IMPORTING LIBRARIES

In [ ]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns
# Import BaseSettings from pydantic_settings
%pip install ydata_profiling
from ydata_profiling import ProfileReport
```

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Collecting ydata_profiling
  Using cached ydata_profiling-4.7.0-py2.py3-none-any.whl.metadata (20 kB)
Collecting scipy<1.12,>=1.4.1 (from ydata_profiling)
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Requirement already satisfied: pandas!=1.4.0,<3,>1.1 in c:\users\surya\appdata\local
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Collecting visions<0.7.7,>=0.7.5 (from visions[type_image_path]<0.7.7,>=0.7.5->ydata
_profiling)
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Requirement already satisfied: attrs>=19.3.0 in c:\users\surya\appdata\local\program
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Requirement already satisfied: networkx>=2.4 in c:\users\surya\appdata\local\program
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Using cached patsy-0.5.6-py2.py3-none-any.whl (233 kB)
Installing collected packages: typeguard, scipy, patsy, llvmlite, dacite, numba, wor
dcloud, visions, statsmodels, seaborn, ydata_profiling
  Attempting uninstall: scipy
    Found existing installation: scipy 1.11.4
    Uninstalling scipy-1.11.4:
      Successfully uninstalled scipy-1.11.4
  Attempting uninstall: visions
    Found existing installation: visions 0.7.6
    Uninstalling visions-0.7.6:
      Successfully uninstalled visions-0.7.6
  Attempting uninstall: seaborn
    Found existing installation: seaborn 0.12.2
    Uninstalling seaborn-0.12.2:
      Successfully uninstalled seaborn-0.12.2
Successfully installed dacite-1.8.1 llvmlite-0.42.0 numba-0.59.1 patsy-0.5.6 scipy-
1.11.4 seaborn-0.12.2 statsmodels-0.14.1 typeguard-4.1.5 visions-0.7.6 wordcloud-1.
9.3 ydata_profiling-4.7.0
Note: you may need to restart the kernel to use updated packages.
```

```
ERROR: pip's dependency resolver does not currently take into account all the packag
es that are installed. This behaviour is the source of the following dependency conf
licts.
pandas-profiling 3.2.0 requires visions[type_image_path]==0.7.4, but you have vision
s 0.7.6 which is incompatible.
scikit-learn 1.4.1.post1 requires joblib>=1.2.0, but you have joblib 1.1.1 which is
incompatible.
```

IMPORTING DATASETS

In [ ]:

```
# Reading The Data By Pandas
data=pd.read_csv("D:\MAIN DRIVE\VSCODE\Regression-Project\data.csv")
# Creating 'X' Matrix For Independent Features In The Dataset
X=data.iloc[:,:-1].values
# Creating 'Y' Matrix For Independent Features In The Dataset
Y=data.iloc[:,-1].values
```

```
<>:2: SyntaxWarning: invalid escape sequence '\M'
<>:2: SyntaxWarning: invalid escape sequence '\M'
C:\Users\surya\AppData\Local\Temp\ipykernel_22704\2686243820.py:2: SyntaxWarning: in
valid escape sequence '\M'
  data=pd.read_csv("D:\MAIN DRIVE\VSCODE\Regression-Project\data.csv")
```

GENRATING PROFILE USING PANDAS PROFILING

In [ ]:

```
profile=ProfileReport(data)
profile.to_notebook_iframe()
```

```
Summarize dataset:   0%|          | 0/5 [00:00<?, ?it/s]
Generate report structure:   0%|          | 0/1 [00:00<?, ?it/s]
Render HTML:   0%|          | 0/1 [00:00<?, ?it/s]
```

Overview

Dataset statistics

Number of variables	14
Number of observations	506
Missing cells	5
Missing cells (%)	0.1%
Duplicate rows	0
Duplicate rows (%)	0.0%
Total size in memory	55.5 KiB
Average record size in memory	112.3 B

Variable types

Numeric	13
Categorical	1

Alerts

`AGE` is highly overall correlated with `CRIM` and 7 other fields (CRIM, DIS, INDUS, LSTAT, MEDV, NOX, TAX, ZN)	**High correlation**
`CRIM` is highly overall correlated with `AGE` and 8 other fields (AGE, DIS, INDUS, LSTAT, MEDV, NOX, RAD, TAX, ZN)	**High correlation**

<!-- Attribute Information:

```
1. CRIM      per capita crime rate by town
2. ZN        proportion of residential land zoned for lots over
25,000 sq.ft.
3. INDUS     proportion of non-retail business acres per town
```

```
4. CHAS      Charles River dummy variable (= 1 if tract bounds
river; 0 otherwise)
5. NOX       nitric oxides concentration (parts per 10 million)
6. RM        average number of rooms per dwelling
7. AGE       proportion of owner-occupied units built prior to 1940
8. DIS       weighted distances to five Boston employment centres
9. RAD       index of accessibility to radial highways
10. TAX      full-value property-tax rate per $10,000
11. PTRATIO  pupil-teacher ratio by town
12. B        1000(Bk - 0.63)^2 where Bk is the proportion of blacks
by town
13. LSTAT    % lower status of the population
14. MEDV     Median value of owner-occupied homes in $1000's -->
```

In [ ]:
```
data
```

Out[ ]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90
...	...	...	...	...	...	...	...	...	...	...	...	...
501	0.06263	0.0	11.93	0	0.573	6.593	69.1	2.4786	1	273	21.0	391.99
502	0.04527	0.0	11.93	0	0.573	6.120	76.7	2.2875	1	273	21.0	396.90
503	0.06076	0.0	11.93	0	0.573	6.976	91.0	2.1675	1	273	21.0	396.90
504	0.10959	0.0	11.93	0	0.573	6.794	89.3	2.3889	1	273	21.0	393.45
505	0.04741	0.0	11.93	0	0.573	6.030	80.8	2.5050	1	273	21.0	396.90

506 rows × 14 columns

In [ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
 #   Column   Non-Null Count  Dtype  
---  ------   --------------  -----  
 0   CRIM     506 non-null    float64
 1   ZN       506 non-null    float64
 2   INDUS    506 non-null    float64
 3   CHAS     506 non-null    int64  
 4   NOX      506 non-null    float64
 5   RM       501 non-null    float64
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    int64  
 9   TAX      506 non-null    int64  
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
 13  MEDV     506 non-null    float64
dtypes: float64(11), int64(3)
memory usage: 55.5 KB
```

In [ ]:

```
# "CHAR" IS A UNBALANCED COLUMN <BIASED>
data['CHAS'].value_counts()
```

Out[ ]:

```
CHAS
0    471
1     35
Name: count, dtype: int64
```

In [ ]:

```
data.describe()
```

Out[ ]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE
count	506.000000	506.000000	506.000000	506.000000	506.000000	501.000000	506.000000
mean	3.613524	11.363636	11.136779	0.069170	0.554695	6.284341	68.574901
std	8.601545	23.322453	6.860353	0.253994	0.115878	0.705587	28.148861
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000	2.900000
25%	0.082045	0.000000	5.190000	0.000000	0.449000	5.884000	45.025000
50%	0.256510	0.000000	9.690000	0.000000	0.538000	6.208000	77.500000
75%	3.677083	12.500000	18.100000	0.000000	0.624000	6.625000	94.075000
max	88.976200	100.000000	27.740000	1.000000	0.871000	8.780000	100.000000

VISUALIZING THE DATASET

In [ ]:

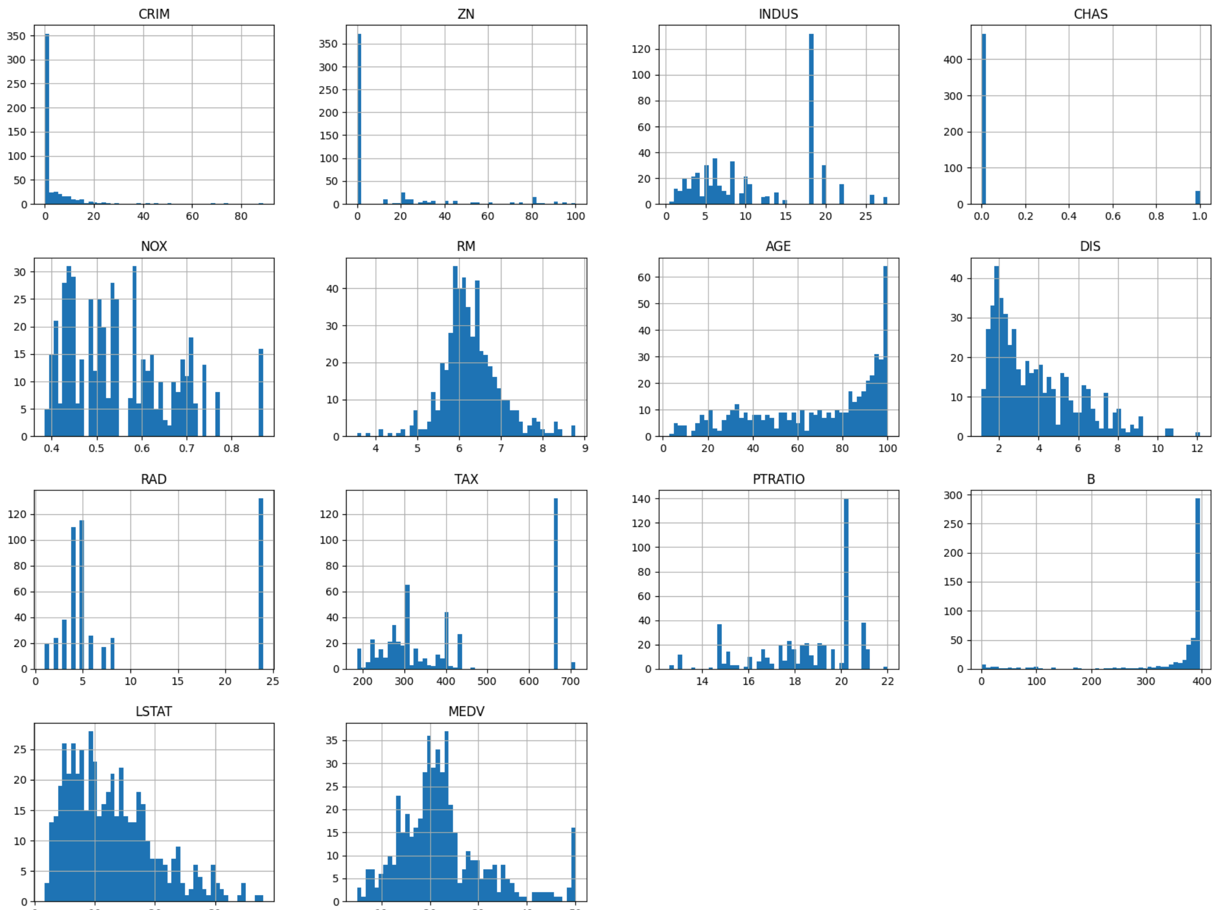
```
#For plotting histogram
print("HISTOGRAM")
```

```
%matplotlib inline
data.hist(bins=50, figsize=(20, 15))
```

```
HISTOGRAM
```

Out[ ]:

```
array([[<Axes: title={'center': 'CRIM'}>, <Axes: title={'center': 'ZN'}>,
        <Axes: title={'center': 'INDUS'}>,
        <Axes: title={'center': 'CHAS'}>],
       [<Axes: title={'center': 'NOX'}>, <Axes: title={'center': 'RM'}>,
        <Axes: title={'center': 'AGE'}>, <Axes: title={'center': 'DIS'}>],
       [<Axes: title={'center': 'RAD'}>, <Axes: title={'center': 'TAX'}>,
        <Axes: title={'center': 'PTRATIO'}>,
        <Axes: title={'center': 'B'}>],
       [<Axes: title={'center': 'LSTAT'}>,
        <Axes: title={'center': 'MEDV'}>, <Axes: >, <Axes: >]],
      dtype=object)
```



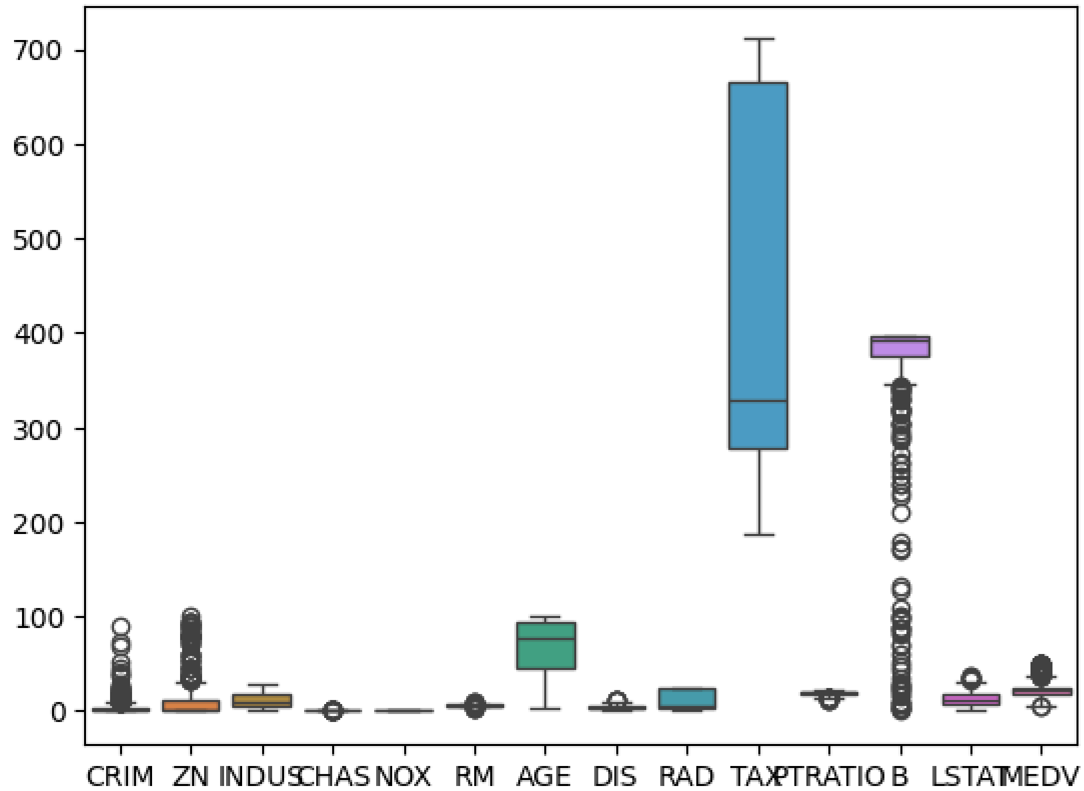
In [ ]:

```
print("COLORED - BOXPLOT")
sns.boxplot(data=data)
```

```
COLORED - BOXPLOT
```

Out[ ]:

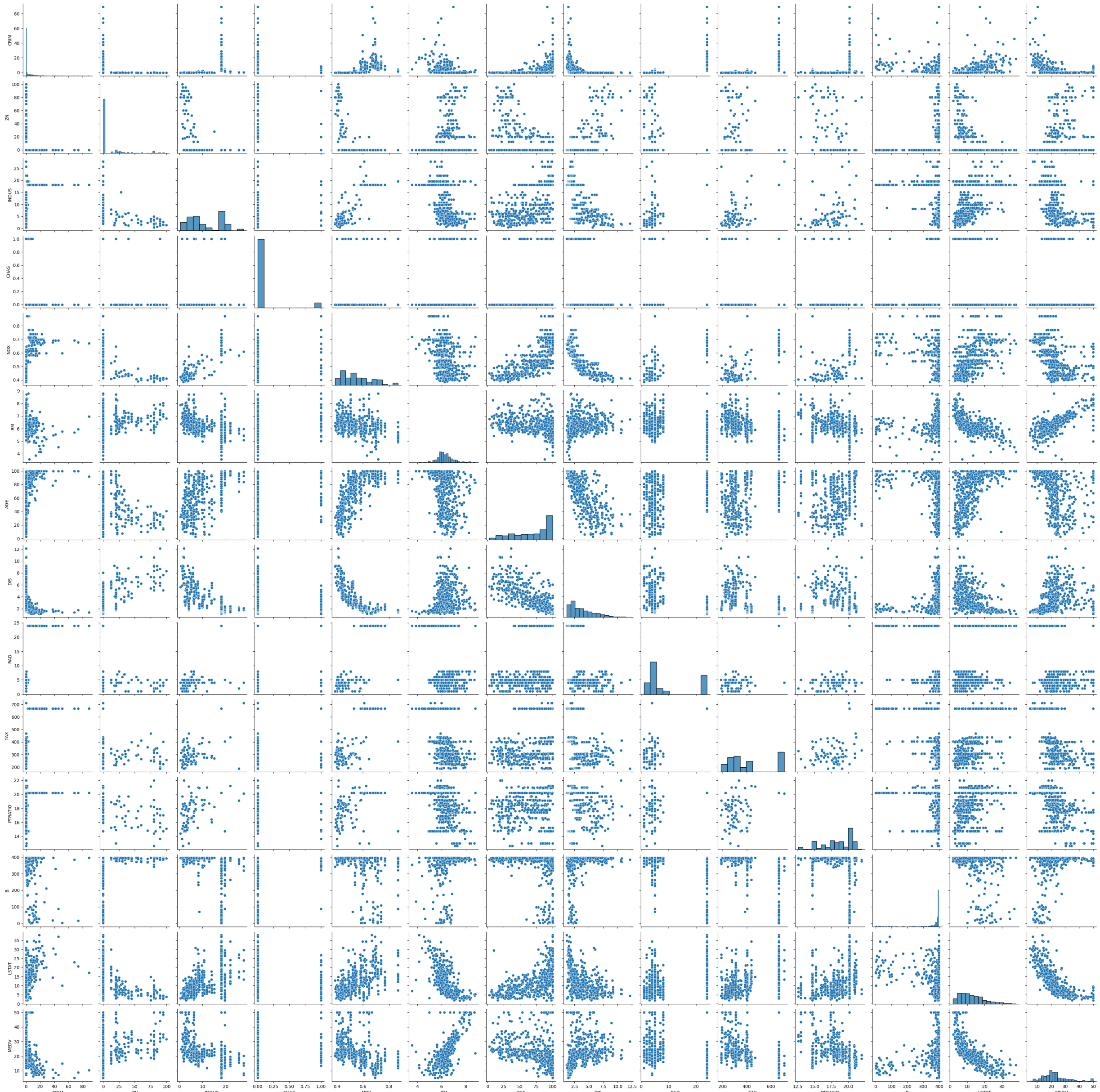
```
<Axes: >
```



In [ ]:
```
print("PAIR - PLOT OF ALL FEATURES WITH LABEL")
sns.pairplot(data)
```

```
PAIR - PLOT OF ALL FEATURES WITH LABEL
```

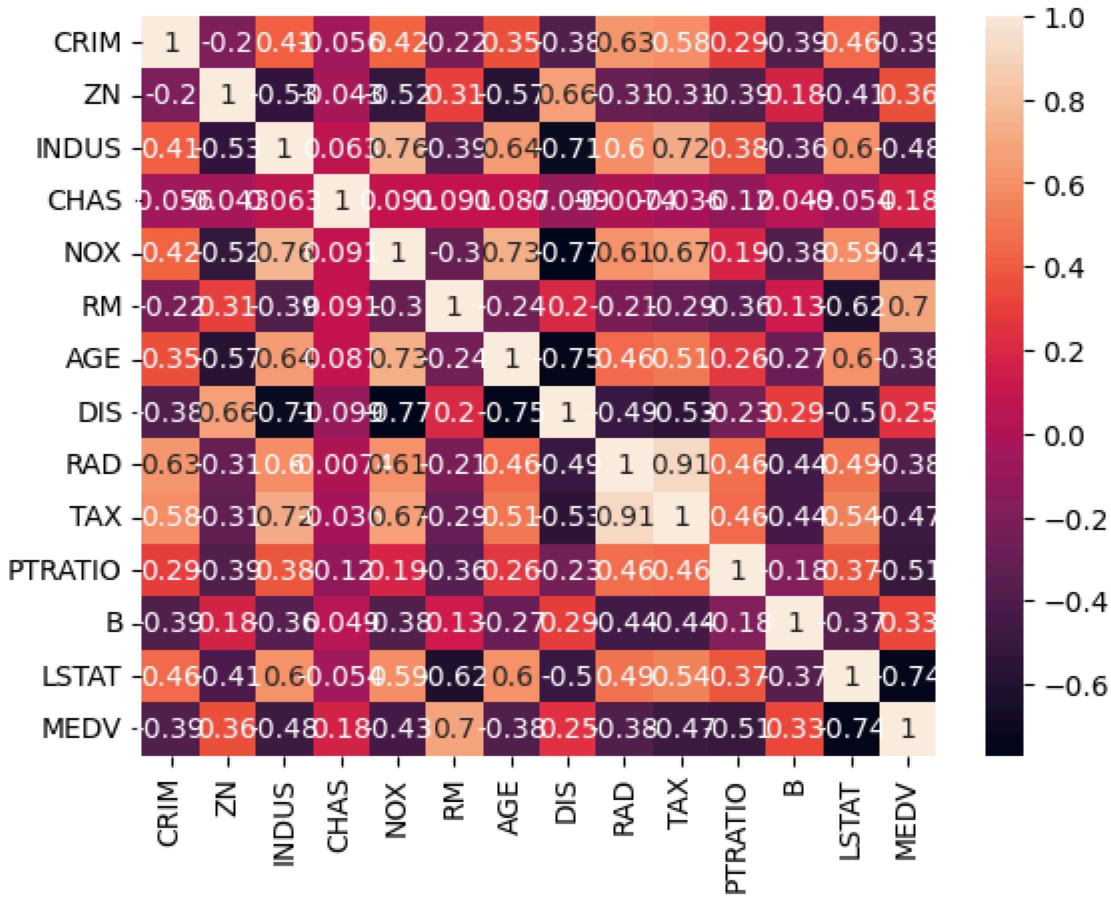
Out[ ]:
```
<seaborn.axisgrid.PairGrid at 0x1c9800d6ff0>
```



In [ ]:
```
print("HEATMAP")
sns.heatmap(data.corr(), annot=True)
```

HEATMAP

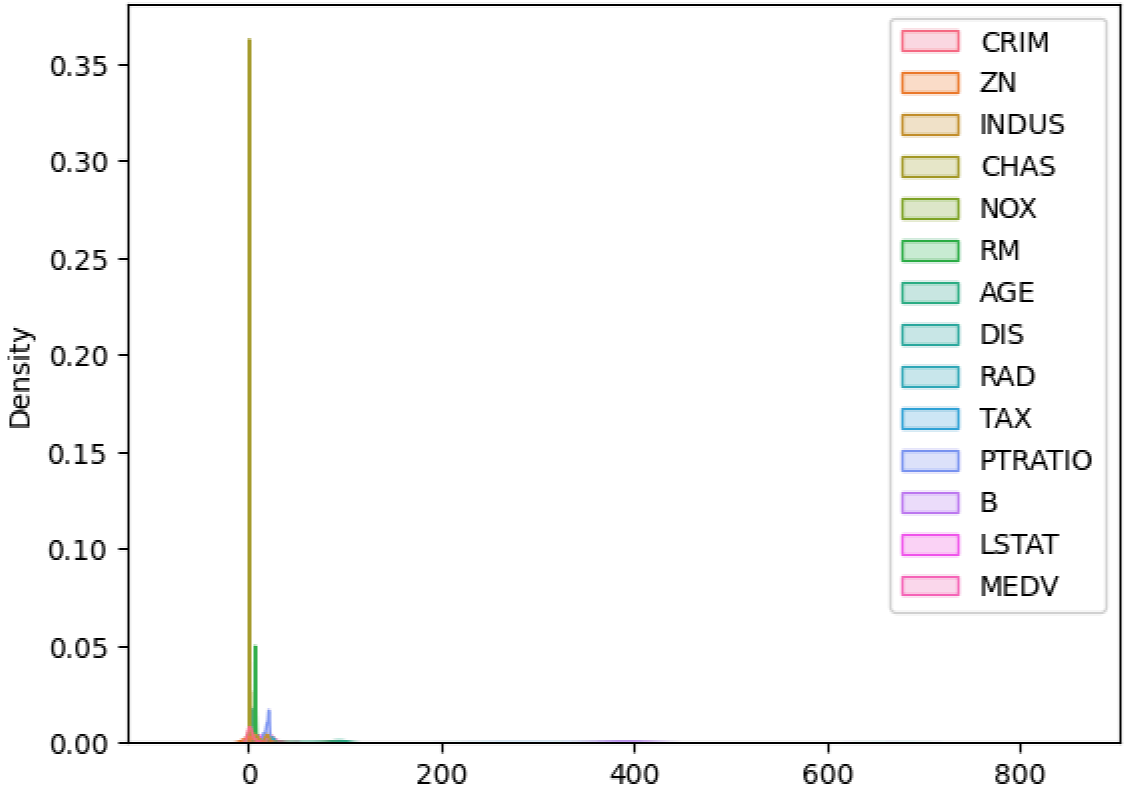
Out[ ]: <Axes: >




```
In [ ]: print("Density - Plot")
        sns.kdeplot(data, fill=True)
```

```
Density - Plot
```

```
Out[ ]: <Axes: ylabel='Density'>
```



INDEPENDENT - FEATURES & DEPENDENT - LABEL

In [ ]:
```
print(F"Matrix For Independent Features In The Dataset -> \n{X}")
```

```
Matrix For Independent Features In The Dataset ->
[[6.3200e-03 1.8000e+01 2.3100e+00 ... 1.5300e+01 3.9690e+02 4.9800e+00]
 [2.7310e-02 0.0000e+00 7.0700e+00 ... 1.7800e+01 3.9690e+02 9.1400e+00]
 [2.7290e-02 0.0000e+00 7.0700e+00 ... 1.7800e+01 3.9283e+02 4.0300e+00]
 ...
 [6.0760e-02 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9690e+02 5.6400e+00]
 [1.0959e-01 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9345e+02 6.4800e+00]
 [4.7410e-02 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9690e+02 7.8800e+00]]
```

In [ ]:
```
print(F"Matrix For Dependent Features In The Dataset -> MEVD \n{Y.reshape(len(Y),1)
```

```
Matrix For Dependent Features In The Dataset -> MEVD
[[24. ]
 [21.6]
 [34.7]
 [33.4]
 [36.2]
 [28.7]
 [22.9]
 [27.1]
 [16.5]
 [18.9]
 [15. ]
 [18.9]
 [21.7]
 [20.4]
 [18.2]
 [19.9]
 [23.1]
 [17.5]
 [20.2]
 [18.2]
 [13.6]
 [19.6]
 [15.2]
 [14.5]
 [15.6]
 [13.9]
 [16.6]
 [14.8]
 [18.4]
 [21. ]
 [12.7]
 [14.5]
 [13.2]
 [13.1]
 [13.5]
 [18.9]
 [20. ]
 [21. ]
 [24.7]
 [30.8]
 [34.9]
 [26.6]
 [25.3]
 [24.7]
 [21.2]
 [19.3]
 [20. ]
 [16.6]
 [14.4]
 [19.4]
 [19.7]
 [20.5]
 [25. ]
 [23.4]
 [18.9]
```

```
[35.4]
[24.7]
[31.6]
[23.3]
[19.6]
[18.7]
[16. ]
[22.2]
[25. ]
[33. ]
[23.5]
[19.4]
[22. ]
[17.4]
[20.9]
[24.2]
[21.7]
[22.8]
[23.4]
[24.1]
[21.4]
[20. ]
[20.8]
[21.2]
[20.3]
[28. ]
[23.9]
[24.8]
[22.9]
[23.9]
[26.6]
[22.5]
[22.2]
[23.6]
[28.7]
[22.6]
[22. ]
[22.9]
[25. ]
[20.6]
[28.4]
[21.4]
[38.7]
[43.8]
[33.2]
[27.5]
[26.5]
[18.6]
[19.3]
[20.1]
[19.5]
[19.5]
[20.4]
[19.8]
[19.4]
[21.7]
```

```
[22.8]
[18.8]
[18.7]
[18.5]
[18.3]
[21.2]
[19.2]
[20.4]
[19.3]
[22. ]
[20.3]
[20.5]
[17.3]
[18.8]
[21.4]
[15.7]
[16.2]
[18. ]
[14.3]
[19.2]
[19.6]
[23. ]
[18.4]
[15.6]
[18.1]
[17.4]
[17.1]
[13.3]
[17.8]
[14. ]
[14.4]
[13.4]
[15.6]
[11.8]
[13.8]
[15.6]
[14.6]
[17.8]
[15.4]
[21.5]
[19.6]
[15.3]
[19.4]
[17. ]
[15.6]
[13.1]
[41.3]
[24.3]
[23.3]
[27. ]
[50. ]
[50. ]
[50. ]
[22.7]
[25. ]
[50. ]
```

```
[23.8]
[23.8]
[22.3]
[17.4]
[19.1]
[23.1]
[23.6]
[22.6]
[29.4]
[23.2]
[24.6]
[29.9]
[37.2]
[39.8]
[36.2]
[37.9]
[32.5]
[26.4]
[29.6]
[50. ]
[32. ]
[29.8]
[34.9]
[37. ]
[30.5]
[36.4]
[31.1]
[29.1]
[50. ]
[33.3]
[30.3]
[34.6]
[34.9]
[32.9]
[24.1]
[42.3]
[48.5]
[50. ]
[22.6]
[24.4]
[22.5]
[24.4]
[20. ]
[21.7]
[19.3]
[22.4]
[28.1]
[23.7]
[25. ]
[23.3]
[28.7]
[21.5]
[23. ]
[26.7]
[21.7]
[27.5]
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 [30.1]
 [44.8]
 [50. ]
 [37.6]
 [31.6]
 [46.7]
 [31.5]
 [24.3]
 [31.7]
 [41.7]
 [48.3]
 [29. ]
 [24. ]
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 [31.5]
 [23.7]
 [23.3]
 [22. ]
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 [17.6]
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 [26.2]
 [24.4]
 [24.8]
 [29.6]
 [42.8]
 [21.9]
 [20.9]
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 [36. ]
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 [33.8]
 [43.1]
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 [30.7]
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 [24.4]
 [35.2]
 [32.4]
 [32. ]
 [33.2]
 [33.1]
 [29.1]
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[35.1]
[45.4]
[35.4]
[46. ]
[50. ]
[32.2]
[22. ]
[20.1]
[23.2]
[22.3]
[24.8]
[28.5]
[37.3]
[27.9]
[23.9]
[21.7]
[28.6]
[27.1]
[20.3]
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[24.8]
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[26.4]
[33.1]
[36.1]
[28.4]
[33.4]
[28.2]
[22.8]
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[19.8]
[23.1]
[21. ]
[23.8]
[23.1]
[20.4]
[18.5]
[25. ]
[24.6]
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[22.2]
[19.3]
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[19.8]
[17.1]
[19.4]
[22.2]
[20.7]
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[21.1]
[19.5]
[18.5]
[20.6]
[19. ]
[18.7]
[32.7]
[16.5]
[23.9]
[31.2]
[17.5]
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[23.1]
[24.5]
[26.6]
[22.9]
[24.1]
[18.6]
[30.1]
[18.2]
[20.6]
[17.8]
[21.7]
[22.7]
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[25. ]
[19.9]
[20.8]
[16.8]
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[23.1]
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[12.3]
[ 8.8]
[ 7.2]
[10.5]
[ 7.4]
[10.2]
[11.5]
[15.1]
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[23.2]
[ 9.7]
[13.8]
[12.7]
[13.1]
[12.5]
[ 8.5]
[ 5. ]
[ 6.3]
[ 5.6]
[ 7.2]
[12.1]
[ 8.3]
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[ 5. ]
[11.9]
[27.9]
[17.2]
[27.5]
[15. ]
[17.2]
[17.9]
[16.3]
[ 7. ]
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[ 7.5]
[10.4]
[ 8.8]
[ 8.4]
[16.7]
[14.2]
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[10.2]
[10.9]
[11. ]
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[ 8.4]
[12.8]
[10.5]
[17.1]
[18.4]
[15.4]
[10.8]
[11.8]
[14.9]
```

```
[12.6]
[14.1]
[13. ]
[13.4]
[15.2]
[16.1]
[17.8]
[14.9]
[14.1]
[12.7]
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[14.9]
[20. ]
[16.4]
[17.7]
[19.5]
[20.2]
[21.4]
[19.9]
[19. ]
[19.1]
[19.1]
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[15.2]
[ 7. ]
[ 8.1]
[13.6]
[20.1]
[21.8]
[24.5]
[23.1]
[19.7]
[18.3]
[21.2]
[17.5]
[16.8]
[22.4]
[20.6]
```

```
[23.9]
[22. ]
[11.9]]
```

VALIDATING THE MISSING VALUES IN THE DATASET

In [ ]:
```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(missing_values=np.nan, strategy='mean')
X[:, :14] = imputer.fit_transform(X[:, :14])
```

In [ ]:
```
print(F"AFTER VALIDATING THE MISSING VALUES IN 'x' MATRIX : \n{X} ")
```

```
AFTER VALIDATING THE MISSING VALUES IN 'x' MATRIX :
[[6.3200e-03 1.8000e+01 2.3100e+00 ... 1.5300e+01 3.9690e+02 4.9800e+00]
 [2.7310e-02 0.0000e+00 7.0700e+00 ... 1.7800e+01 3.9690e+02 9.1400e+00]
 [2.7290e-02 0.0000e+00 7.0700e+00 ... 1.7800e+01 3.9283e+02 4.0300e+00]
 ...
 [6.0760e-02 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9690e+02 5.6400e+00]
 [1.0959e-01 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9345e+02 6.4800e+00]
 [4.7410e-02 0.0000e+00 1.1930e+01 ... 2.1000e+01 3.9690e+02 7.8800e+00]]
```

< NO ENCODNG IS NEEDED >

TRAIN AND TEST SPLIT

In [ ]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.2, random_s
```

In [ ]:
```
print(F"The Independent Training Set :{X_train.shape} \n{X_train}") # Printing The
```

```
The Independent Training Set :(404, 13)
[[3.5809e-01 0.0000e+00 6.2000e+00 ... 1.7400e+01 3.9170e+02 9.7100e+00]
 [1.5876e-01 0.0000e+00 1.0810e+01 ... 1.9200e+01 3.7694e+02 9.8800e+00]
 [1.1329e-01 3.0000e+01 4.9300e+00 ... 1.6600e+01 3.9125e+02 1.1380e+01]
 ...
 [1.5098e-01 0.0000e+00 1.0010e+01 ... 1.7800e+01 3.9451e+02 1.0300e+01]
 [2.2927e-01 0.0000e+00 6.9100e+00 ... 1.7900e+01 3.9274e+02 1.8800e+01]
 [1.3914e-01 0.0000e+00 4.0500e+00 ... 1.6600e+01 3.9690e+02 1.4690e+01]]
```

In [ ]:
```
print(F"The Dependent Training Set : {Y_train.shape} \n{Y_train}") # Printing The D
```

```
The Dependent Training Set : (404,)
[26.7 21.7 22.  22.9 10.4 21.9 20.6 26.4 41.3 17.2 27.1 20.4 16.5 24.4
  8.4 23.   9.7 50.  30.5 12.3 19.4 21.2 20.3 18.8 33.4 18.5 19.6 33.2
 13.1  7.5 13.6 17.4  8.4 35.4 24.  13.4 26.2  7.2 13.1 24.5 37.2 25.
 24.1 16.6 32.9 36.2 11.   7.2 22.8 28.7 14.4 24.4 18.1 22.5 20.5 15.2
 17.4 13.6  8.7 18.2 35.4 31.7 33.  22.2 20.4 23.9 25.  12.7 29.1 12.
 17.7 27.  20.6 10.2 17.5 19.7 29.8 20.5 14.9 10.9 19.5 22.7 19.5 24.6
 25.  24.5 50.  14.3 11.8 31.  28.7 16.2 43.5 25.  22.  19.9 22.1 46.
 22.9 20.2 43.1 34.6 13.8 24.3 21.5 24.4 21.2 23.8 26.6 25.1  9.6 19.4
 19.4  9.5 14.  26.5 13.8 34.7 16.3 21.7 17.5 15.6 20.9 21.7 12.7 18.5
 23.7 19.3 12.7 21.6 23.2 29.6 21.2 23.8 17.1 22.  36.5 18.8 21.9 23.1
 20.2 17.4 37.  24.1 36.2 15.7 32.2 13.5 17.9 13.3 11.7 41.7 18.4 13.1
 25.  21.2 16.  34.9 25.2 24.8 21.5 23.4 18.9 10.8 21.  27.5 17.5 13.5
 28.7 14.8 19.1 28.6 13.1 19.  11.3 13.3 22.4 20.1 18.2 22.9 20.6 25.
 12.8 34.9 23.7 50.  29.  30.1 22.  15.6 23.3 30.1 14.3 22.8 50.  20.8
  6.3 34.9 32.4 19.9 20.3 17.8 23.1 20.4 23.2  7.  16.8 46.7 50.  22.9
 23.9 21.4 21.7 15.4 15.3 23.1 23.9 19.4 11.9 17.8 31.5 33.8 20.8 19.8
 22.4  5.  24.5 19.4 15.1 18.2 19.3 27.1 20.7 37.6 11.7 33.4 30.1 21.4
 45.4 20.1 20.8 26.4 10.4 21.8 32.  21.7 18.4 37.9 17.8 28.  28.2 36.
 18.9 15.  22.5 30.7 20.  19.1 23.3 26.6 21.1 19.7 20.  12.1  7.2 14.2
 17.3 27.5 22.2 10.9 19.2 32.  14.5 24.7 12.6 24.  24.1 50.  16.1 43.8
 26.6 36.1 21.8 29.9 50.  44.  20.6 19.6 28.4 19.1 22.3 20.9 28.4 14.4
 32.7 13.8  8.5 22.5 35.1 31.6 17.8 15.6 20.7 39.8 17.8 19.6 14.9 22.
 48.8 25.  48.5 23.9 20.3 15.2 10.5 19.  16.4  8.8 22.  24.8 50.  19.3
 22.7 37.3 31.6  8.3 23.1 50.  13.9 16.1 25.3 19.5 10.2 19.9 35.2 13.4
 24.7 11.5 23.4 16.7 15.4 18.  28.5 18.4 32.5 50.  50.  19.6 17.6 42.3
 14.5 13.2 16.2 29.6 16.7 13.  22.3 13.4  5.  19.5 14.6 22.   8.1 24.6
 33.2 20.6 14.1 14.1 21.1 30.3 23.7 21.4 18.3  8.5 22.8 22.8 22.2 13.9
 25.  18.5  7.  22.6 20.1 30.8 31.1 23.8 12.5 23.6 23.2 24.2 22.2 27.9
 22.2 33.1 19.3 18.9 22.6 50.  24.8 18.5 36.4 19.2 16.6 23.1]
```

In [ ]:
```
print(F"The Independent Testing Set :{X_test.shape} \n{X_test}") # Printing The Ind
```

```
The Independent Testing Set :(102, 13)
[[6.7240e-02 0.0000e+00 3.2400e+00 ... 1.6900e+01 3.7521e+02 7.3400e+00]
 [9.2323e+00 0.0000e+00 1.8100e+01 ... 2.0200e+01 3.6615e+02 9.5300e+00]
 [1.1425e-01 0.0000e+00 1.3890e+01 ... 1.6400e+01 3.9374e+02 1.0500e+01]
 ...
 [1.4932e-01 2.5000e+01 5.1300e+00 ... 1.9700e+01 3.9511e+02 1.3150e+01]
 [1.4052e-01 0.0000e+00 1.0590e+01 ... 1.8600e+01 3.8581e+02 9.3800e+00]
 [1.2802e-01 0.0000e+00 8.5600e+00 ... 2.0900e+01 3.9524e+02 1.2270e+01]]
```

In [ ]:
```
print(F"The Dependent Testing Set : {Y_test.shape} \n{Y_test}") # Printing The Inde
```

```
The Dependent Testing Set : (102,)
[22.6 50.  23.   8.3 21.2 19.9 20.6 18.7 16.1 18.6  8.8 17.2 14.9 10.5
 50.  29.  23.  33.3 29.4 21.  23.8 19.1 20.4 29.1 19.3 23.1 19.6 19.4
 38.7 18.7 14.6 20.  20.5 20.1 23.6 16.8  5.6 50.  14.5 13.3 23.9 20.
 19.8 13.8 16.5 21.6 20.3 17.  11.8 27.5 15.6 23.1 24.3 42.8 15.6 21.7
 17.1 17.2 15.  21.7 18.6 21.  33.1 31.5 20.1 29.8 15.2 15.  27.5 22.6
 20.  21.4 23.5 31.2 23.7  7.4 48.3 24.4 22.6 18.3 23.3 17.1 27.9 44.8
 50.  23.  21.4 10.2 23.3 23.2 18.9 13.4 21.9 24.8 11.9 24.3 13.8 24.7
 14.1 18.7 28.1 19.8]
```

Resolved The Unbalanced Column 'CHAS'

In [ ]:
```
# Convert it to a pandas Series
X_train_series = pd.DataFrame(X_train)

# Now you can use value_counts() on the Series
counts = X_train_series[3].value_counts()

print(counts)
```

```
3
0.0    376
1.0     28
Name: count, dtype: int64
```

In [ ]:
```
# Convert it to a pandas Series
X_test_series = pd.DataFrame(X_test)

# Now you can use value_counts() on the Series
counts = X_test_series[3].value_counts()

print(counts)
```

```
3
0.0    95
1.0     7
Name: count, dtype: int64
```

In [ ]:
```
print(F"Ratio Of The CHAS IN X_train : {95//7}")
```

```
Ratio Of The CHAS IN X_train : 13
```

In [ ]:
```
print(F"Ratio Of The CHAS IN X_train : {376//28}")
```

```
Ratio Of The CHAS IN X_train : 13
```

The "CHAS" Is Been Resolved And It Has been Splited Evenly In Both 'X_train' & 'X_test' Respectively ABOVE

FEATURE SCALING

In [ ]:
```
from sklearn.preprocessing import StandardScaler
FS=StandardScaler()
X_FS= FS.fit_transform(X_train)
Y_FS = FS.fit_transform(Y_train.reshape(len(Y_train),-1))
```

In [ ]:
```
print(F"Featured Scaled Values of X_train  :{X_FS.shape} \n{X_FS}")
```

```
Featured Scaled Values of X_train  :(404, 13)
[[-0.37257438 -0.49960763 -0.70492455 ... -0.48463784  0.3716906
  -0.41100022]
 [-0.39709866 -0.49960763 -0.04487755 ...  0.33649132  0.20501196
  -0.38768057]
 [-0.402693    0.77116771 -0.88675963 ... -0.84958414  0.36660893
  -0.18191902]
 ...
 [-0.39805586 -0.49960763 -0.15941933 ... -0.30216469  0.40342278
  -0.33006734]
 [-0.38842357 -0.49960763 -0.60326872 ... -0.25654641  0.38343489
   0.8359148 ]
 [-0.39951258 -0.49960763 -1.01275558 ... -0.84958414  0.43041207
   0.27212814]]
```

In [ ]:
```
print(F"Featured Scaled Values of Y_train  :{Y_FS.shape} \n{Y_FS}")
```

```
Featured Scaled Values of Y_train  :(404, 1)
[[ 4.43044345e-01]
 [-9.88238901e-02]
 [-6.63117960e-02]
 [ 3.12244864e-02]
 [-1.32344610e+00]
 [-7.71491607e-02]
 [-2.18034902e-01]
 [ 4.10532251e-01]
 [ 2.02529959e+00]
 [-5.86505302e-01]
 [ 4.86393804e-01]
 [-2.39709631e-01]
 [-6.62366855e-01]
 [ 1.93784957e-01]
 [-1.54019340e+00]
 [ 4.20618512e-02]
 [-1.39930766e+00]
 [ 2.96815032e+00]
 [ 8.54864204e-01]
 [-1.11753617e+00]
 [-3.48083278e-01]
 [-1.53010714e-01]
 [-2.50546996e-01]
 [-4.13107467e-01]
 [ 1.16914778e+00]
 [-4.45619561e-01]
 [-3.26408549e-01]
 [ 1.14747305e+00]
 [-1.03083726e+00]
 [-1.63772968e+00]
 [-9.76650432e-01]
 [-5.64830573e-01]
 [-1.54019340e+00]
 [ 1.38589508e+00]
 [ 1.50435498e-01]
 [-9.98325161e-01]
 [ 3.88857522e-01]
 [-1.67024177e+00]
 [-1.03083726e+00]
 [ 2.04622322e-01]
 [ 1.58096764e+00]
 [ 2.58809145e-01]
 [ 1.61272863e-01]
 [-6.51529490e-01]
 [ 1.11496096e+00]
 [ 1.47259399e+00]
 [-1.25842191e+00]
 [-1.67024177e+00]
 [ 2.03871217e-02]
 [ 6.59791640e-01]
 [-8.89951514e-01]
 [ 1.93784957e-01]
 [-4.88969020e-01]
 [-1.21249724e-02]
 [-2.28872267e-01]
```

```
 [-8.03252596e-01]
 [-5.64830573e-01]
 [-9.76650432e-01]
 [-1.50768130e+00]
 [-4.78131655e-01]
 [ 1.38589508e+00]
 [ 9.84912581e-01]
 [ 1.12579832e+00]
 [-4.46370665e-02]
 [-2.39709631e-01]
 [ 1.39598134e-01]
 [ 2.58809145e-01]
 [-1.07418671e+00]
 [ 7.03141099e-01]
 [-1.15004827e+00]
 [-5.32318479e-01]
 [ 4.75556440e-01]
 [-2.18034902e-01]
 [-1.34512083e+00]
 [-5.53993208e-01]
 [-3.15571184e-01]
 [ 7.79002651e-01]
 [-2.28872267e-01]
 [-8.35764690e-01]
 [-1.26925928e+00]
 [-3.37245914e-01]
 [ 9.54975702e-03]
 [-3.37245914e-01]
 [ 2.15459687e-01]
 [ 2.58809145e-01]
 [ 2.04622322e-01]
 [ 2.96815032e+00]
 [-9.00788879e-01]
 [-1.17172300e+00]
 [ 9.09051028e-01]
 [ 6.59791640e-01]
 [-6.94878949e-01]
 [ 2.26372162e+00]
 [ 2.58809145e-01]
 [-6.63117960e-02]
 [-2.93896455e-01]
 [-5.54744312e-02]
 [ 2.53465573e+00]
 [ 3.12244864e-02]
 [-2.61384361e-01]
 [ 2.22037216e+00]
 [ 1.29919616e+00]
 [-9.54975702e-01]
 [ 1.82947592e-01]
 [-1.20498620e-01]
 [ 1.93784957e-01]
 [-1.53010714e-01]
 [ 1.28760769e-01]
 [ 4.32206981e-01]
 [ 2.69646510e-01]
 [-1.41014502e+00]
```

```
 [-3.48083278e-01]
 [-3.48083278e-01]
 [-1.42098238e+00]
 [-9.33300973e-01]
 [ 4.21369616e-01]
 [-9.54975702e-01]
 [ 1.31003352e+00]
 [-6.84041584e-01]
 [-9.88238901e-02]
 [-5.53993208e-01]
 [-7.59903137e-01]
 [-1.85522808e-01]
 [-9.88238901e-02]
 [-1.07418671e+00]
 [-4.45619561e-01]
 [ 1.17923404e-01]
 [-3.58920643e-01]
 [-1.07418671e+00]
 [-1.09661255e-01]
 [ 6.37365806e-02]
 [ 7.57327922e-01]
 [-1.53010714e-01]
 [ 1.28760769e-01]
 [-5.97342667e-01]
 [-6.63117960e-02]
 [ 1.50510609e+00]
 [-4.13107467e-01]
 [-7.71491607e-02]
 [ 5.28992159e-02]
 [-2.61384361e-01]
 [-5.64830573e-01]
 [ 1.55929291e+00]
 [ 1.61272863e-01]
 [ 1.47259399e+00]
 [-7.49065773e-01]
 [ 1.03909940e+00]
 [-9.87487796e-01]
 [-5.10643749e-01]
 [-1.00916253e+00]
 [-1.18256036e+00]
 [ 2.06864905e+00]
 [-4.56456926e-01]
 [-1.03083726e+00]
 [ 2.58809145e-01]
 [-1.53010714e-01]
 [-7.16553679e-01]
 [ 1.33170825e+00]
 [ 2.80483875e-01]
 [ 2.37134416e-01]
 [-1.20498620e-01]
 [ 8.54113100e-02]
 [-4.02270102e-01]
 [-1.28009664e+00]
 [-1.74685443e-01]
 [ 5.29743263e-01]
 [-5.53993208e-01]
```

```
[-9.87487796e-01]
[ 6.59791640e-01]
[-8.46602055e-01]
[-3.80595373e-01]
[ 6.48954275e-01]
[-1.03083726e+00]
[-3.91432737e-01]
[-1.22590982e+00]
[-1.00916253e+00]
[-2.29623371e-02]
[-2.72221725e-01]
[-4.78131655e-01]
[ 3.12244864e-02]
[-2.18034902e-01]
[ 2.58809145e-01]
[-1.06334935e+00]
[ 1.33170825e+00]
[ 1.17923404e-01]
[ 2.96815032e+00]
[ 6.92303734e-01]
[ 8.11514746e-01]
[-6.63117960e-02]
[-7.59903137e-01]
[ 7.45739453e-02]
[ 8.11514746e-01]
[-9.00788879e-01]
[ 2.03871217e-02]
[ 2.96815032e+00]
[-1.96360172e-01]
[-1.76777806e+00]
[ 1.33170825e+00]
[ 1.06077413e+00]
[-2.93896455e-01]
[-2.50546996e-01]
[-5.21481114e-01]
[ 5.28992159e-02]
[-2.39709631e-01]
[ 6.37365806e-02]
[-1.69191650e+00]
[-6.29854761e-01]
[ 2.61051729e+00]
[ 2.96815032e+00]
[ 3.12244864e-02]
[ 1.39598134e-01]
[-1.31335984e-01]
[-9.88238901e-02]
[-7.81577867e-01]
[-7.92415232e-01]
[ 5.28992159e-02]
[ 1.39598134e-01]
[-3.48083278e-01]
[-1.16088563e+00]
[-5.21481114e-01]
[ 9.63237852e-01]
[ 1.21249724e+00]
[-1.96360172e-01]
```

```
[-3.04733820e-01]
[-2.29623371e-02]
[-1.90866380e+00]
[ 2.04622322e-01]
[-3.48083278e-01]
[-8.14089961e-01]
[-4.78131655e-01]
[-3.58920643e-01]
[ 4.86393804e-01]
[-2.07197537e-01]
[ 1.62431710e+00]
[-1.18256036e+00]
[ 1.16914778e+00]
[ 8.11514746e-01]
[-1.31335984e-01]
[ 2.46963155e+00]
[-2.72221725e-01]
[-1.96360172e-01]
[ 4.10532251e-01]
[-1.32344610e+00]
[-8.79865254e-02]
[ 1.01742468e+00]
[-9.88238901e-02]
[-4.56456926e-01]
[ 1.65682919e+00]
[-5.21481114e-01]
[ 5.83930087e-01]
[ 6.05604816e-01]
[ 1.45091926e+00]
[-4.02270102e-01]
[-8.24927326e-01]
[-1.21249724e-02]
[ 8.76538934e-01]
[-2.83059090e-01]
[-3.80595373e-01]
[ 7.45739453e-02]
[ 4.32206981e-01]
[-1.63848078e-01]
[-3.15571184e-01]
[-2.83059090e-01]
[-1.13921090e+00]
[-1.67024177e+00]
[-9.11626243e-01]
[-5.75667937e-01]
[ 5.29743263e-01]
[-4.46370665e-02]
[-1.26925928e+00]
[-3.69758008e-01]
[ 1.01742468e+00]
[-8.79114149e-01]
[ 2.26297051e-01]
[-1.08502408e+00]
[ 1.50435498e-01]
[ 1.61272863e-01]
[ 2.96815032e+00]
[-7.05716314e-01]
```

```
[ 2.29623371e+00]
[ 4.32206981e-01]
[ 1.46175663e+00]
[-8.79865254e-02]
[ 7.89840016e-01]
[ 2.96815032e+00]
[ 2.31790844e+00]
[-2.18034902e-01]
[-3.26408549e-01]
[ 6.27279546e-01]
[-3.80595373e-01]
[-3.37997018e-02]
[-1.85522808e-01]
[ 6.27279546e-01]
[-8.89951514e-01]
[ 1.09328623e+00]
[-9.54975702e-01]
[-1.52935603e+00]
[-1.21249724e-02]
[ 1.35338298e+00]
[ 9.74075216e-01]
[-5.21481114e-01]
[-7.59903137e-01]
[-2.07197537e-01]
[ 1.86273912e+00]
[-5.21481114e-01]
[-3.26408549e-01]
[-8.35764690e-01]
[-6.63117960e-02]
[ 2.83810195e+00]
[ 2.58809145e-01]
[ 2.80558985e+00]
[ 1.39598134e-01]
[-2.50546996e-01]
[-8.03252596e-01]
[-1.31260874e+00]
[-3.91432737e-01]
[-6.73204220e-01]
[-1.49684394e+00]
[-6.63117960e-02]
[ 2.37134416e-01]
[ 2.96815032e+00]
[-3.58920643e-01]
[ 9.54975702e-03]
[ 1.59180500e+00]
[ 9.74075216e-01]
[-1.55103076e+00]
[ 5.28992159e-02]
[ 2.96815032e+00]
[-9.44138338e-01]
[-7.05716314e-01]
[ 2.91321239e-01]
[-3.37245914e-01]
[-1.34512083e+00]
[-2.93896455e-01]
[ 1.36422035e+00]
```

```
[-9.98325161e-01]
[ 2.26297051e-01]
[-1.20423509e+00]
[ 8.54113100e-02]
[-6.40692126e-01]
[-7.81577867e-01]
[-4.99806384e-01]
[ 6.38116910e-01]
[-4.56456926e-01]
[ 1.07161150e+00]
[ 2.96815032e+00]
[ 2.96815032e+00]
[-3.26408549e-01]
[-5.43155843e-01]
[ 2.13367324e+00]
[-8.79114149e-01]
[-1.01999989e+00]
[-6.94878949e-01]
[ 7.57327922e-01]
[-6.40692126e-01]
[-1.04167462e+00]
[-3.37997018e-02]
[-9.98325161e-01]
[-1.90866380e+00]
[-3.37245914e-01]
[-8.68276785e-01]
[-6.63117960e-02]
[-1.57270549e+00]
[ 2.15459687e-01]
[ 1.14747305e+00]
[-2.18034902e-01]
[-9.22463608e-01]
[-9.22463608e-01]
[-1.63848078e-01]
[ 8.33189475e-01]
[ 1.17923404e-01]
[-1.31335984e-01]
[-4.67294290e-01]
[-1.52935603e+00]
[ 2.03871217e-02]
[ 2.03871217e-02]
[-4.46370665e-02]
[-9.44138338e-01]
[ 2.58809145e-01]
[-4.45619561e-01]
[-1.69191650e+00]
[-1.28760769e-03]
[-2.72221725e-01]
[ 8.87376299e-01]
[ 9.19888393e-01]
[ 1.28760769e-01]
[-1.09586144e+00]
[ 1.07086039e-01]
[ 6.37365806e-02]
[ 1.72110228e-01]
[-4.46370665e-02]
```

```
[ 5.73092722e-01]
[-4.46370665e-02]
[ 1.13663569e+00]
[-3.58920643e-01]
[-4.02270102e-01]
[-1.28760769e-03]
[ 2.96815032e+00]
[ 2.37134416e-01]
[-4.45619561e-01]
[ 1.49426872e+00]
[-3.69758008e-01]
[-6.51529490e-01]
[ 5.28992159e-02]]
```

MODEL SELECTION < SELECTIVE BEST ,< AS PER GIVEN DATA >

LINEAR REGRESSION MODEL

In [ ]:
```
from sklearn.linear_model import LinearRegression
LR=LinearRegression()
LR.fit(X_train, Y_train)
```

Out[ ]:
```
▾ LinearRegression
LinearRegression()
```

Predicting the Test set results < LINEAR REGRESSION >

In [ ]:
```
Y_pred = LR.predict(X_test)
np.set_printoptions(precision=2)
print(np.concatenate((Y_pred.reshape(len(Y_pred),1), Y_test.reshape(len(Y_test),1))
```

```
[[24.87 22.6 ]
 [23.73 50.  ]
 [29.38 23.  ]
 [12.14  8.3 ]
 [21.44 21.2 ]
 [19.3  19.9 ]
 [20.51 20.6 ]
 [21.38 18.7 ]
 [18.91 16.1 ]
 [19.91 18.6 ]
 [ 5.14  8.8 ]
 [16.37 17.2 ]
 [17.08 14.9 ]
 [ 5.61 10.5 ]
 [39.98 50.  ]
 [32.5  29.  ]
 [22.47 23.  ]
 [36.85 33.3 ]
 [30.85 29.4 ]
 [23.16 21.  ]
 [24.78 23.8 ]
 [24.68 19.1 ]
 [20.57 20.4 ]
 [30.35 29.1 ]
 [22.44 19.3 ]
 [10.3  23.1 ]
 [17.65 19.6 ]
 [18.29 19.4 ]
 [35.49 38.7 ]
 [20.94 18.7 ]
 [18.3  14.6 ]
 [17.81 20.  ]
 [20.01 20.5 ]
 [24.08 20.1 ]
 [29.09 23.6 ]
 [19.3  16.8 ]
 [11.15  5.6 ]
 [24.59 50.  ]
 [17.58 14.5 ]
 [15.48 13.3 ]
 [26.22 23.9 ]
 [20.87 20.  ]
 [22.31 19.8 ]
 [15.63 13.8 ]
 [23.   16.5 ]
 [25.18 21.6 ]
 [20.14 20.3 ]
 [22.91 17.  ]
 [10.05 11.8 ]
 [24.26 27.5 ]
 [20.95 15.6 ]
 [17.33 23.1 ]
 [24.53 24.3 ]
 [29.94 42.8 ]
 [13.43 15.6 ]
 [21.74 21.7 ]
```

```
 [20.81 17.1 ]
 [15.52 17.2 ]
 [14.01 15.  ]
 [22.19 21.7 ]
 [17.78 18.6 ]
 [21.59 21.  ]
 [32.9  33.1 ]
 [31.1  31.5 ]
 [17.74 20.1 ]
 [32.75 29.8 ]
 [18.71 15.2 ]
 [19.46 15.  ]
 [19.   27.5 ]
 [22.9  22.6 ]
 [22.96 20.  ]
 [24.02 21.4 ]
 [30.75 23.5 ]
 [28.83 31.2 ]
 [25.9  23.7 ]
 [ 5.24  7.4 ]
 [36.68 48.3 ]
 [23.77 24.4 ]
 [27.25 22.6 ]
 [19.29 18.3 ]
 [28.63 23.3 ]
 [19.16 17.1 ]
 [18.99 27.9 ]
 [37.78 44.8 ]
 [39.16 50.  ]
 [23.72 23.  ]
 [25.36 21.4 ]
 [15.89 10.2 ]
 [26.11 23.3 ]
 [16.69 23.2 ]
 [15.85 18.9 ]
 [13.09 13.4 ]
 [24.76 21.9 ]
 [31.27 24.8 ]
 [22.17 11.9 ]
 [20.29 24.3 ]
 [ 0.6  13.8 ]
 [25.48 24.7 ]
 [15.57 14.1 ]
 [17.98 18.7 ]
 [25.3  28.1 ]
 [22.35 19.8 ]]
```

Evaluating the Model Performance < LINEAR REGRESSION >

In [ ]:
```
from sklearn.metrics import r2_score

# Assuming RMS is the R^2 score
RMS = r2_score(Y_test, Y_pred)
```

```
# Format the RMS value with two decimal points
formatted_RMS = "{:.2f}".format(RMS)

# Convert formatted_RMS to float for comparison
formatted_RMS_float = float(formatted_RMS)
if formatted_RMS_float==1:
    print(f"The R^2 Score {formatted_RMS} %   'Over Fitted Model'")
elif 0.8 < formatted_RMS_float < 0.9:
    print(f"The R^2 Score {formatted_RMS} %   'Perfect Model'")
elif 0.7 < formatted_RMS_float < 0.8:
    print(f"The R^2 Score {formatted_RMS} %   'accurate Model'")
elif 0.6 < formatted_RMS_float <0.7:
    print(f"The R^2 Score {formatted_RMS} %   'Modrate Model'")
elif 0.5< formatted_RMS_float < 0.6:
    print(f"The R^2 Score {formatted_RMS} %   'Under Fitted Model'")
else:
    print(f"The R^2 Score {formatted_RMS} %    'Weak Model'")
```

```
The R^2 Score 0.59 %   'Under Fitted Model'
```

SELECTED MODEL < DECISION REGRESSION >

In [ ]:

```
from sklearn.tree import DecisionTreeRegressor
DT= DecisionTreeRegressor(random_state = 0)
DT.fit(X_train, Y_train)
```

Out[ ]:

```
▾ DecisionTreeRegressor
DecisionTreeRegressor(random_state=0)
```

Predicting the Test set results < DECISION REGRESSION >

In [ ]:

```
Y_pred = DT.predict(X_test)
np.set_printoptions(precision=2)
print(np.concatenate((Y_pred.reshape(len(Y_pred),1), Y_test.reshape(len(Y_test),1))
```

```
[[23.7 22.6]
 [22.4 50. ]
 [19.2 23. ]
 [11.7  8.3]
 [21.7 21.2]
 [20.3 19.9]
 [21.2 20.6]
 [19.6 18.7]
 [19.9 16.1]
 [16.1 18.6]
 [ 7.2  8.8]
 [17.9 17.2]
 [14.2 14.9]
 [ 8.8 10.5]
 [48.5 50. ]
 [34.6 29. ]
 [21.4 23. ]
 [34.9 33.3]
 [24.1 29.4]
 [20.3 21. ]
 [24.7 23.8]
 [21.5 19.1]
 [20.1 20.4]
 [24.7 29.1]
 [21.8 19.3]
 [16.1 23.1]
 [17.5 19.6]
 [16.4 19.4]
 [39.8 38.7]
 [20.4 18.7]
 [12.5 14.6]
 [19.1 20. ]
 [17.6 20.5]
 [22.2 20.1]
 [23.8 23.6]
 [17.7 16.8]
 [ 8.5  5.6]
 [20.3 50. ]
 [11.7 14.5]
 [17.9 13.3]
 [23.4 23.9]
 [21.1 20. ]
 [20.9 19.8]
 [12.5 13.8]
 [22.  16.5]
 [22.  21.6]
 [22.4 20.3]
 [16.4 17. ]
 [13.4 11.8]
 [26.7 27.5]
 [19.  15.6]
 [15.6 23.1]
 [20.3 24.3]
 [35.2 42.8]
 [15.6 15.6]
 [18.9 21.7]
```

```
[19.4 17.1]
[17.5 17.2]
[10.9 15. ]
[22.5 21.7]
[20.6 18.6]
[23.1 21. ]
[29.6 33.1]
[22.8 31.5]
[20.6 20.1]
[24.1 29.8]
[17.4 15.2]
[27.1 15. ]
[16.3 27.5]
[23.1 22.6]
[20.6 20. ]
[26.4 21.4]
[24.1 23.5]
[30.5 31.2]
[25.  23.7]
[ 7.2  7.4]
[41.7 48.3]
[23.1 24.4]
[23.9 22.6]
[18.5 18.3]
[28.6 23.3]
[14.5 17.1]
[20.8 27.9]
[41.7 44.8]
[41.7 50. ]
[25.  23. ]
[21.2 21.4]
[13.8 10.2]
[24.4 23.3]
[12.7 23.2]
[16.6 18.9]
[11.8 13.4]
[20.6 21.9]
[30.1 24.8]
[21.1 11.9]
[20.9 24.3]
[11.9 13.8]
[22.9 24.7]
[12.7 14.1]
[17.6 18.7]
[25.  28.1]
[21.2 19.8]]
```

Evaluating the Model Performance < DECISION REGRESSION >

In [ ]:

```
from sklearn.metrics import r2_score

# Assuming RMS is the R^2 score
RMS = r2_score(Y_test, Y_pred)
```

```
# Format the RMS value with two decimal points
formatted_RMS = "{:.2f}".format(RMS)

# Convert formatted_RMS to float for comparison
formatted_RMS_float = float(formatted_RMS)
if formatted_RMS_float==1.0:
    print(f"The R^2 Score {formatted_RMS} %   'Over Fitted Model'")
elif 0.8 < formatted_RMS_float < 0.9:
    print(f"The R^2 Score {formatted_RMS} %   'Perfect Model'")
elif 0.7 < formatted_RMS_float < 0.8:
    print(f"The R^2 Score {formatted_RMS} %   'accurate Model'")
elif 0.6 < formatted_RMS_float <0.7:
    print(f"The R^2 Score {formatted_RMS} %   'Modrate Model'")
elif 0.0 < formatted_RMS_float < 0.5:
    print(f"The R^2 Score {formatted_RMS} %   'Under Fitted Model'")
elif formatted_RMS_float < 0.0:
    print(f"The R^2 Score {formatted_RMS} %   'BAD Model'")
else:
    print(f"The R^2 Score {formatted_RMS} %    'Weak Model'")
```

```
The R^2 Score 0.63 %   'Modrate Model'
```

SELECTED MODEL < RANDOM FOREST REGRESSION >

In [ ]:

```
from sklearn.ensemble import RandomForestRegressor
RFR = RandomForestRegressor(n_estimators = 5000, random_state = 0)
RFR.fit(X_train, Y_train)
```

Out[ ]:

```
RandomForestRegressor
RandomForestRegressor(n_estimators=5000, random_state=0)
```

Predicting the Test set results < RANDOM FOREST REGRESSION >

In [ ]:

```
Y_predRFR = RFR.predict(X_test)
np.set_printoptions(precision=2)
print(np.concatenate((Y_predRFR.reshape(len(Y_predRFR),1), Y_test.reshape(len(Y_tes
```

```
[[24.06 22.6 ]
 [27.99 50.  ]
 [22.08 23.  ]
 [11.01  8.3 ]
 [20.77 21.2 ]
 [20.74 19.9 ]
 [21.21 20.6 ]
 [20.14 18.7 ]
 [20.5  16.1 ]
 [18.75 18.6 ]
 [ 8.24  8.8 ]
 [15.32 17.2 ]
 [15.02 14.9 ]
 [ 8.43 10.5 ]
 [47.33 50.  ]
 [34.   29.  ]
 [21.07 23.  ]
 [34.69 33.3 ]
 [25.59 29.4 ]
 [21.19 21.  ]
 [23.72 23.8 ]
 [21.96 19.1 ]
 [19.74 20.4 ]
 [24.5  29.1 ]
 [20.39 19.3 ]
 [17.77 23.1 ]
 [18.65 19.6 ]
 [16.05 19.4 ]
 [43.98 38.7 ]
 [19.2  18.7 ]
 [14.87 14.6 ]
 [17.57 20.  ]
 [20.1  20.5 ]
 [21.47 20.1 ]
 [22.97 23.6 ]
 [17.88 16.8 ]
 [ 8.64  5.6 ]
 [27.94 50.  ]
 [14.52 14.5 ]
 [15.51 13.3 ]
 [22.76 23.9 ]
 [20.88 20.  ]
 [22.42 19.8 ]
 [15.16 13.8 ]
 [23.69 16.5 ]
 [22.42 21.6 ]
 [21.15 20.3 ]
 [16.56 17.  ]
 [14.54 11.8 ]
 [25.17 27.5 ]
 [16.32 15.6 ]
 [19.78 23.1 ]
 [21.96 24.3 ]
 [39.87 42.8 ]
 [15.04 15.6 ]
 [21.21 21.7 ]
```

```
 [19.68 17.1 ]
 [19.12 17.2 ]
 [21.72 15.  ]
 [20.08 21.7 ]
 [21.59 18.6 ]
 [21.69 21.  ]
 [33.29 33.1 ]
 [28.01 31.5 ]
 [18.36 20.1 ]
 [26.92 29.8 ]
 [15.99 15.2 ]
 [21.17 15.  ]
 [17.28 27.5 ]
 [22.02 22.6 ]
 [20.15 20.  ]
 [22.89 21.4 ]
 [24.37 23.5 ]
 [30.66 31.2 ]
 [29.56 23.7 ]
 [ 8.63  7.4 ]
 [43.01 48.3 ]
 [22.41 24.4 ]
 [22.8  22.6 ]
 [20.27 18.3 ]
 [26.57 23.3 ]
 [18.22 17.1 ]
 [22.46 27.9 ]
 [42.5  44.8 ]
 [41.7  50.  ]
 [24.37 23.  ]
 [22.7  21.4 ]
 [14.92 10.2 ]
 [26.44 23.3 ]
 [16.07 23.2 ]
 [19.2  18.9 ]
 [12.04 13.4 ]
 [22.51 21.9 ]
 [29.91 24.8 ]
 [21.13 11.9 ]
 [22.02 24.3 ]
 [11.61 13.8 ]
 [23.42 24.7 ]
 [14.88 14.1 ]
 [19.22 18.7 ]
 [24.05 28.1 ]
 [20.06 19.8 ]]
```

Evaluating the Model Performance < RANDOM FOREST REGRESSION >

In [ ]:

```
from sklearn.metrics import r2_score

# Assuming RMS is the R^2 score
RMS = r2_score(Y_test, Y_predRFR)
```

```
# Format the RMS value with two decimal points
formatted_RMS = "{:.2f}".format(RMS)

# Convert formatted_RMS to float for comparison
formatted_RMS_float = float(formatted_RMS)
if formatted_RMS_float==1.0:
    print(f"The R^2 Score {formatted_RMS} %   'Over Fitted Model'")
elif 0.9 < formatted_RMS_float < 1:
    print(f"The R^2 Score {formatted_RMS} %   'Perfect Model'")
elif 0.8 < formatted_RMS_float < 0.9:
    print(f"The R^2 Score {formatted_RMS} %   'accurate Model'")
elif 0.7 < formatted_RMS_float <0.8:
    print(f"The R^2 Score {formatted_RMS} %   'Modrate Model'")
elif 0.5 < formatted_RMS_float < 0.6:
    print(f"The R^2 Score {formatted_RMS} %   'Under Fitted Model'")
elif formatted_RMS_float < 0.0:
    print(f"The R^2 Score {formatted_RMS} %   'BAD Model'")
else:
    print(f"The R^2 Score {formatted_RMS} %    'Weak Model'")
```

```
The R^2 Score 0.77 %   'Modrate Model'
```

Grid Search CV

In [ ]:

```
from sklearn.model_selection import GridSearchCV
from sklearn.ensemble import RandomForestRegressor

# Define the parameter grid
parameters = {
    'n_estimators': [100, 200, 300, 400, 500, 600, 700, 800, 900, 1000],
    'criterion': ["squared_error", "absolute_error", "friedman_mse", "poisson"],
    'max_depth': [20]
}

# Initialize a RandomForestRegressor (you can choose any model)
model = RandomForestRegressor()

# Initialize GridSearchCV with the model, parameter grid, and any other necessary a
GCV = GridSearchCV(estimator=model, param_grid=parameters, cv=5)  # cv is the numbe
GCV.fit(X_train,Y_train)
```

Out[ ]:

```
▸ GridSearchCV
▸ estimator: RandomForestRegressor
  ▸ RandomForestRegressor
```

In [ ]:

```
Best_prarm=GCV.best_params_
print(Best_prarm)
```

```
{'criterion': 'squared_error', 'max_depth': 20, 'n_estimators': 100}
```

In [ ]:
```
Y_predGCV = GCV.predict(X_test)
np.set_printoptions(precision=2)
print(np.concatenate((Y_predRFR.reshape(len(Y_predRFR),1), Y_test.reshape(len(Y_tes
```

```
[[24.06 22.6 ]
 [27.99 50.  ]
 [22.08 23.  ]
 [11.01  8.3 ]
 [20.77 21.2 ]
 [20.74 19.9 ]
 [21.21 20.6 ]
 [20.14 18.7 ]
 [20.5  16.1 ]
 [18.75 18.6 ]
 [ 8.24  8.8 ]
 [15.32 17.2 ]
 [15.02 14.9 ]
 [ 8.43 10.5 ]
 [47.33 50.  ]
 [34.   29.  ]
 [21.07 23.  ]
 [34.69 33.3 ]
 [25.59 29.4 ]
 [21.19 21.  ]
 [23.72 23.8 ]
 [21.96 19.1 ]
 [19.74 20.4 ]
 [24.5  29.1 ]
 [20.39 19.3 ]
 [17.77 23.1 ]
 [18.65 19.6 ]
 [16.05 19.4 ]
 [43.98 38.7 ]
 [19.2  18.7 ]
 [14.87 14.6 ]
 [17.57 20.  ]
 [20.1  20.5 ]
 [21.47 20.1 ]
 [22.97 23.6 ]
 [17.88 16.8 ]
 [ 8.64  5.6 ]
 [27.94 50.  ]
 [14.52 14.5 ]
 [15.51 13.3 ]
 [22.76 23.9 ]
 [20.88 20.  ]
 [22.42 19.8 ]
 [15.16 13.8 ]
 [23.69 16.5 ]
 [22.42 21.6 ]
 [21.15 20.3 ]
 [16.56 17.  ]
 [14.54 11.8 ]
 [25.17 27.5 ]
 [16.32 15.6 ]
 [19.78 23.1 ]
 [21.96 24.3 ]
 [39.87 42.8 ]
 [15.04 15.6 ]
 [21.21 21.7 ]
```

```
 [19.68 17.1 ]
 [19.12 17.2 ]
 [21.72 15.  ]
 [20.08 21.7 ]
 [21.59 18.6 ]
 [21.69 21.  ]
 [33.29 33.1 ]
 [28.01 31.5 ]
 [18.36 20.1 ]
 [26.92 29.8 ]
 [15.99 15.2 ]
 [21.17 15.  ]
 [17.28 27.5 ]
 [22.02 22.6 ]
 [20.15 20.  ]
 [22.89 21.4 ]
 [24.37 23.5 ]
 [30.66 31.2 ]
 [29.56 23.7 ]
 [ 8.63  7.4 ]
 [43.01 48.3 ]
 [22.41 24.4 ]
 [22.8  22.6 ]
 [20.27 18.3 ]
 [26.57 23.3 ]
 [18.22 17.1 ]
 [22.46 27.9 ]
 [42.5  44.8 ]
 [41.7  50.  ]
 [24.37 23.  ]
 [22.7  21.4 ]
 [14.92 10.2 ]
 [26.44 23.3 ]
 [16.07 23.2 ]
 [19.2  18.9 ]
 [12.04 13.4 ]
 [22.51 21.9 ]
 [29.91 24.8 ]
 [21.13 11.9 ]
 [22.02 24.3 ]
 [11.61 13.8 ]
 [23.42 24.7 ]
 [14.88 14.1 ]
 [19.22 18.7 ]
 [24.05 28.1 ]
 [20.06 19.8 ]]
```

Score

In [ ]:

```
G=GCV.best_score_
print(G)
```

```
0.8626805578047279
```

SAVING THE Grid Search CV

In [ ]:
```
from joblib import dump, load
dump(GCV, 'REAL.joblib')
```

Out[ ]:
```
['REAL.joblib']
```

USING THE MODEL

In [ ]:
```
from joblib import dump, load
import numpy as np
GCV = load('REAL.joblib')
features = np.array([[-5.43942006, 4.12628155, -1.6165014, -0.67288841, -1.42262747
       -11.44443979304, -49.31238772,  7.61111401, -26.0016879 , -0.5778192 ,
       -0.97491834,  0.41164221, -66.86091034]])
K=GCV.predict(features)
PRICE=(int(K)*1000)
print(K)
```

```
[29.55]
C:\Users\surya\AppData\Local\Temp\ipykernel_22704\297953511.py:8: DeprecationWarnin
g: Conversion of an array with ndim > 0 to a scalar is deprecated, and will error in
future. Ensure you extract a single element from your array before performing this o
peration. (Deprecated NumPy 1.25.)
  PRICE=(int(K)*1000)
```

[29.55] By GCV

[30.12] RFR

In [ ]:
```
print(F"THE PRICE OF THE HOUSE IS {PRICE} $ IN BOSTON CITY")
```

```
THE PRICE OF THE HOUSE IS 29000 $ IN BOSTON CITY
```

BY RFR <24,39,720 RUPEES> / < 30000 > / / BY GCV <24,07,951 RUPEES>/<29000 >