Importing Libraries:

```
import pandas as pd
import numpy as np
import seaborn as sbs
sbs.set(style="darkgrid")
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error,r2_score
```

Importing Dataset:

```
file=pd.read_csv("train.csv")
file.head()
```

	ID	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	black
0	1	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90
1	2	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90
2	4	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63
3	5	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90
4	7	0.08829	12.5	7.87	0	0.524	6.012	66.6	5.5605	5	311	15.2	395.60

Checking Columns:

```
file.columns
```

```
Index(['ID', 'crim', 'zn', 'indus', 'chas', 'nox', 'rm', 'age', 'dis', 'rad',
       'tax', 'ptratio', 'black', 'lstat', 'medv'],
      dtype='object')
```

Columns Data-Types:

```
file.dtypes
```

```
ID           int64
crim       float64
```

```
zn          float64
indus       float64
chas          int64
nox         float64
rm          float64
age         float64
dis         float64
rad           int64
tax           int64
ptratio     float64
black       float64
lstat       float64
medv        float64
dtype: object
```

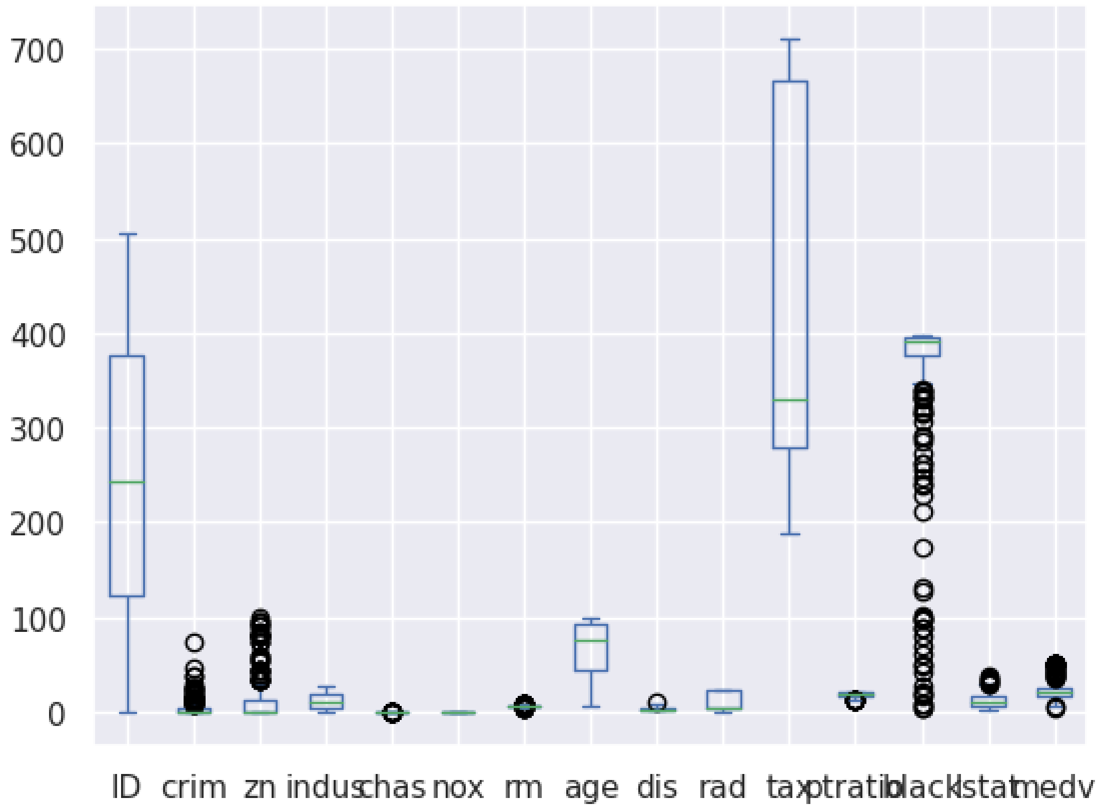
Checking Null-Values:

```
file.isnull().sum()
FILE=file.drop_duplicates()
```

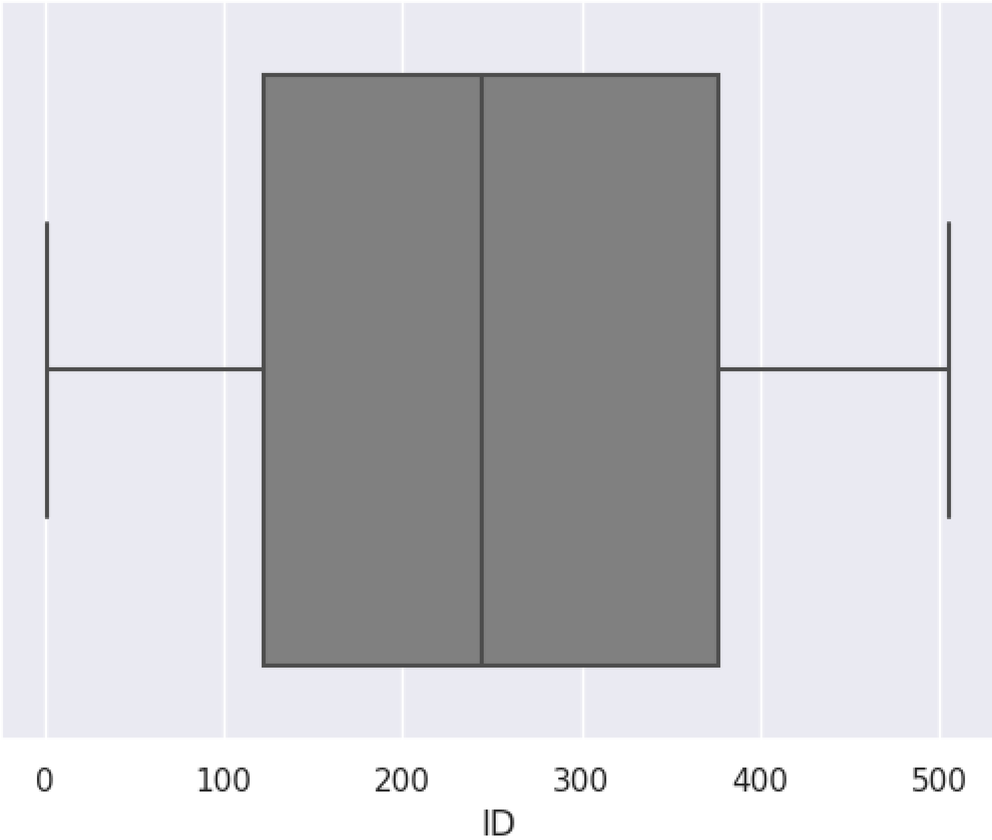
Visualizing Columns:

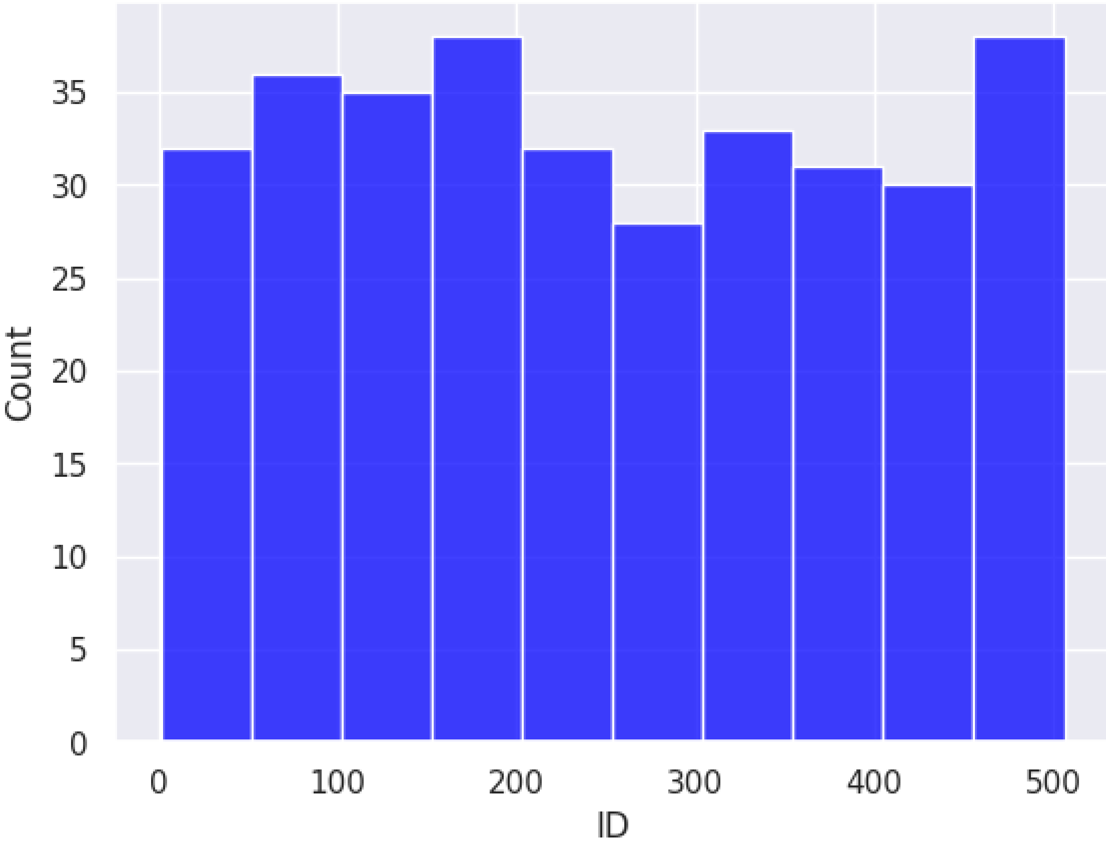
```
FILE.plot.box(grid=True)
```

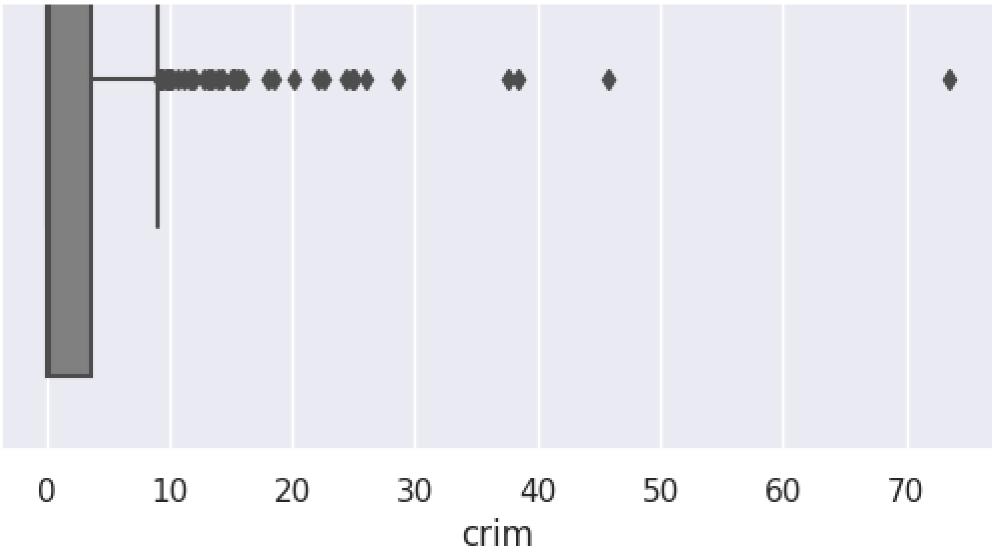
```
<Axes: >
```

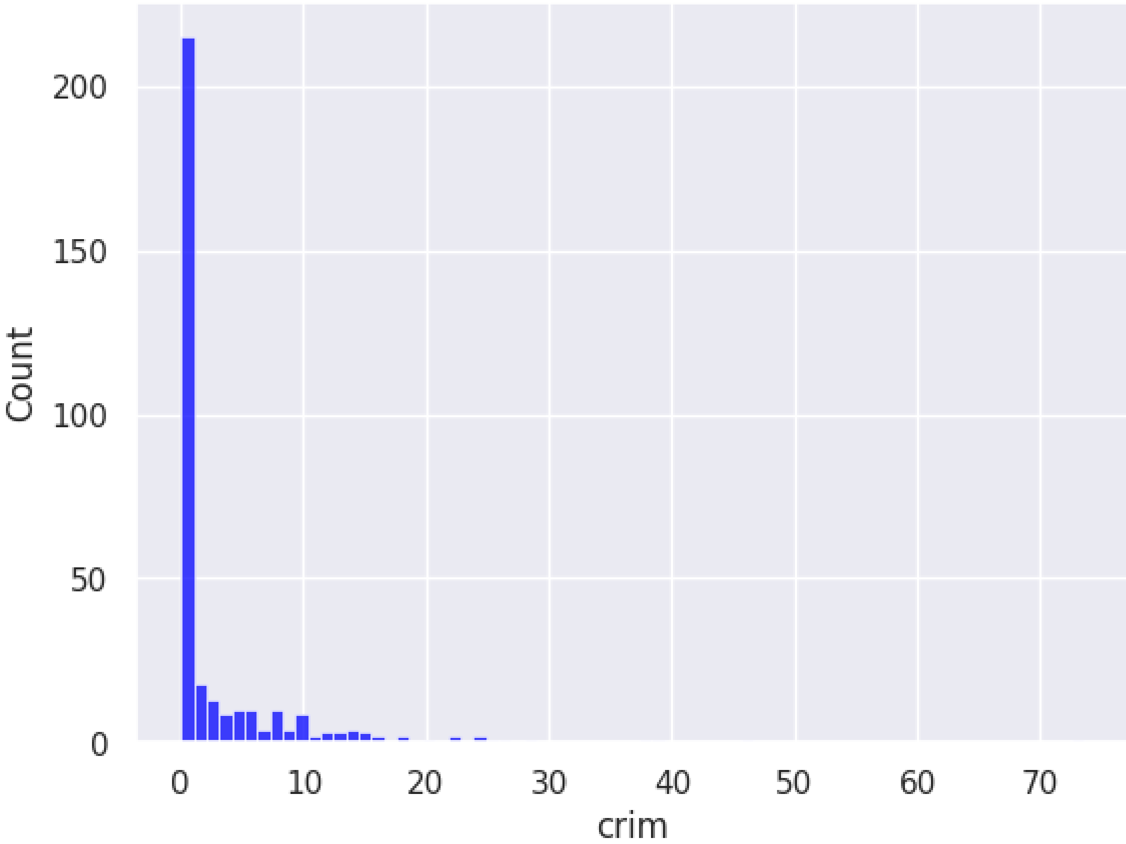


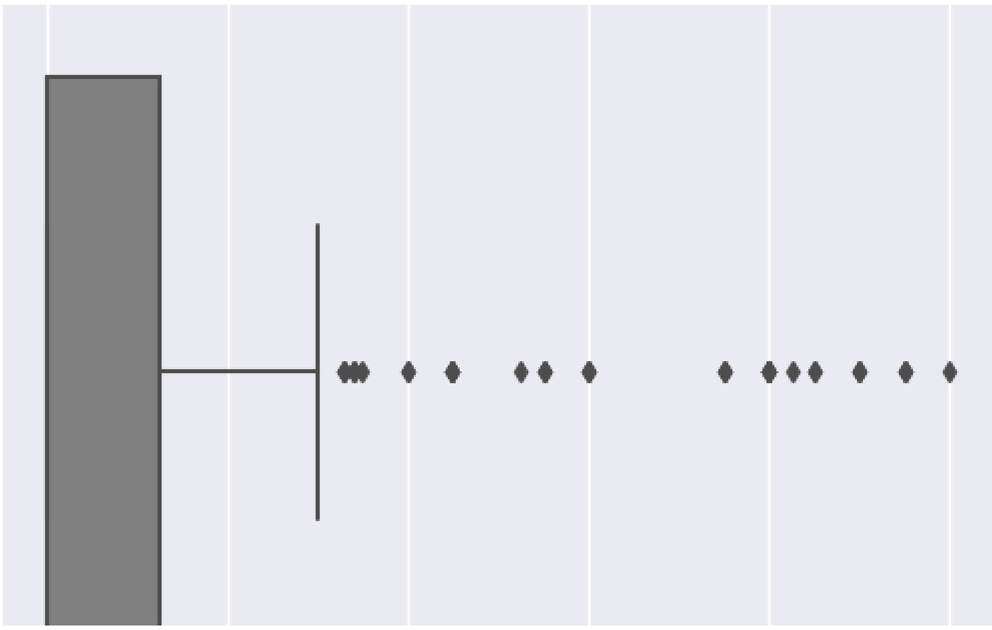
```
for columns in FILE.columns:
  sbs.boxplot(data=FILE,x=columns,color="grey")
  plt.show()
  sbs.histplot(data=FILE,x=columns,color="blue")
  plt.show()
```

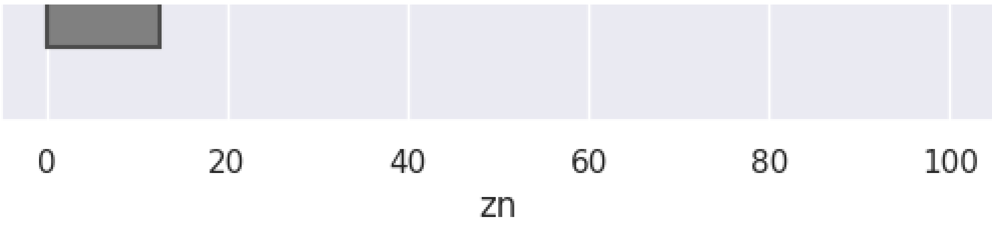

0
100
200
300
400
500
ID

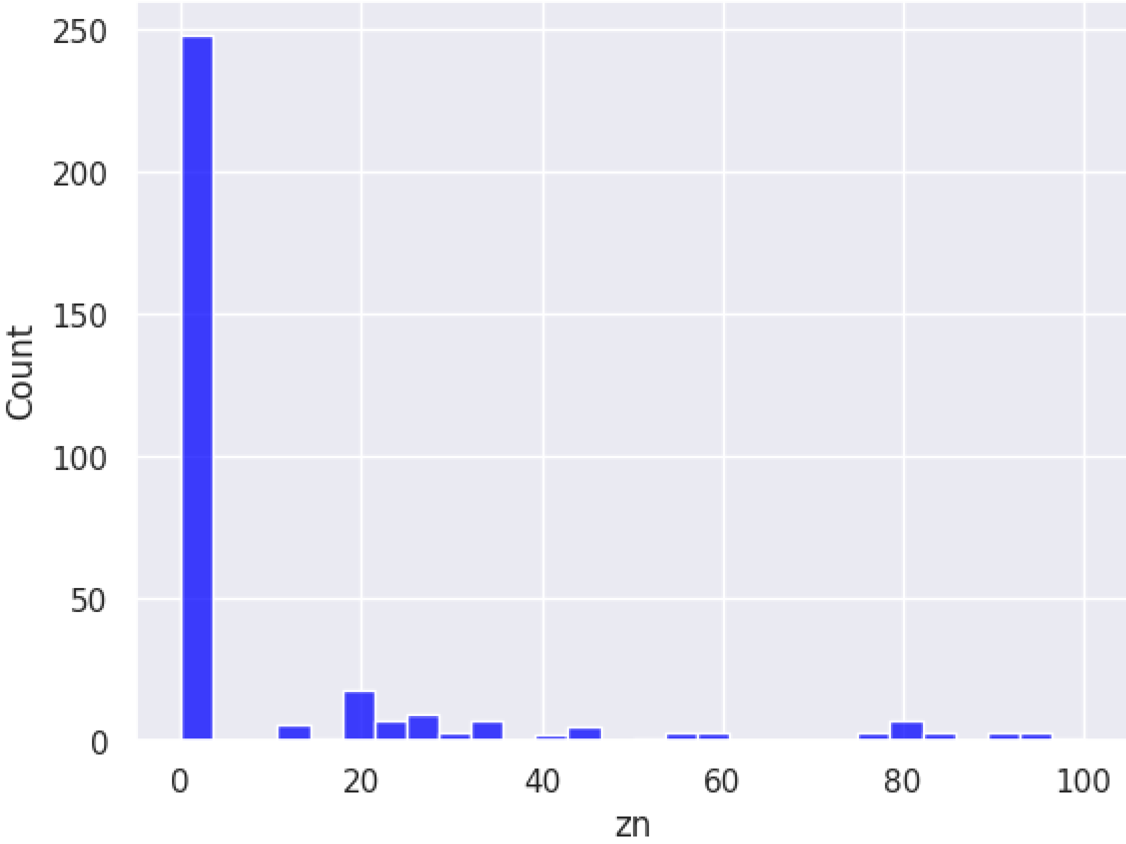

Count
0
5
10
15
20
25
30
35
0
100
200
300
400
500
ID

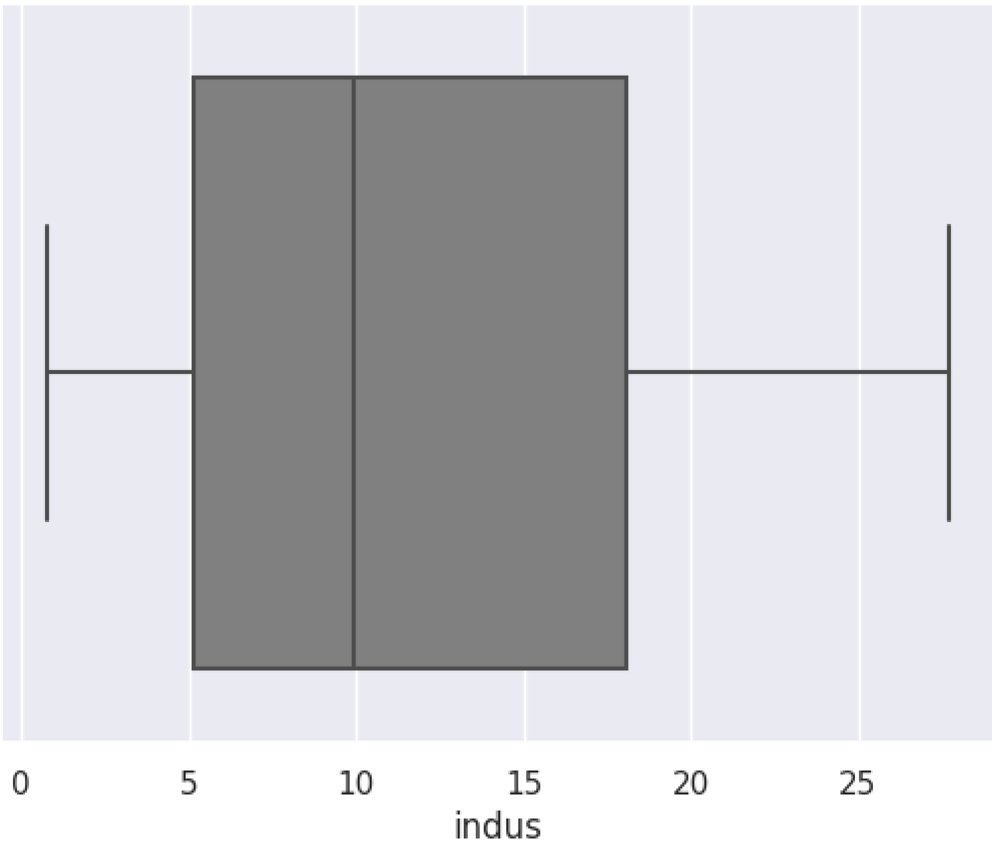

0
10
20
30
40
50
60
70
crim

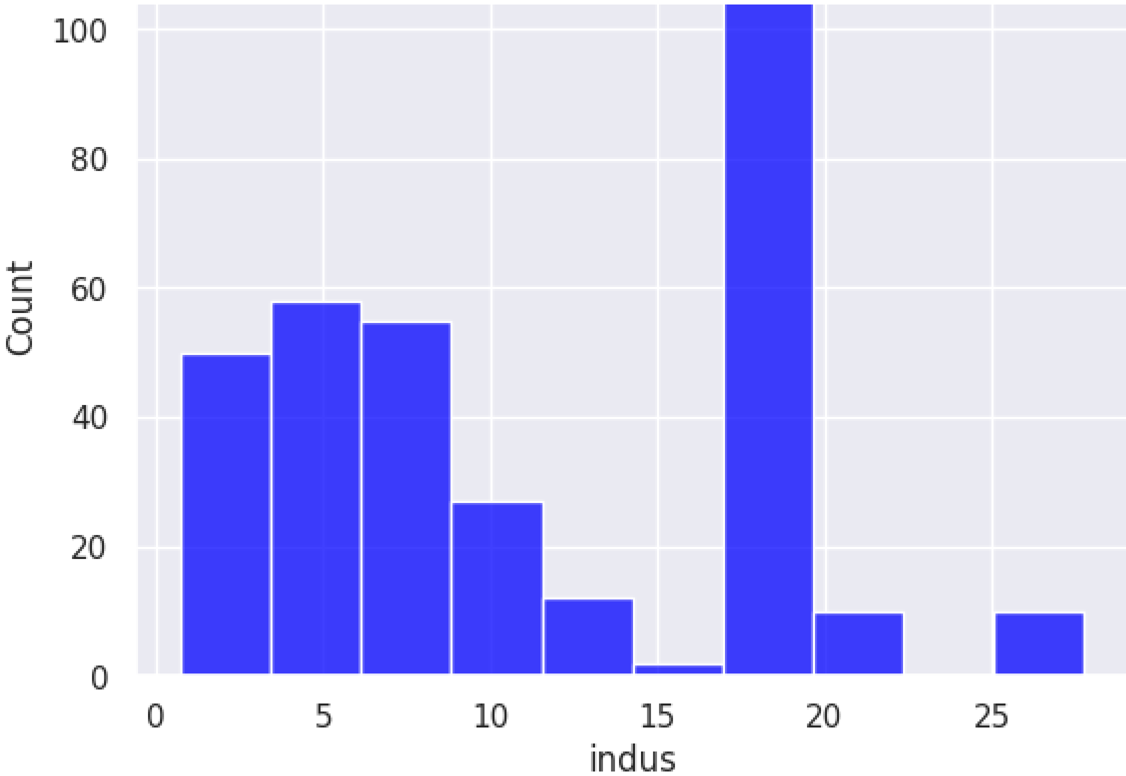

200
150
100
50
0
Count
0
10
20
30
40
50
60
70
crim

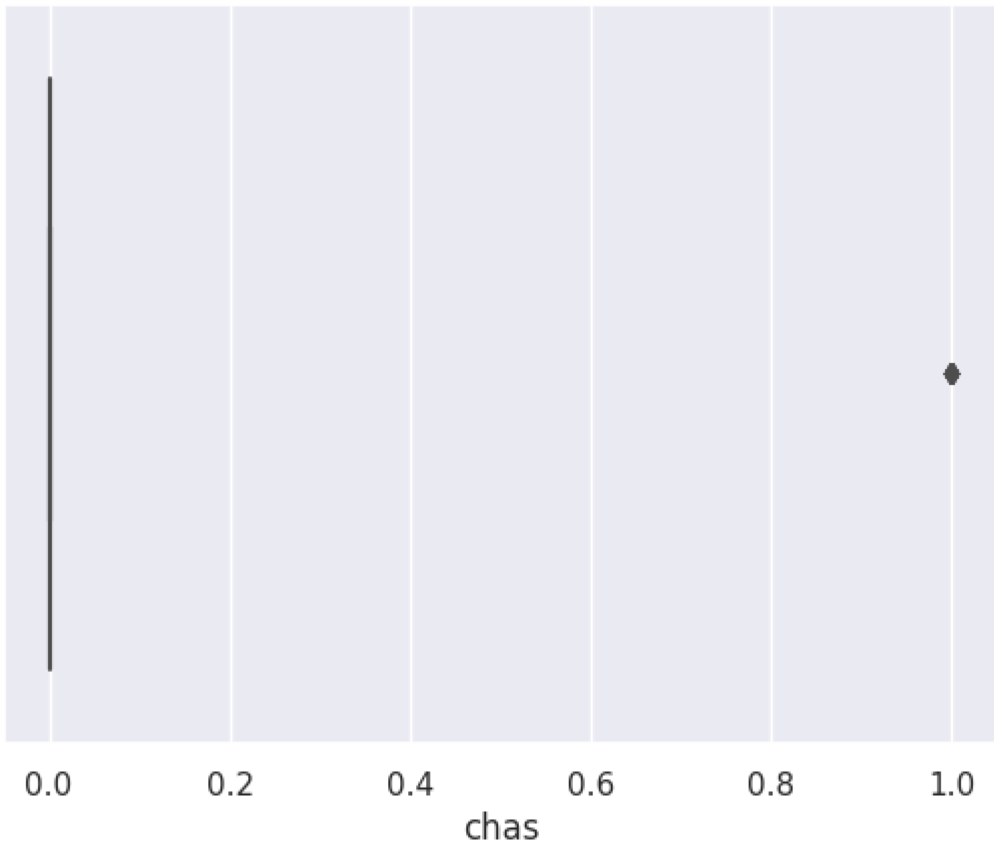


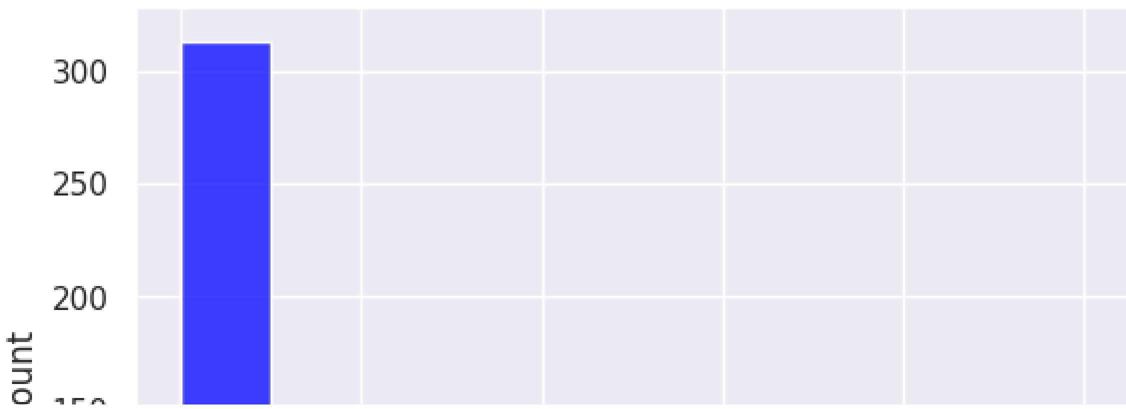

0
20
40
60
80
100
zn

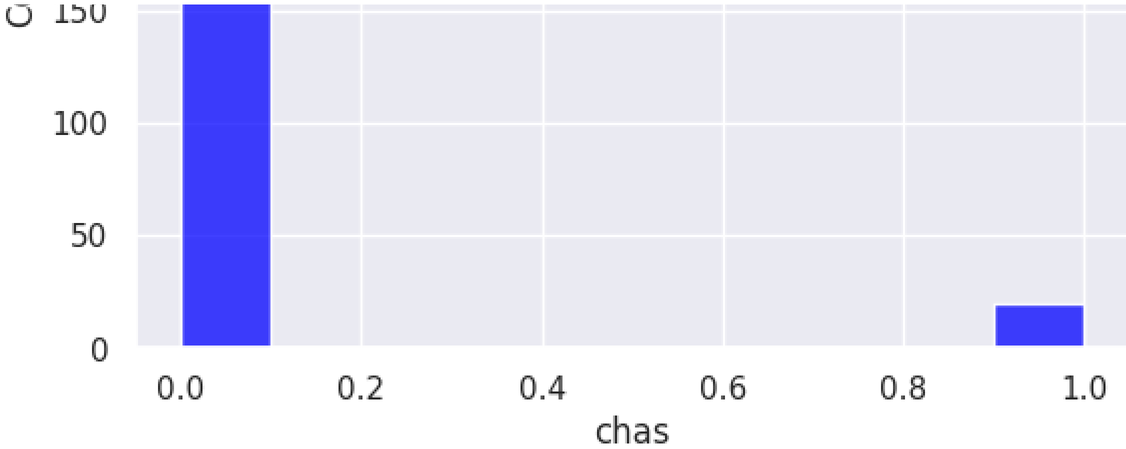

Count
250
200
150
100
50
0
0
20
40
60
80
100
zn

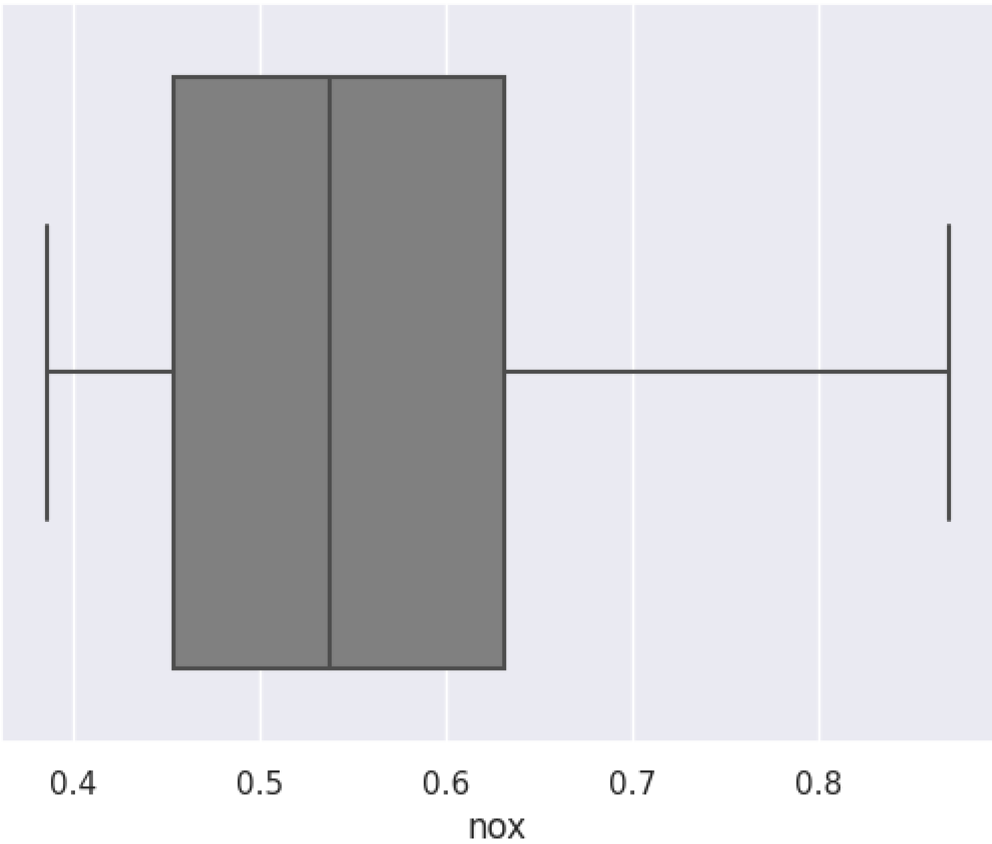

0
5
10
15
20
25
indus

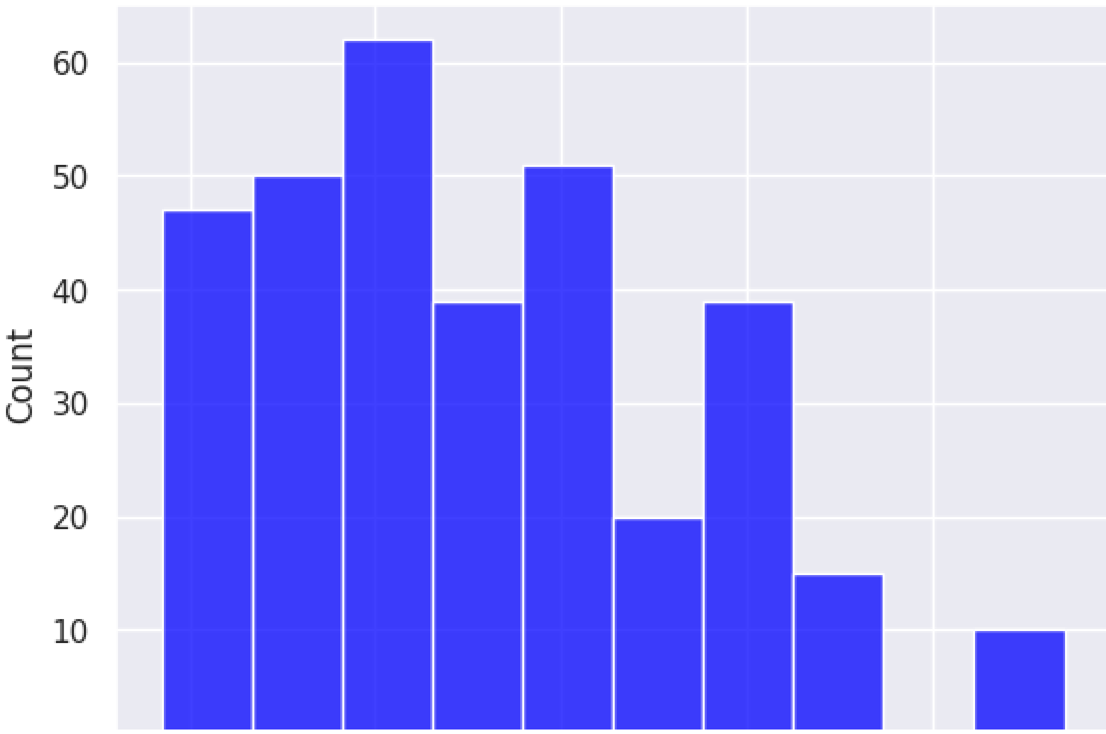

Count
100
80
60
40
20
0
0
5
10
15
20
25
indus


0.0
0.2
0.4
0.6
0.8
1.0
chas

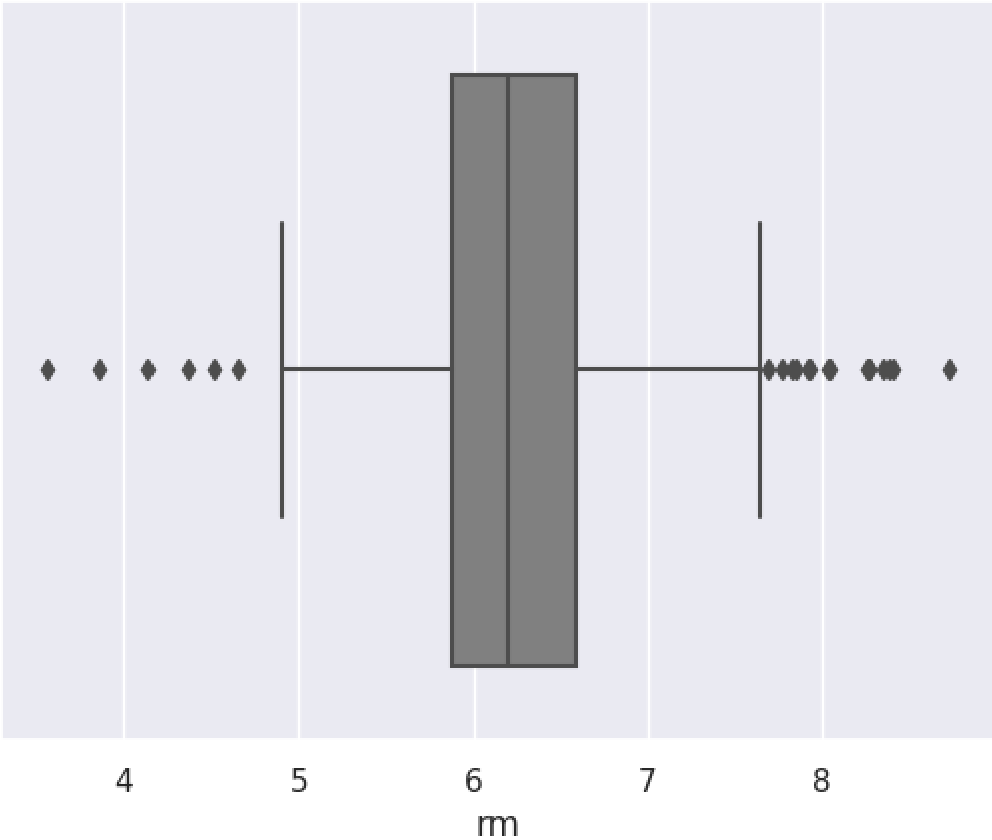

300
250
200

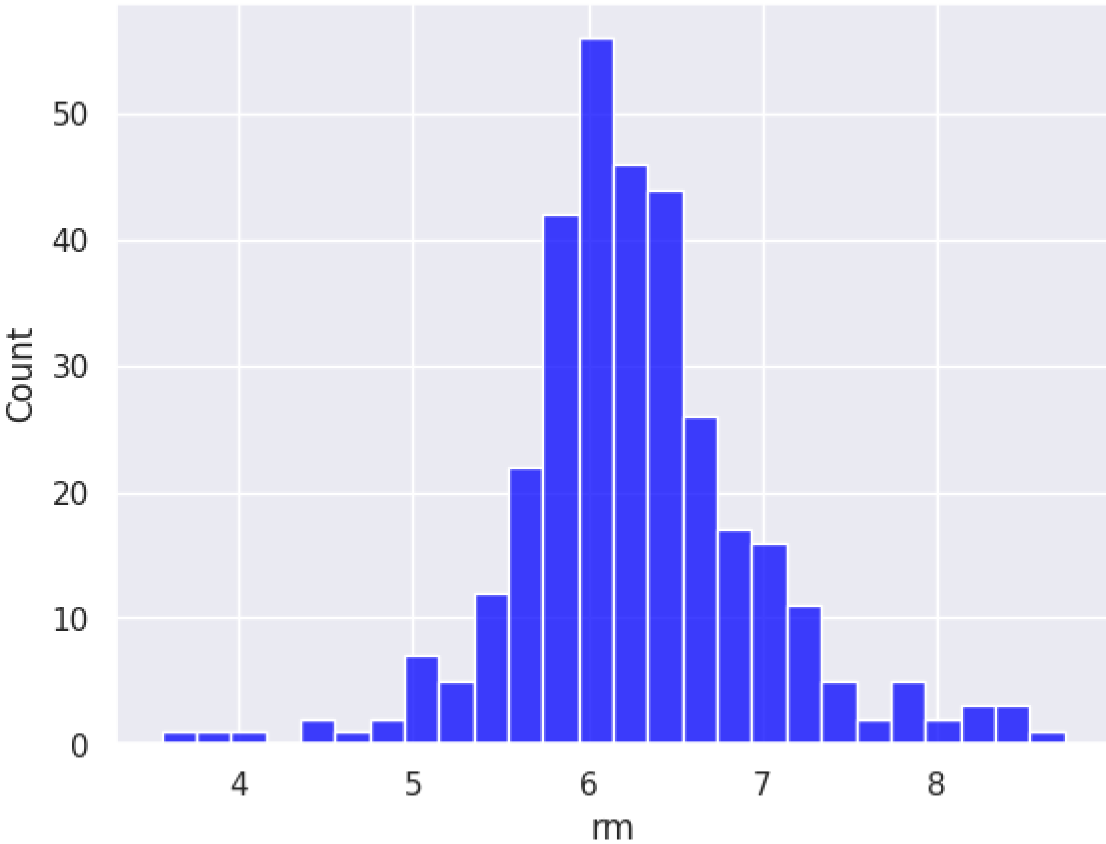

150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
chas

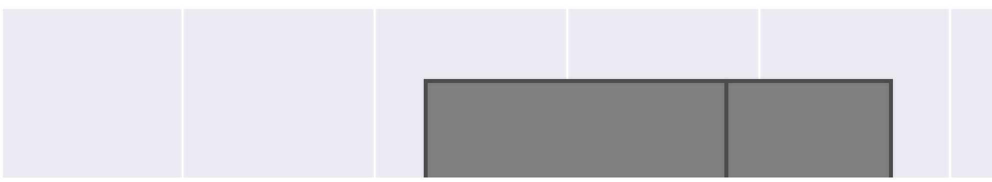

0.4
0.5
0.6
0.7
0.8
nox

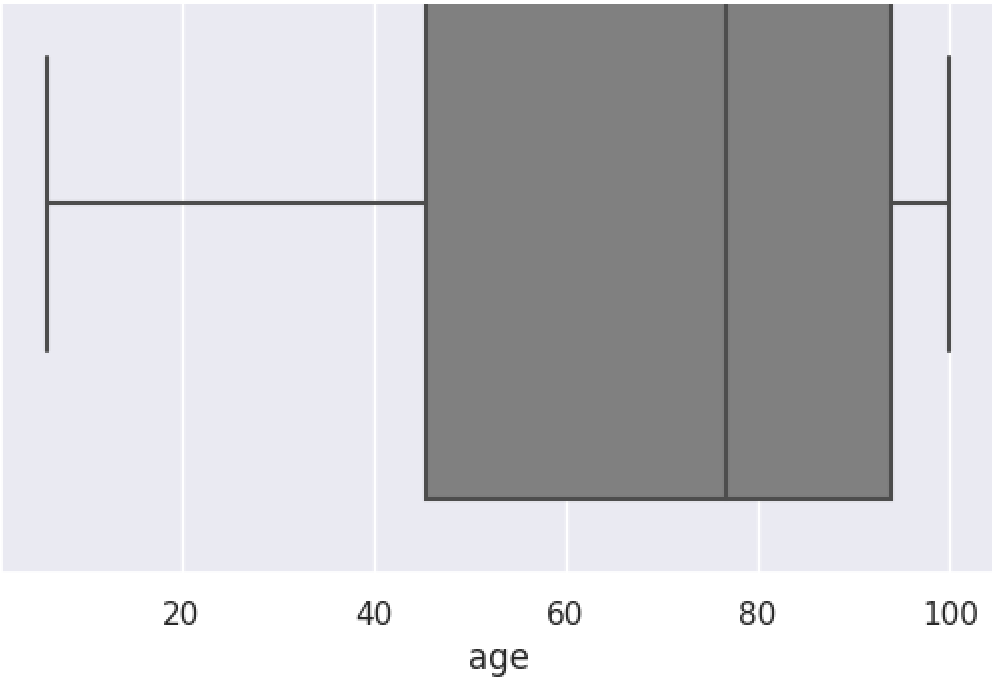

60
50
40
30
20
10
Count

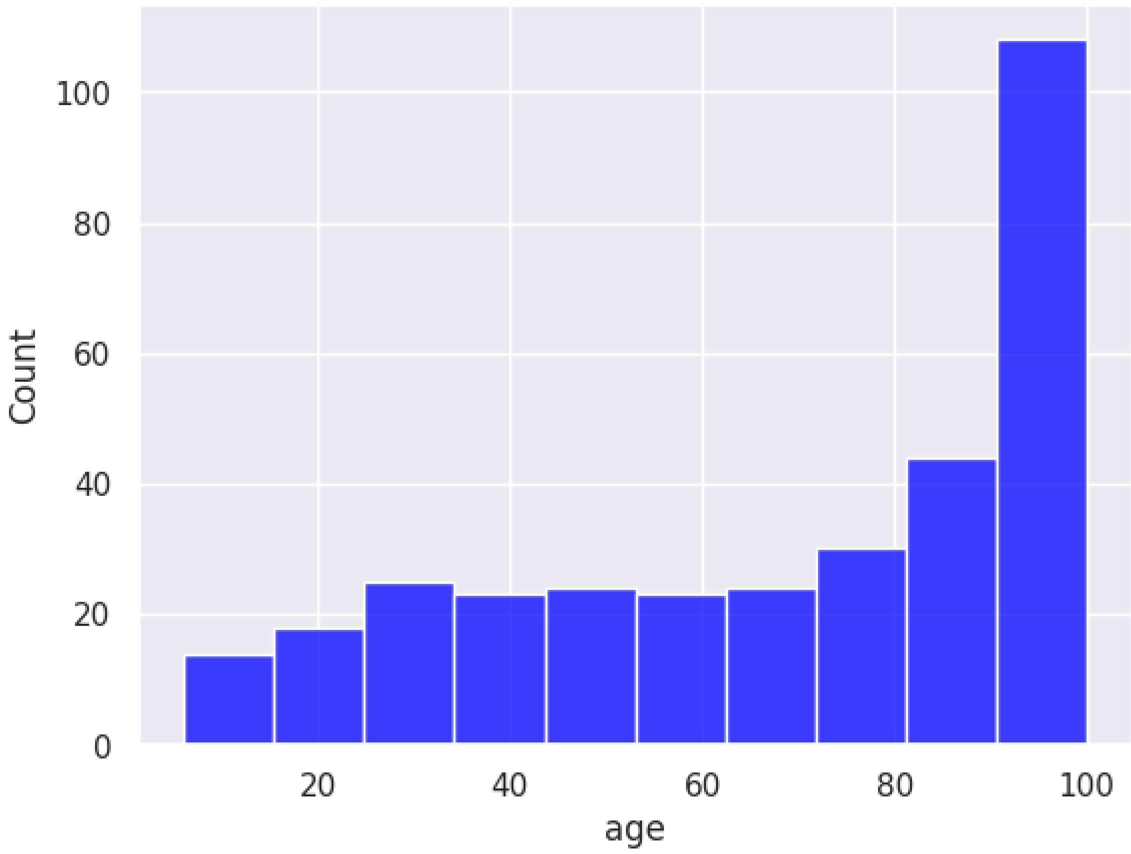

0
0.4
0.5
0.6
0.7
0.8
nox

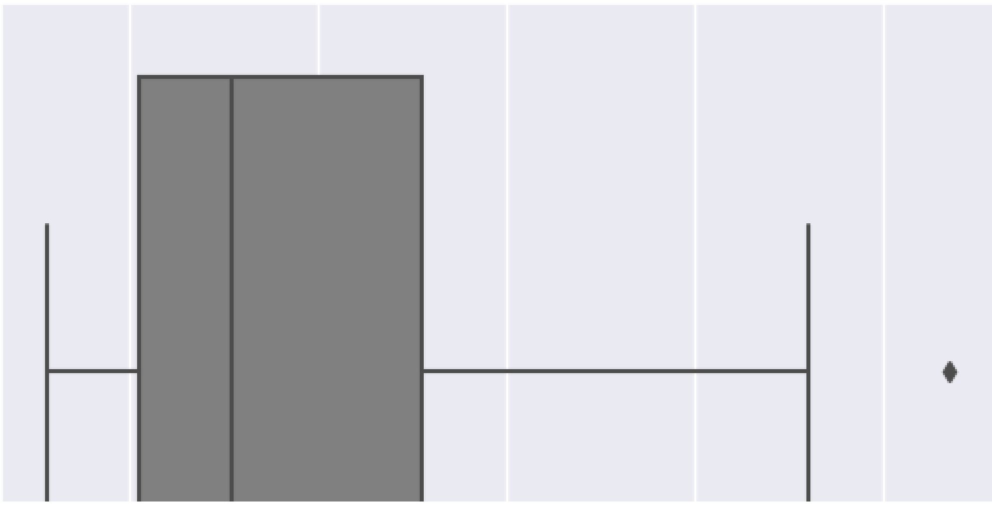

4
5
6
7
8
rm

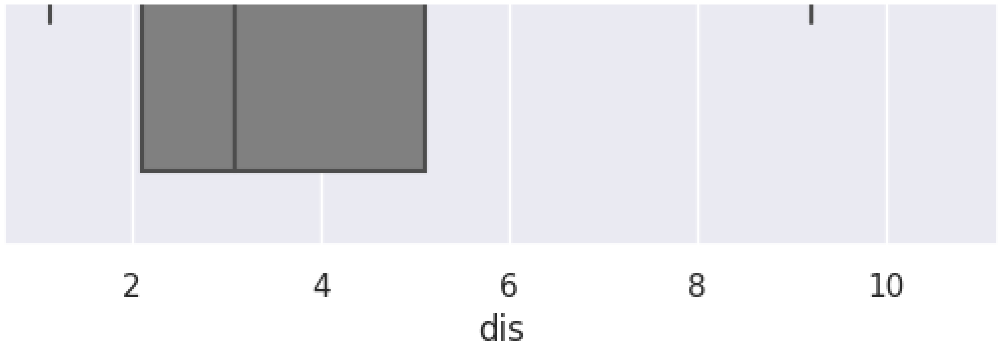

Count
50
40
30
20
10
0
4
5
6
7
8
rm

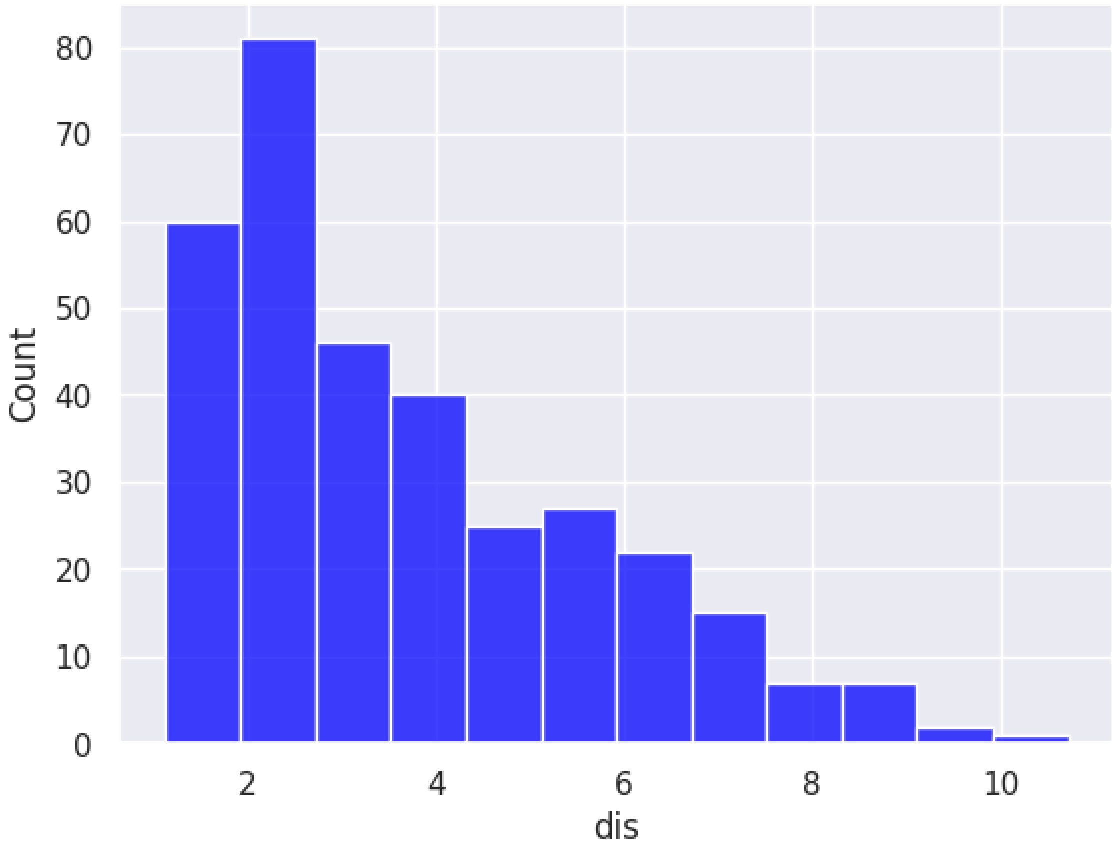


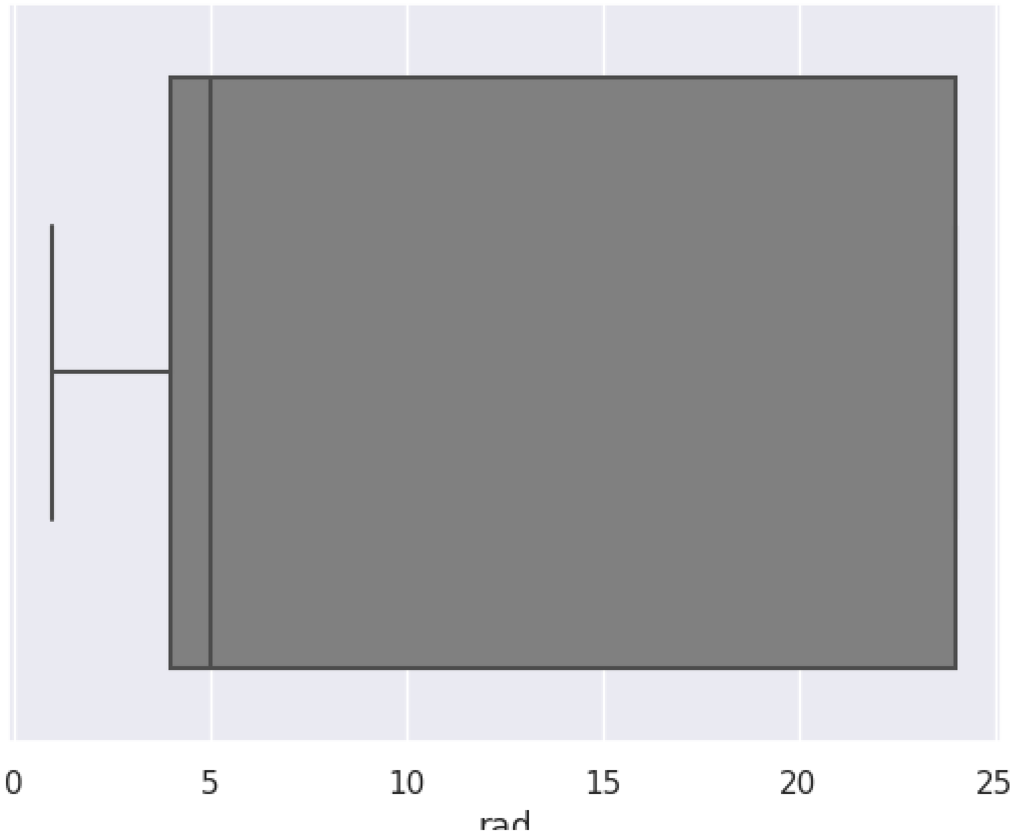

20
40
60
80
100
age

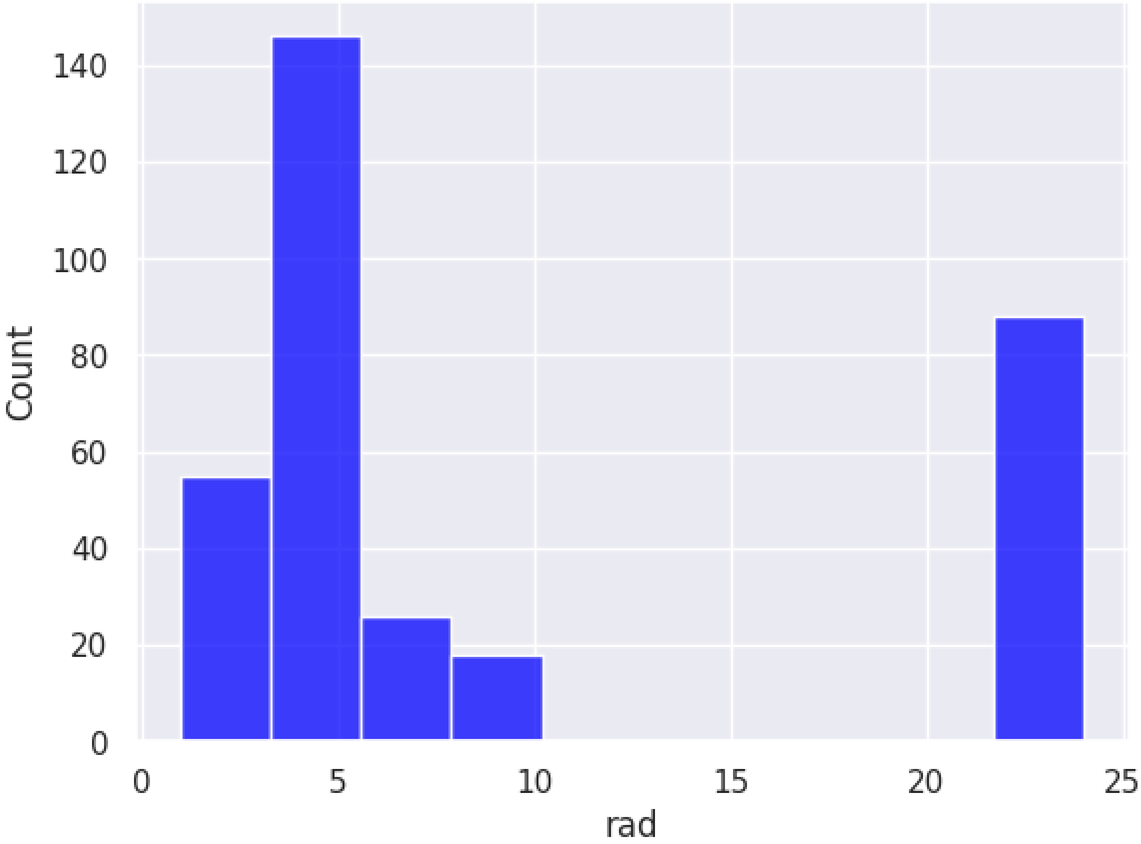

100
80
60
40
20
0
Count
20
40
60
80
100
age

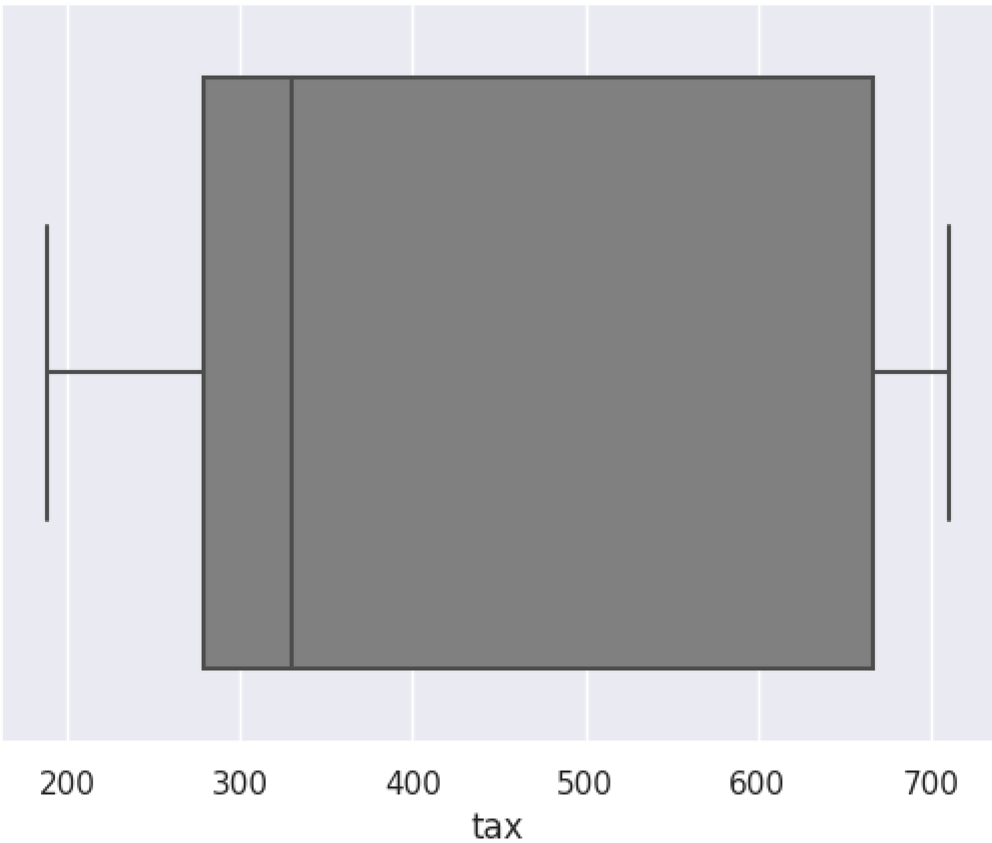


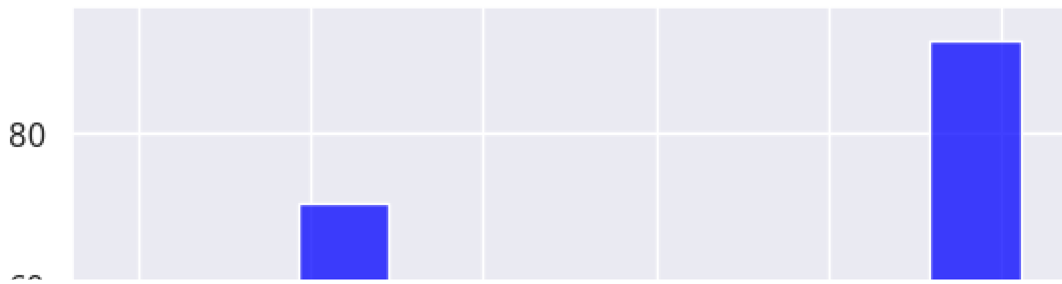

2
4
6
8
10
dis

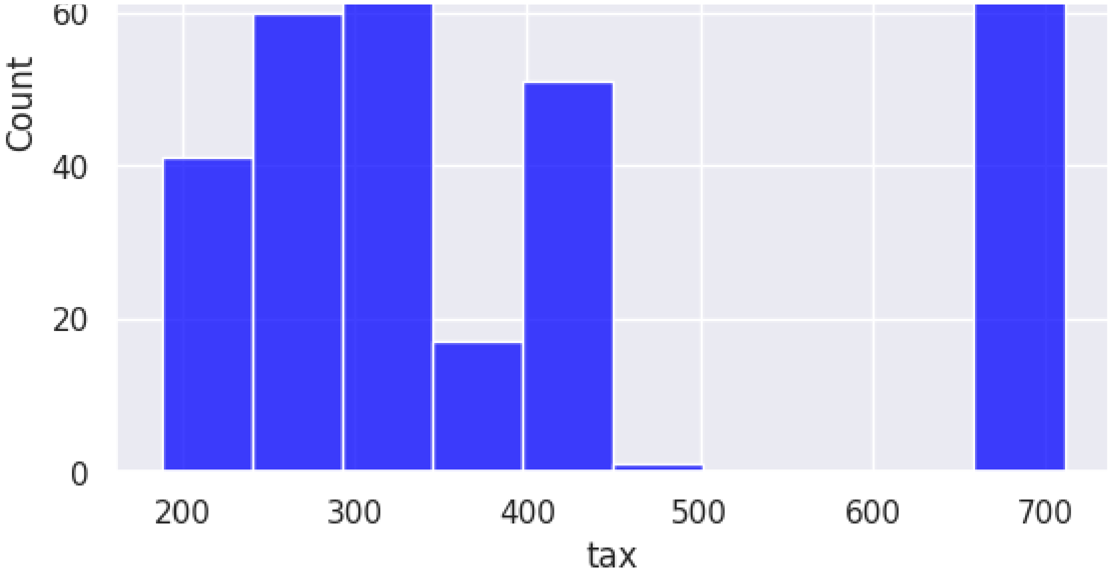

Count
80
70
60
50
40
30
20
10
0
2
4
6
8
10
dis

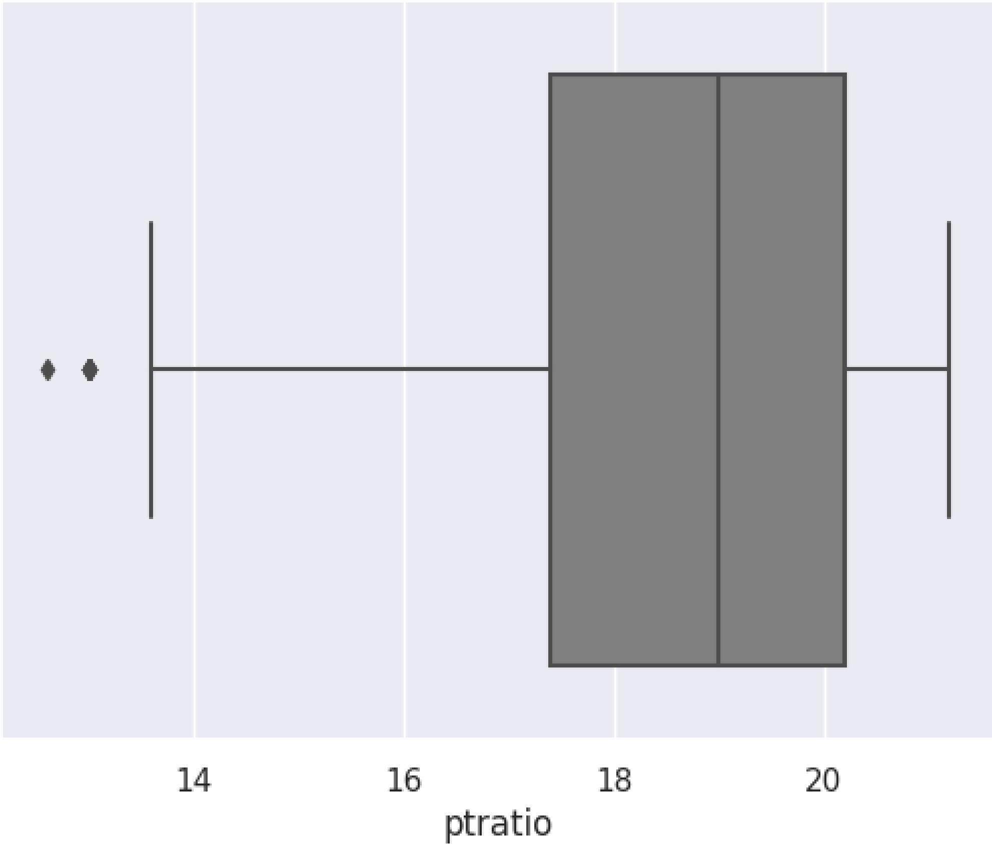

0
5
10
15
20
25
rad

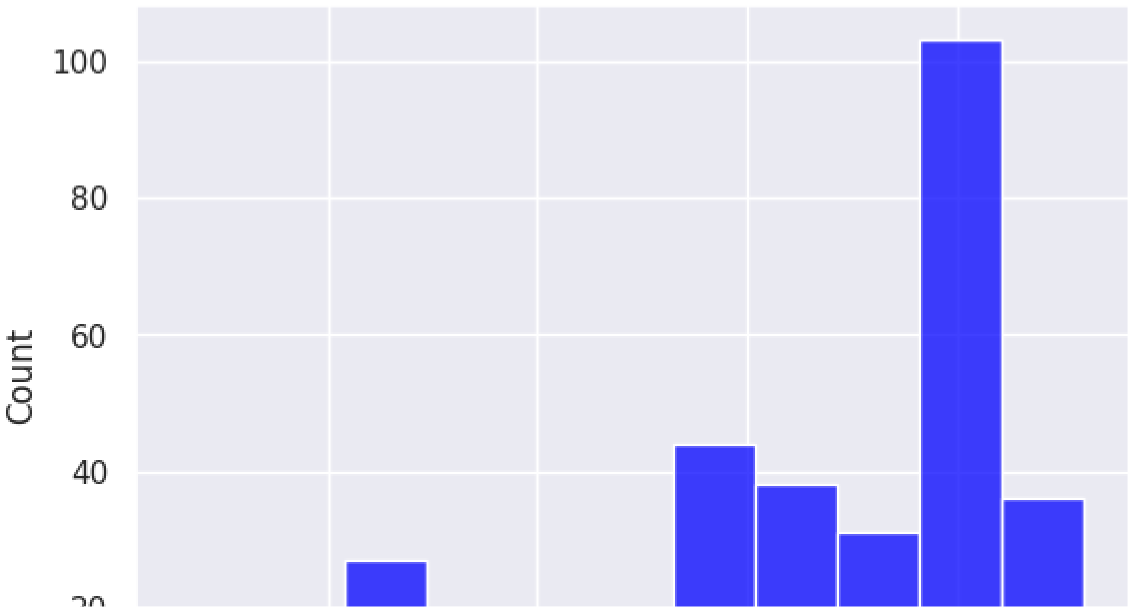

Count
0
20
40
60
80
100
120
140
0
5
10
15
20
25
rad

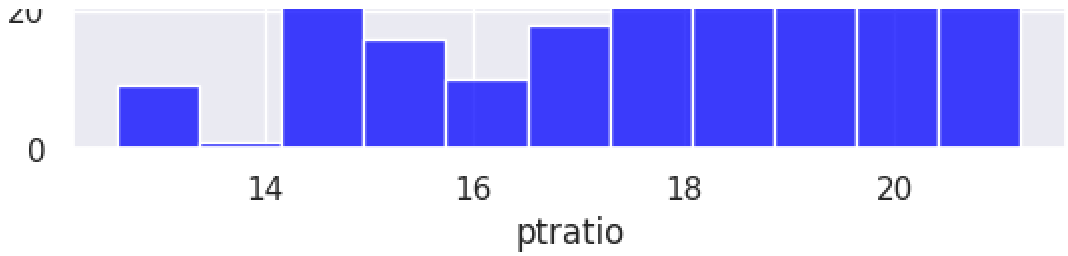

200
300
400
500
600
700
tax

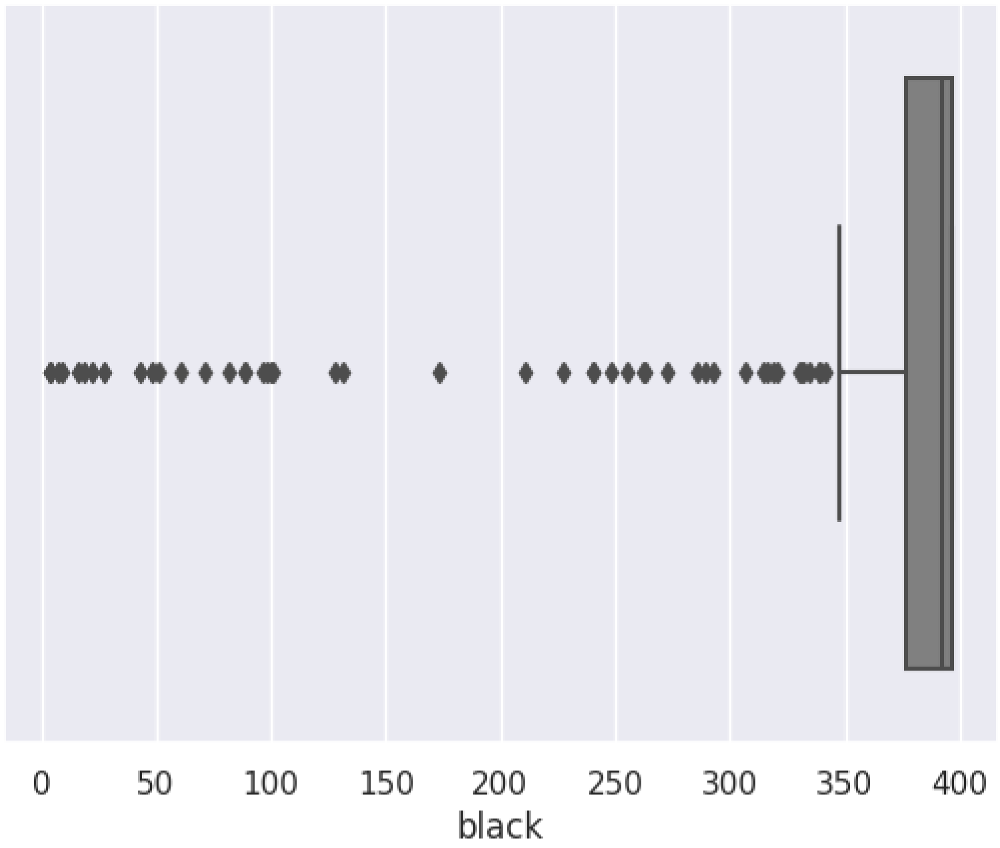

80

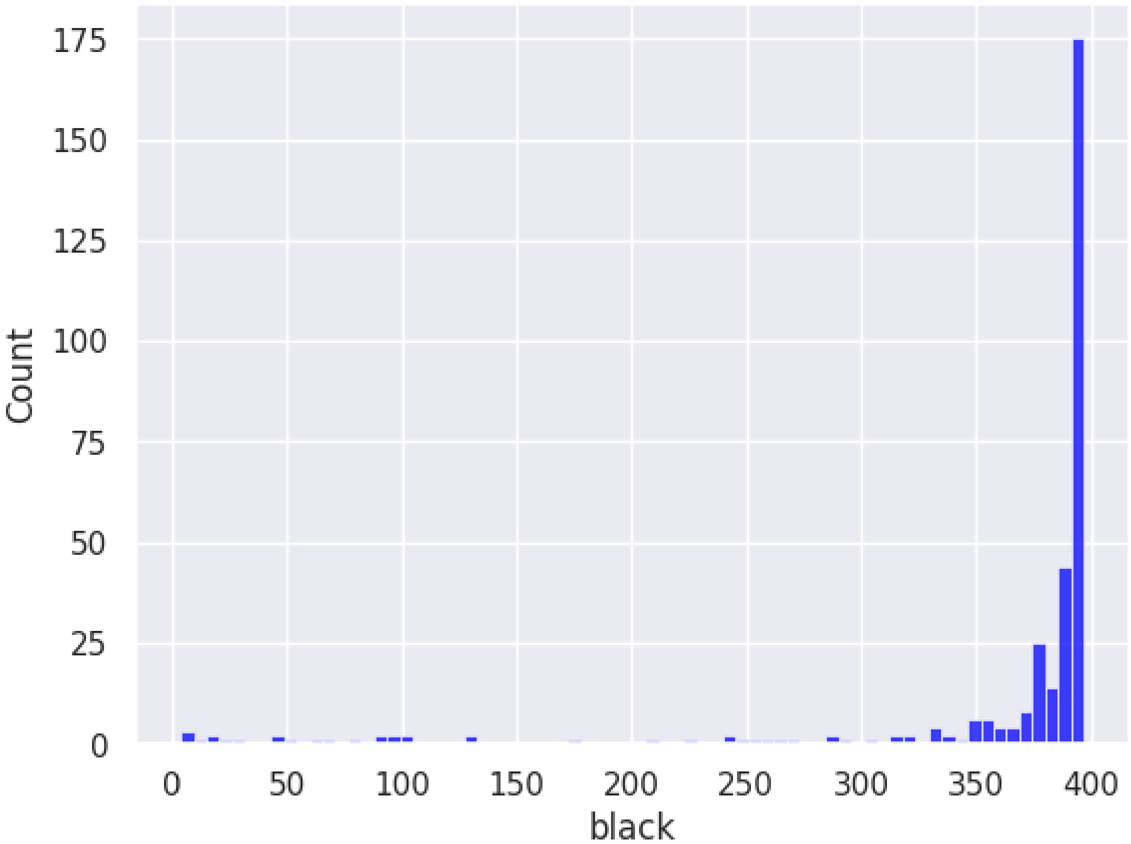

Count
60
40
20
0
200
300
400
500
600
700
tax

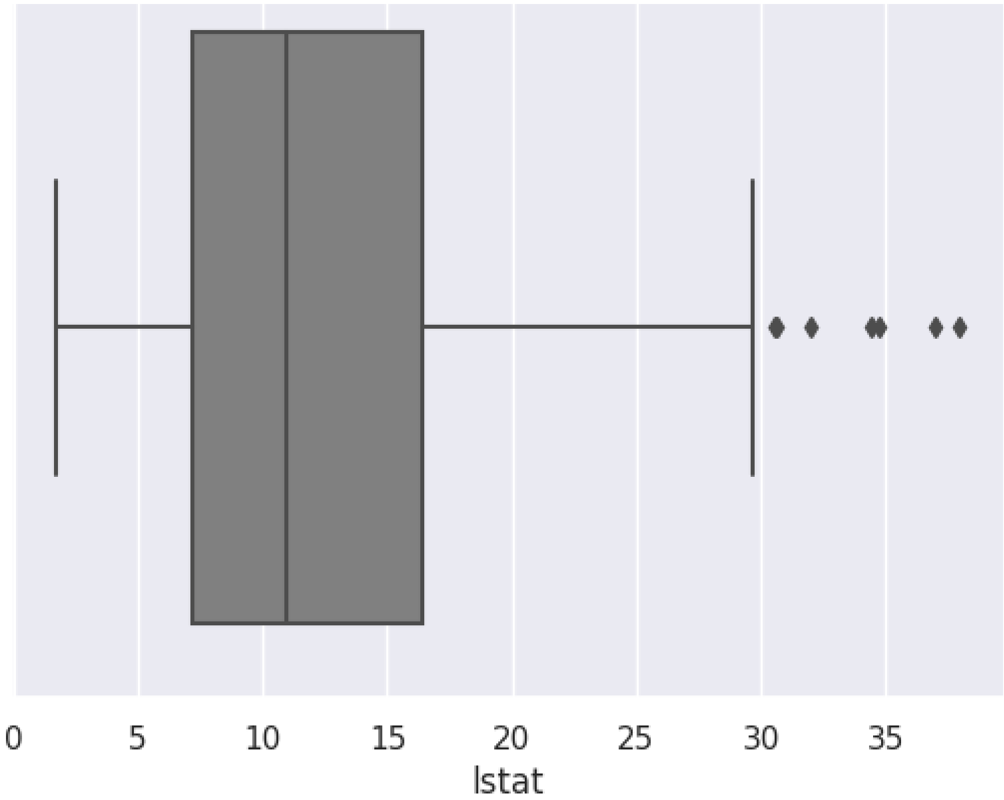

14
16
18
20
ptratio

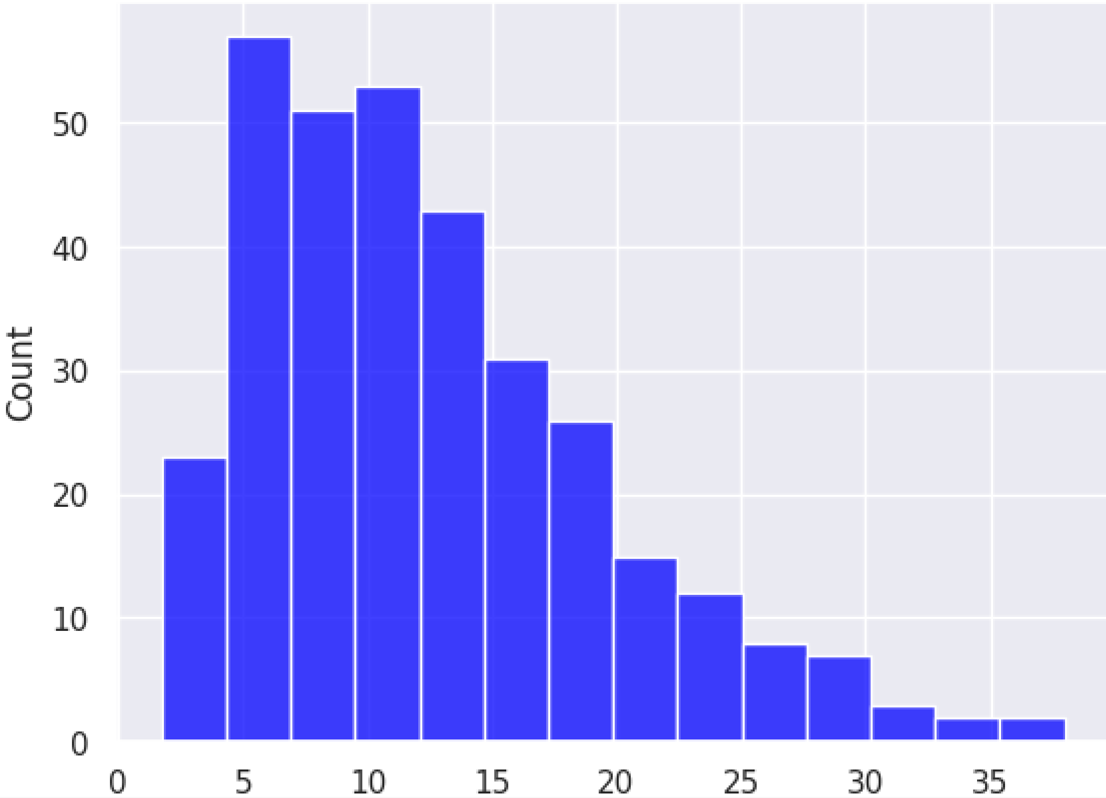

100
80
60
40
Count


20
0
14
16
18
20
ptratio

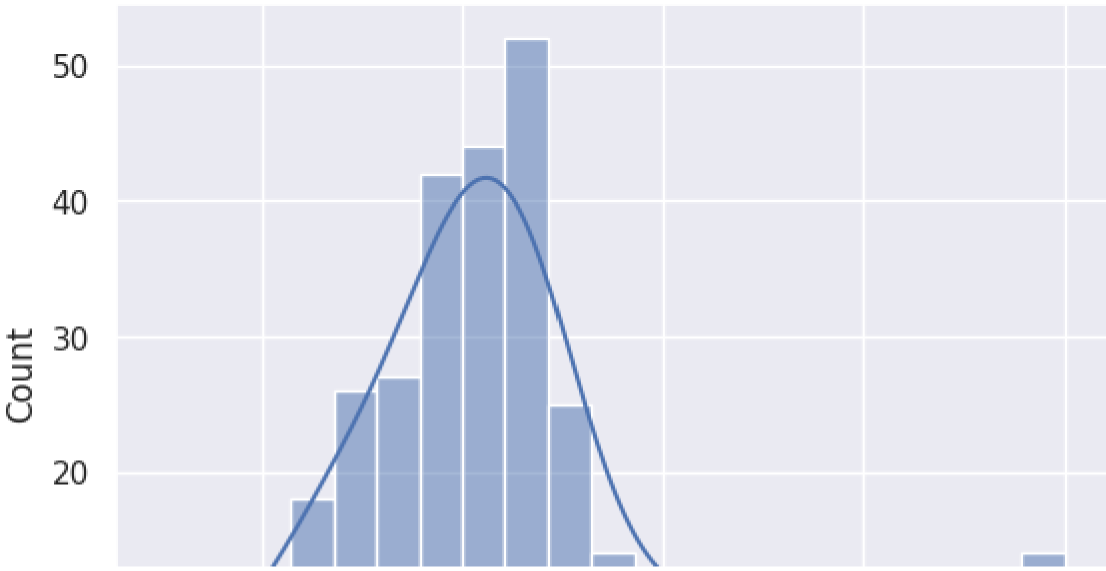

0
50
100
150
200
250
300
350
400
black


175
150
125
100
75
50
25
0
Count
0
50
100
150
200
250
300
350
400
black






```
sbs.histplot(data=FILE,x="medv",kde=True)
plt.show()
```



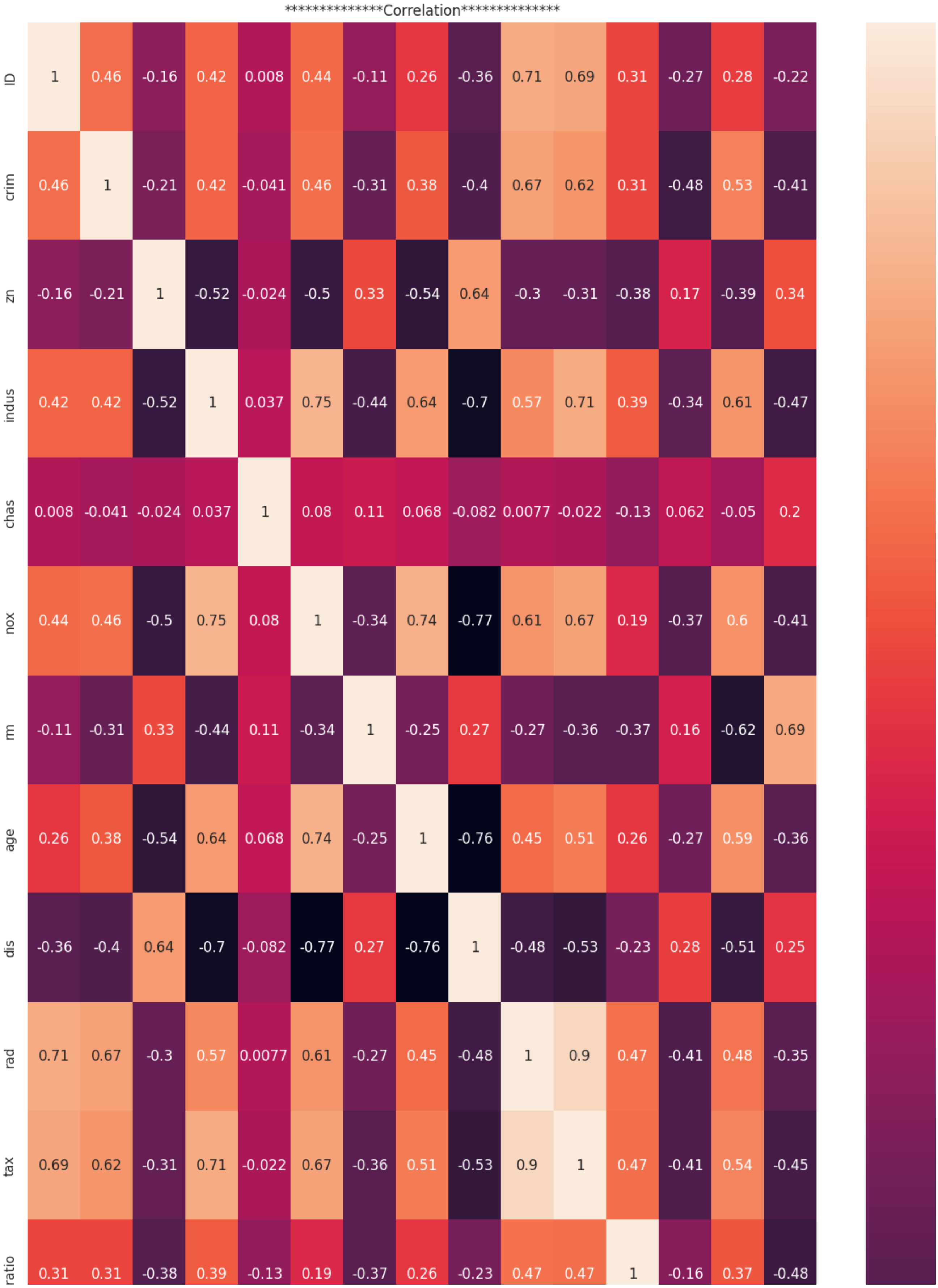
Finding Relationship between columns(COORELATION):

```
FILE.corr()
```

	ID	crim	zn	indus	chas	nox	rm	a
ID	1.000000	0.456312	-0.155639	0.421978	0.007958	0.440185	-0.112790	0.2573
crim	0.456312	1.000000	-0.210913	0.422228	-0.041195	0.463001	-0.310180	0.3790
zn	-0.155639	-0.210913	1.000000	-0.518679	-0.024442	-0.501990	0.328197	-0.5445
indus	0.421978	0.422228	-0.518679	1.000000	0.037496	0.750087	-0.440365	0.6383
chas	0.007958	-0.041195	-0.024442	0.037496	1.000000	0.080275	0.112251	0.0682
nox	0.440185	0.463001	-0.501990	0.750087	0.080275	1.000000	-0.338515	0.7360
rm	-0.112790	-0.310180	0.328197	-0.440365	0.112251	-0.338515	1.000000	-0.2485
age	0.257300	0.379034	-0.544513	0.638378	0.068286	0.736000	-0.248573	1.0000
dis	-0.356461	-0.397067	0.637142	-0.702327	-0.081834	-0.769364	0.269191	-0.7642
rad	0.707526	0.666636	-0.303663	0.569779	0.007714	0.612180	-0.272783	0.4473
tax	0.686246	0.617081	-0.311180	0.708313	-0.021826	0.670722	-0.356987	0.5118
ptratio	0.309838	0.313409	-0.380449	0.391087	-0.125067	0.192513	-0.366927	0.2592
black	-0.271619	-0.475796	0.168130	-0.335049	0.062029	-0.369416	0.155202	-0.2680
lstat	0.281953	0.532077	-0.388112	0.614155	-0.050055	0.598874	-0.615747	0.5888
medv	-0.221694	-0.407454	0.344842	-0.473932	0.204390	-0.413054	0.689598	-0.3588

```
plt.figure(figsize=(15, 25))
sbs.heatmap(FILE.corr(),annot=True)
```

```
plt.title("**************Correlation**************")
plt.show()
```



Spliting Into 70/30 Ratio:

```
X=FILE.rm
Y=FILE.medv
```

```
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.3)
```

Perform scaling on the X_test and X_train values

```
object=StandardScaler()
X_train=X_train.values.reshape(-1,1)
X_test=X_test.values.reshape(-1,1)
X_train=object.fit_transform(X_train)
X_test=object.transform(X_test)
```

Training the Model:

```
liner_regression= LinearRegression()
liner_regression.fit(X_train, Y_train)
Y_CAP = liner_regression.predict(X_test)
```

Hypothesis:Y-predicted=mx+c:

```
# complete this function implementation
def hypothesis(x, theta):
  hypothesis_x=theta[0]+theta[1]*x
  return hypothesis_x
```

Cost-value:

```
# complete this function implementation
def loss(hypothesis_x, y):
  SLOPE=len(hypothesis_x)
  ans=np.sum((hypothesis_x-y)**2)*(0.5*SLOPE)
  return ans
```

Gradient-Descent Algorithm:

```
# complete this function implementation
def gradientDescent(x, y, theta, numIterations=15000, alpha=0.015):
  slope=len(x)
  count=0
  Loss=[]
  while(count<numIterations):
      y_pred=hypothesis(x,theta)
      theta[0]=theta[0]-(alpha)*((1/slope)*sum(y_pred-y))
```

```
      theta[1]=theta[1]-(alpha)*((1/slope)*(np.sum((y_pred-y)*x)))
      count=count+1
      if(count%500==0):
        Loss=loss(y_pred,y)
        print(Loss)
```

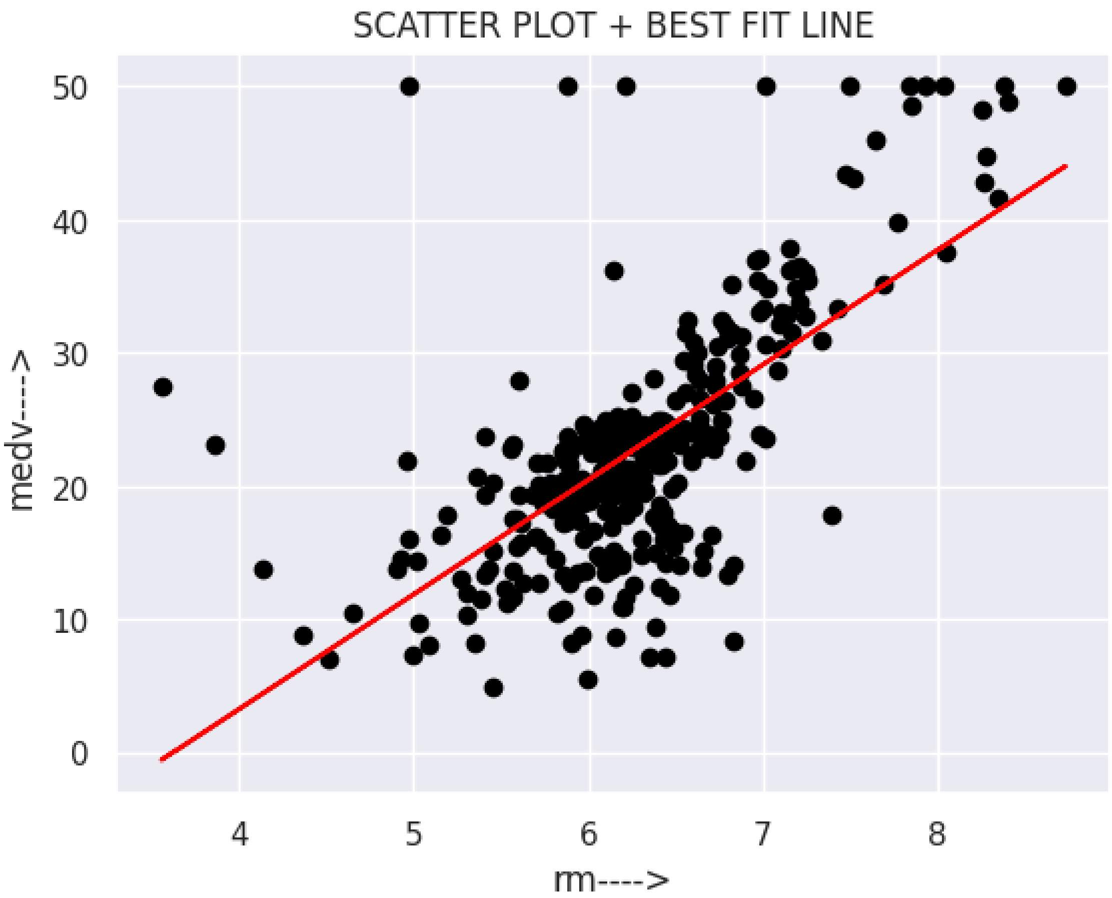
```
theta=[0,0]
print("COST_VALUE=")
gradientDescent(X,Y,theta,15000,0.015)
slOPE=theta[1]
inteRcept=theta[0]
print("SLOPE=",slOPE)
print("INTERCEPT=",inteRcept)
```

```
COST_VALUE=
3108125.422349711
2996934.0445588566
2904237.7234120606
2826960.077205426
2762536.4352598
2708828.7222888297
2664054.500505363
2626727.814533859
2595609.8759049457
2569667.950461788
2548041.084244085
2530011.5303690904
2514980.928632384
2502450.4472830473
2492004.2279236037
2483295.5841083056
2476035.4956023935
2469983.0164527595
2464937.278535526
2460730.8251963262
2457224.0537418644
2454300.5823415653
2451863.3875772804
2449831.5844549877
2448137.7420143853
2446725.6454474973
2445548.430456055
2444567.0279312036
2443748.867337952
2443066.795772616
SLOPE= 8.635318277732214
INTERCEPT= -31.309836357966436
```

Visualization:Y=mx+c:

```
plt.scatter(FILE.rm,FILE.medv,color="BLACK")
plt.plot(FILE.rm,theta[1]*X+theta[0],color="RED")#hereX=FILE.rm
plt.xlabel("rm---->")
plt.ylabel("medv---->")
```

```
plt.title("SCATTER PLOT + BEST FIT LINE")
plt.show()
```



Checking Model Performance/Quality:

```
M_S_E=mean_squared_error(Y_test,Y_CAP)
print("MSE=",M_S_E)
```

```
MSE= 34.74707862692635
```

```
R_2=r2_score(Y_test,Y_CAP)
print("R_Sqaured=",R_2)
```

```
R_Sqaured= 0.6291520729535067
```