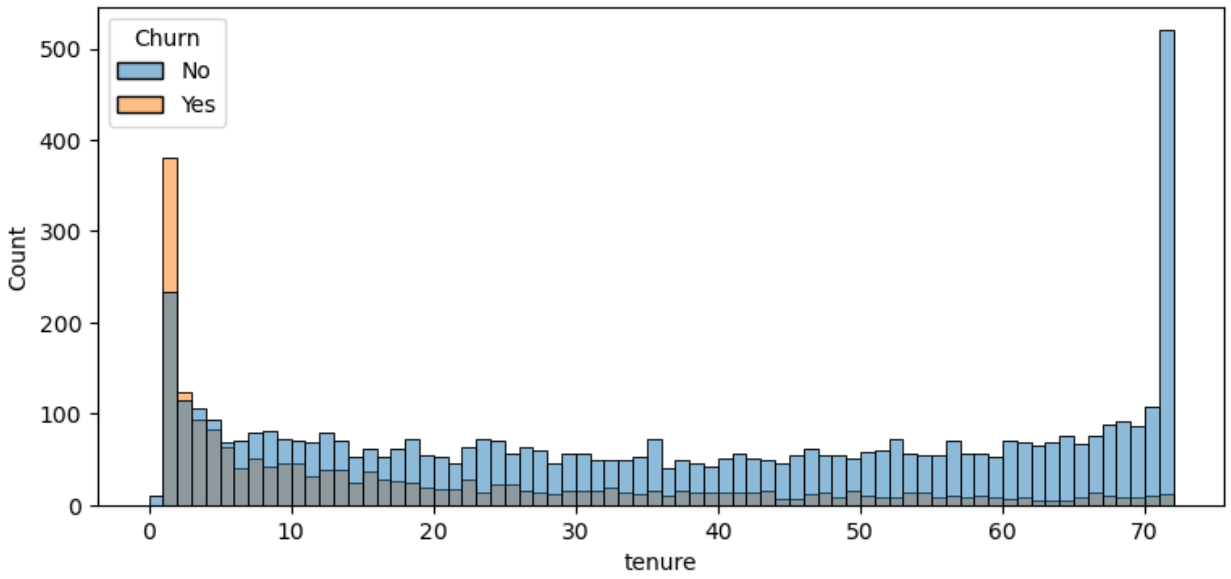



```
counts = df.groupby(["gender", "Churn"]).size().unstack()

# 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()
```

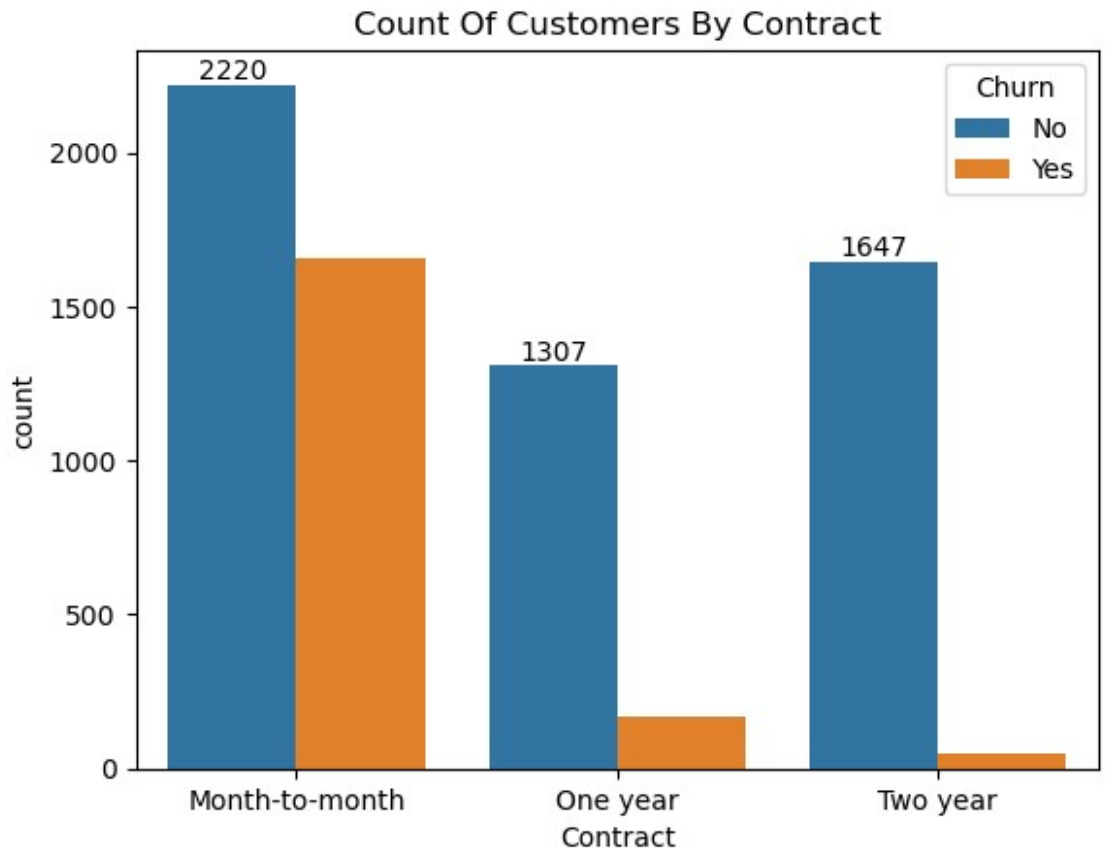



```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.show()
```

```
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):
```



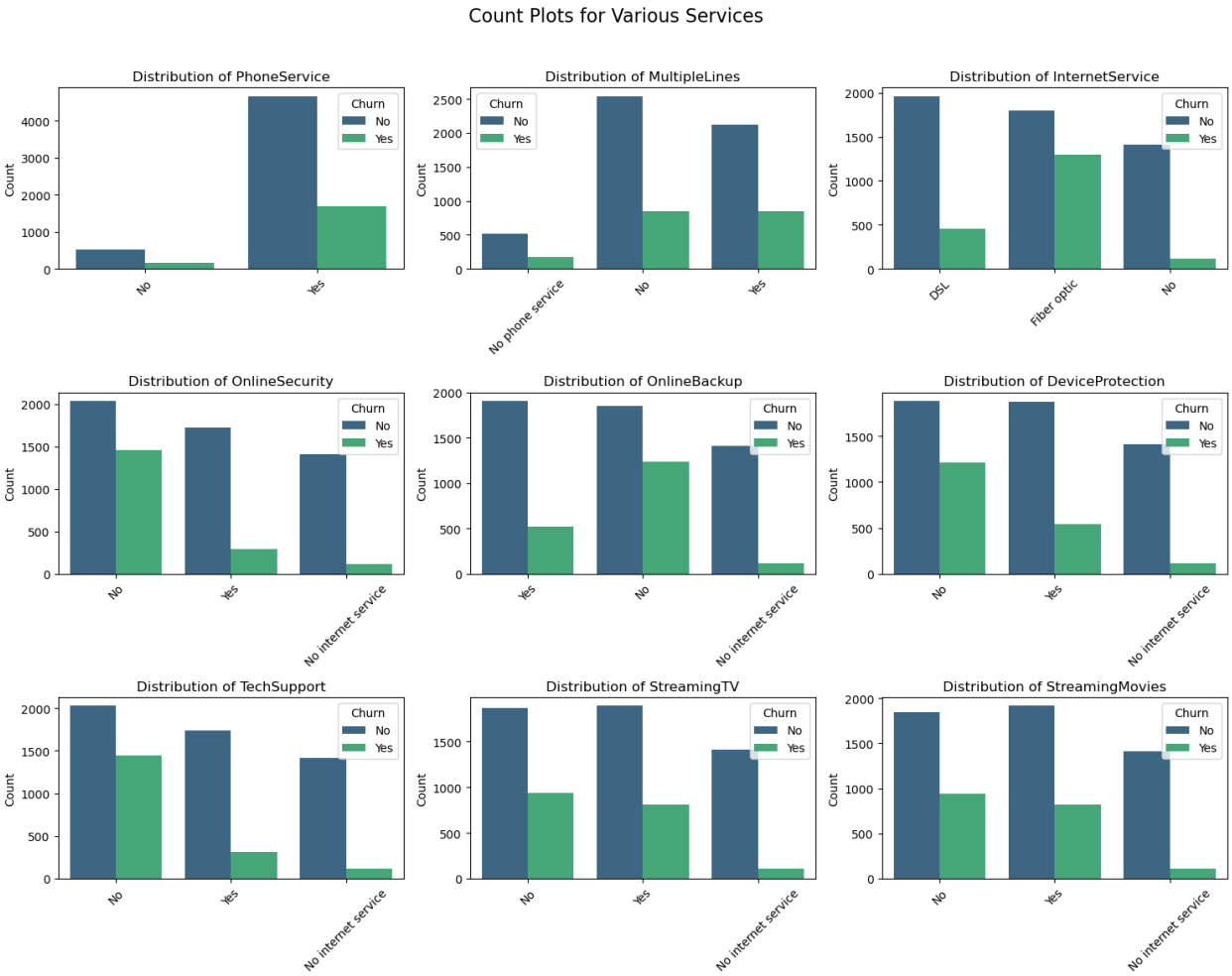

```
ax = sns.countplot(x = "Contract", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.title("Count Of Customers By Contract")
plt.show()
```



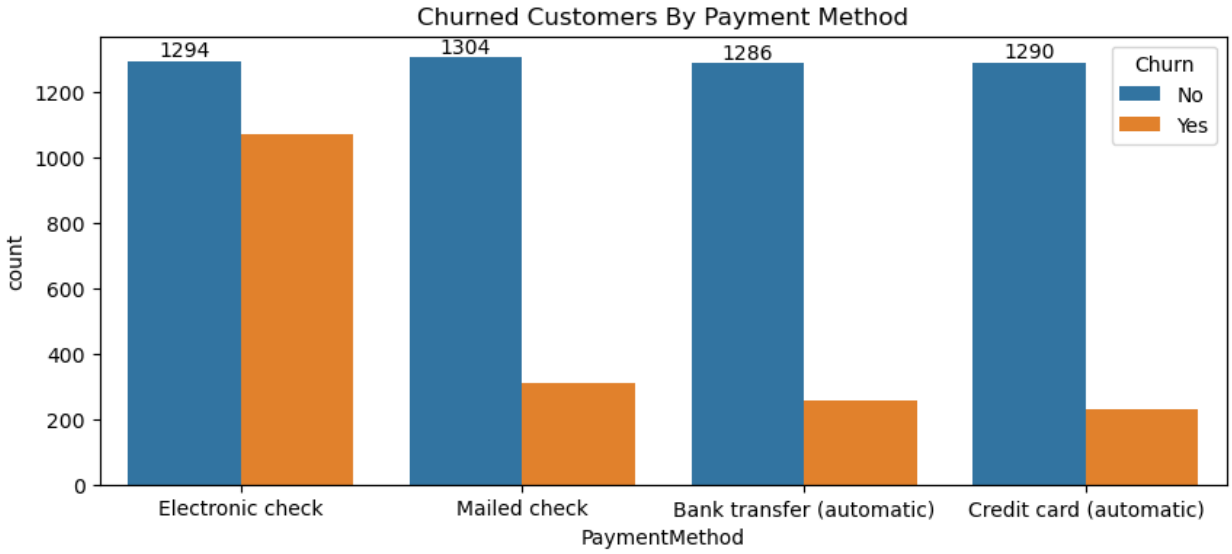
```
df.columns.values
```

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

```
columns = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           '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

# Adjust layout
plt.tight_layout(rect=[0, 0, 1, 0.96])  # Leave space for the main
title
plt.show()
```




```
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()
```


Churned Customers By Payment Method
1294
1304
1286
1290
Churn
No
Yes
count
0
200
400
600
800
1000
1200
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod