Descriptive Statistics - Assignment by P.Pallavi

July 16, 2022

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sn
```

[2]:
```
#sn.get_dataset_names()
```

[3]:
```
#Assignment (submit by 20th Feb 2022)

# Make use of EDA to comment on the values of each feature (visualization)
# Use both outlier detection methods
# Provide your analysis about the outliers obtained
# Did you observe any difference in the two methods of outliers?

# Share your responses in the same file as comments (so that it is␣
↪understandable)

# Download the JN as pdf and share in the below link:

# https://drive.google.com/drive/folders/13kfcc4biDHxx576UU8bvMTAJotPF3MNr?
↪usp=sharing
```

[4]:
```
df = sn.load_dataset('tips')
df
```

[4]:
```
     total_bill   tip     sex smoker   day    time  size
0         16.99  1.01  Female     No   Sun  Dinner     2
1         10.34  1.66    Male     No   Sun  Dinner     3
2         21.01  3.50    Male     No   Sun  Dinner     3
3         23.68  3.31    Male     No   Sun  Dinner     2
4         24.59  3.61  Female     No   Sun  Dinner     4
..          …     …       …      …     …       …     …
239       29.03  5.92    Male     No   Sat  Dinner     3
240       27.18  2.00  Female    Yes   Sat  Dinner     2
241       22.67  2.00    Male    Yes   Sat  Dinner     2
242       17.82  1.75    Male     No   Sat  Dinner     2
```

```
243        18.78  3.00  Female     No  Thur  Dinner     2

[244 rows x 7 columns]
```

[5]:
```
df.info()
```

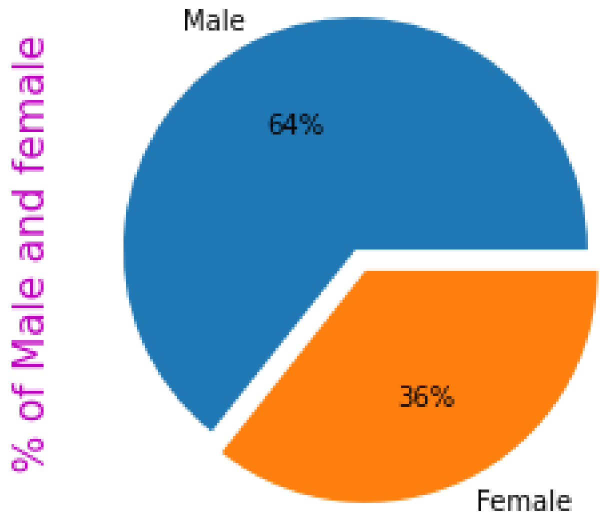
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 244 entries, 0 to 243
Data columns (total 7 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   total_bill  244 non-null    float64
 1   tip         244 non-null    float64
 2   sex         244 non-null    category
 3   smoker      244 non-null    category
 4   day         244 non-null    category
 5   time        244 non-null    category
 6   size        244 non-null    int64
dtypes: category(4), float64(2), int64(1)
memory usage: 7.4 KB
```

[6]:
```
df.to_csv("tips.csv")
```

[7]:
```
# The no.of males in the dataset are more than the no.of females in the dataset
gender_count =  df["sex"].value_counts()
gender_count[0]
print(" The no. of males in dataset = {} and no.of females in dateset = {}".
 ↪format(gender_count[0],gender_count[1]))
ax = (df["sex"].value_counts()).plot.pie(explode=[0,0.1],␣
 ↪labels=['Male',"Female"],autopct='%.0f%%')
ax.set_ylabel(" % of Male and female ", fontsize = 15, c = 'm')
```

```
 The no. of males in dataset = 157 and no.of females in dateset = 87
```

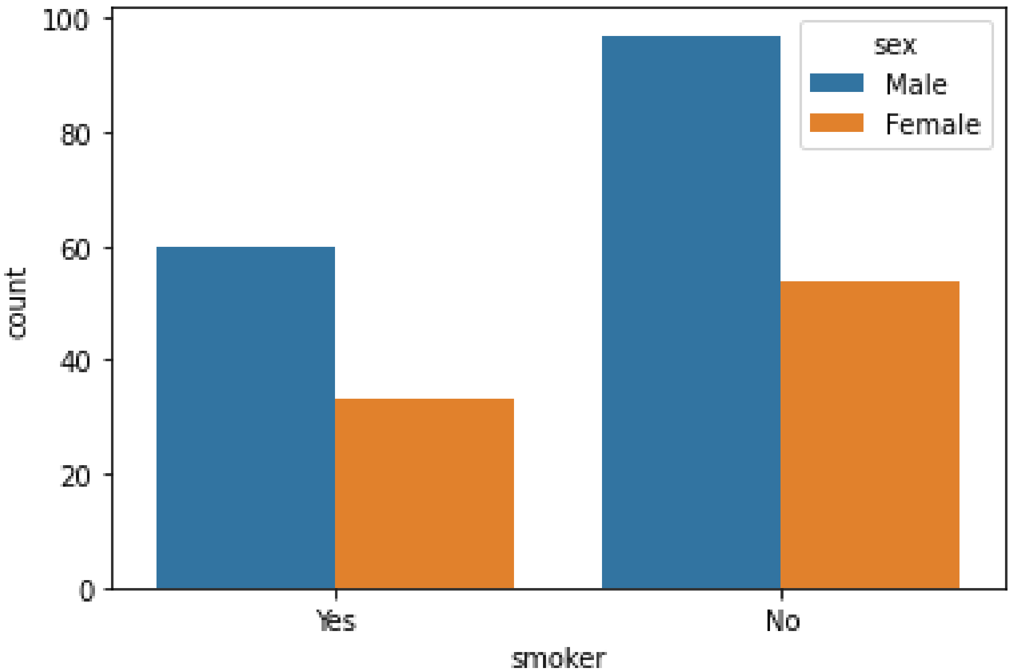
[7]:
```
Text(0, 0.5, ' % of Male and female ')
```



[8]:
```
# The no. of smokers in the dataset are less than the no.of non-smokers.
sn.countplot(df["smoker"], hue = df['sex'])
```

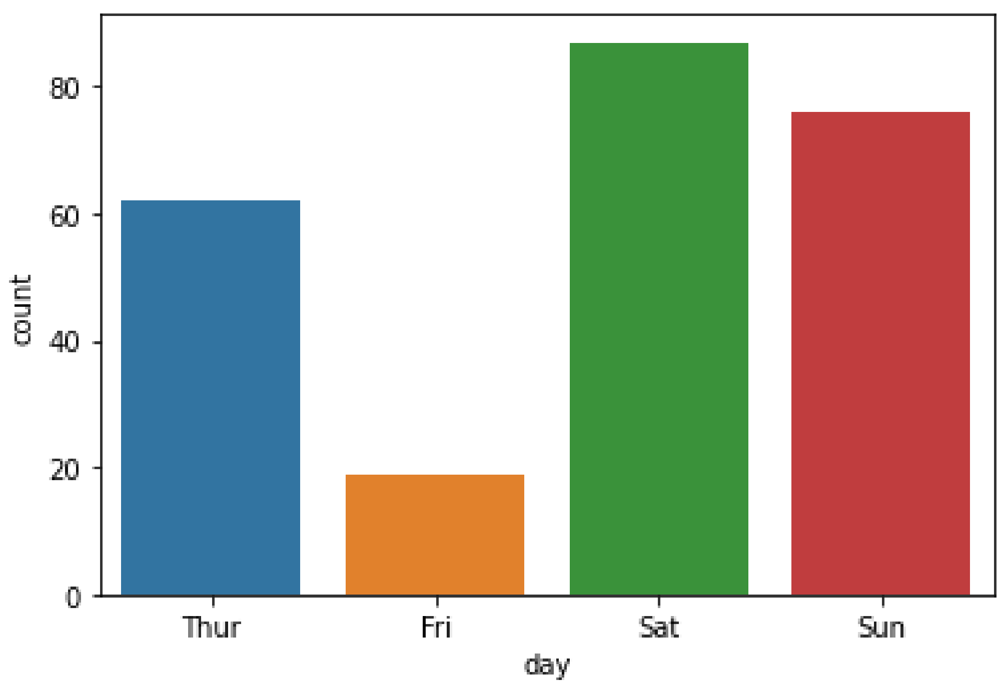
```
C:\Users\barun\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variable as a keyword arg: x. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

[8]:
```
<AxesSubplot:xlabel='smoker', ylabel='count'>
```



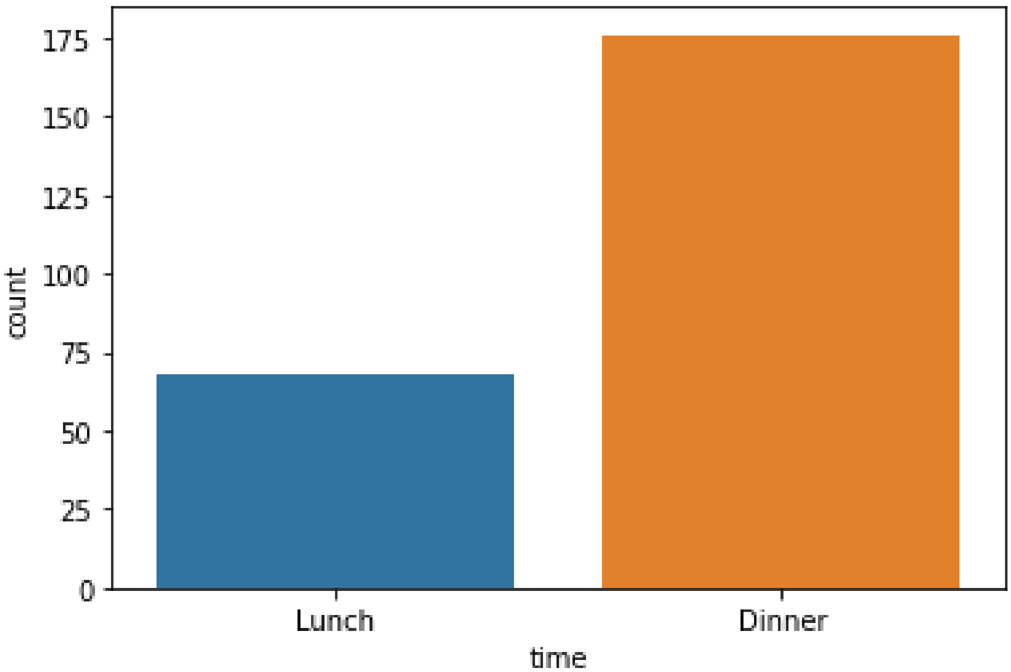
[9]:
```
# The customers in the dataset prefer to dinein on weekends
sn.countplot(df["day"])
```

[9]: <AxesSubplot:xlabel='day', ylabel='count'>



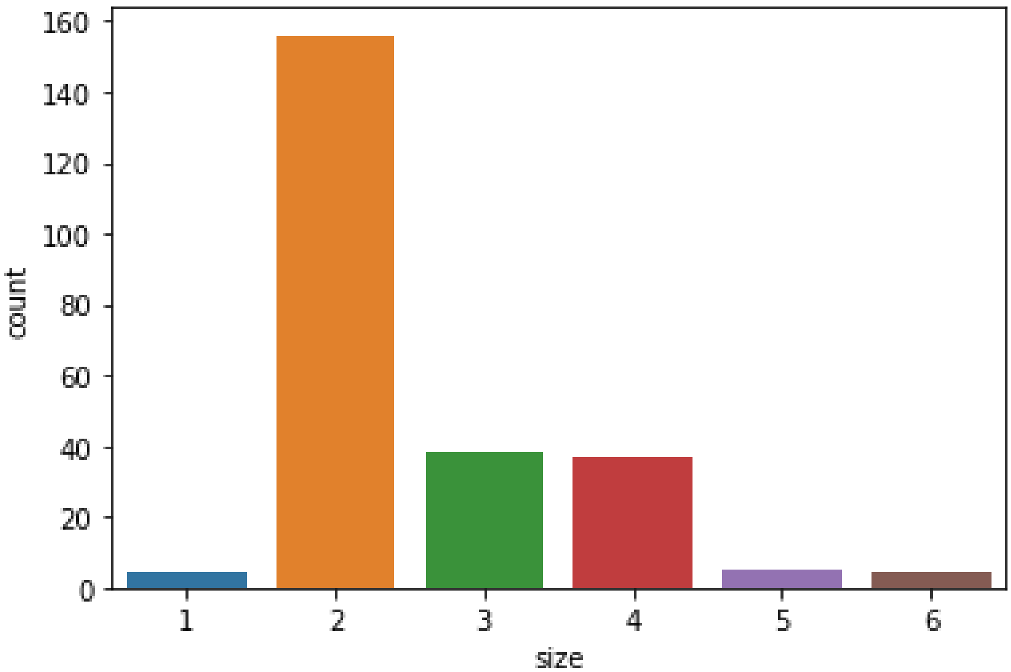
[10]:
```
# The customers in the dataset prefer to dinein for dinner than lunch.
sn.countplot(df["time"])
```

[10]:
```
<AxesSubplot:xlabel='time', ylabel='count'>
```



[11]:
```
sn.countplot(df["size"])
```

[11]:
```
<AxesSubplot:xlabel='size', ylabel='count'>
```



[12]:
```
df.describe(include = 'all')
```

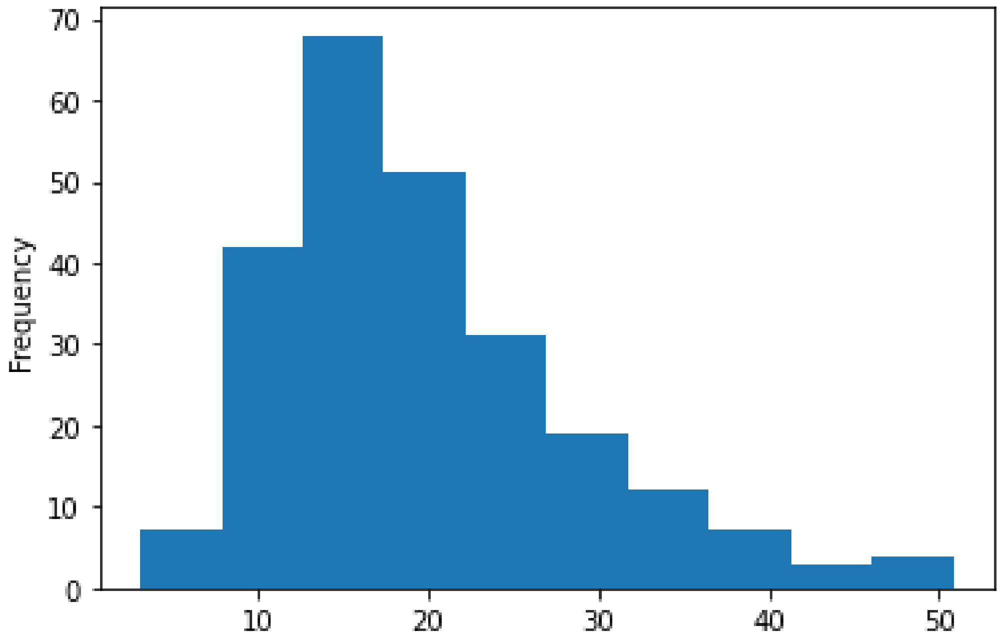
[12]:

	total_bill	tip	sex	smoker	day	time	size
count	244.000000	244.000000	244	244	244	244	244.000000
unique	NaN	NaN	2	2	4	2	NaN
top	NaN	NaN	Male	No	Sat	Dinner	NaN
freq	NaN	NaN	157	151	87	176	NaN
mean	19.785943	2.998279	NaN	NaN	NaN	NaN	2.569672
std	8.902412	1.383638	NaN	NaN	NaN	NaN	0.951100
min	3.070000	1.000000	NaN	NaN	NaN	NaN	1.000000
25%	13.347500	2.000000	NaN	NaN	NaN	NaN	2.000000
50%	17.795000	2.900000	NaN	NaN	NaN	NaN	2.000000
75%	24.127500	3.562500	NaN	NaN	NaN	NaN	3.000000
max	50.810000	10.000000	NaN	NaN	NaN	NaN	6.000000

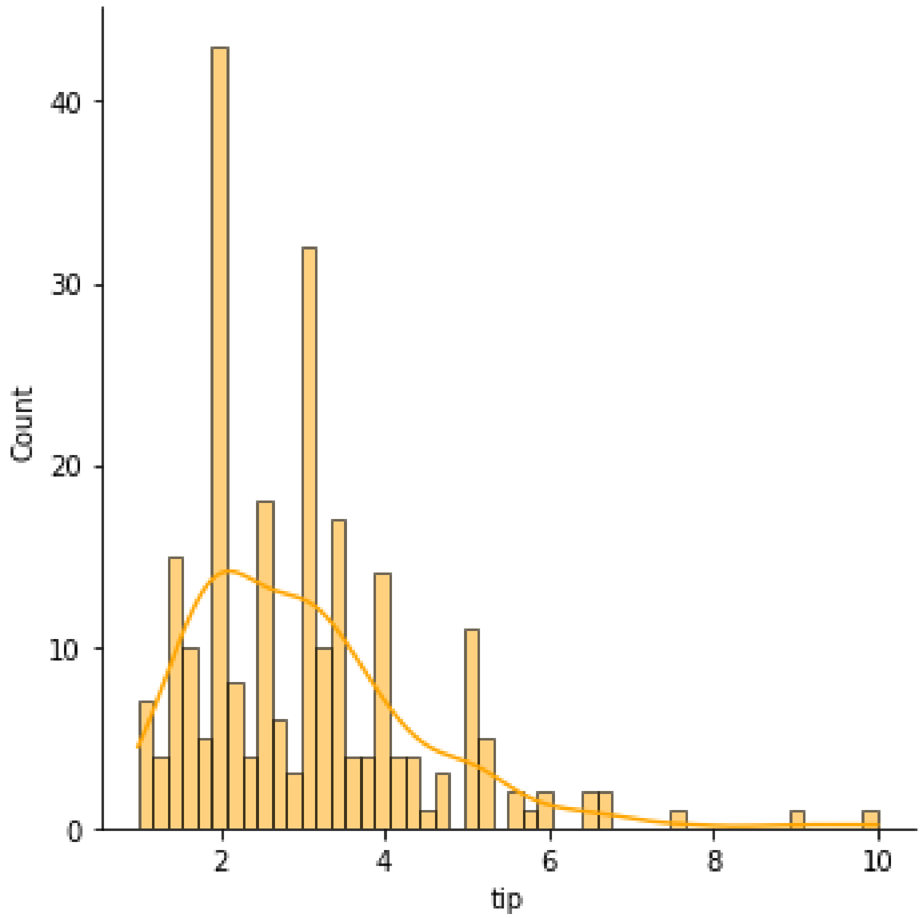
0.0.1 Data Visualization

[13]:
```
# From the plot, it is observed that data in total_bill feature is slightly␣
↪right skewed.
#hist = sn.displot(df['total_bill'], kde=True, bins=50 ,color = "orange")
df["total_bill"].plot(kind = 'hist')
```

[13]: <AxesSubplot:ylabel='Frequency'>



[14]:
```
# From the plot, it is observed that data in tip feature is  right skewed.
hist = sn.displot(df['tip'], kde=True, bins=50 ,color = "orange")
```



0.0.2 Detection of outliers using various methods

[18]:
```
#. 1. Detection of outliers using sort method. Here sort method is used to find␣
↪the outliers in the total_bill feature but
# unable to depict clearly the exact boundaries which are to be considered as␣
↪outliers.
```

[19]:
```
df.sort_values("total_bill", ascending=True, inplace=False)
```

[19]:
```
     total_bill   tip     sex smoker   day    time  size
67         3.07  1.00  Female    Yes   Sat  Dinner     1
92         5.75  1.00  Female    Yes   Fri  Dinner     2
111        7.25  1.00  Female     No   Sat  Dinner     1
172        7.25  5.15    Male    Yes   Sun  Dinner     2
149        7.51  2.00    Male     No  Thur   Lunch     2
..          …     …       …      …     …       …     …
182       45.35  3.50    Male    Yes   Sun  Dinner     3
156       48.17  5.00    Male     No   Sun  Dinner     6
```

```
59          48.27   6.73    Male      No   Sat  Dinner     4
212         48.33   9.00    Male      No   Sat  Dinner     4
170         50.81  10.00    Male     Yes   Sat  Dinner     3

[244 rows x 7 columns]
```

[20]:
```
df.sort_values("tip", ascending=True, inplace=False)
```

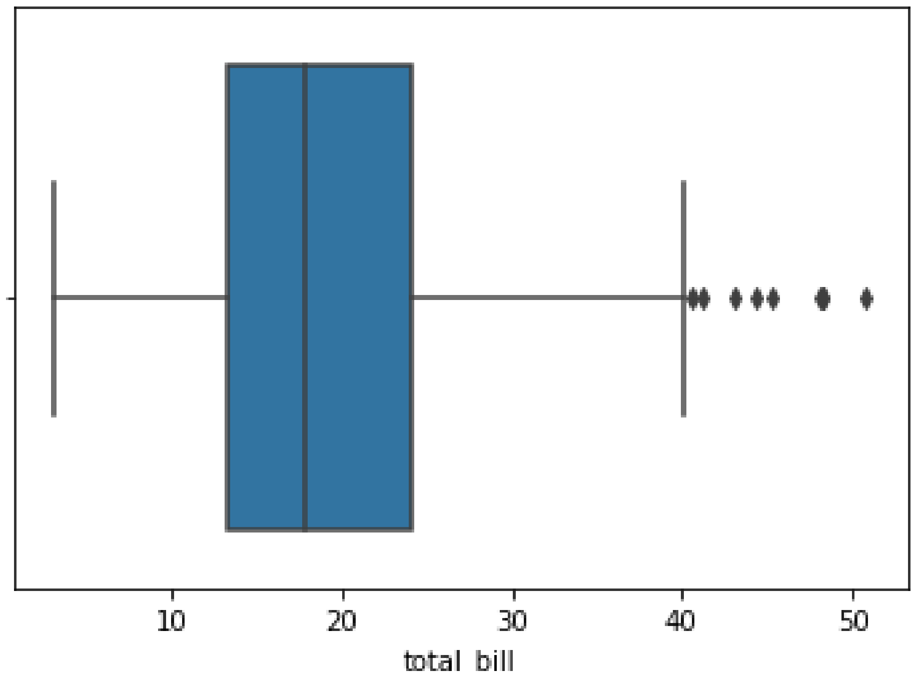
[20]:
```
     total_bill    tip     sex smoker   day    time  size
67         3.07   1.00  Female    Yes   Sat  Dinner     1
236       12.60   1.00    Male    Yes   Sat  Dinner     2
92         5.75   1.00  Female    Yes   Fri  Dinner     2
111        7.25   1.00  Female     No   Sat  Dinner     1
0         16.99   1.01  Female     No   Sun  Dinner     2
..          …      …      …      …     …      …    …
141       34.30   6.70    Male     No  Thur   Lunch     6
59        48.27   6.73    Male     No   Sat  Dinner     4
23        39.42   7.58    Male     No   Sat  Dinner     4
212       48.33   9.00    Male     No   Sat  Dinner     4
170       50.81  10.00    Male    Yes   Sat  Dinner     3

[244 rows x 7 columns]
```

[21]:
```
# 2. Detection of outliers using boxplot and scatterplot. From the boxplot, it␣
↪is clearly visible that outliers can be
# found easily. From the scatter plot too, we can identify the outliers present␣
↪in the dataset but boxplot is easy to
# to understand.
```

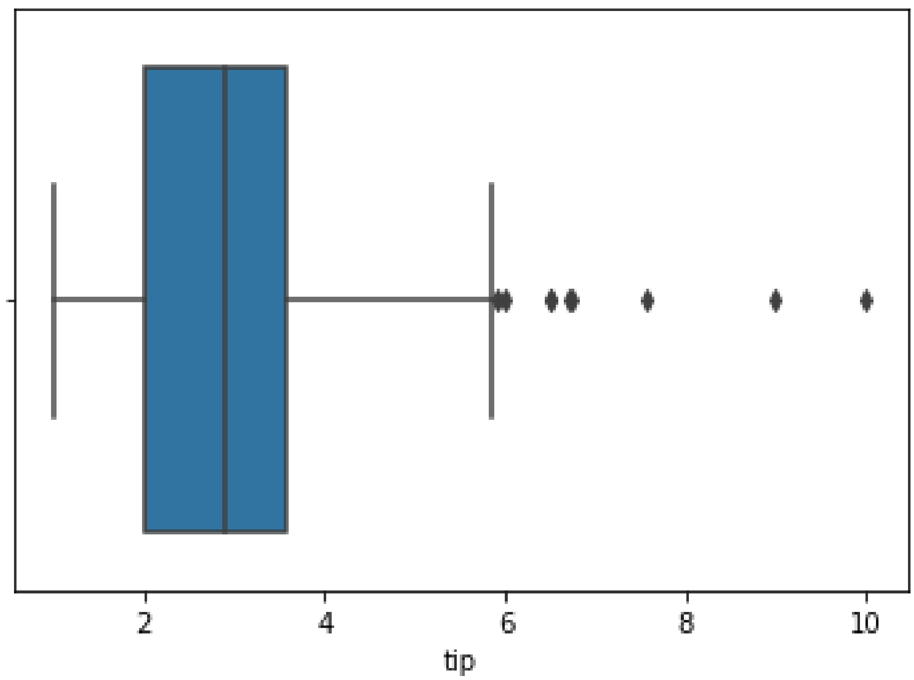
[22]:
```
sn.boxplot(x = df["total_bill"])
```

[22]: <AxesSubplot:xlabel='total_bill'>



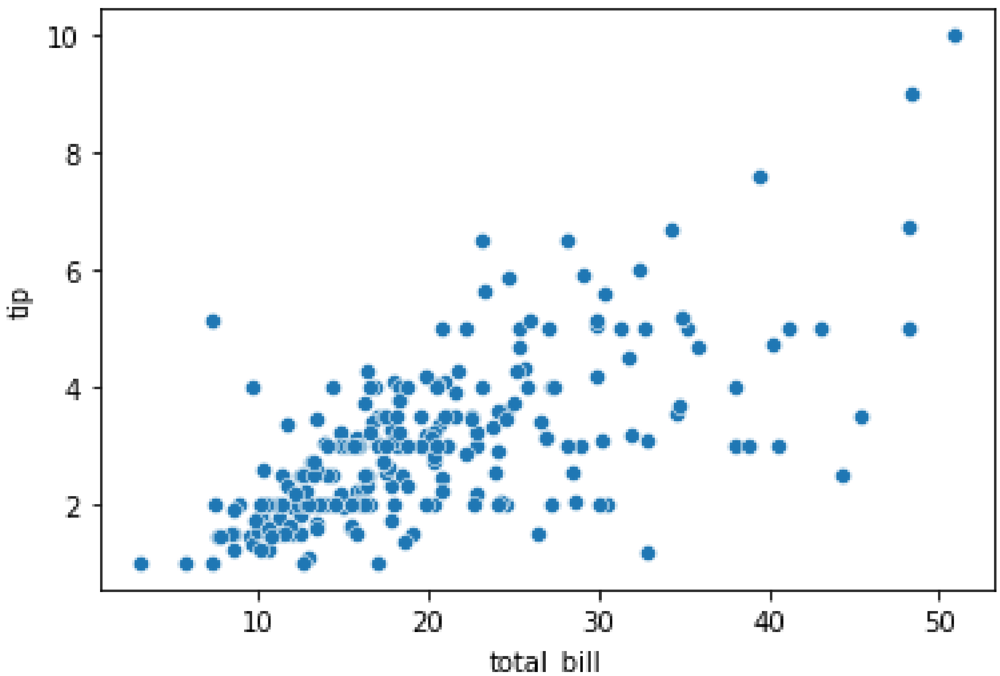
[23]:
```
sn.boxplot(x = df["tip"])
```

[23]: <AxesSubplot:xlabel='tip'>



[24]:
```
sn.scatterplot( x = df["total_bill"] , y = df['tip'])
```

[24]: <AxesSubplot:xlabel='total_bill', ylabel='tip'>



[25]:
```
#3. Dectection of outliers using IQR method.
# From the above, it is observed that data in total_bill and tip features are␣
↪right-skewed. with the help of IQR method, the
# outliers in the data are found.
```

[26]:
```
list_column = ["total_bill","tip"]
for col in list_column:
    print(" Outliers in {} feature of dataset using IQR method :".format(col))
    sort_data = np.sort(df[col])
    Q1 = np.percentile(df[col], 25, interpolation = 'midpoint')
    Q2 = np.percentile(df[col], 50, interpolation = 'midpoint')
    Q3 = np.percentile(df[col], 75, interpolation = 'midpoint')
    IQR = Q3-Q1
    print(' 25 percentile of the given data is {:.3f} '.format(Q1))
    print(' 50 percentile of the given data is {:.3f} '.format(Q2))
    print(' 75 percentile of the given data is {:.3f} '.format(Q3))
    print(" Inter Quartile range is : {:.3f}" .format(IQR))
    lower_limit = Q1 - 1.5*(IQR)
    upper_limit = Q3 + 1.5*(IQR)
```

```
    print(" Lower limit is {:.3f} ".format(lower_limit))
    print(" upper limit is {:.3f} ".format(upper_limit))
    outlier_IQR = []
    for i in df[col]:
        if i < lower_limit or i > upper_limit:
            outlier_IQR.append(i)
    outlier_IQR.sort()
    print(" The outliers in the feature using IQR method:  ", outlier_IQR,"\n")
```

```
 Outliers in total_bill feature of dataset using IQR method :
 25 percentile of the given data is 13.325
 50 percentile of the given data is 17.795
 75 percentile of the given data is 24.175
 Inter Quartile range is : 10.850
 Lower limit is -2.950
 upper limit is 40.450
 The outliers in the feature using IQR method:   [40.55, 41.19, 43.11, 44.3,
45.35, 48.17, 48.27, 48.33, 50.81]

 Outliers in tip feature of dataset using IQR method :
 25 percentile of the given data is 2.000
 50 percentile of the given data is 2.900
 75 percentile of the given data is 3.575
 Inter Quartile range is : 1.575
 Lower limit is -0.363
 upper limit is 5.938
 The outliers in the feature using IQR method:   [6.0, 6.5, 6.5, 6.7, 6.73,
7.58, 9.0, 10.0]
```

[27]:

```
#4. Detection of outliers using Z-score method.
# with Z-Score method, the outliers in the dataset are found.
```

[28]:

```
list_column = ["total_bill","tip"]
for col in list_column:
    print("Outliers in {} feature of dataset using Z-score method :".
 ↪format(col))
    mean = np.mean(df[col])
    std = np.std(df[col])
    print('mean of the dataset is {:.3f}'.format(mean))
    print('std. deviation is {:.3f}'.format(std))
    outlier_Z = []
    for i in df[col]:
        z = (i - mean)/std
        if  z<-3 or z > 3:
            outlier_Z.append(i)
        outlier_Z.sort()
```

```
    print("The outliers in the feature using Z-score method :", outlier_Z,"\n")
```

```
Outliers in total_bill feature of dataset using Z-score method :
mean of the dataset is 19.786
std. deviation is 8.884
The outliers in the feature using Z-score method : [48.17, 48.27, 48.33, 50.81]

Outliers in tip feature of dataset using Z-score method :
mean of the dataset is 2.998
std. deviation is 1.381
The outliers in the feature using Z-score method : [7.58, 9.0, 10.0]
```

[29]:
```
# Inorder to evaluate the best method to find outliers, choosing only␣
↪total_bill feature for evaluation
sort_data = np.sort(df["total_bill"])
Q1 = np.percentile(df["total_bill"], 25, interpolation = 'midpoint')
Q2 = np.percentile(df["total_bill"], 50, interpolation = 'midpoint')
Q3 = np.percentile(df["total_bill"], 75, interpolation = 'midpoint')
IQR = Q3-Q1
print(" The outliers in total_bill feature :")
print(' 25 percentile of the given data is {:.3f} '.format(Q1))
print(' 50 percentile of the given data is {:.3f} '.format(Q2))
print(' 75 percentile of the given data is {:.3f} '.format(Q3))
print(" Inter Quartile range is : {:.3f}" .format(IQR))
lower_limit = Q1 - 1.5*(IQR)
upper_limit = Q3 + 1.5*(IQR)
print(" Lower limit is {:.3f} ".format(lower_limit))
print(" upper limit is {:.3f} ".format(upper_limit))
outlier_IQR = []
for i in df["total_bill"]:
    if i < lower_limit or i > upper_limit:
        outlier_IQR.append(i)
outlier_IQR.sort()
print(" The outliers in the feature using IQR method: ", outlier_IQR)
```

```
 The outliers in total_bill feature :
 25 percentile of the given data is 13.325
 50 percentile of the given data is 17.795
 75 percentile of the given data is 24.175
 Inter Quartile range is : 10.850
 Lower limit is -2.950
 upper limit is 40.450
 The outliers in the feature using IQR method:  [40.55, 41.19, 43.11, 44.3,
45.35, 48.17, 48.27, 48.33, 50.81]
```

[30]:
```
# Creating a dataframe df_IQR removing the outliers obtained by IQR method in␣
↪the dataset
df_IQR = df[(df["total_bill"] <= upper_limit) & (df['total_bill'] >=␣
↪lower_limit)]
df_IQR.count()
```

[30]:
```
total_bill    235
tip           235
sex           235
smoker        235
day           235
time          235
size          235
dtype: int64
```

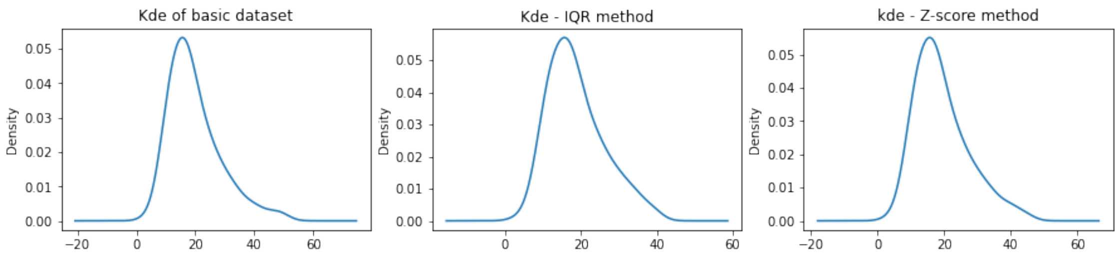
[31]:
```
# Creating a dataframe df_Z removing the outliers obtained by Z-score method in␣
↪the dataset
df["Z-score"] = (df["total_bill"]-df["total_bill"].mean())/df["total_bill"].
↪std()
df_Z  = df[(df["Z-score"] > -3)  & (df["Z-score"] < 3)]
df_Z.count()
```

[31]:
```
total_bill    240
tip           240
sex           240
smoker        240
day           240
time          240
size          240
Z-score       240
dtype: int64
```

[32]:
```
# Plotted kde plots for feature total_bill, total_bill after removing outliers␣
↪using IQR method, total_bill after removing out
#-liers using Z_Score method.
plt.figure(figsize=(15,10))
plt.subplot(3,3,1)
df["total_bill"].plot(kind = 'kde', title ="Kde of basic dataset")
plt.subplot(3,3,2)
df_IQR["total_bill"].plot(kind = 'kde',title="Kde - IQR method")
plt.subplot(3,3,3)
df_Z["total_bill"].plot(kind = 'kde',title ="kde - Z-score method")
print("Basic dataset - skewness :{:.3f}, kurtosis:{:.3f} ".
↪format(df["total_bill"].skew(),df["total_bill"].kurt()))
print("Using IQR method - skewness :{:.3f}, kurtosis:{:.3f} ".
↪format(df_IQR["total_bill"].skew(),df_IQR["total_bill"].kurt()))
```

```
print("Using Z-score method - skewness :{:.3f}, kurtosis:{:.3f} ".
    ↪format(df_Z["total_bill"].skew(),df_Z["total_bill"].kurt()))
```

```
Basic dataset - skewness :1.133, kurtosis:1.218
Using IQR method - skewness :0.726, kurtosis:0.051
Using Z-score method - skewness :0.915, kurtosis:0.536
```



[33]:
```
# From the EDA, from finding outliers using various methods to Kde plots, it is␣
    ↪observed that boxplot and IQR methods are best
# suitable for finding outliers if the data is skewed. It is also observed␣
    ↪that, since Z-score method is preferable for normal
# distribution, applying the z-score method to skewed data led to account some␣
    ↪of the outliers into valid dataset. This led to
# high skewness and kurtosis. IQR method gives the best outliers than Z-score␣
    ↪which can be seen from above values of skewness
# and kurtosis which are low.
```

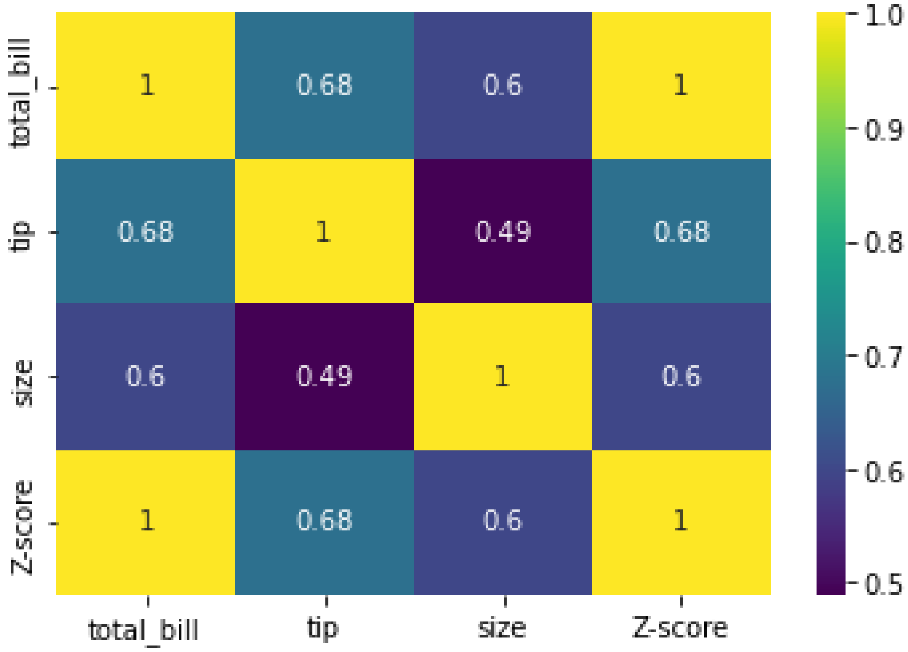
[34]:
```
# to find the relation between the features
df.corr()
```

[34]:

	total_bill	tip	size	Z-score
total_bill	1.000000	0.675734	0.598315	1.000000
tip	0.675734	1.000000	0.489299	0.675734
size	0.598315	0.489299	1.000000	0.598315
Z-score	1.000000	0.675734	0.598315	1.000000

[35]:
```
#. From the heatmap, it can be concluded that total_bill and tip features in␣
    ↪the dataset are postively correlated and
#  the value of correlation coefficient is 0.68
sn.heatmap(df.corr(), annot = True, cmap = 'viridis')
```

[35]: <AxesSubplot:>



total_bill
tip
size
Z-score
1
0.68
0.6
1
0.68
1
0.49
0.68
0.6
0.49
1
0.6
1
0.68
0.6
1
total_bill
tip
size
Z-score
1.0
0.9
0.8
0.7
0.6
0.5


```
[ ]:
```

```
[ ]:
```