```
In [1]: import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        %matplotlib inline
```

```
In [2]: data = pd.read_csv('hou_all.csv')
```

```
In [3]: data.head()
```

Out[3]:

	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	black	lstat	medv	Ur
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0	1
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6	1
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7	1
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4	1
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2	1

```
In [4]: data.info()

        <class 'pandas.core.frame.DataFrame'>
        RangeIndex: 506 entries, 0 to 505
        Data columns (total 15 columns):
        crim           506 non-null float64
        zn             506 non-null float64
        indus          506 non-null float64
        chas           506 non-null int64
        nox            506 non-null float64
        rm             506 non-null float64
        age            506 non-null float64
        dis            506 non-null float64
        rad            506 non-null int64
        tax            506 non-null int64
        ptratio        506 non-null float64
        black          506 non-null float64
        lstat          506 non-null float64
        medv           506 non-null float64
        Unnamed: 14    506 non-null int64
        dtypes: float64(11), int64(4)
        memory usage: 59.4 KB
```

```
In [6]: data.isna().sum()

Out[6]: crim           0
        zn             0
        indus          0
        chas           0
        nox            0
        rm             0
        age            0
        dis            0
        rad            0
        tax            0
        ptratio        0
        black          0
        lstat          0
        medv           0
        Unnamed: 14    0
        dtype: int64
```

Last Column `Unnamned:` 14 doesn't have and significance so remove it

In [8]:
```
data = data.drop('Unnamed: 14',axis=1)
```

In [9]:
```
data.head()
```

Out[9]:

	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	black	lstat	medv
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2

Generally, NaN or missing values can be in any form like 0, ? or may be written as “missing” and in our case, we can see that there are a lot of 0’s, so we can replace them with NaN to calculate how much data we are missing.

In [10]:
```
data.zn.replace(0,np.nan,inplace = True)
data.chas.replace(0,np.nan,inplace=True)
```

In [11]:
```
data.head()
```

Out[11]:

	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	black	lstat	medv
0	0.00632	18.0	2.31	NaN	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	NaN	7.07	NaN	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	NaN	7.07	NaN	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	NaN	2.18	NaN	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	NaN	2.18	NaN	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2

In [12]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
crim       506 non-null float64
zn         134 non-null float64
indus      506 non-null float64
chas       35 non-null float64
nox        506 non-null float64
rm         506 non-null float64
age        506 non-null float64
dis        506 non-null float64
rad        506 non-null int64
tax        506 non-null int64
ptratio    506 non-null float64
black      506 non-null float64
lstat      506 non-null float64
medv       506 non-null float64
dtypes: float64(12), int64(2)
memory usage: 55.4 KB
```

In [13]:
```
#Percent of data which is not available
data.isnull().sum()/len(data) * 100
```

Out[13]:
```
crim        0.000000
zn         73.517787
indus       0.000000
chas       93.083004
nox         0.000000
rm          0.000000
age         0.000000
dis         0.000000
rad         0.000000
tax         0.000000
ptratio     0.000000
black       0.000000
lstat       0.000000
medv        0.000000
dtype: float64
```

both “ZN” and “CHAS” are missing more than 70% data, so will remove both these features

In [14]:
```
data = data.drop(['zn','chas'],axis=1)
```

In [16]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 12 columns):
crim       506 non-null float64
indus      506 non-null float64
nox        506 non-null float64
rm         506 non-null float64
age        506 non-null float64
dis        506 non-null float64
rad        506 non-null int64
tax        506 non-null int64
ptratio    506 non-null float64
black      506 non-null float64
lstat      506 non-null float64
medv       506 non-null float64
dtypes: float64(10), int64(2)
memory usage: 47.5 KB
```

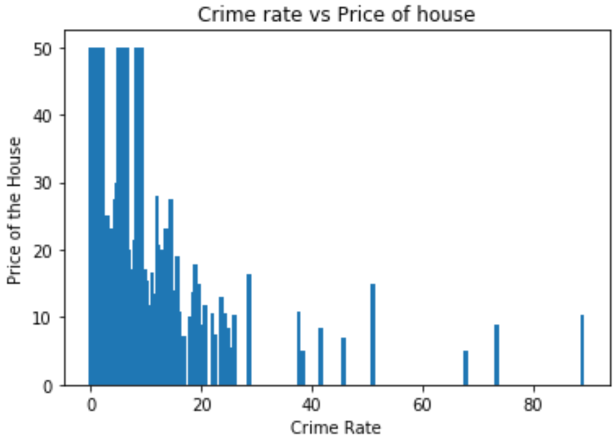
In [17]:
```
data.describe()
```

Out[17]:

	crim	indus	nox	rm	age	dis	rad	
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	50
mean	3.613524	11.136779	0.554695	6.284634	68.574901	3.795043	9.549407	40
std	8.601545	6.860353	0.115878	0.702617	28.148861	2.105710	8.707259	16
min	0.006320	0.460000	0.385000	3.561000	2.900000	1.129600	1.000000	18
25%	0.082045	5.190000	0.449000	5.885500	45.025000	2.100175	4.000000	27
50%	0.256510	9.690000	0.538000	6.208500	77.500000	3.207450	5.000000	33
75%	3.677082	18.100000	0.624000	6.623500	94.075000	5.188425	24.000000	66
max	88.976200	27.740000	0.871000	8.780000	100.000000	12.126500	24.000000	71

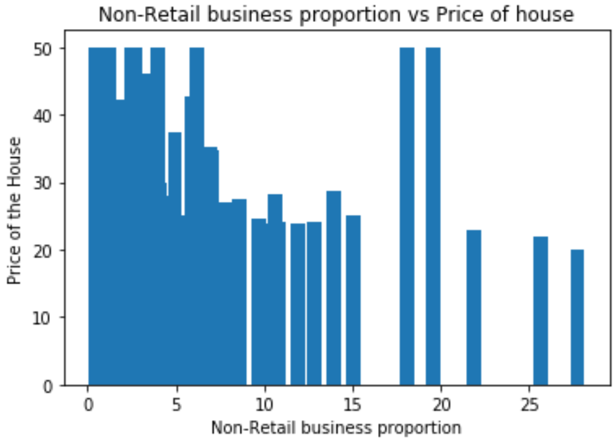
Separating the dependent and independent variables

```
In [21]: plt.bar(data.crim,data.medv)
         plt.xlabel('Crime Rate')
         plt.ylabel('Price of the House')
         plt.title('Crime rate vs Price of house')
         plt.plot()

Out[21]: []
```

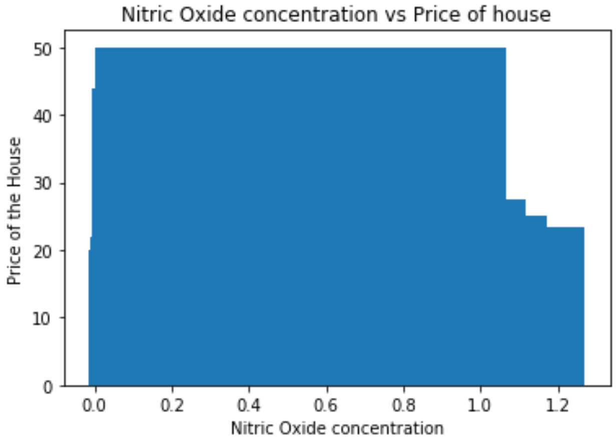


As Crime rate increases the rate of House decreases

```
In [22]: plt.bar(data.indus,data.medv)
         plt.xlabel('Non-Retail business proportion')
         plt.ylabel('Price of the House')
         plt.title('Non-Retail business proportion vs Price of house')
         plt.plot()

Out[22]: []
```

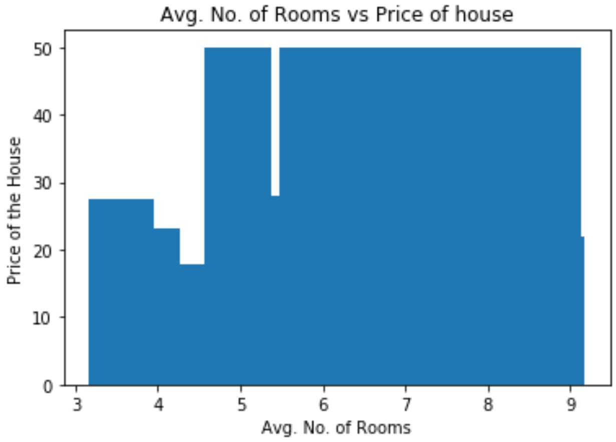


```
In [23]: plt.bar(data.nox,data.medv)
         plt.xlabel('Nitric Oxide concentration')
         plt.ylabel('Price of the House')
         plt.title('Nitric Oxide concentration vs Price of house')
         plt.plot()

Out[23]: []
```



As Nitric Oxide concentration increases the rate of House decreases

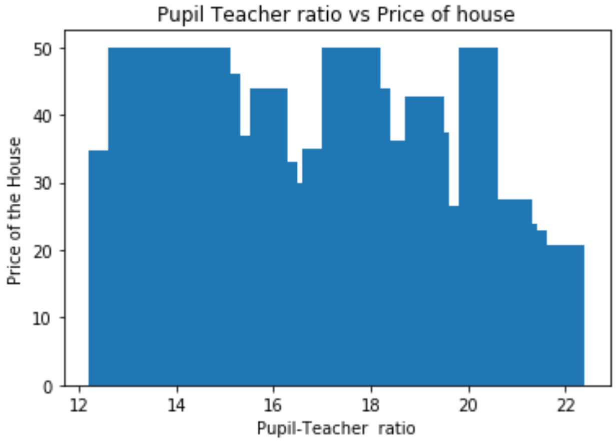
```
In [24]: plt.bar(data.rm,data.medv)
         plt.xlabel('Avg. No. of Rooms')
         plt.ylabel('Price of the House')
         plt.title('Avg. No. of Rooms vs Price of house')
         plt.plot()

Out[24]: []
```



As no. of rooms increases price of house increases

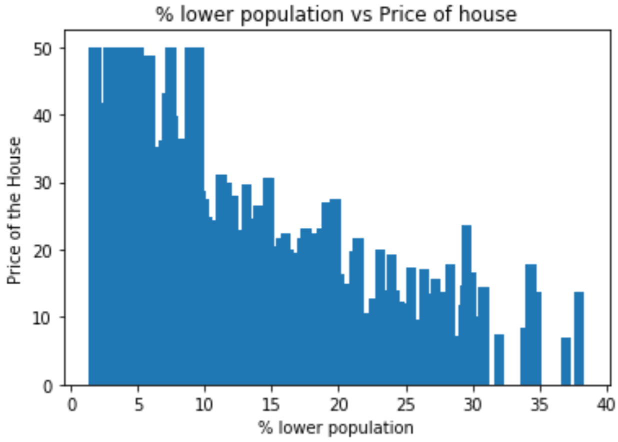
In [25]:
```
plt.bar(data.ptratio,data.medv)
plt.xlabel('Pupil-Teacher  ratio')
plt.ylabel('Price of the House')
plt.title('Pupil Teacher ratio vs Price of house')
plt.plot()
```

Out[25]:
```
[]
```



In [36]:
```
plt.bar(data.lstat,data.medv)
plt.xlabel('% lower population')
plt.ylabel('Price of the House')
plt.title('% lower population vs Price of house')
plt.plot()
```

Out[36]:
```
[]
```



Where the lower status population is low price of houses are high

In [27]:
```
X = data.iloc[:,:-1]
y = data.iloc[:,-1]
```

In [30]:
```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.30,rand
om_state=0)
```

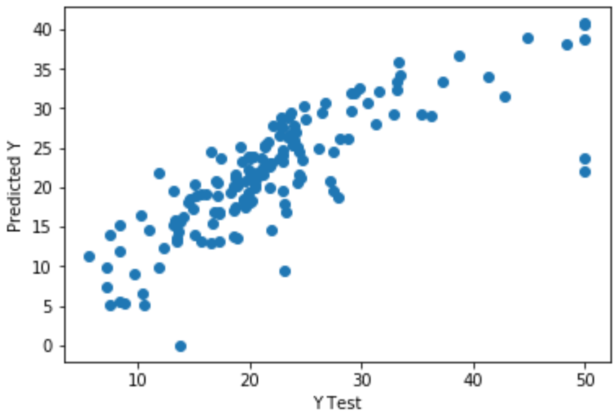
```
In [33]: from sklearn.linear_model import LinearRegression
         model = LinearRegression()
         model.fit(X_train, y_train) # Fitting our model to the training set

Out[33]: LinearRegression(copy_X=True, fit_intercept=True, n_jobs=1, normalize=Fal
         se)
```

```
In [34]: y_pred = model.predict(X_test)
```

Print the coefficent of the Model

```
In [37]: # The coefficients
         print('Coefficients: \n', model.coef_)

         Coefficients:
          [-1.19332593e-01  1.20970593e-02 -1.73005334e+01  4.12170424e+00
          -1.37417904e-02 -1.25055232e+00  2.44921612e-01 -9.67542136e-03
          -1.18932063e+00  7.56361429e-03 -4.79845036e-01]
```

```
In [38]: plt.scatter(y_test,y_pred)
         plt.xlabel('Y Test')
         plt.ylabel('Predicted Y')

Out[38]: Text(0,0.5,'Predicted Y')
```



```
In [39]: from sklearn import metrics
         print("MAE", metrics.mean_absolute_error(y_test, y_pred))
         print("MSE", metrics.mean_squared_error(y_test, y_pred))
         print("RMSE", np.sqrt(metrics.mean_squared_error(y_test, y_pred)))
         print("Score:", model.score(X_test, y_test))

         MAE 3.7125347264819153
         MSE 28.477481110580698
         RMSE 5.336429622002027
         Score: 0.6579918387799596
```