In [21]:
```
import pandas as pd
import numpy as np
from sklearn.datasets import load_boston
boston = load_boston()
```

In [22]:
```
print(boston.keys())
```

```
dict_keys(['data', 'target', 'feature_names', 'DESCR', 'filename'])
```

In [23]:
```
print(boston.data.shape)
```

```
(506, 13)
```

In [24]:
```
print(boston.feature_names)
```

```
['CRIM' 'ZN' 'INDUS' 'CHAS' 'NOX' 'RM' 'AGE' 'DIS' 'RAD' 'TAX' 'PTRATIO'
 'B' 'LSTAT']
```

In [25]:
```
print(boston.DESCR)
```

```
.. _boston_dataset:

Boston house prices dataset
---------------------------

**Data Set Characteristics:**

    :Number of Instances: 506

    :Number of Attributes: 13 numeric/categorical predictive. Median Value (at
tribute 14) is usually the target.

    :Attribute Information (in order):
        - CRIM     per capita crime rate by town
        - ZN       proportion of residential land zoned for lots over 25,000 s
q.ft.
        - INDUS    proportion of non-retail business acres per town
        - CHAS     Charles River dummy variable (= 1 if tract bounds river; 0
otherwise)
        - NOX      nitric oxides concentration (parts per 10 million)
        - RM       average number of rooms per dwelling
        - AGE      proportion of owner-occupied units built prior to 1940
        - DIS      weighted distances to five Boston employment centres
        - RAD      index of accessibility to radial highways
        - TAX      full-value property-tax rate per $10,000
        - PTRATIO  pupil-teacher ratio by town
        - B        1000(Bk - 0.63)^2 where Bk is the proportion of black peopl
e by town
        - LSTAT    % lower status of the population
        - MEDV     Median value of owner-occupied homes in $1000's

    :Missing Attribute Values: None

    :Creator: Harrison, D. and Rubinfeld, D.L.

This is a copy of UCI ML housing dataset.
https://archive.ics.uci.edu/ml/machine-learning-databases/housing/


This dataset was taken from the StatLib library which is maintained at Carnegi
e Mellon University.

The Boston house-price data of Harrison, D. and Rubinfeld, D.L. 'Hedonic
```

```
prices and the demand for clean air', J. Environ. Economics & Management,
vol.5, 81-102, 1978.   Used in Belsley, Kuh & Welsch, 'Regression diagnostics
...', Wiley, 1980.   N.B. Various transformations are used in the table on
pages 244-261 of the latter.

The Boston house-price data has been used in many machine learning papers that
address regression
problems.

.. topic:: References

   - Belsley, Kuh & Welsch, 'Regression diagnostics: Identifying Influential D
ata and Sources of Collinearity', Wiley, 1980. 244-261.
   - Quinlan,R. (1993). Combining Instance-Based and Model-Based Learning. In
Proceedings on the Tenth International Conference of Machine Learning, 236-24
3, University of Massachusetts, Amherst. Morgan Kaufmann.
```

In [26]:

```
boston_pd = pd.DataFrame(boston.data)

print(boston_pd.head())
```

```
         0     1     2    3      4      5     6       7    8      9    10  \
0  0.00632  18.0  2.31  0.0  0.538  6.575  65.2  4.0900  1.0  296.0  15.3
1  0.02731   0.0  7.07  0.0  0.469  6.421  78.9  4.9671  2.0  242.0  17.8
2  0.02729   0.0  7.07  0.0  0.469  7.185  61.1  4.9671  2.0  242.0  17.8
3  0.03237   0.0  2.18  0.0  0.458  6.998  45.8  6.0622  3.0  222.0  18.7
4  0.06905   0.0  2.18  0.0  0.458  7.147  54.2  6.0622  3.0  222.0  18.7

       11    12
0  396.90  4.98
1  396.90  9.14
2  392.83  4.03
3  394.63  2.94
4  396.90  5.33
```

In [27]:

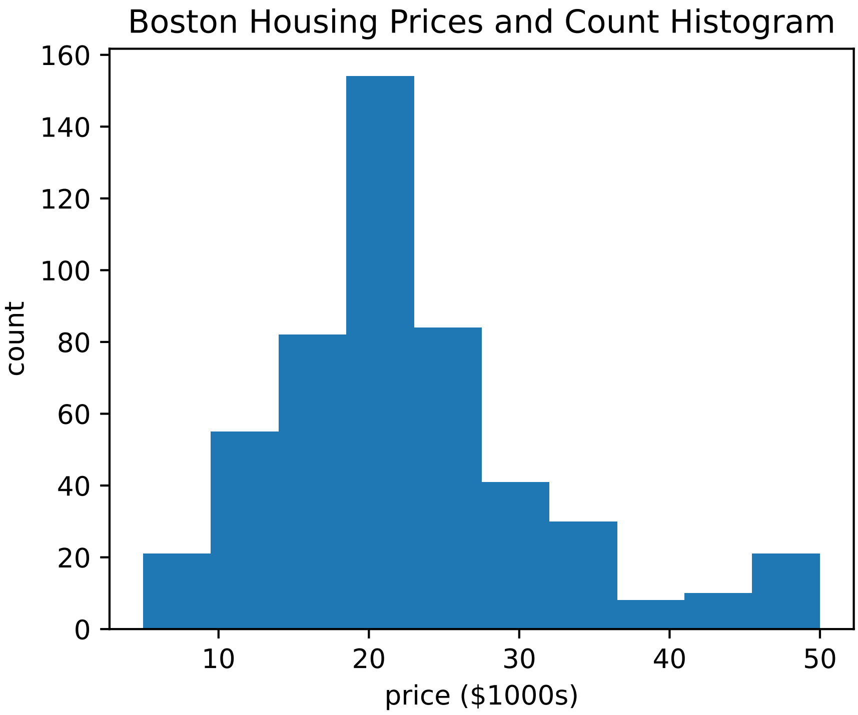
```
boston_pd.columns = boston.feature_names
print(boston_pd.head())
boston_pd["Prices"] = boston.target
```

```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900  1.0  296.0
1  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671  2.0  242.0
2  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671  2.0  242.0
3  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622  3.0  222.0
4  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622  3.0  222.0

   PTRATIO       B  LSTAT
0     15.3  396.90   4.98
1     17.8  396.90   9.14
2     17.8  392.83   4.03
3     18.7  394.63   2.94
4     18.7  396.90   5.33
```

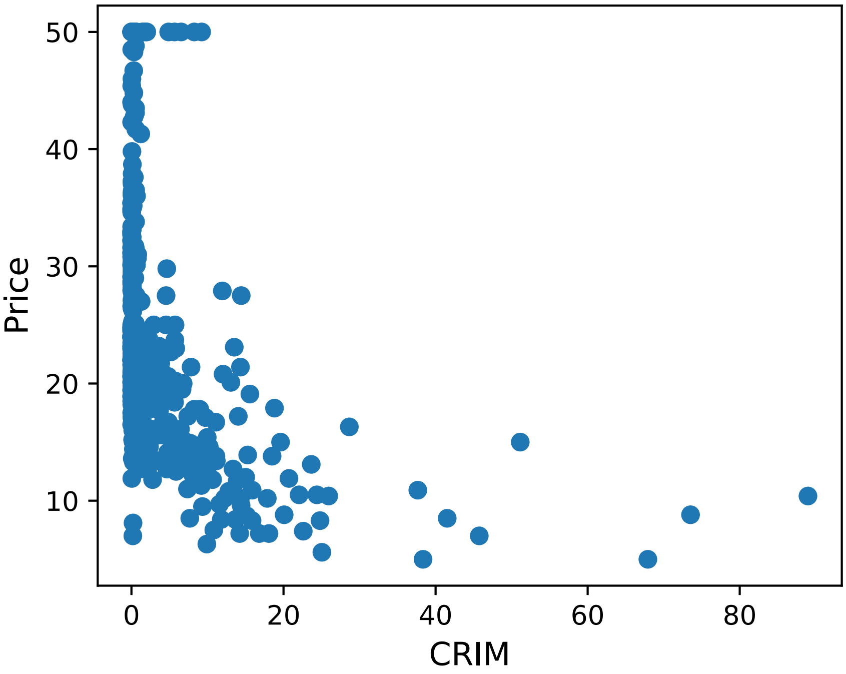
In [28]:

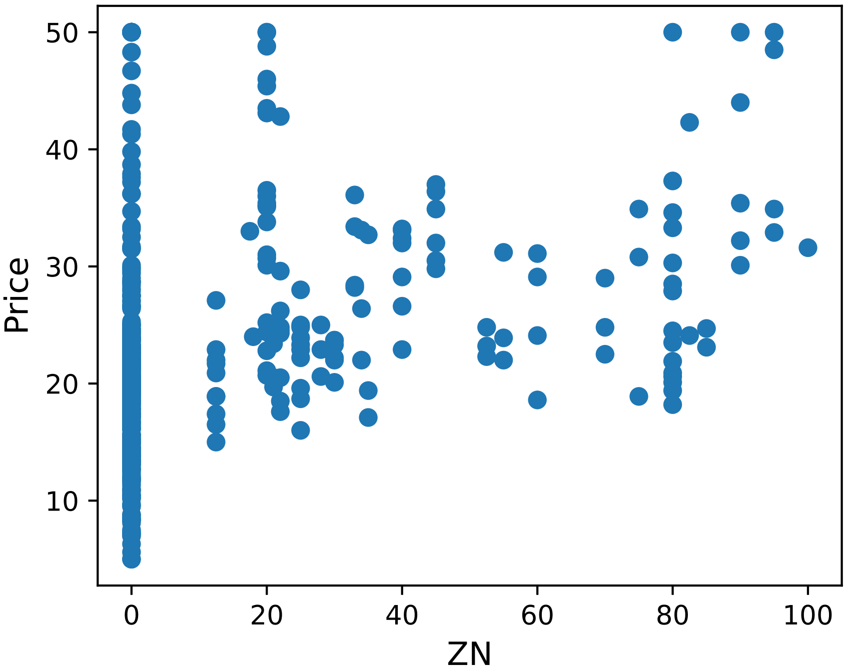
```
from sklearn.datasets import load_boston
import pandas as pd
import matplotlib.pyplot as plt
boston = load_boston()
plt.figure(figsize=(5, 4))
plt.hist(boston.target)
plt.title('Boston Housing Prices and Count Histogram')
plt.xlabel('price ($1000s)')
plt.ylabel('count')
plt.show()
```

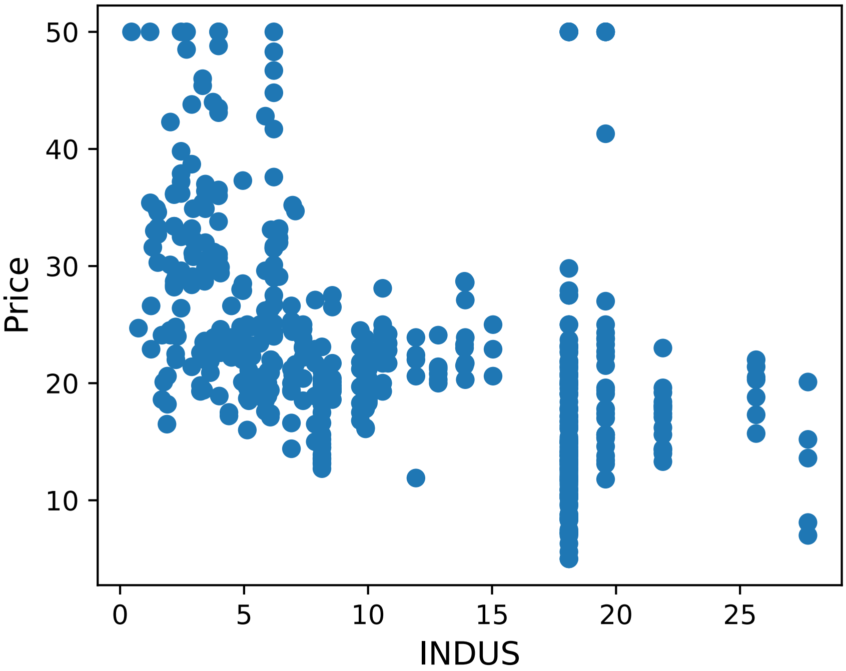


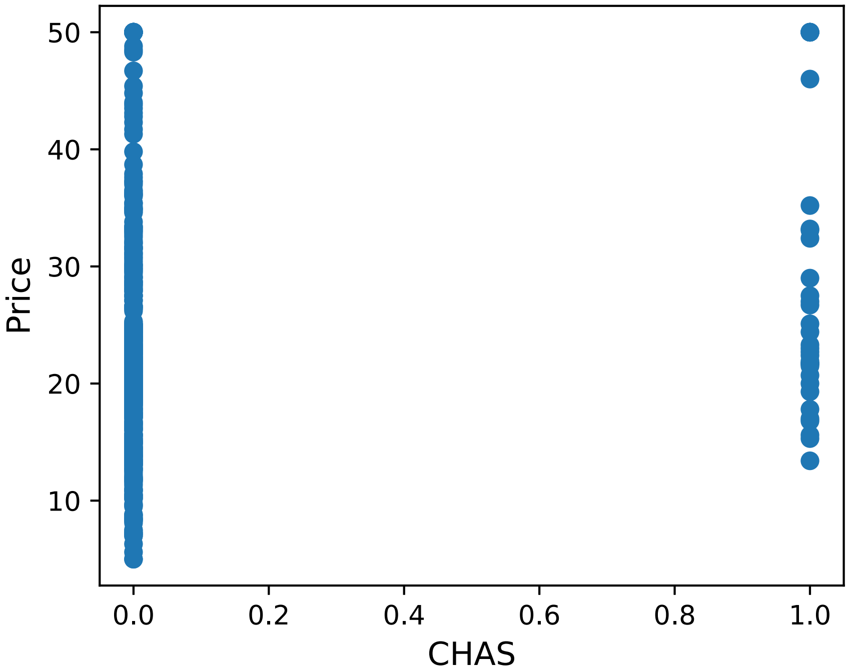
In [29]:

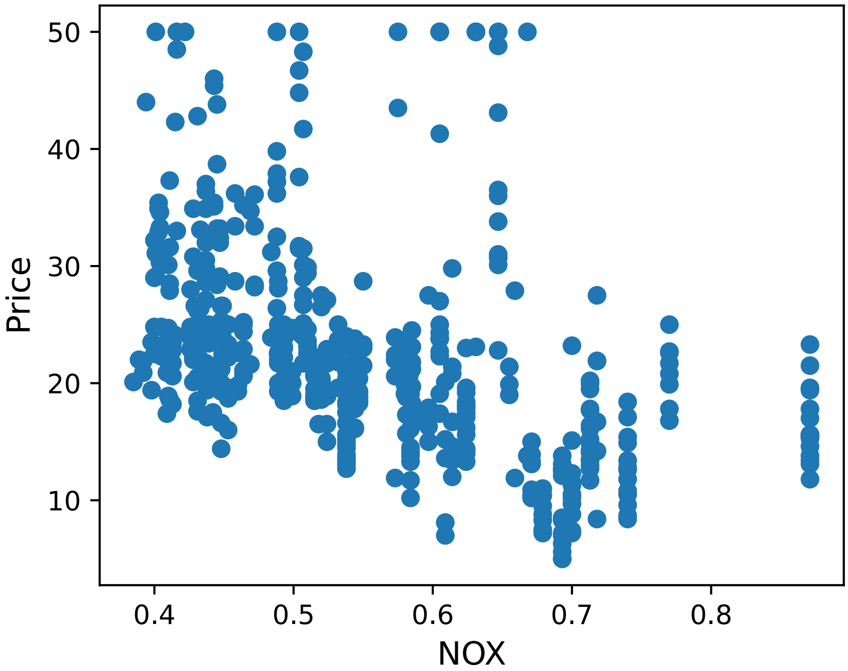
```
for index, feature_name in enumerate(boston.feature_names):
    plt.figure(figsize=(5, 4))
    plt.scatter(boston.data[:, index], boston.target)
    plt.ylabel('Price', size=12)
    plt.xlabel(feature_name, size=12)
    plt.show()
```

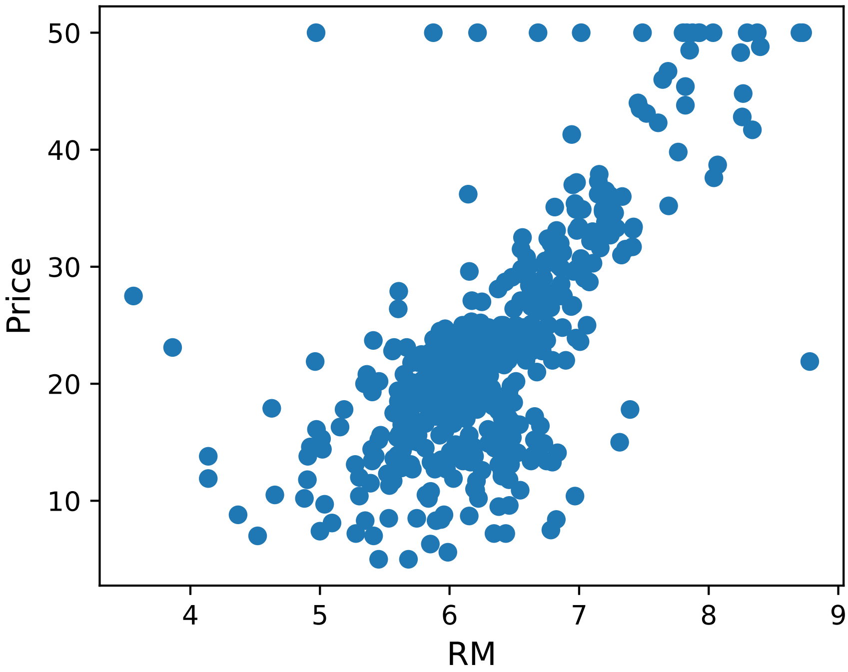


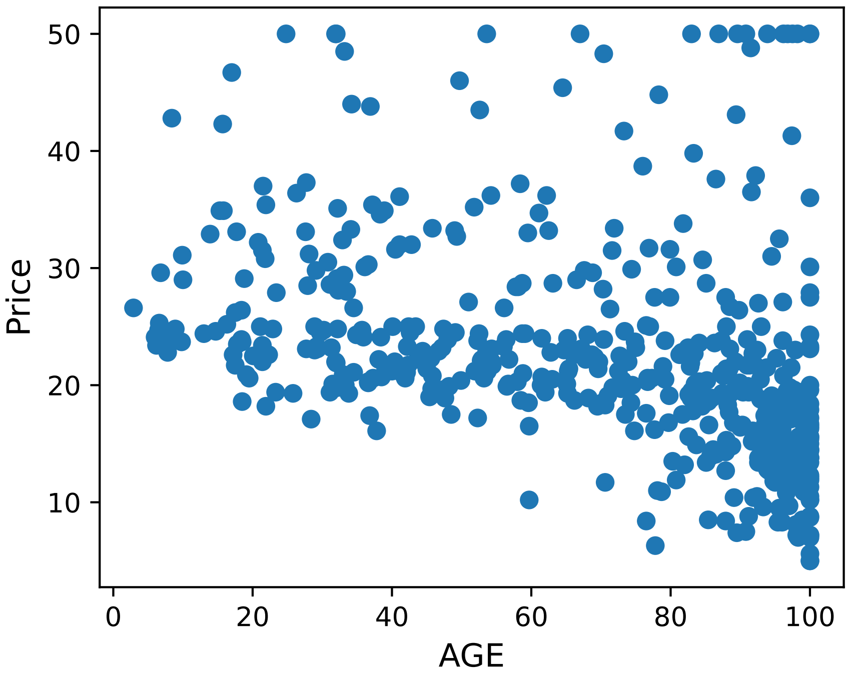

50
40
30
20
10
Price
0
20
40
60
80
100
ZN

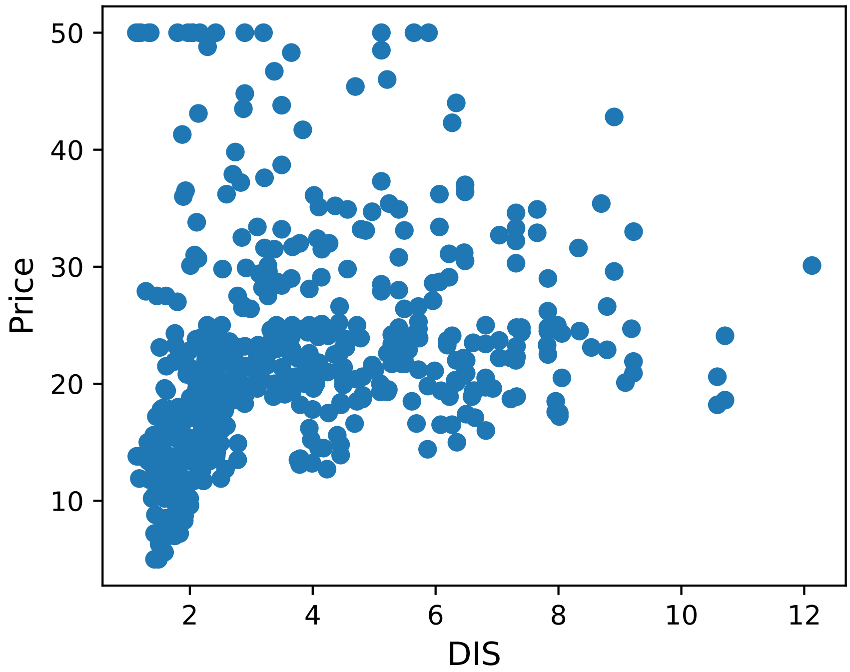

50
40
30
20
10
Price
0
5
10
15
20
25
INDUS

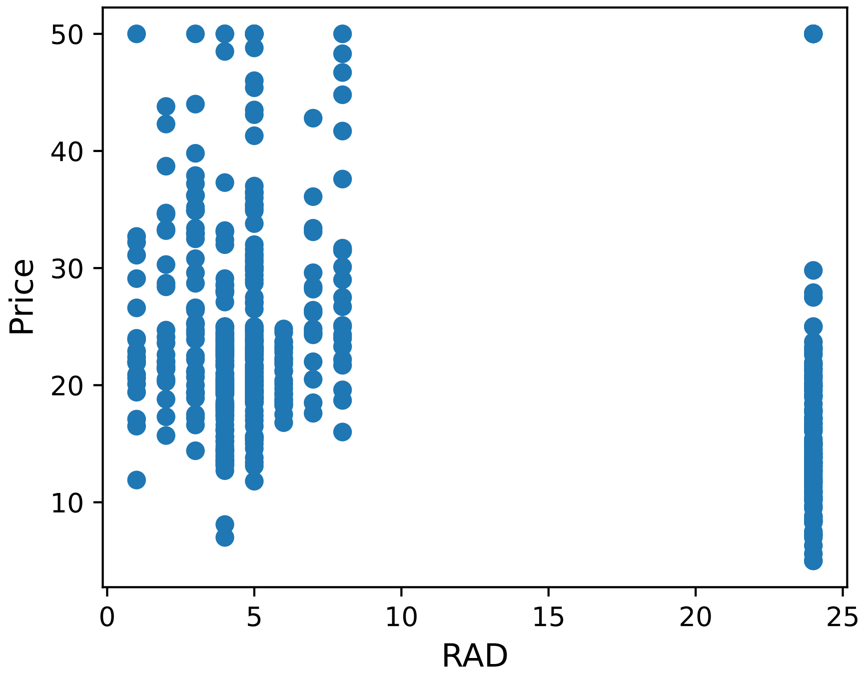

Price
CHAS
0.0
0.2
0.4
0.6
0.8
1.0
10
20
30
40
50

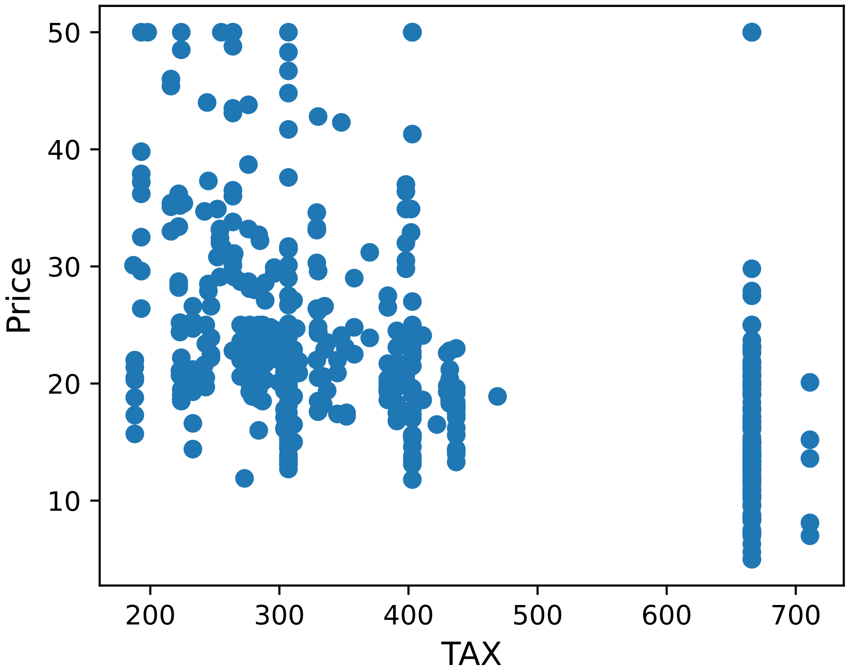

Price
NOX
0.4
0.5
0.6
0.7
0.8
10
20
30
40
50

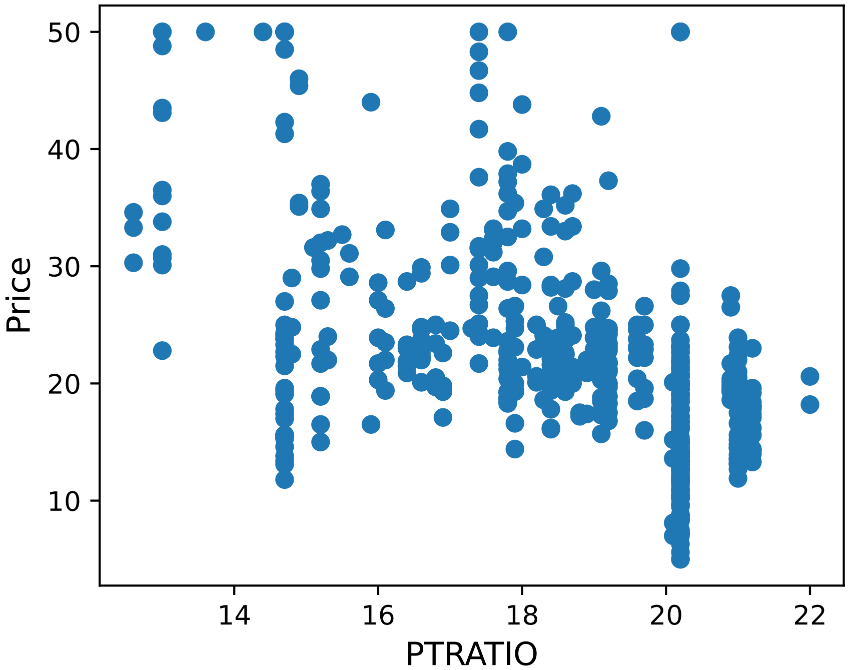

Price
RM
50
40
30
20
10
4
5
6
7
8
9

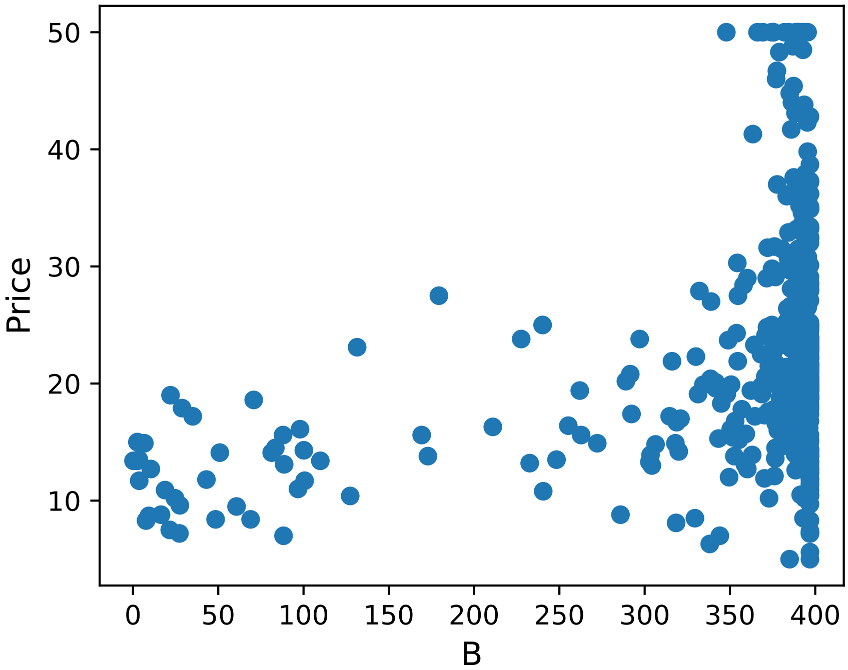

Price
AGE
50
40
30
20
10
0
20
40
60
80
100

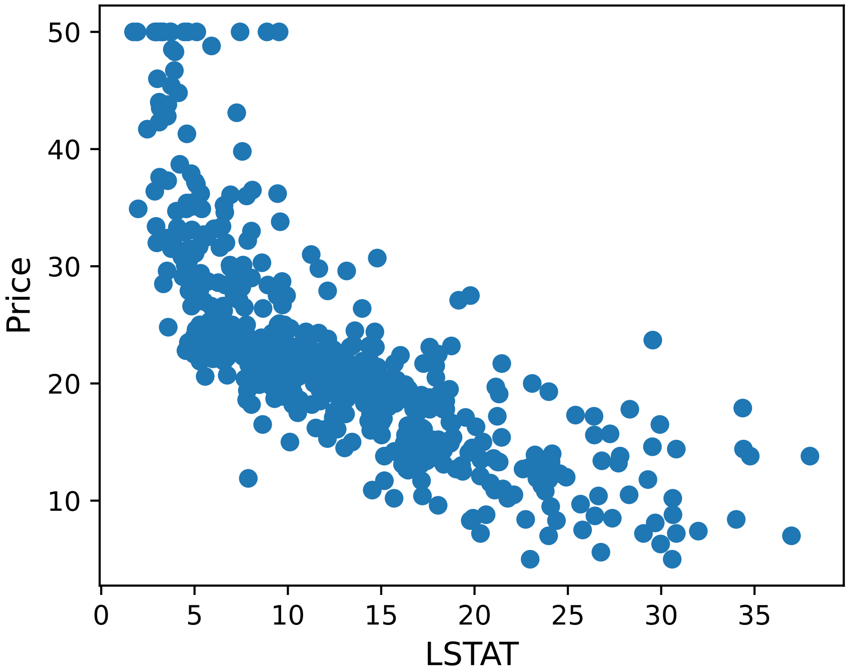

Price
DIS
50
40
30
20
10
2
4
6
8
10
12


Price
RAD
50
40
30
20
10
0
5
10
15
20
25


50
40
30
20
10
Price
200
300
400
500
600
700
TAX


50
40
30
20
10
Price
14
16
18
20
22
PTRATIO

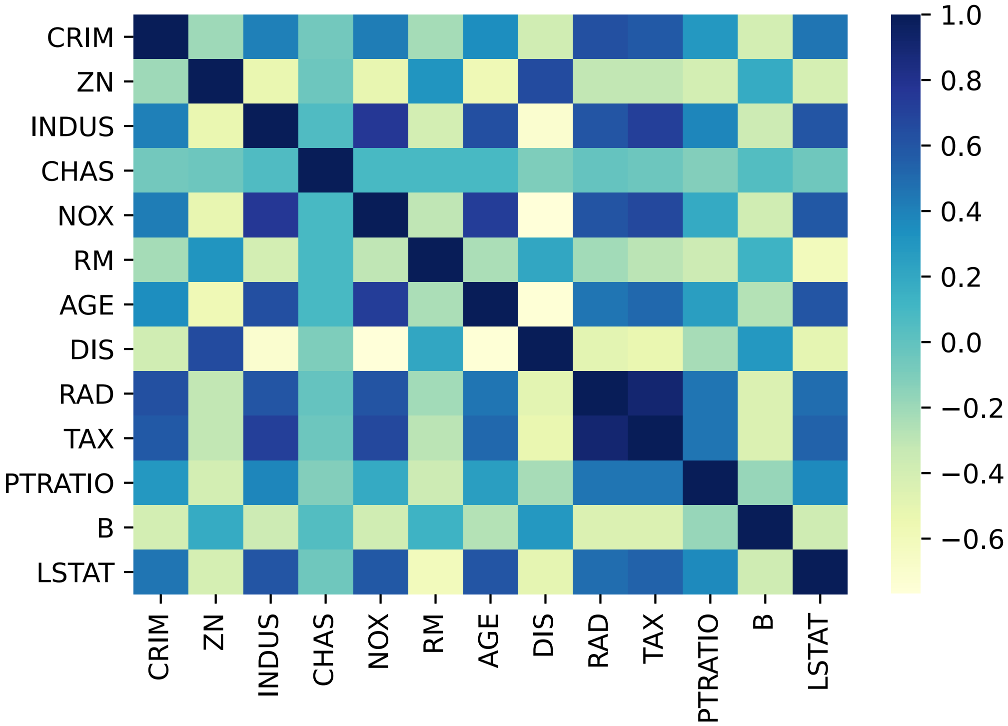




In [31]:

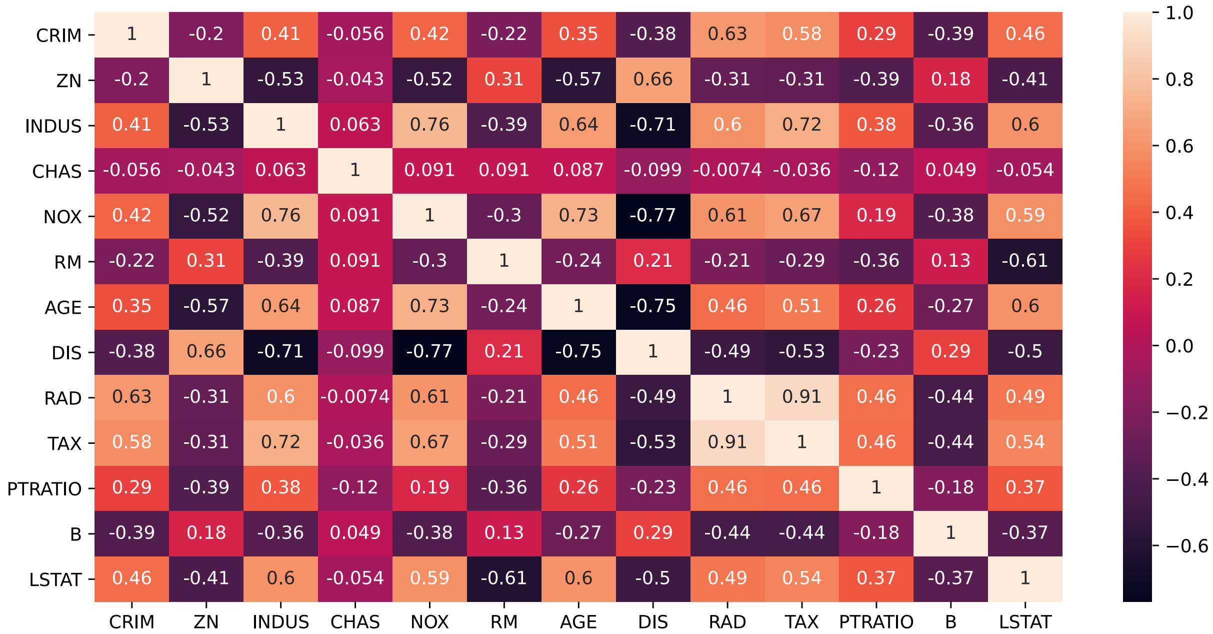
```
from sklearn.datasets import load_boston
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

boston = load_boston()
boston_pd = pd.DataFrame(boston.data, columns = boston.feature_names)
correlation_matrix = boston_pd.corr().round(2)
sns.heatmap(correlation_matrix, cmap="YlGnBu")
plt.show()
```



In [32]:
```
import seaborn as sns
import matplotlib.pyplot as plt
plt.figure(figsize=(12,6))
sns.heatmap(boston_pd.corr(), annot=True)
```

Out[32]: <AxesSubplot:>



In [35]:
```
boston_pd.head
boston_pd.dtypes
boston_pd["Prices"] = boston.target
```

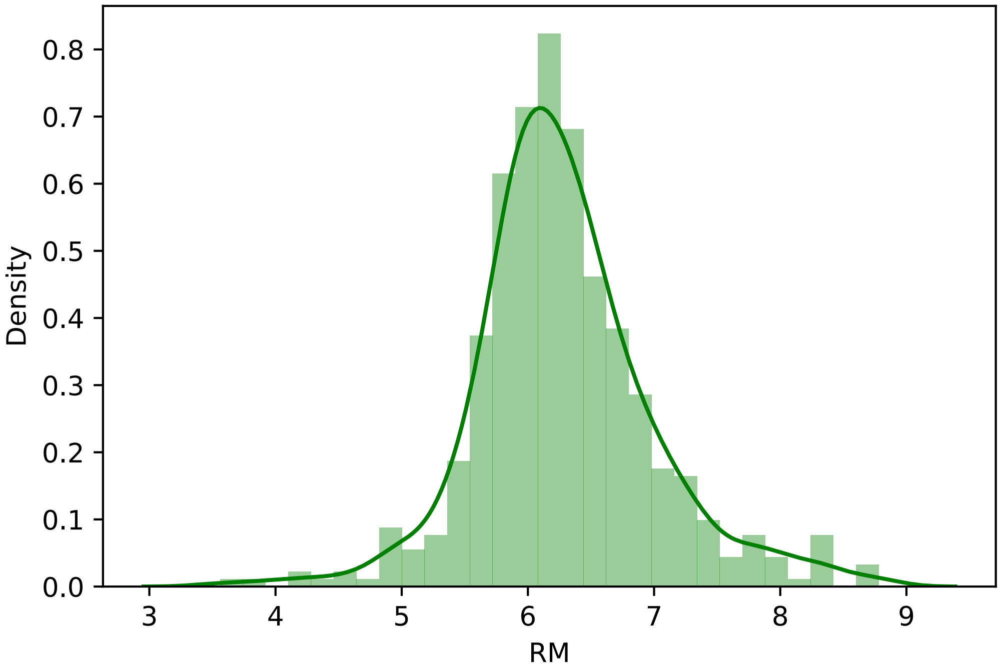
In [37]:
```
sns.distplot(boston_pd["RM"], color="g")
```

```
/Users/janthomsen/opt/anaconda3/lib/python3.8/site-packages/seaborn/distributi
ons.py:2557: FutureWarning: `distplot` is a deprecated function and will be re
moved in a future version. Please adapt your code to use either `displot` (a f
```

```
igure-level function with similar flexibility) or `histplot` (an axes-level fu
nction for histograms).
  warnings.warn(msg, FutureWarning)
```

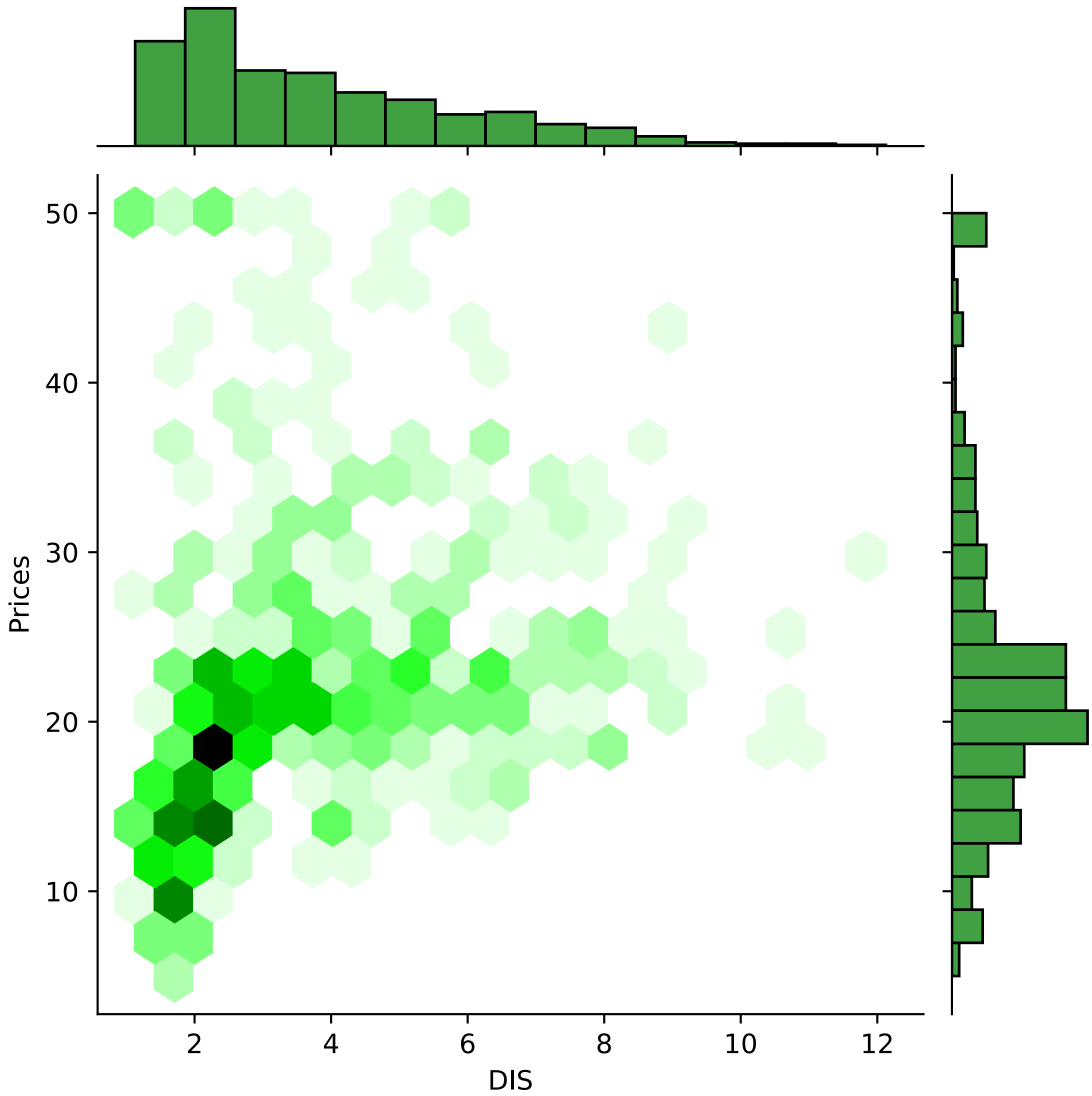
Out[37]:

```
<AxesSubplot:xlabel='RM', ylabel='Density'>
```



In [43]:

```
sns.jointplot(data=boston_pd, x="DIS", y="Prices", kind="hex", color="g");
```



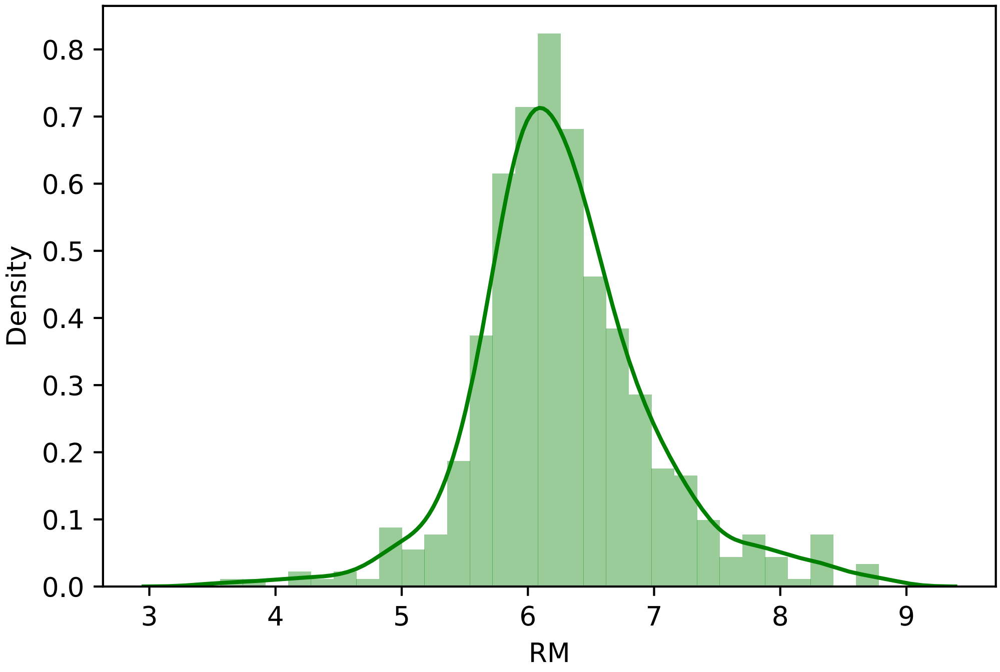
In [44]:

```
sns.distplot(boston_pd["RM"], color="g")
```

```
/Users/janthomsen/opt/anaconda3/lib/python3.8/site-packages/seaborn/distributi
ons.py:2557: FutureWarning: `distplot` is a deprecated function and will be re
moved in a future version. Please adapt your code to use either `displot` (a f
igure-level function with similar flexibility) or `histplot` (an axes-level fu
nction for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[44]:

```
<AxesSubplot:xlabel='RM', ylabel='Density'>
```



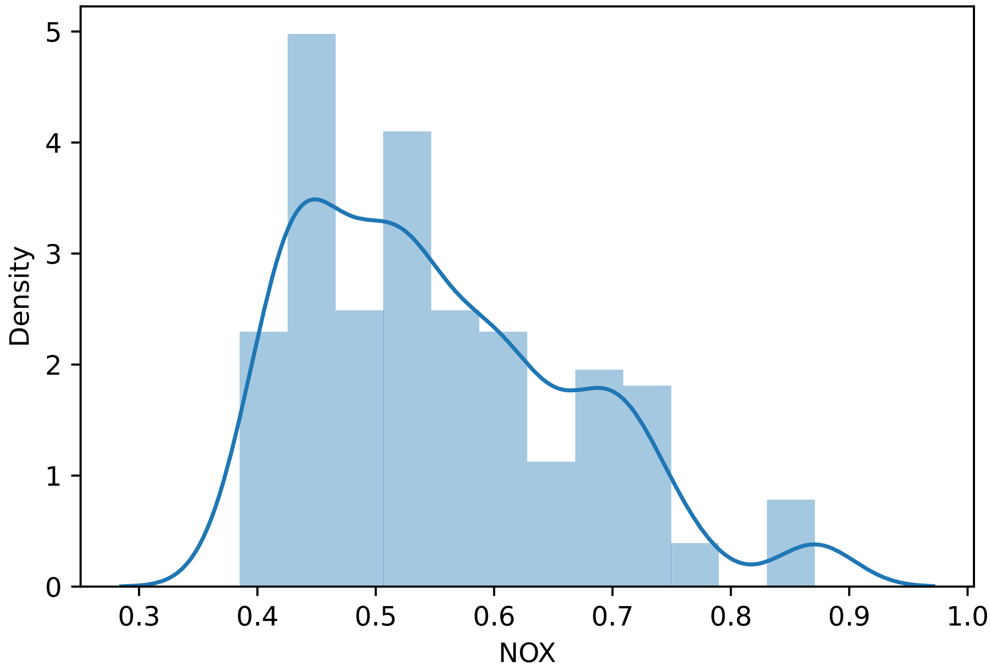
In [15]:
```
boston_pd.hist("Prices", color="m", bins=10)
```

Out[15]:
```
array([[<AxesSubplot:title={'center':'Prices'}>]], dtype=object)
```

In [40]:
```
sns.distplot(boston_pd["NOX"])
```

```
/Users/janthomsen/opt/anaconda3/lib/python3.8/site-packages/seaborn/distributi
ons.py:2557: FutureWarning: `distplot` is a deprecated function and will be re
moved in a future version. Please adapt your code to use either `displot` (a f
igure-level function with similar flexibility) or `histplot` (an axes-level fu
nction for histograms).
  warnings.warn(msg, FutureWarning)
```

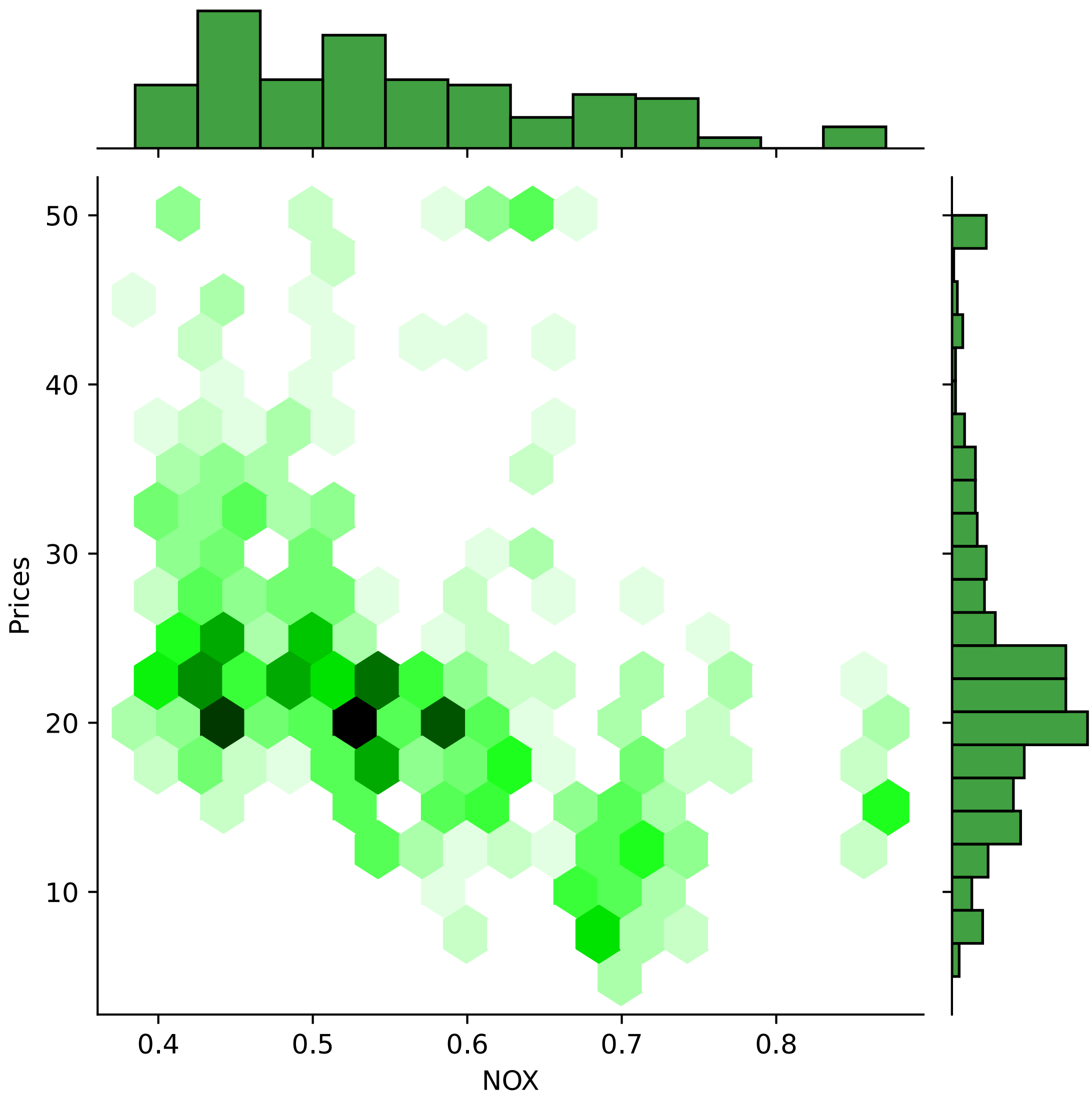
Out[40]:
```
<AxesSubplot:xlabel='NOX', ylabel='Density'>
```



In [42]:

```
sns.jointplot(data=boston_pd, x="NOX", y="Prices", kind="hex", color="green")
```

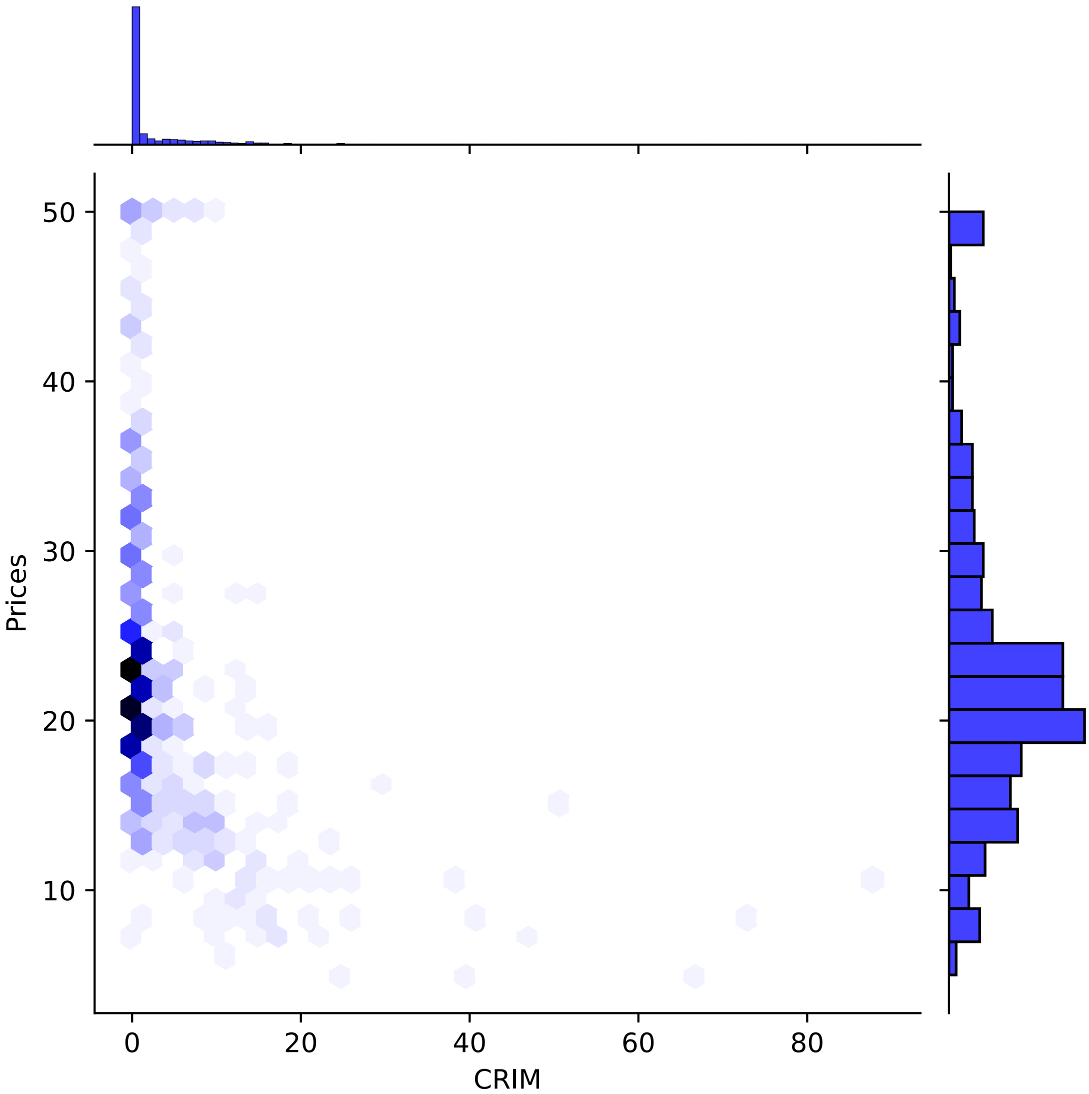
Out[42]: <seaborn.axisgrid.JointGrid at 0x123e32dc0>



In [30]:

```
sns.jointplot(data=boston_pd, x="CRIM", y="Prices", kind="hex", color="blue")
```

Out[30]: <seaborn.axisgrid.JointGrid at 0x1210ae5b0>



In [ ]: