Week 3 Assignment

August 25, 2021

```
[41]: import pandas as pd
      import numpy as np
      import matplotlib.pyplot as plt
      import seaborn as sns
```

```
[228]: churn=pd.read_csv('churn.csv')
       churn2=churn.copy()
       churn3=churn.copy()
       churn.head()
```

```
[228]:   customerID tenure         Contract PaperlessBilling  \
       0  8260-NGFNY    One  Month-to-month               No
       1  2359-QWQUL     39        One year              Yes
       2  6598/RFFVI      2        One year               No
       3  IXSTS-8780      6  Month-to-month              Yes
       4  2674/MIAHT   Four  Month-to-month              Yes

                    PaymentMethod  MonthlyCharges  TotalCharges  gender  \
       0             Mailed check            25.2         25.20  Female
       1  Credit card (automatic)           104.7       4134.85  Female
       2  Credit card (automatic)            19.3         28.30    Male
       3         Electronic check            90.1        521.30  Female
       4             Mailed check            80.3        324.20  Female

          SeniorCitizen Partner  … PhoneService       MultipleLines InternetService  \
       0            0.0      No  …           No  No phone service             DSL
       1            0.0     Yes  …          Yes                No     Fiber optic
       2            0.0      No  …          Yes                No              No
       3            0.0      No  …          Yes               Yes     Fiber optic
       4            0.0      No  …          Yes               Yes     Fiber optic

                OnlineSecurity         OnlineBackup      DeviceProtection  \
       0                    No                   No                    No
       1                   Yes                   No                   Yes
       2  No internet service  No internet service  No internet service
       3                    No                  Yes                    No
       4                    No                  Yes                    No
```

```
        TechSupport          StreamingTV        StreamingMovies Churn
0                No                   No                     No   Yes
1               Yes                  Yes                    Yes   Yes
2  No internet service  No internet service  No internet service   Yes
3                No                  Yes                     No   Yes
4                No                   No                     No    No

[5 rows x 21 columns]
```

0.0.1 Solution 2

```
[11]: cust_det_extr1 = churn[churn.InternetService == 'Fiber optic']
      cust_det_extr1.head()
```

```
[11]:   customerID tenure        Contract PaperlessBilling  \
      1  2359-QWQUL     39        One year              Yes
      3  IXSTS-8780      6  Month-to-month              Yes
      4  2674/MIAHT   Four  Month-to-month              Yes
      5  6077-BDPXA      3  Month-to-month              Yes
      6  7929/SKFGK     70        Two year               No

                   PaymentMethod  MonthlyCharges  TotalCharges  gender  \
      1  Credit card (automatic)          104.70       4134.85  Female
      3         Electronic check           90.10        521.30  Female
      4             Mailed check           80.30        324.20  Female
      5         Electronic check           70.15        194.20  Female
      6  Credit card (automatic)          114.30       8244.30    Male

         SeniorCitizen Partner  … PhoneService MultipleLines InternetService  \
      1            0.0     Yes  …          Yes            No    Fiber optic
      3            0.0      No  …          Yes           Yes    Fiber optic
      4            0.0      No  …          Yes           Yes    Fiber optic
      5            0.0      No  …          Yes            No    Fiber optic
      6            0.0     Yes  …          Yes           Yes    Fiber optic

        OnlineSecurity OnlineBackup DeviceProtection TechSupport StreamingTV  \
      1            Yes           No              Yes         Yes         Yes
      3             No          Yes               No          No         Yes
      4             No          Yes               No          No          No
      5             No           No               No          No          No
      6            Yes          Yes              Yes         Yes         Yes

        StreamingMovies Churn
      1             Yes   Yes
      3              No   Yes
      4              No    No
      5              No    No
```

```
6               Yes       No
```

```
[5 rows x 21 columns]
```

```
[12]: cust_det_extr2 = churn.loc[churn.InternetService == 'Fiber optic']
      cust_det_extr2.head()
```

```
[12]:    customerID tenure         Contract PaperlessBilling  \
      1   2359-QWQUL      39         One year              Yes
      3   IXSTS-8780       6  Month-to-month              Yes
      4   2674/MIAHT    Four  Month-to-month              Yes
      5   6077-BDPXA       3  Month-to-month              Yes
      6   7929/SKFGK      70         Two year               No

                   PaymentMethod  MonthlyCharges  TotalCharges  gender  \
      1  Credit card (automatic)          104.70       4134.85  Female
      3          Electronic check          90.10        521.30  Female
      4             Mailed check           80.30        324.20  Female
      5          Electronic check          70.15        194.20  Female
      6  Credit card (automatic)          114.30       8244.30    Male

         SeniorCitizen Partner  … PhoneService MultipleLines InternetService  \
      1            0.0     Yes  …          Yes            No     Fiber optic
      3            0.0      No  …          Yes           Yes     Fiber optic
      4            0.0      No  …          Yes           Yes     Fiber optic
      5            0.0      No  …          Yes            No     Fiber optic
      6            0.0     Yes  …          Yes           Yes     Fiber optic

         OnlineSecurity OnlineBackup DeviceProtection TechSupport StreamingTV  \
      1            Yes           No              Yes         Yes         Yes
      3             No          Yes               No          No         Yes
      4             No          Yes               No          No          No
      5             No           No               No          No          No
      6            Yes          Yes              Yes         Yes         Yes

         StreamingMovies Churn
      1             Yes    Yes
      3              No    Yes
      4              No     No
      5              No     No
      6             Yes     No
```

```
[5 rows x 21 columns]
```

```
[13]: cust_det_extr3 = churn.loc[churn.InternetService.isin(['Fiber optic'])]
      cust_det_extr3.head()
```

```
[13]:      customerID tenure        Contract PaperlessBilling  \
      1    2359-QWQUL     39        One year             Yes
      3    IXSTS-8780      6   Month-to-month             Yes
      4    2674/MIAHT   Four   Month-to-month             Yes
      5    6077-BDPXA      3   Month-to-month             Yes
      6    7929/SKFGK     70        Two year              No


                    PaymentMethod  MonthlyCharges  TotalCharges  gender  \
      1  Credit card (automatic)           104.70       4134.85  Female
      3          Electronic check           90.10        521.30  Female
      4             Mailed check            80.30        324.20  Female
      5          Electronic check           70.15        194.20  Female
      6  Credit card (automatic)           114.30       8244.30    Male

         SeniorCitizen Partner  … PhoneService MultipleLines InternetService  \
      1            0.0     Yes  …          Yes            No     Fiber optic
      3            0.0      No  …          Yes           Yes     Fiber optic
      4            0.0      No  …          Yes           Yes     Fiber optic
      5            0.0      No  …          Yes            No     Fiber optic
      6            0.0     Yes  …          Yes           Yes     Fiber optic


         OnlineSecurity OnlineBackup DeviceProtection TechSupport StreamingTV  \
      1            Yes           No              Yes         Yes         Yes
      3             No          Yes               No          No         Yes
      4             No          Yes               No          No          No
      5             No           No               No          No          No
      6            Yes          Yes              Yes         Yes         Yes


         StreamingMovies Churn
      1            Yes    Yes
      3             No    Yes
      4             No     No
      5             No     No
      6            Yes     No

      [5 rows x 21 columns]

[14]:  cust_det_extr4 = churn.loc[churn.isin(['Fiber optic'])]
       cust_det_extr4.head()


       ----------------------------------------------------------------------------
       ValueError                                Traceback (most recent call last)
       <ipython-input-14-f1ac1091d9a1> in <module>
       ----> 1 cust_det_extr4 = churn.loc[churn.isin(['Fiber optic'])]
             2 cust_det_extr4.head()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\indexing.py in␣
 ↪__getitem__(self, key)
    929
    930                maybe_callable = com.apply_if_callable(key, self.obj)
--> 931                return self._getitem_axis(maybe_callable, axis=axis)
    932
    933        def _is_scalar_access(self, key: tuple):


C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\indexing.py in␣
 ↪_getitem_axis(self, key, axis)
   1149
   1150                    if hasattr(key, "ndim") and key.ndim > 1:
-> 1151                        raise ValueError("Cannot index with multidimensional␣
 ↪key")
   1152
   1153                    return self._getitem_iterable(key, axis=axis)


ValueError: Cannot index with multidimensional key
```

0.0.2 Solution 3

```
[18]: [i for i in churn['customerID'] if len(i)!=10]
```

```
[18]: []
```

Answer: All the customer IDs are consistent

0.0.3 Solution 4

```
[27]: churn2['Dependents'].value_counts()
```

```
[27]: No     171
      Yes     80
      1@#      6
      Name: Dependents, dtype: int64
```

```
[39]: churn2['Dependents'].replace('1@#','No',inplace=True)
```

```
[40]: churn2['Dependents'].value_counts()
```

```
[40]: No     177
      Yes     80
      Name: Dependents, dtype: int64
```

Answer: 177, 80

0.0.4 Solution 5

```
[42]: sns.boxplot(y='MonthlyCharges',x='InternetService',data=churn)
```

```
[42]: <AxesSubplot:xlabel='InternetService', ylabel='MonthlyCharges'>
```
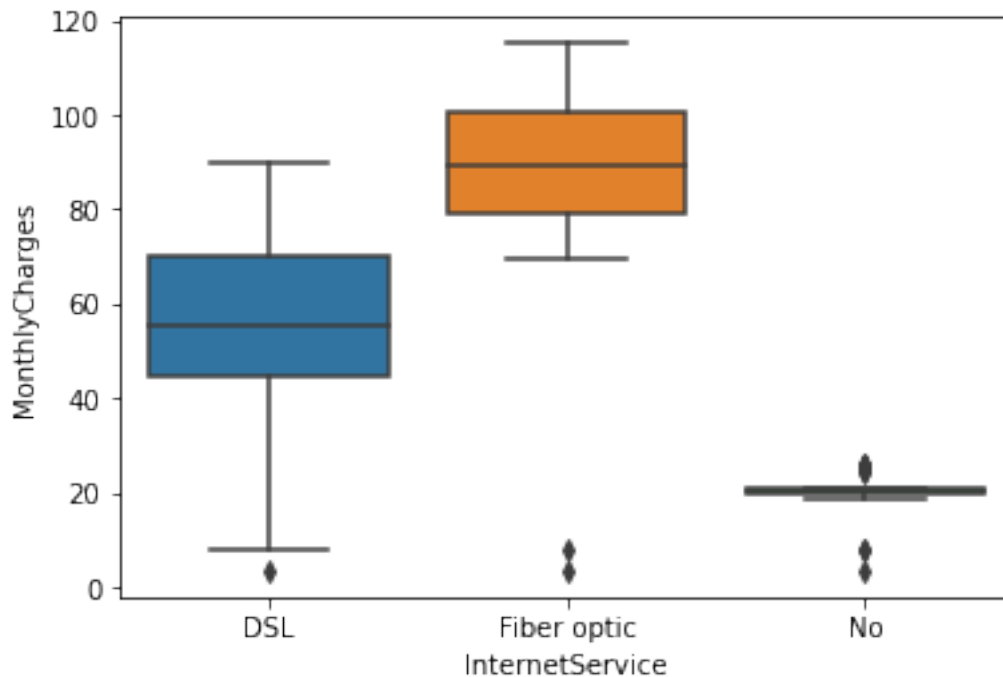

Answer: Customers who have opted for a Fiber optic line pay more than for a DSL connection

0.0.5 Solution 6

```
[87]: churn_nointernet=churn[churn['InternetService']=='No']
```

```
[88]: churn_nointernet.
      →drop(columns=['customerID','tenure','Contract','PaperlessBilling','PaymentMethod','MonthlyC
```

```
C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\frame.py:4901:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return super().drop(
```

```
[98]: churn_nointernet.replace('No internet service',np.nan,inplace=True)
      churn_nointernet.head()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\frame.py:5233:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return super().replace(
```

[98]:

	OnlineSecurity	OnlineBackup	DeviceProtection	TechSupport	StreamingTV \
2	NaN	NaN	NaN	NaN	NaN
8	NaN	NaN	NaN	NaN	NaN
13	Yes	Yes	NaN	NaN	Yes
14	NaN	NaN	NaN	NaN	NaN
15	Yes	Yes	NaN	NaN	Yes

	StreamingMovies
2	NaN
8	NaN
13	NaN
14	NaN
15	NaN

[97]:
```
len(churn_nointernet.any(1)[churn_nointernet.any(1)==True])
```

[97]: 25

Answer: 25

0.0.6 Solution 7

[229]:
```
churn3.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 257 entries, 0 to 256
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   customerID        257 non-null    object
 1   tenure            257 non-null    object
 2   Contract          257 non-null    object
 3   PaperlessBilling  257 non-null    object
 4   PaymentMethod     257 non-null    object
 5   MonthlyCharges    247 non-null    float64
 6   TotalCharges      242 non-null    float64
 7   gender            257 non-null    object
 8   SeniorCitizen     252 non-null    float64
 9   Partner           257 non-null    object
 10  Dependents        257 non-null    object
 11  PhoneService      257 non-null    object
```

```
 12  MultipleLines     257 non-null    object
 13  InternetService   257 non-null    object
 14  OnlineSecurity    257 non-null    object
 15  OnlineBackup      257 non-null    object
 16  DeviceProtection  257 non-null    object
 17  TechSupport       257 non-null    object
 18  StreamingTV       257 non-null    object
 19  StreamingMovies   257 non-null    object
 20  Churn             257 non-null    object
dtypes: float64(3), object(18)
memory usage: 42.3+ KB
```

[230]: `churn3.head()`

[230]:
```
   customerID tenure         Contract PaperlessBilling  \
0  8260-NGFNY    One  Month-to-month               No
1  2359-QWQUL     39        One year              Yes
2  6598/RFFVI      2        One year               No
3  IXSTS-8780      6  Month-to-month              Yes
4  2674/MIAHT   Four  Month-to-month              Yes


          PaymentMethod  MonthlyCharges  TotalCharges  gender  \
0           Mailed check            25.2         25.20  Female
1  Credit card (automatic)         104.7       4134.85  Female
2  Credit card (automatic)          19.3         28.30    Male
3        Electronic check           90.1        521.30  Female
4           Mailed check            80.3        324.20  Female


   SeniorCitizen Partner  … PhoneService      MultipleLines InternetService  \
0            0.0      No  …           No  No phone service             DSL
1            0.0     Yes  …          Yes                No     Fiber optic
2            0.0      No  …          Yes                No              No
3            0.0      No  …          Yes               Yes     Fiber optic
4            0.0      No  …          Yes               Yes     Fiber optic


       OnlineSecurity        OnlineBackup     DeviceProtection  \
0                  No                  No                  No
1                 Yes                  No                 Yes
2  No internet service  No internet service  No internet service
3                  No                 Yes                  No
4                  No                 Yes                  No


          TechSupport          StreamingTV      StreamingMovies Churn
0                  No                  No                  No   Yes
1                 Yes                 Yes                 Yes   Yes
2  No internet service  No internet service  No internet service   Yes
3                  No                 Yes                  No   Yes
```

```
4                No                No                No    No
```

[5 rows x 21 columns]

[231]: `sns.countplot(churn3['InternetService'])`

C:\ProgramData\Anaconda3\lib\site-packages\seaborn_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(

[231]: <AxesSubplot:xlabel='InternetService', ylabel='count'>
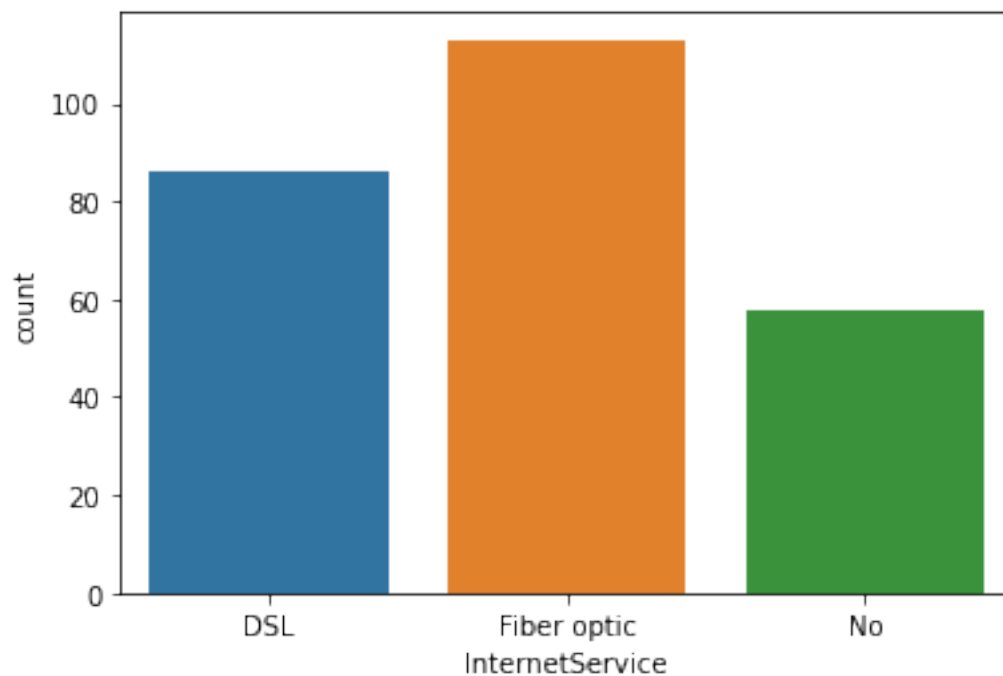
[238]:
```python
for j in range(len(churn3['InternetService'])):
    sum=0
    for i in range(14,20):
        if churn3.iloc[j,i]=='Yes':
            sum+=1
        else:
            sum=sum
    if sum>=2:
        churn3['InternetService'][j]=churn3['InternetService'].mode()[0]
    else:
```

```
        for k in range (14,20):
            churn3.iloc[j,k]='No internet service'
```

<ipython-input-238-5806b7a53505>:9: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  churn3['InternetService'][j]=churn3['InternetService'].mode()[0]

[241]: churn3.head(50)

[241]:   customerID tenure   Contract PaperlessBilling \
        0   8260-NGFNY   One Month-to-month   No
        1   2359-QWQUL   39   One year   Yes
        2   6598/RFFVI   2   One year   No
        3   IXSTS-8780   6 Month-to-month   Yes
        4   2674/MIAHT   Four Month-to-month   Yes
        5   6077-BDPXA   3 Month-to-month   Yes
        6   7929/SKFGK   70   Two year   No
        7   7547-EKNFS   42 Month-to-month   Yes
        8   5854-KSRBJ   70   Two year   No
        9   5054-IEXZT   One Month-to-month   Yes
        10 1877-HKBQX   11   One year   Yes
        11 7235-NXZCP   2 Month-to-month   Yes
        12 3325-FUYCG   28   One year   No
        13 2452-MRMZF   72   Two year   Yes
        14 9184-GALIL   38 Month-to-month   No
        15 9374-YOLBJ   One Month-to-month   No
        16 2612-PHGOX   64   Two year   Yes
        17 6874-SGLHU   30   One year   Yes
        18 9588-YRFHY   49   Two year   Yes
        19 6513-EECDB   One Month-to-month   Yes
        20 1306-RPWXZ   49   Two year   No
        21 3797-VTIDR   One Month-to-month   Yes
        22 2657-VPXTA   10 Month-to-month   Yes
        23 8464-EETCQ   57   Two year   No
        24 0307-BCOPK   16   One year   No
        25 9762-YAQAA   39   One year   No
        26 1114-CENIM   54 Month-to-month   Yes
        27 1090-PYKCI   69   One year   Yes
        28 6362-QHAFM   42   One year   Yes
        29 7978-DKUQH   25 Month-to-month   Yes
        30 6463-HHXJR   71   Two year   No
        31 2592-YKDIF   One Month-to-month   No
        32 3307-TLCUD   17 Month-to-month   No
        33 6651-AZVTJ   49 Month-to-month   Yes
```

```
34  7181-OQCUT     21  Month-to-month              No
35  2307-FYNNL     65         Two year             Yes
36  3671-SHRSP   Four  Month-to-month             Yes
37  3399-BMLVW     51         Two year              No
38  7572-KPVKK     62         Two year             Yes
39  8898-KASCD     39         One year              No
40  8853-TZDGH     72         Two year             Yes
41  4910-AQFFX      9  Month-to-month             Yes
42  7359-SSBJK     64         Two year             Yes
43  4106-HADHQ     39         One year              No
44  4822-NGOCH     13  Month-to-month             Yes
45  9067-SQTNS     44         One year              No
46  9067-SQTNS     44         One year              No
47  9067-SQTNS     44         One year              No
48  9067-SQTNS     44         One year              No
49  9067-SQTNS     44         One year              No


               PaymentMethod  MonthlyCharges  TotalCharges  gender  \
0               Mailed check           25.20         25.20  Female
1      Credit card (automatic)        104.70       4134.85  Female
2      Credit card (automatic)         19.30         28.30    Male
3            Electronic check          90.10        521.30  Female
4               Mailed check           80.30        324.20  Female
5            Electronic check          70.15        194.20  Female
6      Credit card (automatic)        114.30       8244.30    Male
7    Bank transfer (automatic)         95.25       3959.35    Male
8               Mailed check           25.40       1782.05    Male
9            Electronic check          75.35         75.35    Male
10              Mailed check           54.60        617.85  Female
11              Mailed check           74.85        156.40    Male
12           Electronic check         106.10       2847.40    Male
13     Credit card (automatic)         25.70           NaN  Female
14              Mailed check           20.45        781.25  Female
15           Electronic check          19.25         19.25  Female
16   Bank transfer (automatic)         76.10       4818.80    Male
17   Bank transfer (automatic)         97.00       3021.30    Male
18     Credit card (automatic)         19.90       1022.60    Male
19           Electronic check          73.55         73.55    Male
20     Credit card (automatic)          8.00       1024.65  Female
21           Electronic check          23.45         23.45    Male
22           Electronic check           3.50        929.45  Female
23     Credit card (automatic)         18.80       1094.35    Male
24              Mailed check           19.05        326.65  Female
25     Credit card (automatic)         81.40       3213.75    Male
26     Credit card (automatic)         55.00       3092.65    Male
27     Credit card (automatic)        105.10       7234.80  Female
28           Electronic check         108.30       4586.15    Male
```

```
29       Electronic check      74.60    1797.75  Female
30  Bank transfer (automatic)  100.50   7030.65  Female
31            Mailed check      20.35     20.35  Female
32            Mailed check      34.40    592.75    Male
33       Electronic check      99.80    4872.45    Male
34            Mailed check     103.85    2215.00    Male
35       Electronic check     109.05    7108.20    Male
36            Mailed check      80.60    319.15     Male
37   Credit card (automatic)   60.50    3121.45    Male
38       Electronic check     104.05    6590.50    Male
39            Mailed check      35.55    1309.15    Male
40  Bank transfer (automatic)  111.60   8012.75  Female
41  Bank transfer (automatic)   79.35        NaN    Male
42   Credit card (automatic)   70.20    4481.00  Female
43   Credit card (automatic)   80.00    3182.95    Male
44       Electronic check      84.45    1058.60  Female
45  Bank transfer (automatic)   20.60    926.00     Male
46  Bank transfer (automatic)   20.60    926.00     Male
47  Bank transfer (automatic)   20.60    926.00     Male
48  Bank transfer (automatic)   20.60    926.00     Male
49  Bank transfer (automatic)   20.60    926.00     Male


    SeniorCitizen Partner  … PhoneService      MultipleLines InternetService  \
0            0.0      No  …          No  No phone service             DSL
1            0.0     Yes  …         Yes                No     Fiber optic
2            0.0      No  …         Yes                No              No
3            0.0      No  …         Yes               Yes     Fiber optic
4            0.0      No  …         Yes               Yes     Fiber optic
5            0.0      No  …         Yes                No     Fiber optic
6            0.0     Yes  …         Yes               Yes     Fiber optic
7            0.0     Yes  …         Yes               Yes     Fiber optic
8            0.0     Yes  …         Yes               Yes              No
9            0.0      No  …         Yes                No     Fiber optic
10           0.0      No  …         Yes                No     Fiber optic
11           1.0      No  …         Yes               Yes     Fiber optic
12           0.0     Yes  …         Yes               Yes     Fiber optic
13           1.0     Yes  …         Yes               Yes     Fiber optic
14           0.0     Yes  …         Yes                No              No
15           0.0     Yes  …         Yes                No     Fiber optic
16           0.0     Yes  …         Yes               Yes     Fiber optic
17           0.0      No  …         Yes                No     Fiber optic
18           0.0      No  …         Yes                No              No
19           1.0     Yes  …         Yes               Yes     Fiber optic
20           0.0      No  …         Yes                No              No
21           0.0     Yes  …          No  No phone service             DSL
22           0.0     Yes  …         Yes                No     Fiber optic
23           0.0      No  …         Yes                No     Fiber optic
```

24	0.0	No	…	Yes	No	No
25	0.0	No	…	Yes	Yes	Fiber optic
26	0.0	No	…	Yes	Yes	DSL
27	0.0	Yes	…	Yes	Yes	Fiber optic
28	0.0	Yes	…	Yes	Yes	Fiber optic
29	0.0	Yes	…	Yes	No	Fiber optic
30	0.0	Yes	…	Yes	Yes	Fiber optic
31	0.0	No	…	Yes	No	No
32	0.0	Yes	…	No	No phone service	Fiber optic
33	0.0	Yes	…	Yes	Yes	Fiber optic
34	0.0	No	…	Yes	Yes	Fiber optic
35	1.0	No	…	Yes	Yes	Fiber optic
36	0.0	Yes	…	Yes	No	Fiber optic
37	0.0	Yes	…	Yes	No	Fiber optic
38	0.0	No	…	Yes	Yes	Fiber optic
39	0.0	No	…	No	No phone service	Fiber optic
40	0.0	No	…	Yes	Yes	Fiber optic
41	0.0	Yes	…	Yes	Yes	Fiber optic
42	NaN	No	…	Yes	No	Fiber optic
43	0.0	Yes	…	Yes	No	Fiber optic
44	0.0	No	…	Yes	Yes	Fiber optic
45	0.0	Yes	…	Yes	No	Fiber optic
46	0.0	Yes	…	Yes	No	Fiber optic
47	0.0	Yes	…	Yes	No	Fiber optic
48	0.0	Yes	…	Yes	No	Fiber optic
49	0.0	Yes	…	Yes	No	Fiber optic

	OnlineSecurity	OnlineBackup	DeviceProtection \
0	No internet service	No internet service	No internet service
1	Yes	No	Yes
2	No internet service	No internet service	No internet service
3	No	Yes	No
4	No internet service	No internet service	No internet service
5	No internet service	No internet service	No internet service
6	Yes	Yes	Yes
7	No	Yes	Yes
8	No internet service	No internet service	No internet service
9	No internet service	No internet service	No internet service
10	Yes	No	No
11	No internet service	No internet service	No internet service
12	Yes	Yes	No
13	Yes	Yes	No internet service
14	No internet service	No internet service	No internet service
15	Yes	Yes	No internet service
16	No	Yes	Yes
17	No	Yes	No
18	No internet service	No internet service	No internet service

```
19  No internet service  No internet service  No internet service
20  No internet service  No internet service  No internet service
21  No internet service  No internet service  No internet service
22                  No                  No                  No
23                 Yes                 Yes  No internet service
24  No internet service  No internet service  No internet service
25  No internet service  No internet service  No internet service
26  No internet service  No internet service  No internet service
27                 Yes                 Yes                 Yes
28                  No                  No                 Yes
29  No internet service  No internet service  No internet service
30                 Yes                 Yes                 Yes
31  No internet service  No internet service  No internet service
32                 Yes                  No                 Yes
33                  No                  No                 Yes
34                 Yes                  No                 Yes
35                 Yes                  No                 Yes
36                  No                  No                 Yes
37                 Yes                 Yes                  No
38                  No                  No                 Yes
39                  No                  No                 Yes
40                  No                 Yes                 Yes
41  No internet service  No internet service  No internet service
42                 Yes                 Yes                  No
43                 Yes                  No                 Yes
44                  No                 Yes                 Yes
45                 Yes                 Yes  No internet service
46                 Yes                 Yes  No internet service
47                 Yes                 Yes  No internet service
48                 Yes                 Yes  No internet service
49                 Yes                 Yes  No internet service


           TechSupport          StreamingTV       StreamingMovies Churn
0   No internet service  No internet service  No internet service   Yes
1                  Yes                 Yes                   Yes   Yes
2   No internet service  No internet service  No internet service   Yes
3                   No                 Yes                    No   Yes
4   No internet service  No internet service  No internet service    No
5   No internet service  No internet service  No internet service    No
6                  Yes                 Yes                   Yes    No
7                   No                 Yes                    No   Yes
8   No internet service  No internet service  No internet service    No
9   No internet service  No internet service  No internet service   Yes
10                 Yes                  No                    No    No
11  No internet service  No internet service  No internet service   Yes
12                  No                 Yes                   Yes   Yes
13  No internet service                 Yes  No internet service    No
```

14	No internet service	No internet service	No internet service	No
15	No internet service	Yes	No internet service	No
16	Yes	No internet service	No internet service	No
17	No	Yes	Yes	No
18	No internet service	No internet service	No internet service	No
19	No internet service	No internet service	No internet service	Yes
20	No internet service	No internet service	No internet service	No
21	No internet service	No internet service	No internet service	Yes
22	No	Yes	Yes	No
23	No internet service	Yes	No internet service	No
24	No internet service	No internet service	No internet service	No
25	No internet service	No internet service	No internet service	No
26	No internet service	No internet service	No internet service	Yes
27	Yes	Yes	No	No
28	Yes	Yes	Yes	No
29	No internet service	No internet service	No internet service	No
30	No	Yes	No	No
31	No internet service	No internet service	No internet service	No
32	No	No	No	No
33	No	Yes	Yes	Yes
34	No	Yes	Yes	No
35	Yes	Yes	Yes	No
36	Yes	No	No	Yes
37	Yes	No	No	No
38	Yes	Yes	Yes	No
39	Yes	No	No	No
40	Yes	Yes	Yes	No
41	No internet service	No internet service	No internet service	Yes
42	Yes	No internet service	No internet service	Yes
43	Yes	Yes	Yes	Yes
44	No	No	No	Yes
45	No internet service	Yes	No internet service	No
46	No internet service	Yes	No internet service	No
47	No internet service	Yes	No internet service	No
48	No internet service	Yes	No internet service	No
49	No internet service	Yes	No internet service	No

[50 rows x 21 columns]

```python
[240]: sns.countplot(churn3['InternetService'])
```

C:\ProgramData\Anaconda3\lib\site-packages\seaborn_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(

```
[240]: <AxesSubplot:xlabel='InternetService', ylabel='count'>
```
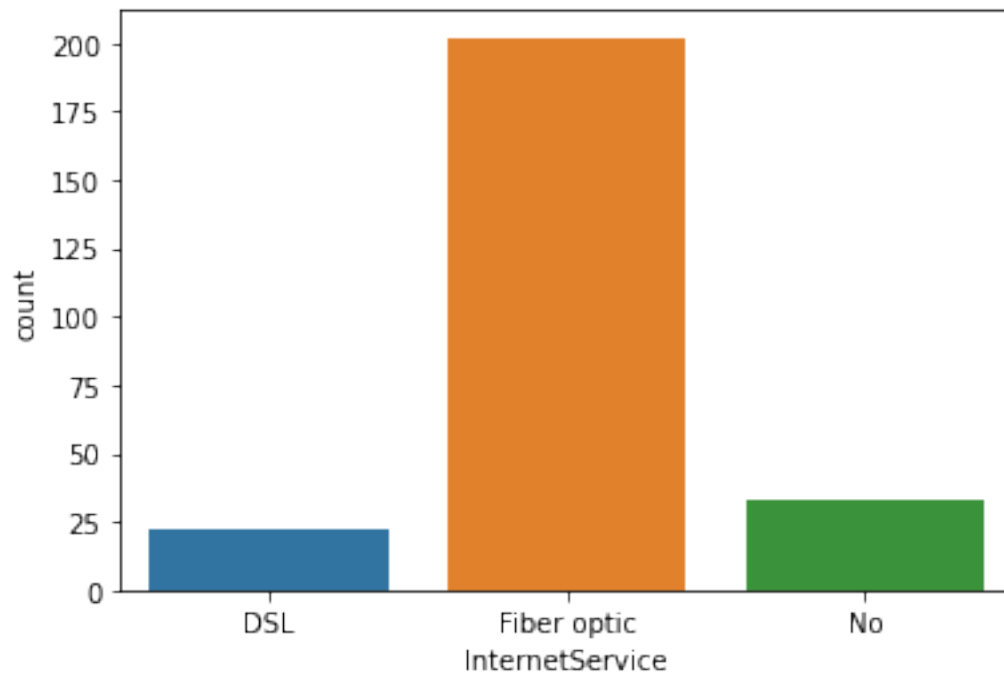

Answer: None of the above

0.0.7 Solution 8

```
[123]: churn2['tenure'].value_counts()
```

```
[123]: One      20
       72       15
       44       11
       2         9
       Four      9
                ..
       30        1
       54        1
       47        1
       994       1
       971       1
       Name: tenure, Length: 71, dtype: int64
```

```
[121]: churn2['tenure'].unique()
```

```
[121]: array(['One', '39', '2', '6', 'Four', '3', '70', '42', '11', '28', '72',
              '38', '64', '30', '49', '10', '57', '16', '54', '69', '25', '71',
```

```
        '17', '21', '65', '51', '62', '9', '13', '44', '8', '68', '971',
        '63', '61', '48', '5', '32', '37', '31', '1008', '46', '36', '18',
        '34', '66', '22', '43', '29', '994', '47', '27', '55', '58', '59',
        '56', '52', '7', '12', '19', '45', '14', '53', '992', '15', '41',
        '40', '969', '67', '964', '50'], dtype=object)
```

[126]:
```python
churn2['tenure'].replace('One',1,inplace=True)
churn2['tenure'].replace('Four',4,inplace=True)
```

[127]:
```python
churn2['tenure'].unique()
```

[127]:
```
array([1, '39', '2', '6', 4, '3', '70', '42', '11', '28', '72', '38',
       '64', '30', '49', '10', '57', '16', '54', '69', '25', '71', '17',
       '21', '65', '51', '62', '9', '13', '44', '8', '68', '971', '63',
       '61', '48', '5', '32', '37', '31', '1008', '46', '36', '18', '34',
       '66', '22', '43', '29', '994', '47', '27', '55', '58', '59', '56',
       '52', '7', '12', '19', '45', '14', '53', '992', '15', '41', '40',
       '969', '67', '964', '50'], dtype=object)
```

[128]:
```python
churn2['tenure']=churn2['tenure'].astype(int)
```

[129]:
```python
churn2['tenure'].unique()
```

[129]:
```
array([   1,   39,    2,    6,    4,    3,   70,   42,   11,   28,   72,
         38,   64,   30,   49,   10,   57,   16,   54,   69,   25,   71,
         17,   21,   65,   51,   62,    9,   13,   44,    8,   68,  971,
         63,   61,   48,    5,   32,   37,   31, 1008,   46,   36,   18,
         34,   66,   22,   43,   29,  994,   47,   27,   55,   58,   59,
         56,   52,    7,   12,   19,   45,   14,   53,  992,   15,   41,
         40,  969,   67,  964,   50])
```

[132]:
```python
plt.figure(figsize=(10,8))
sns.boxplot(y=churn2['tenure'])
```

[132]: <AxesSubplot:ylabel='tenure'>
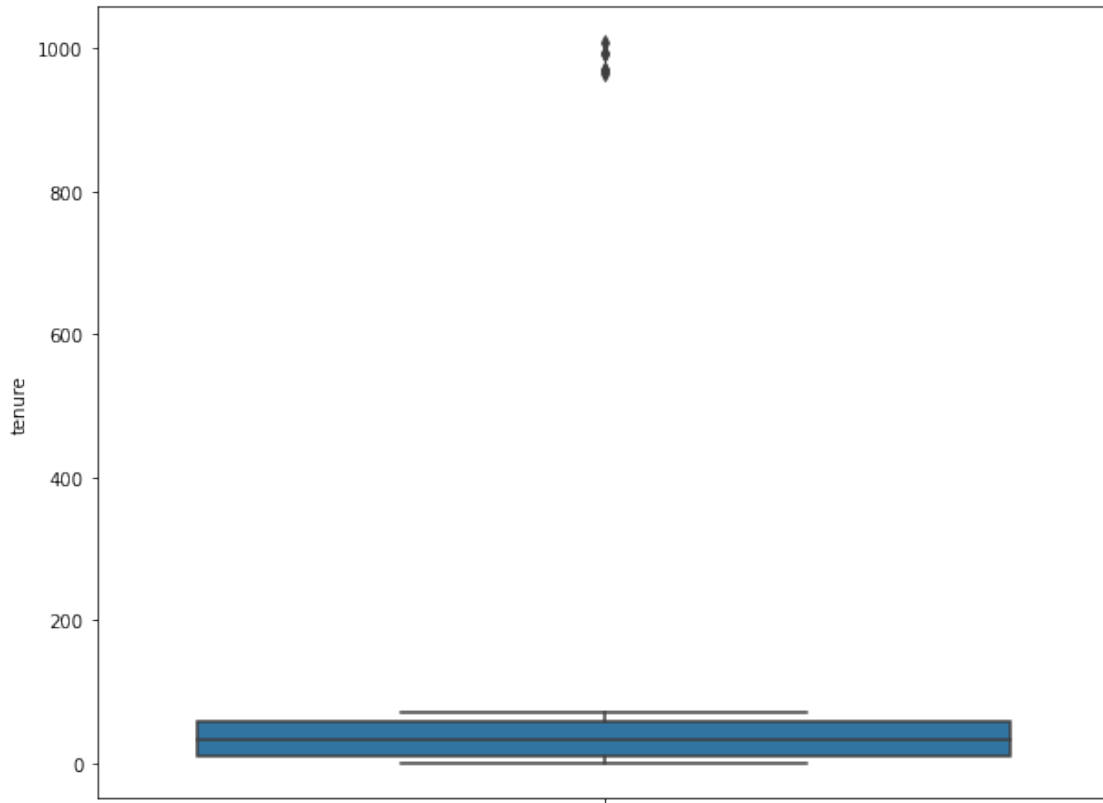
```
[134]: churn2.describe()
```

```
[134]:            tenure  MonthlyCharges  TotalCharges  SeniorCitizen
       count   257.000000      247.000000    242.000000     252.000000
       mean     55.618677       62.473482   2267.953719       0.134921
       std     145.797814       31.126525   2270.876564       0.342319
       min       1.000000        3.500000     18.850000       0.000000
       25%       9.000000       25.700000    450.687500       0.000000
       50%      34.000000       70.300000   1313.025000       0.000000
       75%      58.000000       88.325000   3691.187500       0.000000
       max    1008.000000      115.100000   8337.450000       1.000000
```

Answer: Median, as the Mean is heavily affected due to the outliers.

0.0.8 Solution 9

Answer: churn['SeniorCitizen'].fillna(churn['SeniorCitizen'].mode()[0],inplace = True)

SeniorCitizen is a categorical variable, so we need to use the mode.

0.0.9 Solution 10

```
[167]: yeschurn=churn2[churn2['Churn']=='Yes']
```

```
[168]: nochurn=churn2[churn2['Churn']=='No']
```

```
[169]: yeschurn
```

```
[169]:      customerID  tenure        Contract PaperlessBilling  \
       0     8260-NGFNY       1  Month-to-month               No
       1     2359-QWQUL      39        One year              Yes
       2     6598/RFFVI       2        One year               No
       3     IXSTS-8780       6  Month-to-month              Yes
       7     7547-EKNFS      42  Month-to-month              Yes
       ..           …       …              …                …
       245   4088-YLDSU      55        One year              Yes
       251   4625-EWPTF       8  Month-to-month              Yes
       252   8111-RKSPX       4  Month-to-month              Yes
       254   5192-EBGOV       1  Month-to-month              Yes
       256   9318-NKNFC       1  Month-to-month              Yes

                      PaymentMethod  MonthlyCharges  TotalCharges  gender  \
       0               Mailed check           25.20         25.20  Female
       1      Credit card (automatic)        104.70       4134.85  Female
       2      Credit card (automatic)         19.30         28.30    Male
       3             Electronic check          90.10        521.30  Female
       7      Bank transfer (automatic)        95.25       3959.35    Male
       ..                         …             …             …       …
       245           Electronic check         104.15       5743.05    Male
       251           Electronic check          30.45        226.45    Male
       252    Bank transfer (automatic)        72.20        305.55    Male
       254           Electronic check           NaN         85.70  Female
       256               Mailed check          18.85         18.85    Male

            SeniorCitizen Partner  … PhoneService       MultipleLines  \
       0              0.0      No  …           No  No phone service
       1              0.0     Yes  …          Yes                No
       2              0.0      No  …          Yes                No
       3              0.0      No  …          Yes               Yes
       7              0.0     Yes  …          Yes               Yes
       ..              …       …  …            …                 …
       245            0.0     Yes  …          Yes               Yes
       251            0.0      No  …           No  No phone service
       252            0.0      No  …          Yes               Yes
       254            1.0      No  …          Yes               Yes
       256            0.0      No  …          Yes                No

            InternetService     OnlineSecurity       OnlineBackup  \
```

```
0        DSL                 No                  No
1   Fiber optic                Yes                  No
2        No  No internet service  No internet service
3   Fiber optic                No                 Yes
7   Fiber optic                No                 Yes
..        …                  …                  …
245  Fiber optic                No                  No
251       DSL                Yes                  No
252  Fiber optic                No                  No
254  Fiber optic                No                  No
256        No  No internet service  No internet service

         DeviceProtection          TechSupport          StreamingTV  \
0                   No                  No                  No
1                  Yes                 Yes                 Yes
2   No internet service  No internet service  No internet service
3                   No                  No                 Yes
7                  Yes                  No                 Yes
..                  …                  …                  …
245                 Yes                 Yes                 Yes
251                  No                  No                  No
252                  No                  No                  No
254                  No                  No                 Yes
256  No internet service  No internet service  No internet service

         StreamingMovies Churn
0                   No   Yes
1                  Yes   Yes
2   No internet service   Yes
3                   No   Yes
7                   No   Yes
..                  …     …
245                 Yes   Yes
251                  No   Yes
252                  No   Yes
254                  No   Yes
256  No internet service   Yes

[78 rows x 21 columns]
```

```python
yeschurn['TotalCharges'].fillna(yeschurn['TotalCharges'].mean(), inplace = True)
nochurn['TotalCharges'].fillna(nochurn['TotalCharges'].mean(), inplace = True)

yeschurn['MonthlyCharges'].fillna(yeschurn['MonthlyCharges'].mean(), inplace =
 →True)
nochurn['MonthlyCharges'].fillna(nochurn['MonthlyCharges'].mean(), inplace =
 →True)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\generic.py:6383:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return self._update_inplace(result)
```

[171]: `yeschurn`

[171]:
```
     customerID  tenure        Contract PaperlessBilling  \
0    8260-NGFNY       1  Month-to-month               No
1    2359-QWQUL      39        One year              Yes
2    6598/RFFVI       2        One year               No
3    IXSTS-8780       6  Month-to-month              Yes
7    7547-EKNFS      42  Month-to-month              Yes
..          ...     ...             ...              ...
245  4088-YLDSU      55        One year              Yes
251  4625-EWPTF       8  Month-to-month              Yes
252  8111-RKSPX       4  Month-to-month              Yes
254  5192-EBGOV       1  Month-to-month              Yes
256  9318-NKNFC       1  Month-to-month              Yes

              PaymentMethod  MonthlyCharges  TotalCharges  gender  \
0              Mailed check          25.200         25.20  Female
1     Credit card (automatic)      104.700       4134.85  Female
2     Credit card (automatic)       19.300         28.30    Male
3            Electronic check        90.100        521.30  Female
7     Bank transfer (automatic)      95.250       3959.35    Male
..                        ...           ...           ...     ...
245          Electronic check       104.150       5743.05    Male
251          Electronic check        30.450        226.45    Male
252  Bank transfer (automatic)       72.200        305.55    Male
254          Electronic check        71.436         85.70  Female
256              Mailed check        18.850         18.85    Male

     SeniorCitizen Partner  … PhoneService      MultipleLines  \
0              0.0      No  …           No  No phone service
1              0.0     Yes  …          Yes                No
2              0.0      No  …          Yes                No
3              0.0      No  …          Yes               Yes
7              0.0     Yes  …          Yes               Yes
..             ...     ... …           ...               ...
245            0.0     Yes  …          Yes               Yes
251            0.0      No  …           No  No phone service
252            0.0      No  …          Yes               Yes
254            1.0      No  …          Yes               Yes
```

```
256          0.0     No  …          Yes                 No

       InternetService        OnlineSecurity         OnlineBackup  \
0                  DSL                    No                   No
1            Fiber optic                 Yes                  No
2                   No   No internet service  No internet service
3            Fiber optic                 No                   Yes
7            Fiber optic                 No                   Yes
..                   …                    …                    …
245          Fiber optic                 No                   No
251                 DSL                  Yes                  No
252          Fiber optic                 No                   No
254          Fiber optic                 No                   No
256                 No   No internet service  No internet service

          DeviceProtection           TechSupport           StreamingTV  \
0                      No                    No                    No
1                     Yes                   Yes                   Yes
2      No internet service   No internet service   No internet service
3                      No                    No                   Yes
7                     Yes                    No                   Yes
..                     …                    …                    …
245                   Yes                   Yes                   Yes
251                    No                    No                    No
252                    No                    No                    No
254                    No                    No                   Yes
256    No internet service   No internet service   No internet service

          StreamingMovies Churn
0                      No   Yes
1                     Yes   Yes
2      No internet service   Yes
3                      No   Yes
7                      No   Yes
..                     …    …
245                   Yes   Yes
251                    No   Yes
252                    No   Yes
254                    No   Yes
256    No internet service   Yes

[78 rows x 21 columns]
```

[173]: nochurn

[173]:   customerID tenure   Contract PaperlessBilling \
      4   2674/MIAHT   4 Month-to-month   Yes

```
5    6077-BDPXA     3  Month-to-month              Yes
6    7929/SKFGK    70        Two year              No
8    5854-KSRBJ    70        Two year              No
10   1877-HKBQX    11        One year              Yes
..          …     …               …                …
248  3845-FXCYS     2  Month-to-month              Yes
249  7690-KPNCU    64        One year              Yes
250  2589-AYCRP    50        One year              No
253  6922-NCEDI    56        One year              Yes
255  8495-PRWFH    42  Month-to-month              No

                 PaymentMethod  MonthlyCharges  TotalCharges  gender  \
4                  Mailed check           80.30        324.20  Female
5             Electronic check           70.15        194.20  Female
6       Credit card (automatic)         114.30       8244.30    Male
8                  Mailed check           25.40       1782.05    Male
10                 Mailed check           54.60        617.85  Female
..                          …              …             …       …
248           Electronic check           19.65         31.20    Male
249      Credit card (automatic)          73.05       4688.65    Male
250   Bank transfer (automatic)           19.75        989.05  Female
253                Mailed check           21.20       1238.65    Male
255           Electronic check           55.65       2421.75  Female

     SeniorCitizen Partner  … PhoneService MultipleLines InternetService  \
4              0.0      No  …          Yes           Yes     Fiber optic
5              0.0      No  …          Yes            No     Fiber optic
6              0.0     Yes  …          Yes           Yes     Fiber optic
8              0.0     Yes  …          Yes           Yes              No
10             0.0      No  …          Yes            No             DSL
..              …       …  …           …             …               …
248            0.0      No  …          Yes            No              No
249            0.0     Yes  …          Yes            No             DSL
250            0.0      No  …          Yes            No              No
253            0.0      No  …          Yes            No              No
255            1.0      No  …          Yes           Yes             DSL

            OnlineSecurity         OnlineBackup      DeviceProtection  \
4                       No                  Yes                    No
5                       No                   No                    No
6                      Yes                  Yes                   Yes
8       No internet service  No internet service  No internet service
10                     Yes                   No                    No
..                       …                    …                     …
248     No internet service  No internet service  No internet service
249                    Yes                   No                   Yes
250     No internet service  No internet service  No internet service
```

```
253   No internet service  No internet service  No internet service
255                    No                   No                  Yes

             TechSupport           StreamingTV       StreamingMovies Churn
4                     No                   No                   No    No
5                     No                   No                   No    No
6                    Yes                  Yes                  Yes    No
8      No internet service  No internet service  No internet service    No
10                   Yes                   No                   No    No
..                   ...                  ...                  ...   ...
248    No internet service  No internet service  No internet service    No
249                   No                  Yes                  Yes    No
250    No internet service  No internet service  No internet service    No
253    No internet service  No internet service  No internet service    No
255                   No                   No                   No    No

[179 rows x 21 columns]
```

[193]:
```python
(len(yeschurn['MonthlyCharges'])*yeschurn['MonthlyCharges'].
 mean()+len(nochurn['MonthlyCharges'])*nochurn['MonthlyCharges'].mean())/
 (len(nochurn['MonthlyCharges'])+len(yeschurn['MonthlyCharges']))
```

[193]: 62.47165699936657

[194]:
```python
(len(yeschurn['TotalCharges'])*yeschurn['TotalCharges'].
 mean()+len(nochurn['TotalCharges'])*nochurn['TotalCharges'].mean())/
 (len(nochurn['TotalCharges'])+len(yeschurn['TotalCharges']))
```

[194]: 2275.439863370537

Answer: 2275.439, 62.471