Import the libraries

In [1]:
```
import pandas as pd
import numpy as np
from pandas.plotting import scatter_matrix

import matplotlib.pyplot as plt
#matplotlib notebook
%matplotlib inline
import seaborn as sns

from sklearn.impute import SimpleImputer
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
```

Loading the dataset

In [2]:
```
Data=pd.read_excel('C:\\Users\\lenovo\\Downloads\\DS - Assignment Part 1 data set.xlsx')
```

In [3]:
```
Data_pd=pd.DataFrame(Data)
```

In [4]:
```
Data.head()
```

Out[4]:

	Transaction date	House Age	Distance from nearest Metro station (km)	Number of convenience stores	latitude	longitude	Number of bedrooms	House size (sqft)	House price of unit area
0	2012.916667	32.0	84.87882	10	24.98298	121.54024	1	575	37.9
1	2012.916667	19.5	306.59470	9	24.98034	121.53951	2	1240	42.2
2	2013.583333	13.3	561.98450	5	24.98746	121.54391	3	1060	47.3
3	2013.500000	13.3	561.98450	5	24.98746	121.54391	2	875	54.8
4	2012.833333	5.0	390.56840	5	24.97937	121.54245	1	491	43.1

In [5]:
```
Data.describe()
```

Out[5]:

	Transaction date	House Age	Distance from nearest Metro station (km)	Number of convenience stores	latitude	longitude	Number of bedrooms	House size (sqft)	House price of unit area
count	414.000000	414.000000	414.000000	414.000000	414.000000	414.000000	414.000000	414.000000	414.000000
mean	2013.148953	17.712560	1083.885689	4.094203	24.969030	121.533361	1.987923	931.475845	37.980193
std	0.281995	11.392485	1262.109595	2.945562	0.012410	0.015347	0.818875	348.910269	13.606488
min	2012.666667	0.000000	23.382840	0.000000	24.932070	121.473530	1.000000	402.000000	7.600000
25%	2012.916667	9.025000	289.324800	1.000000	24.963000	121.528085	1.000000	548.000000	27.700000
50%	2013.166667	16.100000	492.231300	4.000000	24.971100	121.538630	2.000000	975.000000	38.450000
75%	2013.416667	28.150000	1454.279000	6.000000	24.977455	121.543305	3.000000	1234.750000	46.600000
max	2013.583333	43.800000	6488.021000	10.000000	25.014590	121.566270	3.000000	1500.000000	117.500000

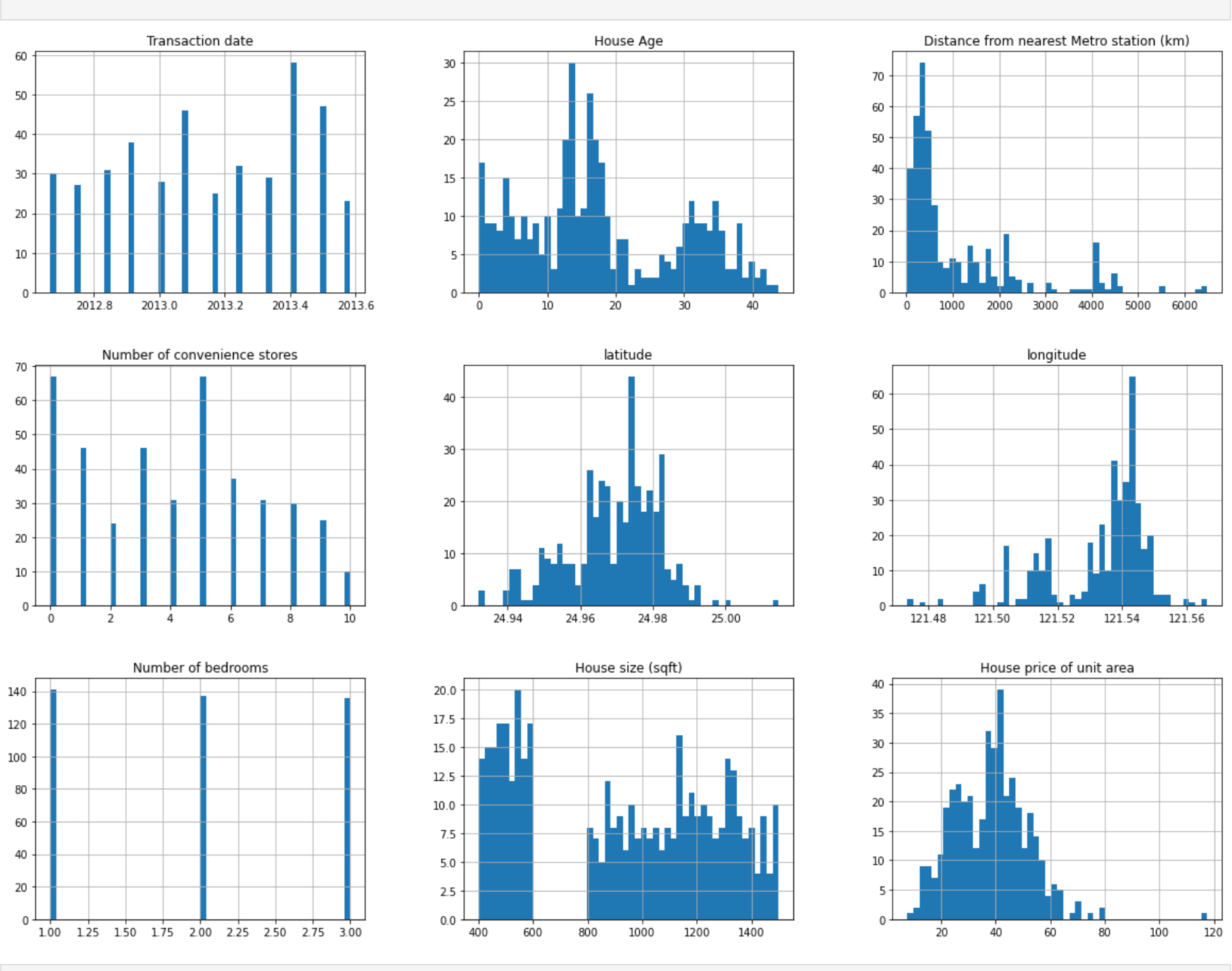
In [6]:
```
Data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 414 entries, 0 to 413
Data columns (total 9 columns):
 #   Column                                  Non-Null Count  Dtype
---  ------                                  --------------  -----
 0   Transaction date                        414 non-null    float64
 1   House Age                               414 non-null    float64
 2   Distance from nearest Metro station (km) 414 non-null   float64
 3   Number of convenience stores            414 non-null    int64
 4   latitude                                414 non-null    float64
 5   longitude                               414 non-null    float64
 6   Number of bedrooms                      414 non-null    int64
 7   House size (sqft)                       414 non-null    int64
 8   House price of unit area                414 non-null    float64
dtypes: float64(6), int64(3)
memory usage: 29.2 KB
```

In [7]:
```
Data.isnull().sum()
```

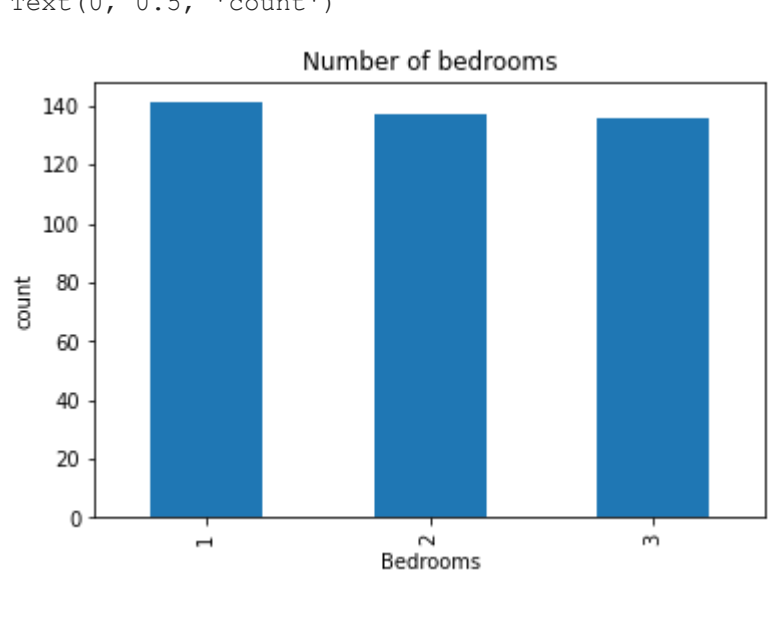
Out[7]:
```
Transaction date                            0
House Age                                   0
Distance from nearest Metro station (km)    0
Number of convenience stores                0
latitude                                    0
longitude                                   0
Number of bedrooms                          0
House size (sqft)                           0
House price of unit area                    0
dtype: int64
```

In [8]:
```
%matplotlib inline
import matplotlib.pyplot as plt
Data.hist(bins=50, figsize=(20,15))
plt.show()
```



In [9]:
```
# Which is the most common house (Bedroom wise)
Data['Number of bedrooms'].value_counts().plot(kind='bar')
plt.title('Number of bedrooms')
plt.xlabel('Bedrooms')
plt.ylabel('count')
```

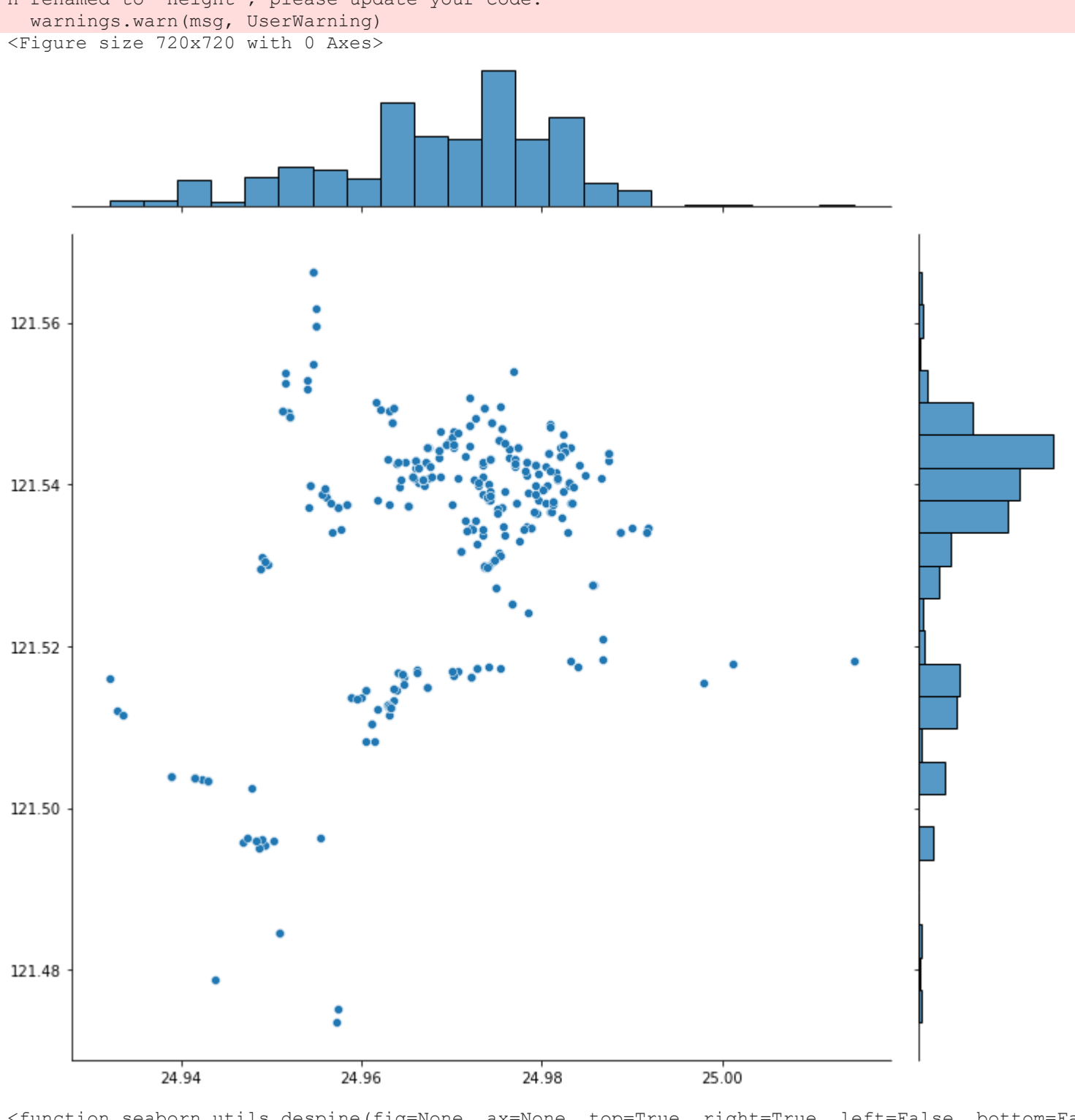
Out[9]: Text(0, 0.5, 'count')



Visualizing the location of the houses based on latitude and longitude

In [10]:
```
plt.figure(figsize=(10,10))
sns.jointplot(x=Data.latitude.values, y=Data.longitude.values, size=10)
plt.ylabel('Longitude',fontsize=12)
plt.xlabel('Latitude',fontsize=12)
plt.show()
sns.despine
```

```
C:\Users\lenovo\Anaconda3\lib\site-packages\seaborn\axisgrid.py:2073: UserWarning: The `size` parameter has bee
n renamed to `height`; please update your code.
  warnings.warn(msg, UserWarning)
<Figure size 720x720 with 0 Axes>
```



Out[10]: <function seaborn.utils.despine(fig=None, ax=None, top=True, right=True, left=False, bottom=False, offset=None, trim=False)>

correlation matrix

In [16]:
```
hcorr = Data.corr()
hcorr.style.background_gradient()
```

Out[16]:

	Transaction date	House Age	Distance from nearest Metro station (km)	Number of convenience stores	latitude	longitude	Number of bedrooms	House size (sqft)	House price of unit area
Transaction date	1.000000	0.017542	0.060880	0.009544	0.035016	-0.041065	0.061985	0.068405	0.087529
House Age	0.017542	1.000000	0.025622	0.049593	0.054420	-0.048520	-0.008756	-0.060361	-0.210567
Distance from nearest Metro station (km)	0.060880	0.025622	1.000000	-0.602519	-0.591067	-0.806317	-0.046856	0.001795	-0.673613
Number of convenience stores	0.009544	0.049593	-0.602519	1.000000	0.444143	0.449099	0.043638	0.033286	0.571005
latitude	0.035016	0.054420	-0.591067	0.444143	1.000000	0.412924	0.043921	0.031696	0.546307
longitude	-0.041065	-0.048520	-0.806317	0.449099	0.412924	1.000000	0.041680	0.009322	0.523287
Number of bedrooms	0.061985	-0.008756	-0.046856	0.043638	0.043921	0.041680	1.000000	0.752276	0.050265
House size (sqft)	0.068405	-0.060361	0.001795	0.033286	0.031696	0.009322	0.752276	1.000000	0.046489
House price of unit area	0.087529	-0.210567	-0.673613	0.571005	0.546307	0.523287	0.050265	0.046489	1.000000

In [17]:
```
# Heatmap using seaborn
sns.set(context='paper',font='monospace')
Data_corr_matrix = Data.corr()

# set the matplotlib figure
fig, axe = plt.subplots(figsize=(12,8))

# Generate color polettes
cmap = sns.diverging_palette(220,10,center='light',as_cmap=True)

#Draw the heatmap
sns.heatmap(Data_corr_matrix,square=True, cmap=cmap,annot =True)
```

Out[17]: <AxesSubplot:>

Train and Test the data

In [19]:
```
Data_ind = Data.drop('House price of unit area',axis=1)
print(Data_ind.head())
Data_dep =Data['House price of unit area']

print("House price of unit area")
print(Data_dep.head())
```

```
   Transaction date  House Age  Distance from nearest Metro station (km)  \
0       2012.916667       32.0                                  84.87882
1       2012.916667       19.5                                 306.59470
2       2013.583333       13.3                                 561.98450
3       2013.500000       13.3                                 561.98450
4       2012.833333        5.0                                 390.56840

   Number of convenience stores  latitude  longitude  Number of bedrooms  \
0                            10  24.98298  121.54024                   1
1                             9  24.98034  121.53951                   2
2                             5  24.98746  121.54391                   3
3                             5  24.98746  121.54391                   2
4                             5  24.97937  121.54245                   1

   House size (sqft)
0                575
1               1240
2               1060
3                875
4                491
House price of unit area
0    37.9
1    42.2
2    47.3
3    54.8
4    43.1
Name: House price of unit area, dtype: float64
```

In [20]:
```
# Check for rand_state
X_train,X_test,y_train,y_test =train_test_split(Data_ind,Data_dep,test_size=0.2,random_state=42)

#print(X_train.head())
#print(X_test.head())
#print(y_train.head())
#print(X_test.head())

print("X_train shape {} and size {}".format(X_train.shape,X_train.size))
print("X_test shape {} and size {}".format(X_test.shape,X_test.size))
print("y_train shape {} and size {}".format(y_train.shape,y_train.size))
print("y_test shape {} and size {}".format(y_test.shape,y_test.size))
```

```
X_train shape (331, 8) and size 2648
X_test shape (83, 8) and size 664
y_train shape (331,) and size 331
y_test shape (83,) and size 83
```

In [21]:
```
Data.head()
```

Out[21]:

	Transaction date	House Age	Distance from nearest Metro station (km)	Number of convenience stores	latitude	longitude	Number of bedrooms	House size (sqft)	House price of unit area
0	2012.916667	32.0	84.87882	10	24.98298	121.54024	1	575	37.9
1	2012.916667	19.5	306.59470	9	24.98034	121.53951	2	1240	42.2
2	2013.583333	13.3	561.98450	5	24.98746	121.54391	3	1060	47.3
3	2013.500000	13.3	561.98450	5	24.98746	121.54391	2	875	54.8
4	2012.833333	5.0	390.56840	5	24.97937	121.54245	1	491	43.1

In [22]:
```
# the train independent variables
X_train.head()
```

Out[22]:

	Transaction date	House Age	Distance from nearest Metro station (km)	Number of convenience stores	latitude	longitude	Number of bedrooms	House size (sqft)
192	2013.166667	43.8	57.58945	7	24.96750	121.54069	3	1000
234	2013.250000	8.0	2216.61200	4	24.96007	121.51361	1	494
5	2012.666667	7.1	2175.03000	3	24.96305	121.51254	3	828
45	2013.083333	36.6	488.81930	8	24.97015	121.54494	1	572
245	2013.416667	7.5	639.61980	5	24.97258	121.54814	2	1219

In [23]:
```
# Standardize training and test datasets

# Feature scaling is to bring all the independent variables in a dataset into same scale, to avoid any variable
#the model, Here we will not transform the dependent variables.

independent_scaler = StandardScaler()
X_train = independent_scaler.fit_transform(X_train)
X_test = independent_scaler.transform(X_test)
print(X_train[0:5,1])
print('test data')
print(X_test[0:5,1])
```

```
[ 2.34401494 -0.82128138 -0.90085586  1.70741903 -0.86548943]
test data
[-1.43135245 -0.36151767 -1.52861016 -0.40572571  0.25739502]
```

In [24]:
```
# Initantiate the linear regression
linearRegModel = LinearRegression(n_jobs=-1)

# Fit the model to the training and coefficients
linearRegModel.fit(X_train,y_train)
# print the intercept and coefficient

print("Intercept is "+str(linearRegModel.intercept_))
print("coefficient is "+str(linearRegModel.coef_))
```

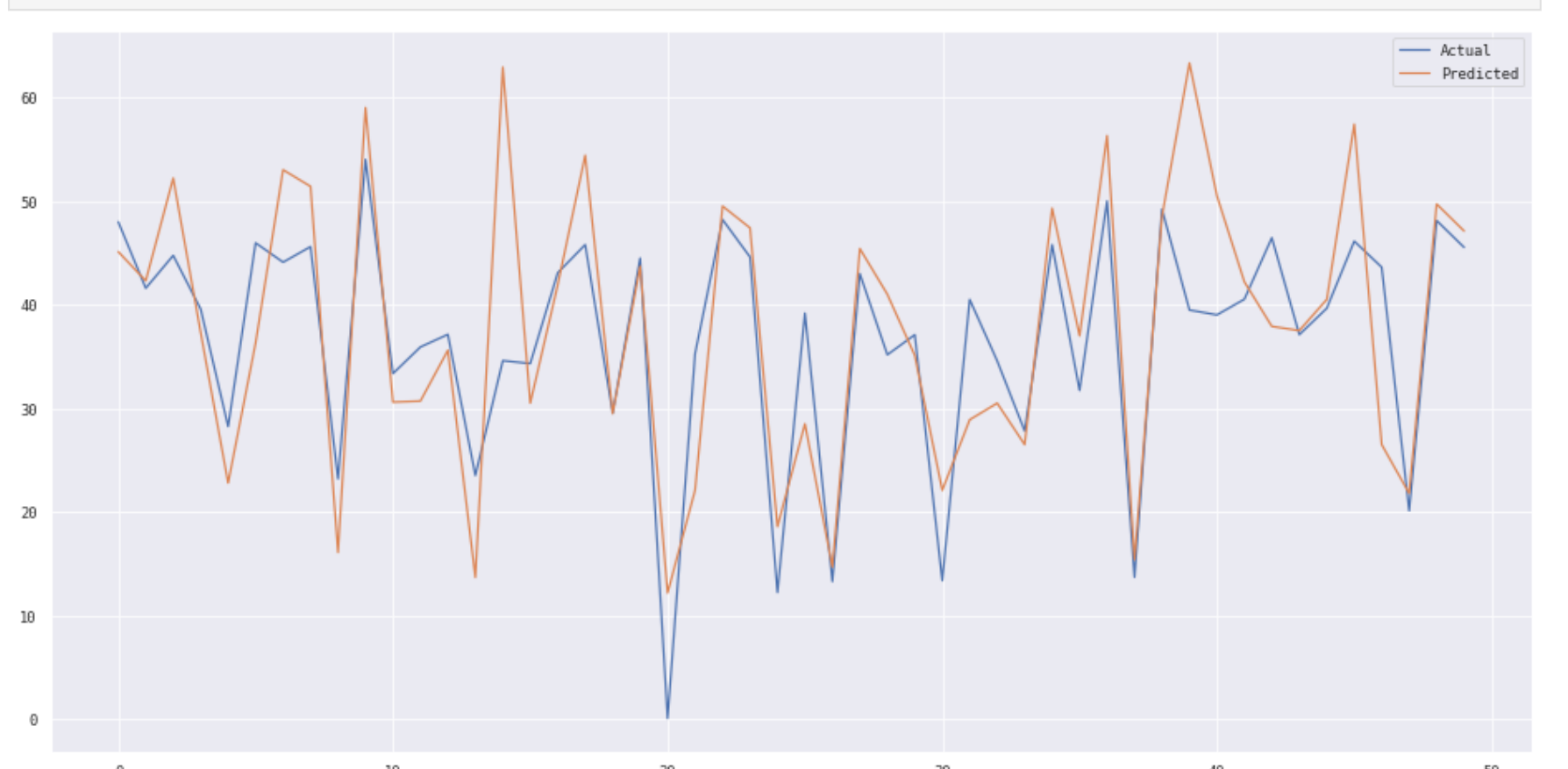
```
Intercept is 38.391540785496794
coefficient is [ 1.49886596 -3.01603553 -5.84573055  3.17483201  2.81894774 -0.47753505
 -0.1308024   0.68596562]
```

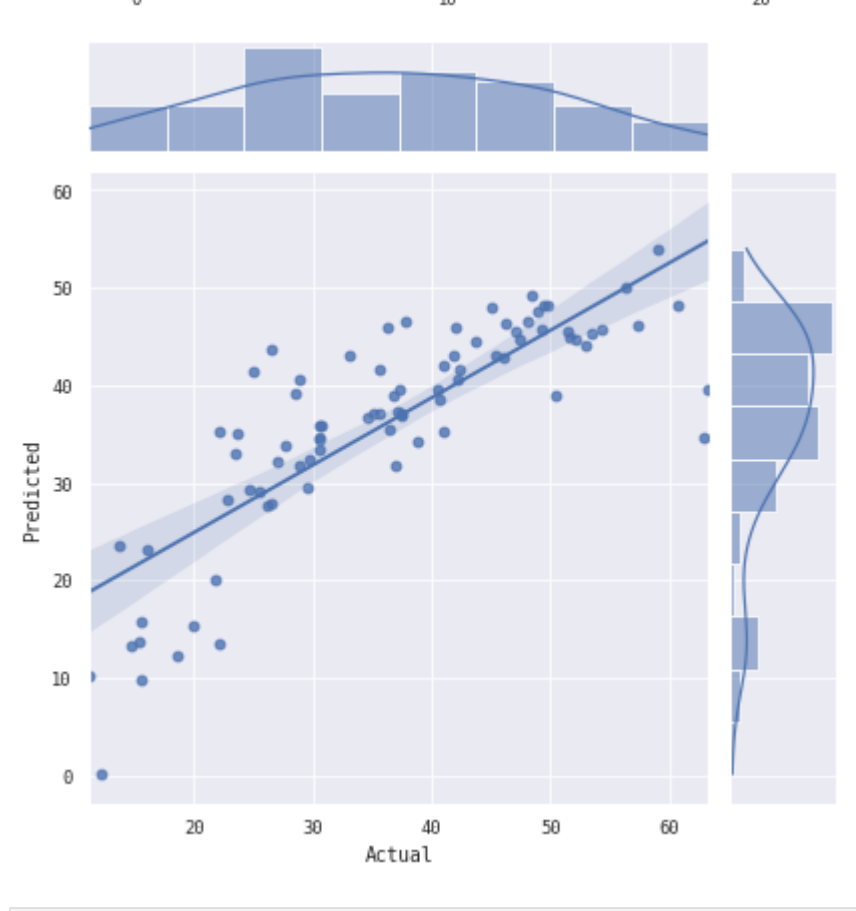
In [25]:
```
# Predict on the test data
y_pred = linearRegModel.predict(X_test)
```

In [26]:
```
print(len(y_pred))
print(len(y_test))
print(y_pred[0:5])
print(y_test[0:5])
```

```
83
83
[47.98193109 41.58475049 44.74158856 39.56897075 28.25053404]
358    45.1
350    42.3
373    52.2
399    37.3
369    22.8
Name: House price of unit area, dtype: float64
```

In [27]:
```
# Plotting the test and the predicted results
test = pd.DataFrame({'Predicted':y_pred,'Actual':y_test})
fig = plt.figure(figsize=(16,8))
test = test.reset_index()
test = test.drop(['index'],axis=1)
plt.plot(test[:50])
plt.legend(['Actual','Predicted'])
sns.jointplot(x='Actual',y='Predicted',data=test,kind='reg',);
```





In [28]:
```
# Accuracy metrics
from sklearn import metrics
print(np.sqrt(metrics.mean_squared_error(y_test,y_pred)))
print(np.sqrt(metrics.mean_squared_error(y_train,linearRegModel.predict(X_train))))
```

```
7.454135914547554
9.097513878212775
```

In [29]:
```
# Instantiating and fitting the decision tree regression
dtReg = DecisionTreeRegressor(max_depth=9)
dtReg.fit(X_train,y_train)
```

Out[29]: DecisionTreeRegressor(max_depth=9)

In [30]:
```
# Predictions
dtReg_y_pred = dtReg.predict(X_test)
dtReg_y_pred
```

Out[30]:
```
array([49.65      , 39.01538462, 43.5       , 29.3       , 25.6       ,
       36.5      , 53.51428571, 53.51428571, 13.8       , 61.46666667,
       21.5      , 32.18      , 42.3       , 12.8       , 32.85      ,
       24.43076923, 32.95      , 57.8       , 24.43076923, 41.73076923,
       13.775     , 24.43076923, 54.65      , 26.9       , 11.6       ,
       29.3      , 13.775     , 43.5       , 42.7       , 31.7       ,
       22.6      , 24.43076923, 38.24      , 26.975     , 53.51428571,
       38.31     , 52.65      , 13.775     , 36.5       , 67.7       ,
       54.8      , 39.01538462, 46.4       , 39.01538462, 39.01538462,
       52.65      , 39.01538462, 24.43076923, 46.39      , 53.3       ,
       49.65      , 56.9       , 38.31      , 41.73076923, 39.01538462,
       13.775     , 38.31      , 27.3       , 24.43076923, 53.51428571,
       24.43076923, 27.       , 13.775     , 13.2       , 18.3       ,
       25.6      , 30.1       , 39.01538462, 38.31      , 26.975     ,
       39.3      , 54.8       , 57.8       , 46.39      , 31.7       ,
       41.73076923, 39.01538462, 49.2       , 55.3       , 31.1       ,
       39.01538462, 48.6       , 26.975     ])
```

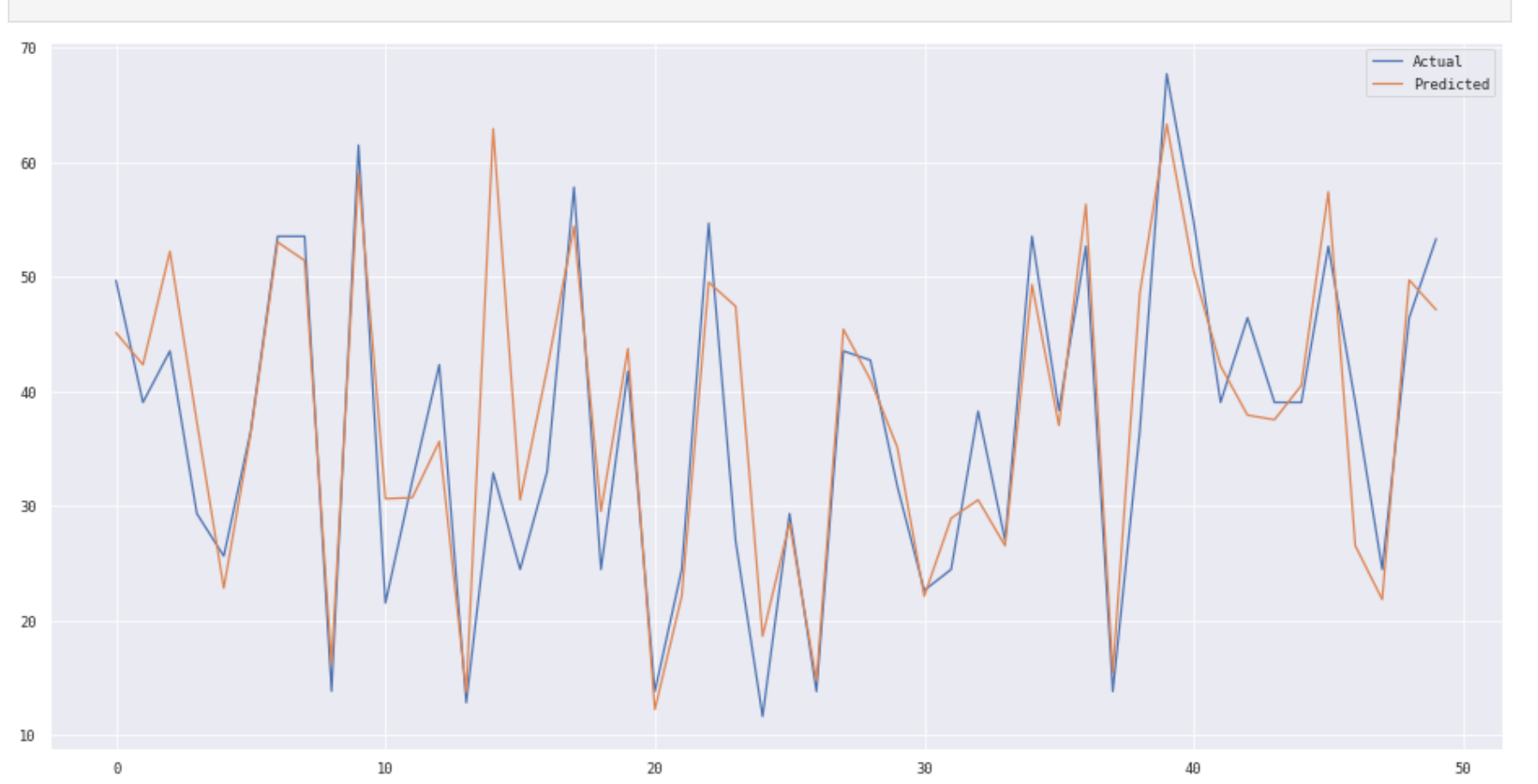
In [31]:
```
print(len(dtReg_y_pred))
print(len(y_test))
print(dtReg_y_pred[0:10])
print(y_test[0:10])
```

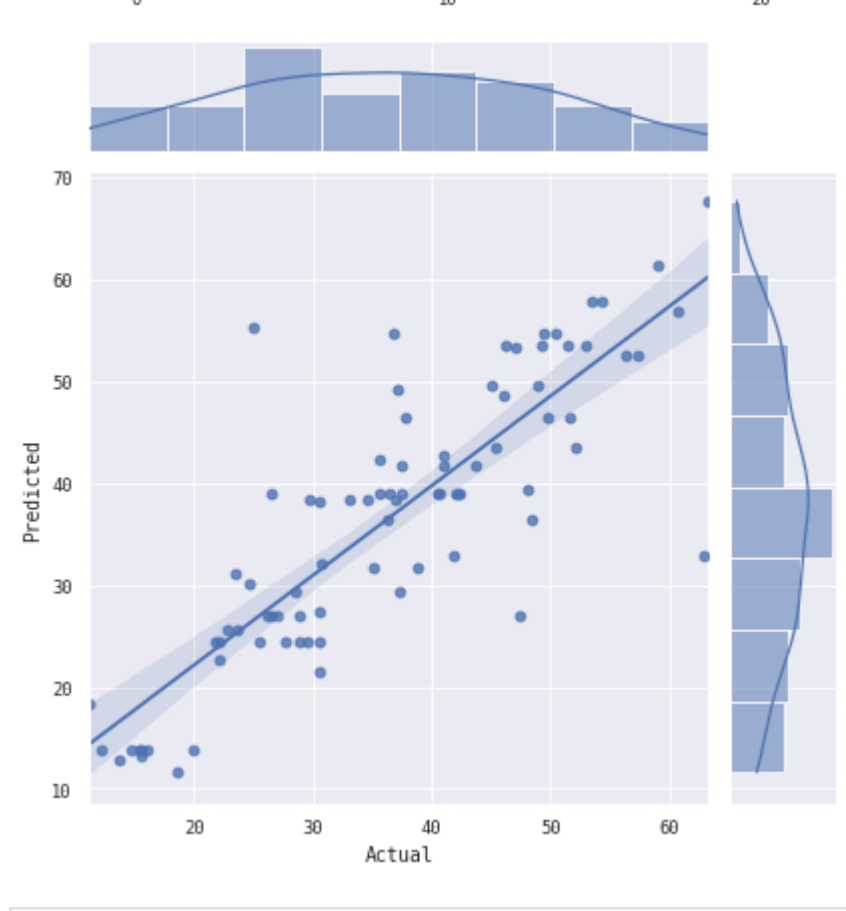
```
83
83
[49.65       39.01538462 43.5        29.3        25.6        36.5
 53.51428571 53.51428571 13.8        61.46666667]
358    45.1
350    42.3
373    52.2
399    37.3
369    22.8
72     36.3
262    53.0
140    51.4
93     16.1
70     59.0
Name: House price of unit area, dtype: float64
```

In [32]:
```
# Accuracy score
print(np.sqrt(metrics.mean_squared_error(y_test,dtReg_y_pred)))
```

```
7.397798034367055
```

In [33]:
```
# Plotting the test and the predicted results
test = pd.DataFrame({'Predicted':dtReg_y_pred,'Actual':y_test})
fig = plt.figure(figsize=(16,8))
test = test.reset_index()
test = test.drop(['index'],axis=1)
plt.plot(test[:50])
plt.legend(['Actual','Predicted'])
sns.jointplot(x='Actual',y='Predicted',data=test,kind='reg',);
```





In [34]:
```
# Random forest regressor
rfReg = RandomForestRegressor(30)
rfReg.fit(X_train,y_train)
```

Out[34]: RandomForestRegressor(n_estimators=30)

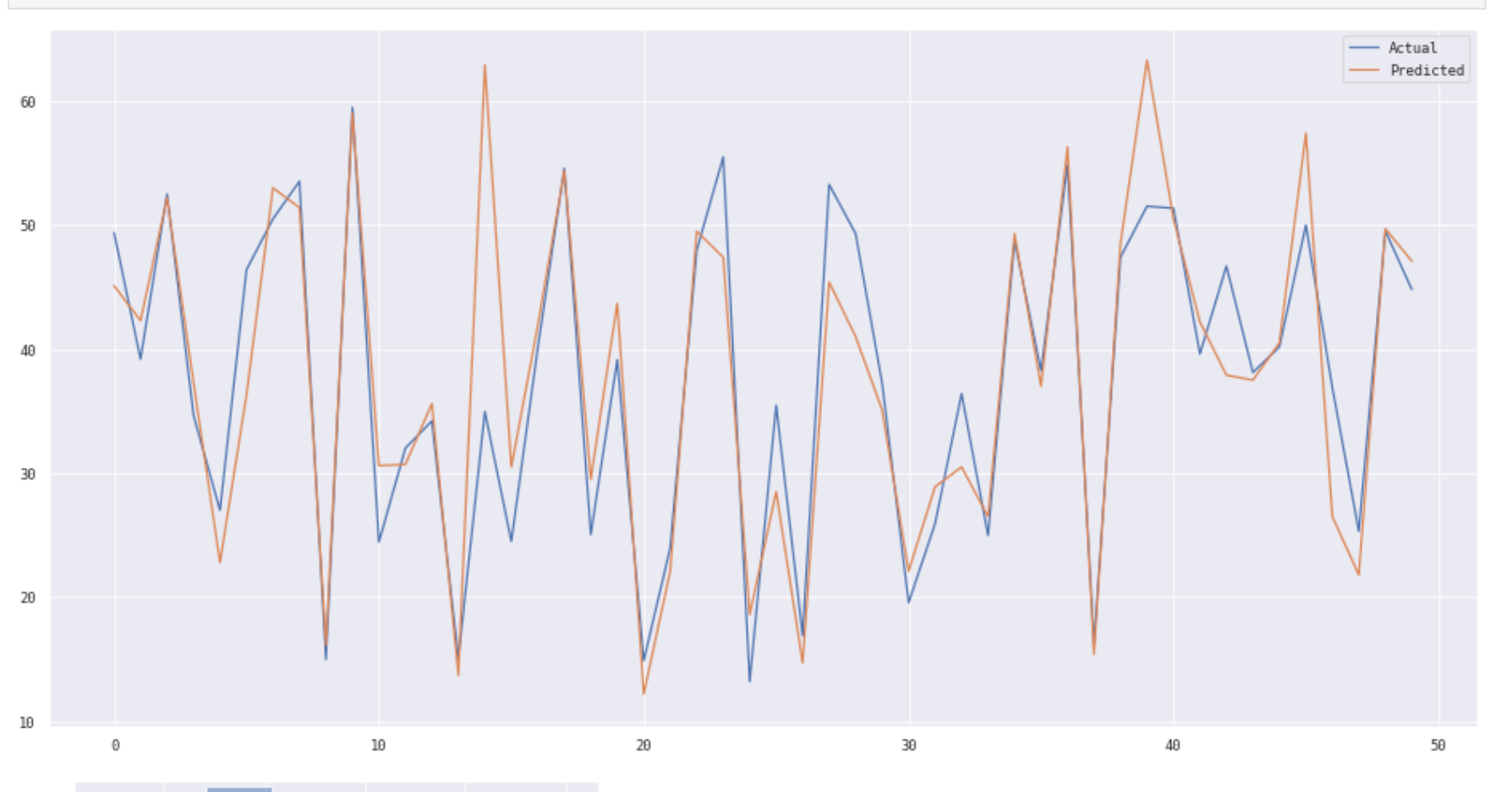
In [35]:
```
# Predictions
rfReg_y_pred = rfReg.predict(X_test)
print(len(rfReg_y_pred))
print(len(y_test))
print(rfReg_y_pred[0:10])
print(y_test[0:10])
```

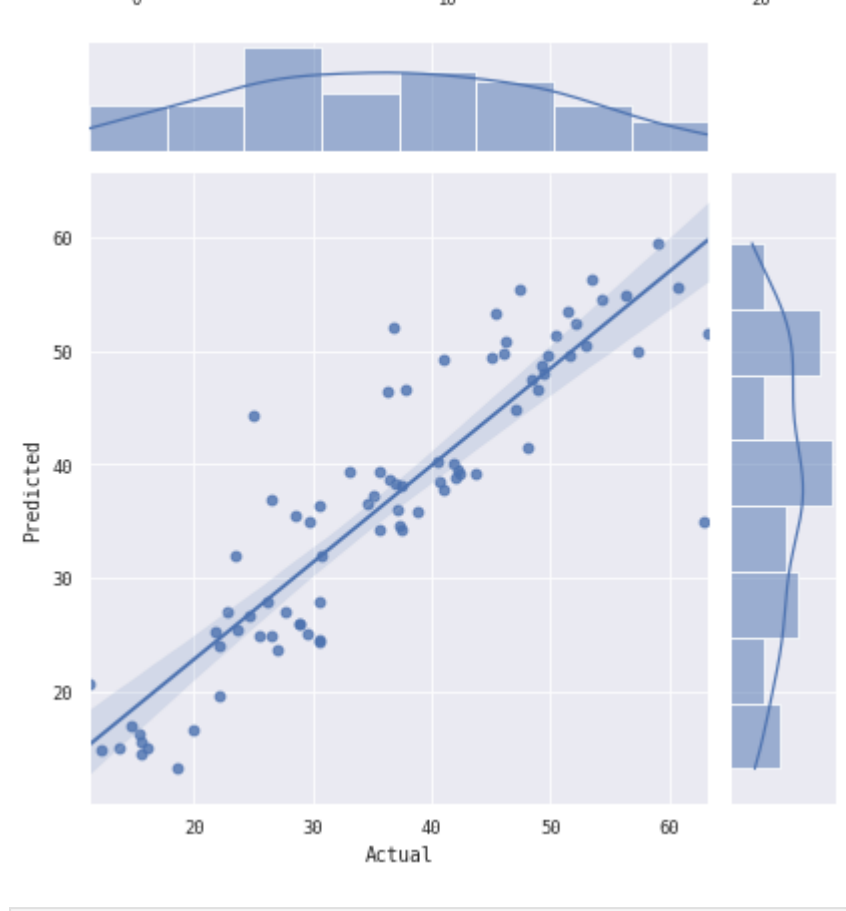
```
83
83
[49.38333333 39.19333333 52.49666667 34.65       27.01       46.4
 50.49666667 53.53       14.99       59.47666667]
358    45.1
350    42.3
373    52.2
399    37.3
369    22.8
72     36.3
262    53.0
140    51.4
93     16.1
70     59.0
Name: House price of unit area, dtype: float64
```

In [36]:
```
# Accuracy Score
print(np.sqrt(metrics.mean_squared_error(y_test,rfReg_y_pred)))
```

```
5.914179079981744
```

In [37]:
```
# Plotting the test and the predicted results
test = pd.DataFrame({'Predicted':rfReg_y_pred,'Actual':y_test})
fig = plt.figure(figsize=(16,8))
test = test.reset_index()
test = test.drop(['index'],axis=1)
plt.plot(test[:50])
plt.legend(['Actual','Predicted'])
sns.jointplot(x='Actual',y='Predicted',data=test,kind='reg',);
```





In [ ]: