In [1]:
```
import pandas as pd
import numpy as np
from numpy import linalg as la
from sklearn import decomposition
from sklearn.decomposition import PCA
from sklearn.neighbors import KNeighborsRegressor
from sklearn.preprocessing import StandardScaler
from matplotlib import*
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
```

In [2]:
```
#raw_data
df = pd.read_csv("kc_house_data.csv")
df.head(3)
```

Out[2]:

| | id | date | price | bedrooms | bathrooms | sqft_living | sqft_lot |
|---|---|---|---|---|---|---|---|
| 0 | 7129300520 | 20141013T000000 | 221900.0 | 3 | 1.00 | 1180 | 5650 |
| 1 | 6414100192 | 20141209T000000 | 538000.0 | 3 | 2.25 | 2570 | 7242 |
| 2 | 5631500400 | 20150225T000000 | 180000.0 | 2 | 1.00 | 770 | 10000 |

3 rows × 21 columns

In [3]:
```
#pre-processing and cleaning
#drop id and zipcode
df=df.drop(['id','date','zipcode','yr_renovated','view','waterfront'],1)
df.head(3)
```

Out[3]:

| | price | bedrooms | bathrooms | sqft_living | sqft_lot | floors | condition | grade | sqft_ab |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 221900.0 | 3 | 1.00 | 1180 | 5650 | 1.0 | 3 | 7 | 1180 |
| 1 | 538000.0 | 3 | 2.25 | 2570 | 7242 | 2.0 | 3 | 7 | 2170 |
| 2 | 180000.0 | 2 | 1.00 | 770 | 10000 | 1.0 | 3 | 6 | 770 |

In [4]:
```
df.shape
```

Out[4]: (21613, 15)

In [5]:
```
X=df.drop(['price'],1)
Y=df[['price']]
```

In [6]:
```
# df_n=(df-df.min())/((df.max())-(df.min()))
Xs=(X-X.mean())/(X.std())
Xs.head(3)
```

Out[6]:

| | bedrooms | bathrooms | sqft_living | sqft_lot | floors | condition | grade | sqft_ab |
|---|---|---|---|---|---|---|---|---|
| **0** | -0.398728 | -1.447430 | -0.979812 | -0.228316 | -0.915406 | -0.629172 | -0.558823 | -0.73469 |
| **1** | -0.398728 | 0.175603 | 0.533622 | -0.189881 | 0.936484 | -0.629172 | -0.558823 | 0.46083 |
| **2** | -1.473925 | -1.447430 | -1.426221 | -0.123296 | -0.915406 | -0.629172 | -1.409554 | -1.22980 |

In [7]:
```
Xs_cov=Xs.cov()
```

In [8]:
```
Xs_cov.head(3)
```

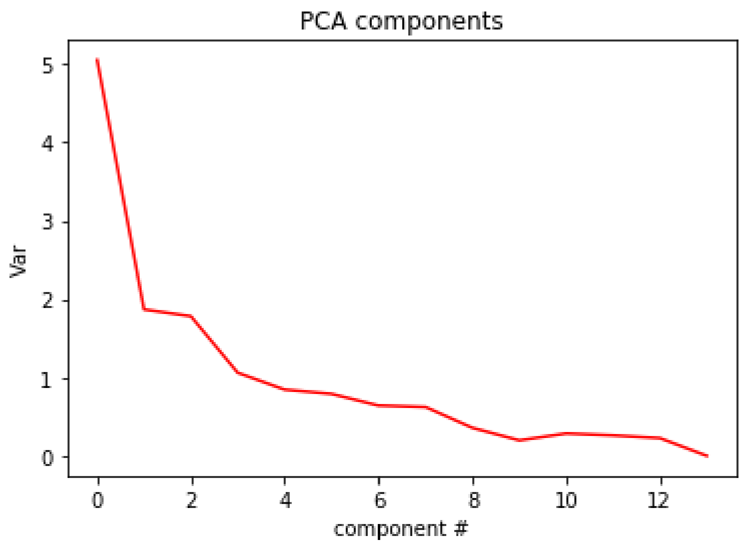
Out[8]:

| | bedrooms | bathrooms | sqft_living | sqft_lot | floors | condition | grade |
|---|---|---|---|---|---|---|---|
| **bedrooms** | 1.000000 | 0.515884 | 0.576671 | 0.031703 | 0.175429 | 0.028472 | 0.356967 |
| **bathrooms** | 0.515884 | 1.000000 | 0.754665 | 0.087740 | 0.500653 | -0.124982 | 0.664983 |
| **sqft_living** | 0.576671 | 0.754665 | 1.000000 | 0.172826 | 0.353949 | -0.058753 | 0.762704 |

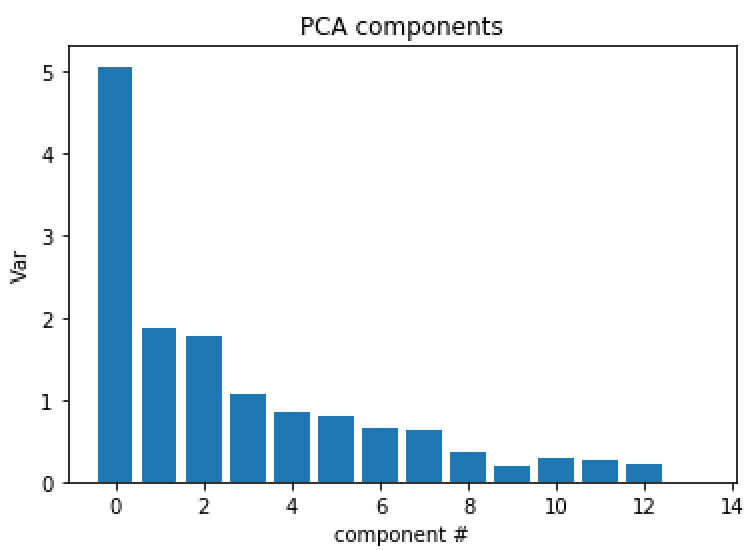
In [9]:
```
eigen_value,eigen_vector=la.eig(Xs_cov)
print(eigen_value[:])
```

```
[ 5.05098374e+00  1.87016338e+00  1.78387613e+00  1.06173180e+00
  8.46223892e-01  7.91520746e-01  6.43049873e-01  6.23275717e-01
  3.57342162e-01  1.97983067e-01  2.85894277e-01  2.61373183e-01
  2.26582035e-01 -3.47668819e-16]
```

In [10]:
```
index = np.arange(len(eigen_value))
plt.plot(index, eigen_value, color='r')
plt.xlabel('component #')
plt.ylabel('Var')
plt.title('PCA components')
plt.show()
```




In [11]:
```
index = np.arange(len(eigen_value))
plt.bar(index, eigen_value)
plt.xlabel('component #')
plt.ylabel('Var')
plt.title('PCA components')
plt.show()
```




A good number of PCA would be 6.

In [12]:
```
X_train, X_test, y_train, y_test = train_test_split(Xs, Y, test_size=0.2, rand
om_state=0)
```

In [13]:
```
pca=PCA(n_components=6)
X_train=pca.fit_transform(X_train)
X_test=pca.transform(X_test)
```

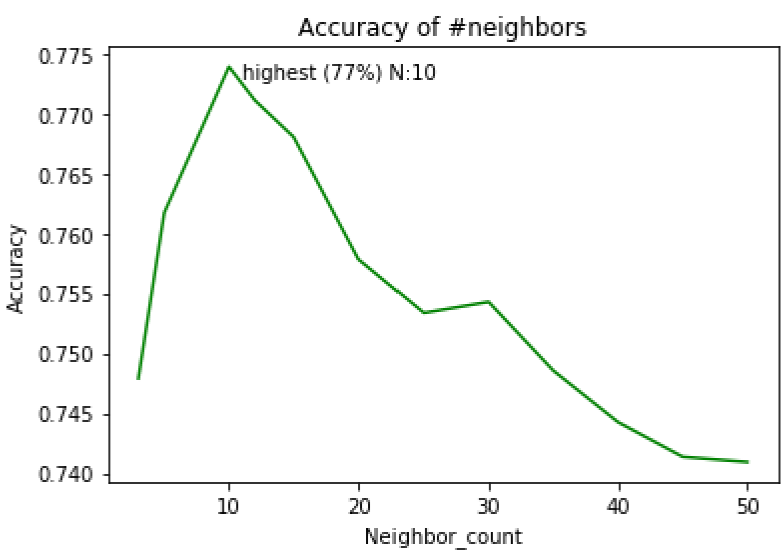
In [14]:
```
#KNN model
```

In [15]:
```
accuracy_values=[]
neighbor_count=[3,5,10,12,15,20,25,30,35,40,45,50]
for i in neighbor_count:
    neigh = KNeighborsRegressor(n_neighbors = i, metric = 'euclidean')
    neigh.fit(X_train,y_train)
    PRED=neigh.predict(X_test)
    ten_score=neigh.score(X_test,y_test)
    accuracy_values.append(ten_score)
```

In [16]:
```
print accuracy_values
```

```
[0.7479055812734365, 0.7617455364358612, 0.7739490041290873, 0.77114547336347
73, 0.76807469746629, 0.757863388380646, 0.7533808823565806, 0.75430160684516
97, 0.7485568777792191, 0.744254971983161, 0.7413575045397784, 0.740919820783
1815]
```

In [17]:
```
plt.plot(neighbor_count,accuracy_values,color='g')
plt.xlabel('Neighbor_count')
plt.ylabel('Accuracy')
plt.title('Accuracy of #neighbors')
plt.text(11,0.773, r'highest (77%) N:10')
plt.show()
```




From the plot its cleara to say an optimal number of nearest neighbours would be 10.

In [18]:
```
#training the final model
neigh = KNeighborsRegressor(n_neighbors = 10, metric = 'euclidean')
neigh.fit(X,Y)
```

Out[18]:
```
KNeighborsRegressor(algorithm='auto', leaf_size=30, metric='euclidean',
          metric_params=None, n_jobs=1, n_neighbors=10, p=2,
          weights='uniform')
```