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

# 2) Load the dataset

In [2]:
```
df = pd.read_csv("housing.csv")
```

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

Out[3]:

| | price | area | bedrooms | bathrooms | stories | mainroad | guestroom | basement | hotwaterheating | airconditio |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13300000 | 7420 | 4 | 2 | 3 | yes | no | no | no | |
| **1** | 12250000 | 8960 | 4 | 4 | 4 | yes | no | no | no | |
| **2** | 12250000 | 9960 | 3 | 2 | 2 | yes | no | yes | no | |
| **3** | 12215000 | 7500 | 4 | 2 | 2 | yes | no | yes | no | |
| **4** | 11410000 | 7420 | 4 | 1 | 2 | yes | yes | yes | no | |

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 545 entries, 0 to 544
Data columns (total 12 columns):
 #   Column            Non-Null Count  Dtype 
---  ------            --------------  ----- 
 0   price             545 non-null    int64 
 1   area              545 non-null    int64 
 2   bedrooms          545 non-null    int64 
 3   bathrooms         545 non-null    int64 
 4   stories           545 non-null    int64 
 5   mainroad          545 non-null    object
 6   guestroom         545 non-null    object
 7   basement          545 non-null    object
 8   hotwaterheating   545 non-null    object
 9   airconditioning   545 non-null    object
 10  parking           545 non-null    int64 
 11  furnishingstatus  545 non-null    object
dtypes: int64(6), object(6)
memory usage: 51.2+ KB
```

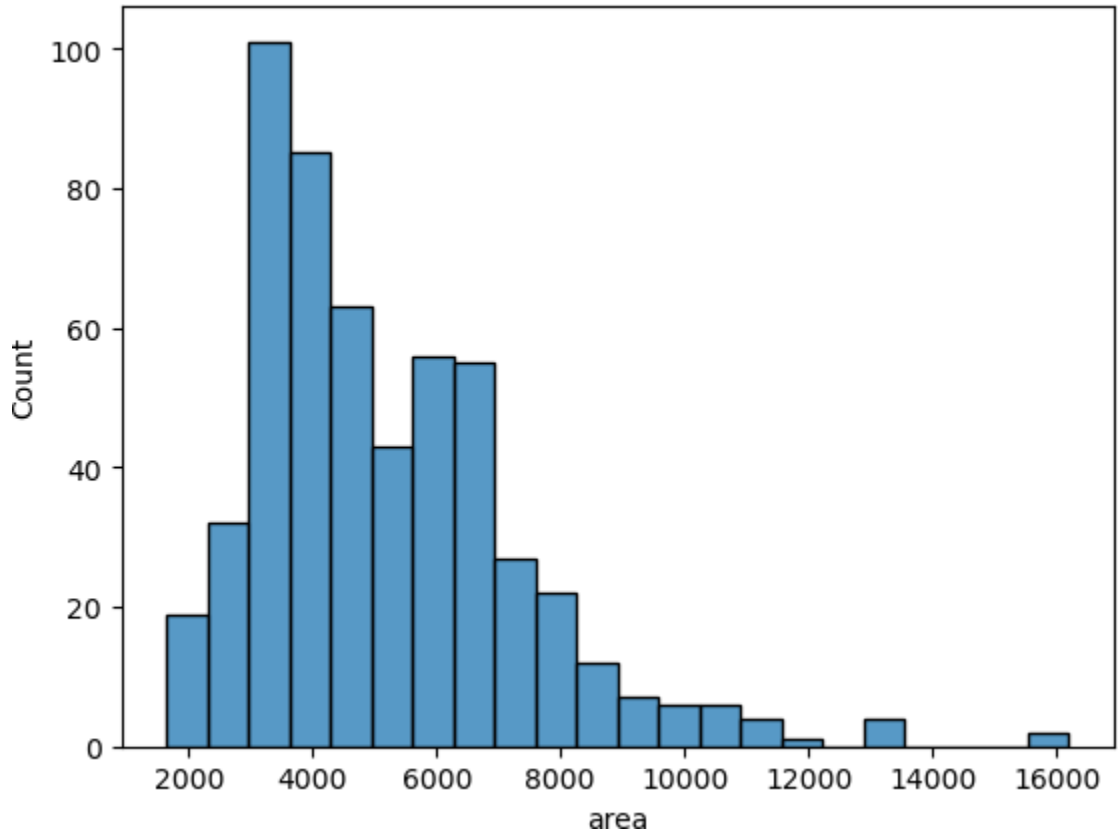
# 3. Perform Below Visualizations.

- **Univariate Analysis**
- **Bi - Variate Analysis**
- **Multi - Variate Analysis**

**univariate analysis**

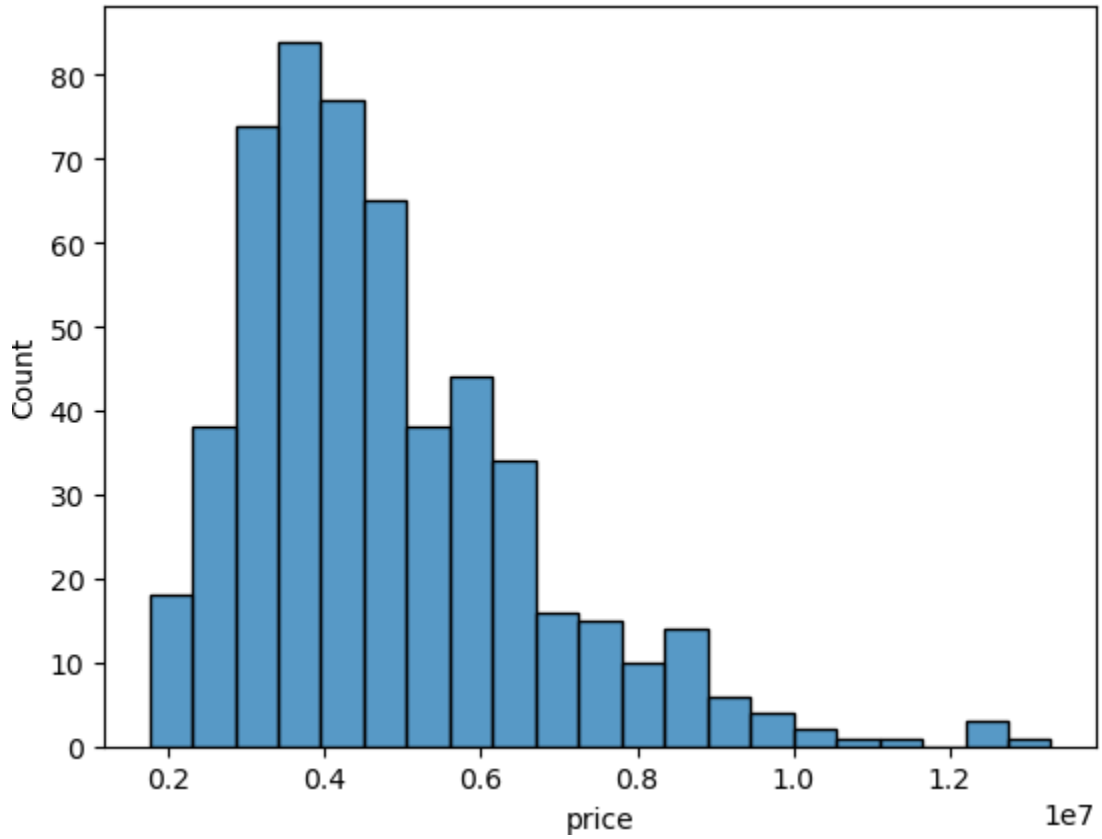
In [5]:
```
sns.histplot(df['area'])
```

Out[5]: <Axes: xlabel='area', ylabel='Count'>



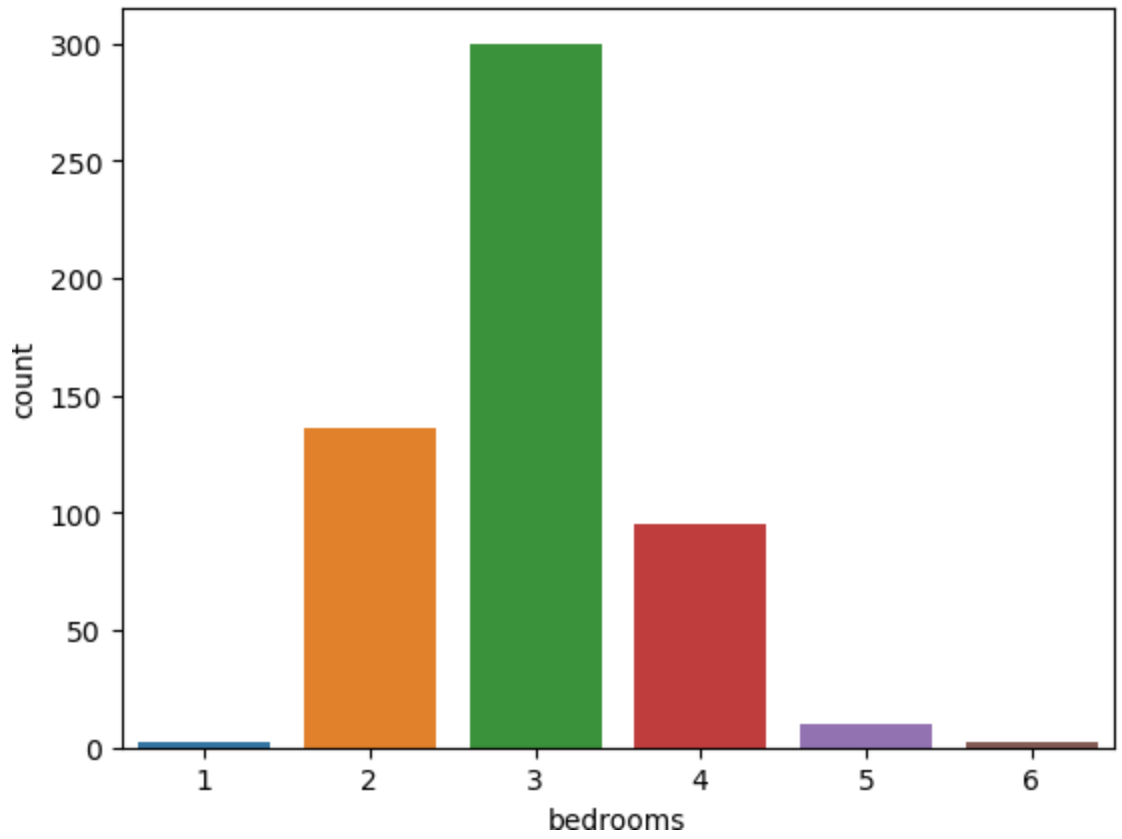

In [6]:
```
sns.histplot(df['price'])
```

Out[6]: <Axes: xlabel='price', ylabel='Count'>



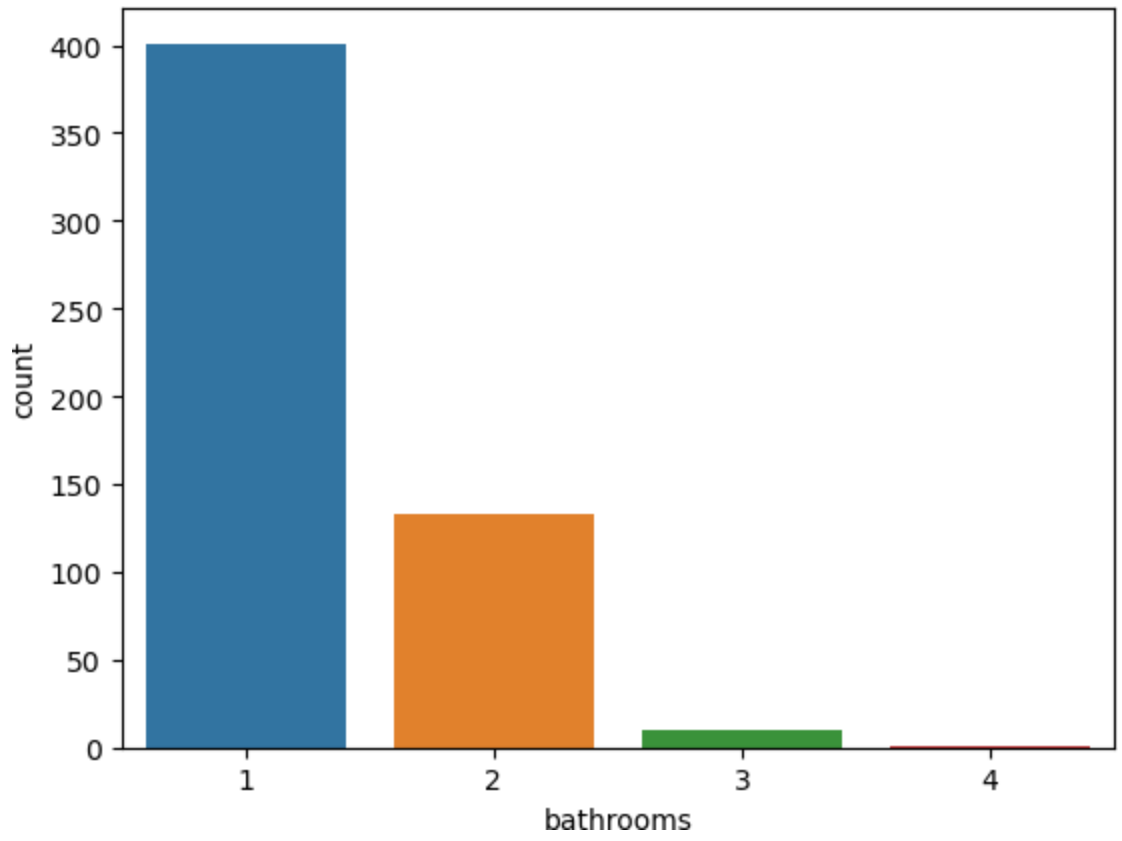

In [7]:
```
sns.countplot(x = df['bedrooms'])
```

Out[7]: <Axes: xlabel='bedrooms', ylabel='count'>



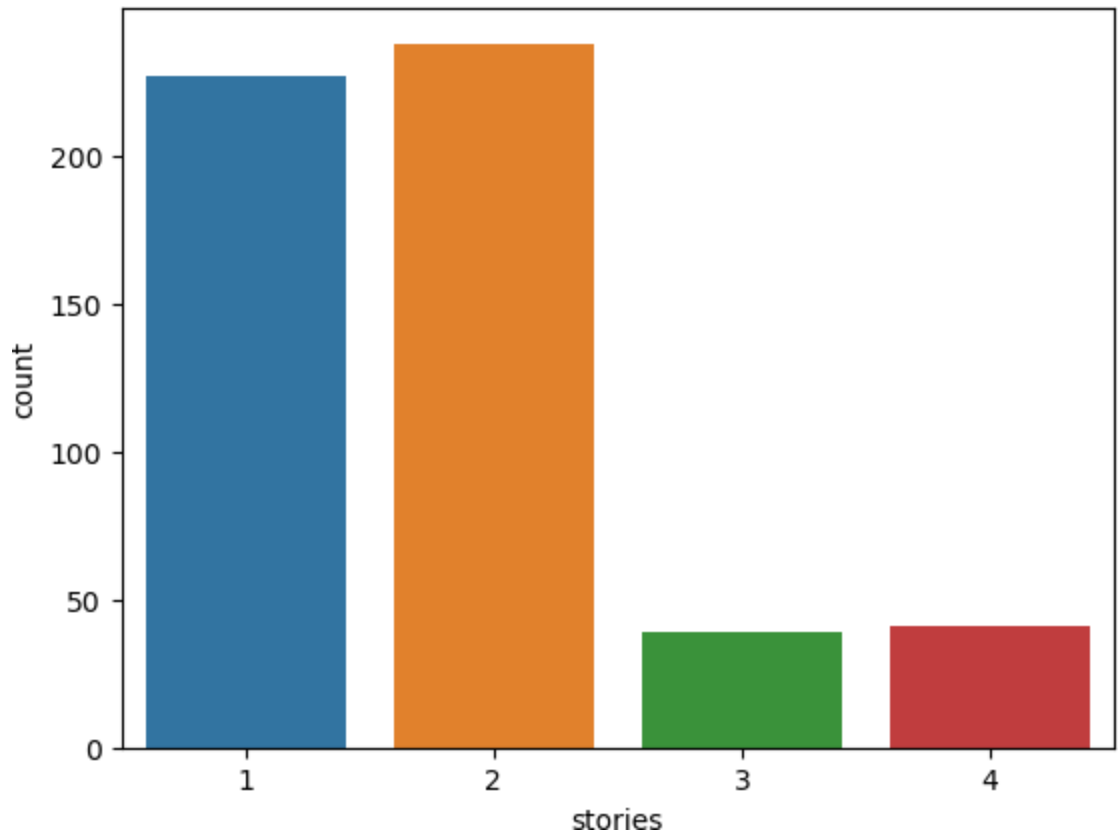

In [8]:
```
sns.countplot(x = df['bathrooms'])
```

Out[8]:
```
<Axes: xlabel='bathrooms', ylabel='count'>
```



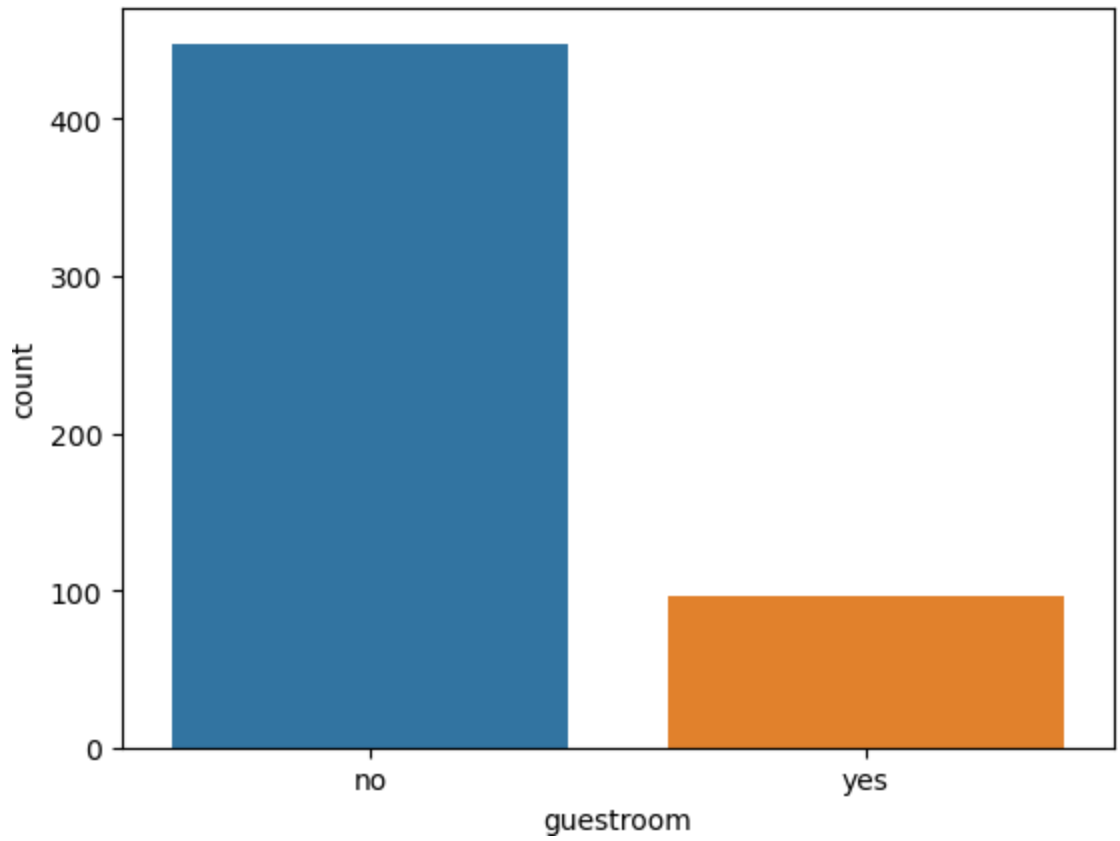

In [9]:
```
sns.countplot(x = df['stories'])
```

Out[9]:
```
<Axes: xlabel='stories', ylabel='count'>
```



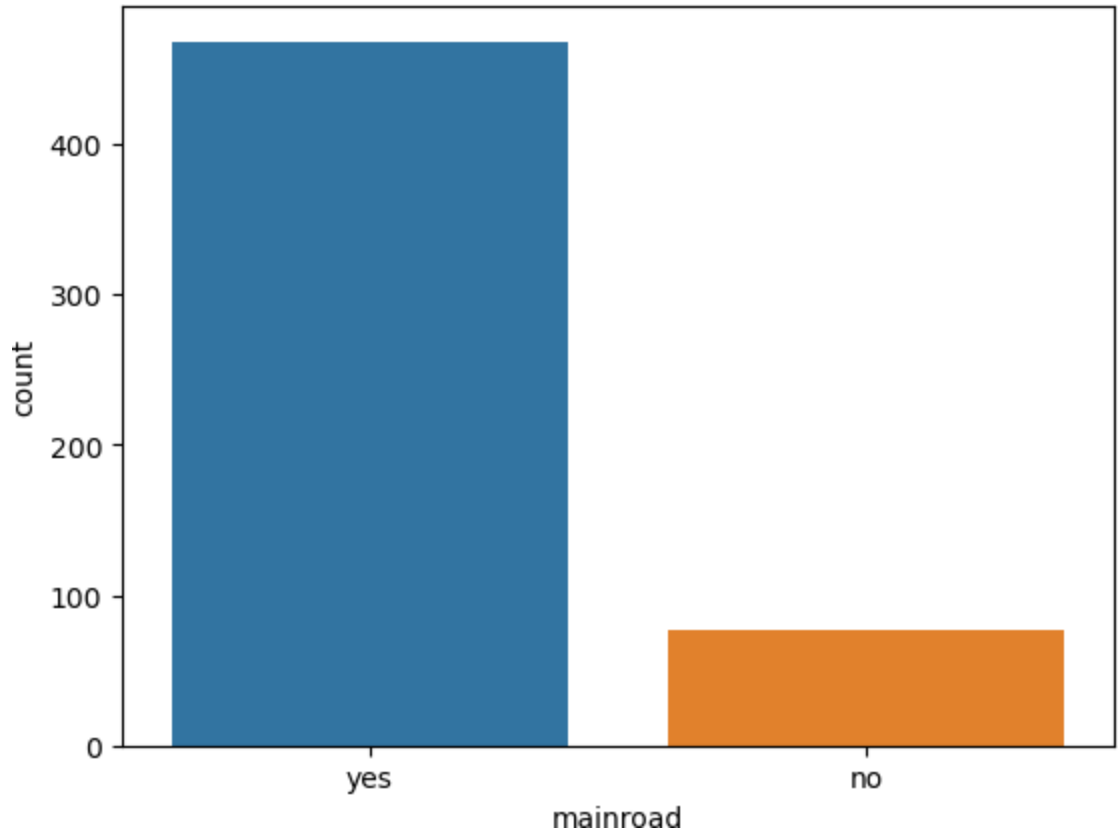

In [10]:
```
sns.countplot(x = df['guestroom'])
```

Out[10]:
```
<Axes: xlabel='guestroom', ylabel='count'>
```



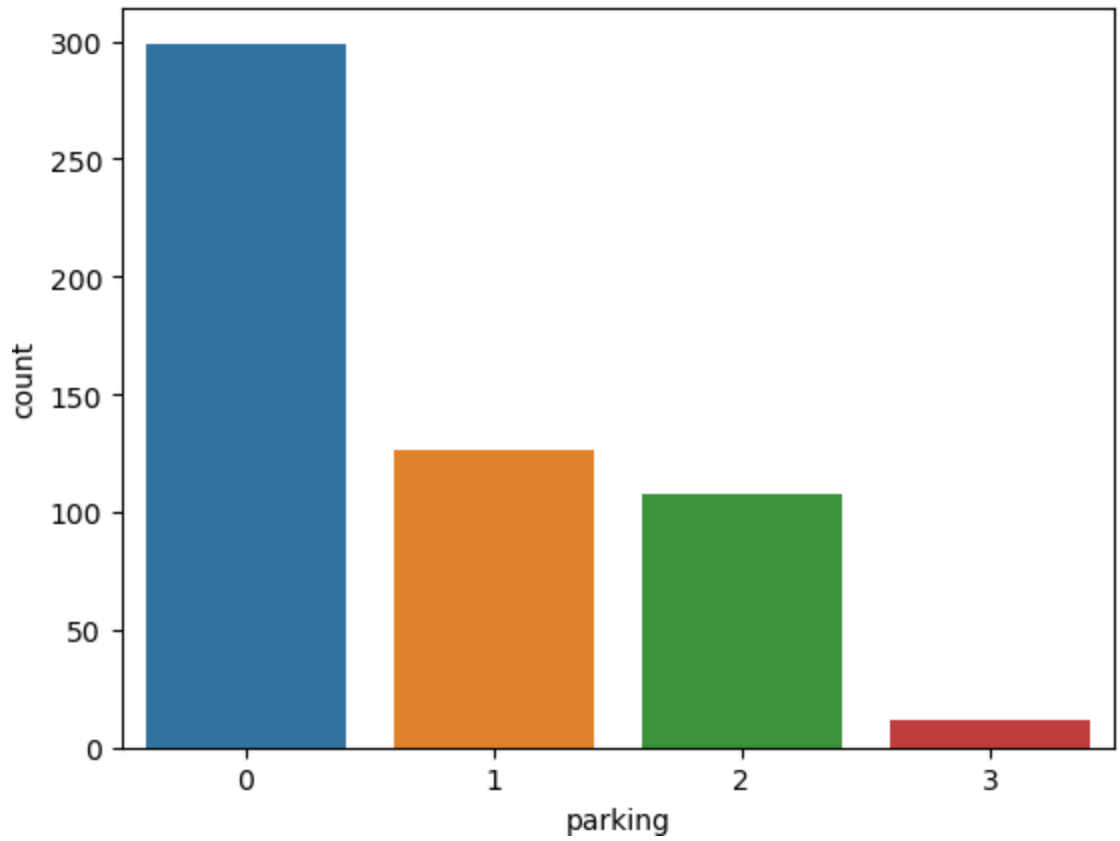

In [11]:
```
sns.countplot(x = df['mainroad'])
```

Out[11]:
```
<Axes: xlabel='mainroad', ylabel='count'>
```



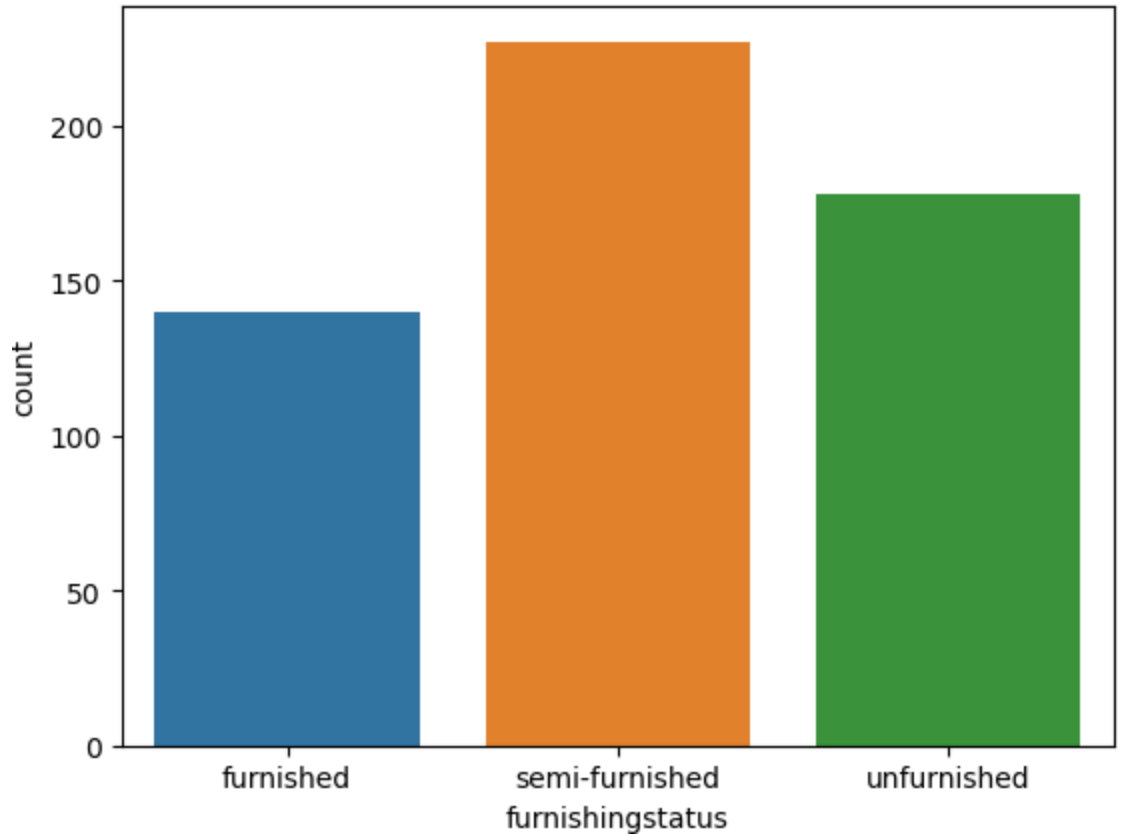

In [12]:
```
sns.countplot(x = df['parking'])
```

Out[12]:
```
<Axes: xlabel='parking', ylabel='count'>
```




In [13]:
```
sns.countplot(x = df['furnishingstatus'])
```

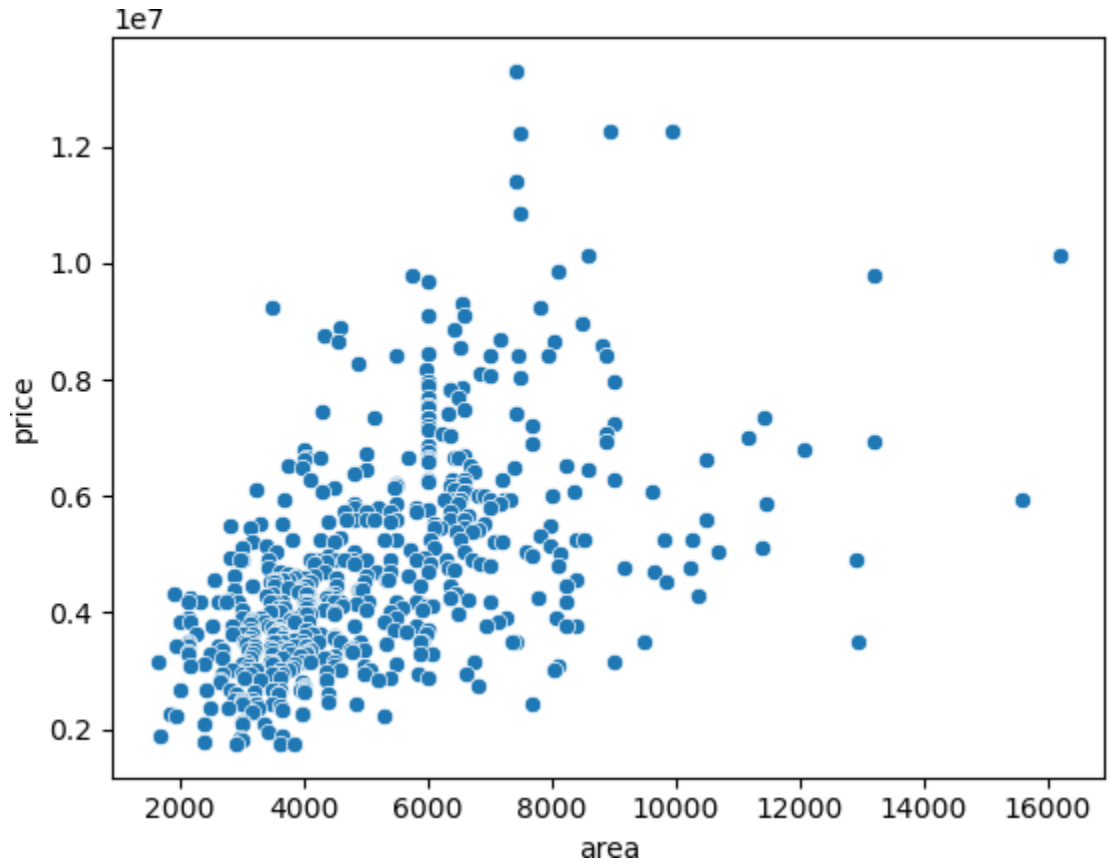
Out[13]:
```
<Axes: xlabel='furnishingstatus', ylabel='count'>
```




### bivariate analysis

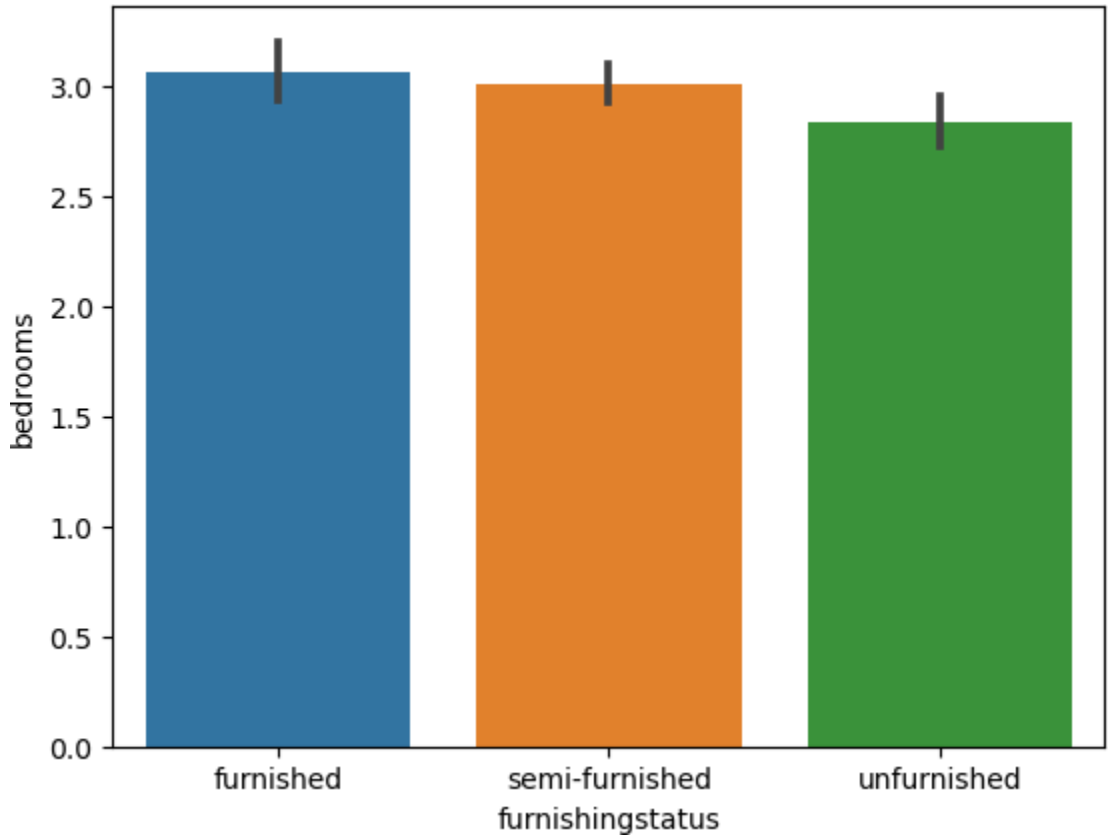
In [14]:
```
sns.scatterplot(data = df, x = 'area', y = 'price')
```

Out[14]:
```
<Axes: xlabel='area', ylabel='price'>
```



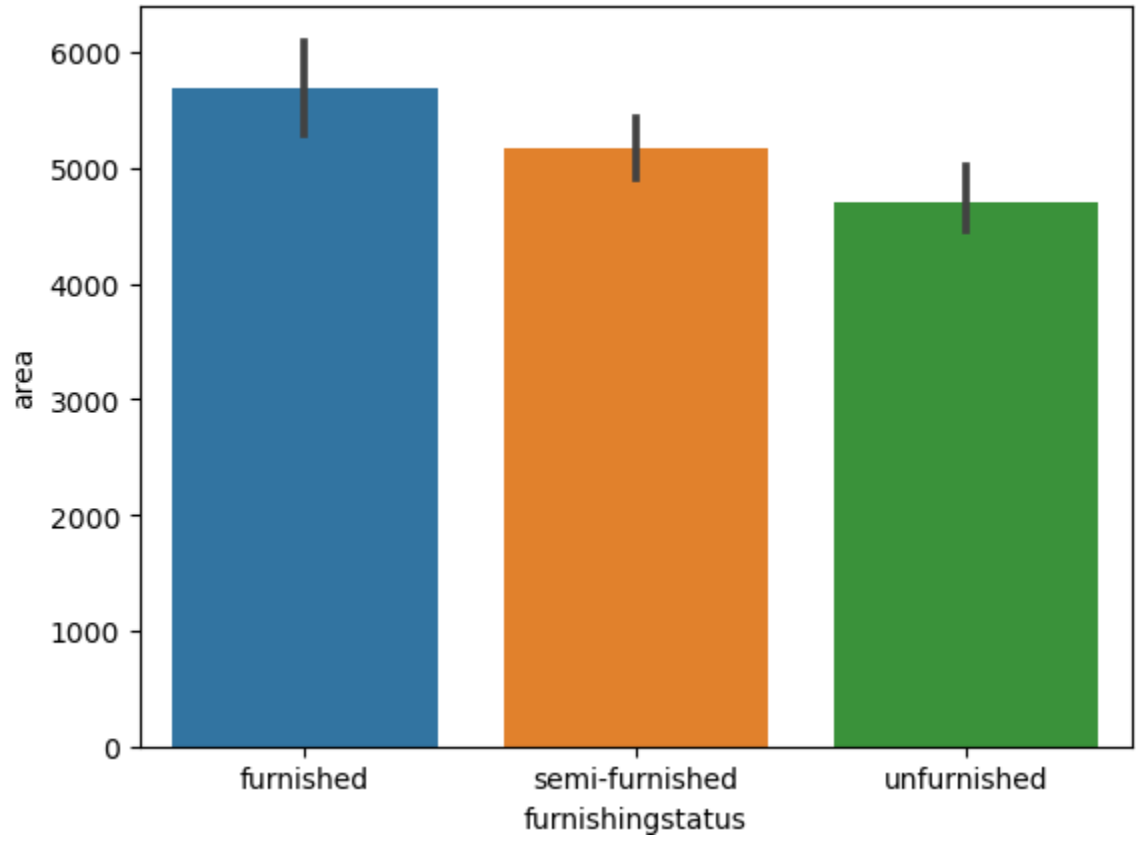

In [15]:
```
sns.barplot(data = df, x = 'furnishingstatus', y = 'bedrooms')
```

Out[15]: <Axes: xlabel='furnishingstatus', ylabel='bedrooms'>



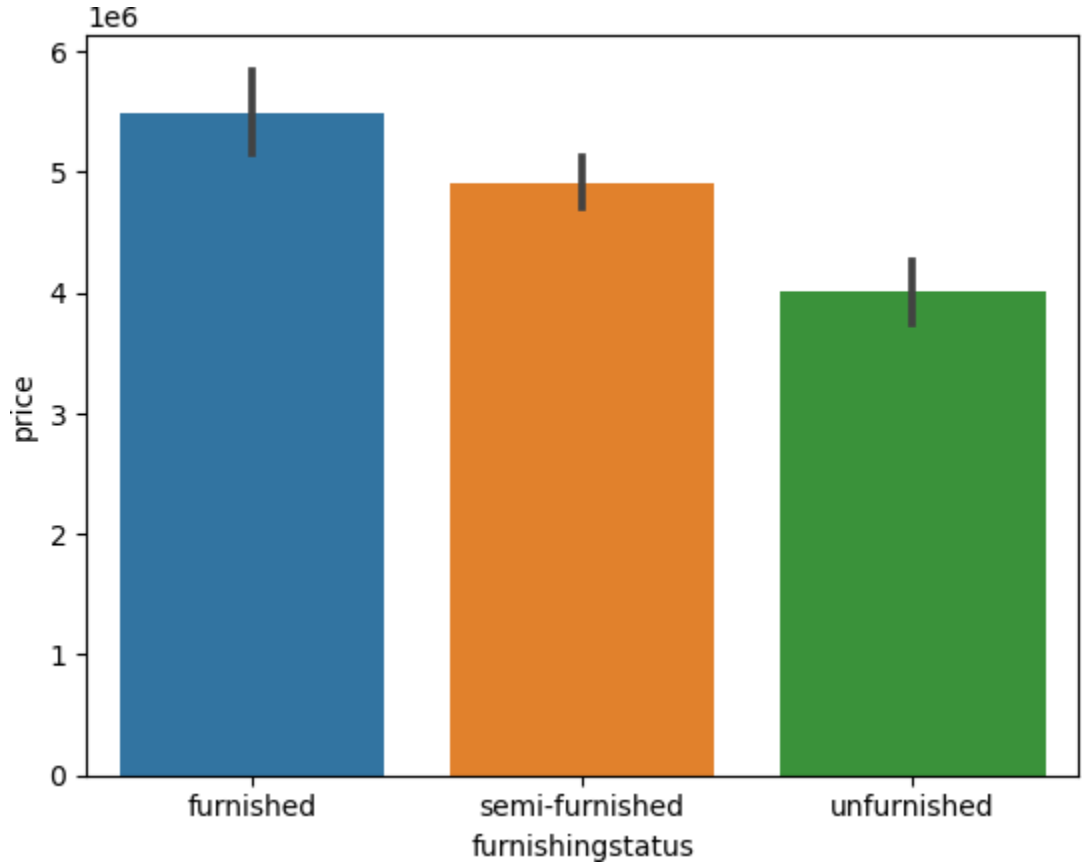

In [16]:
```
sns.barplot(data = df, x = 'furnishingstatus', y = 'area')
```

Out[16]: <Axes: xlabel='furnishingstatus', ylabel='area'>



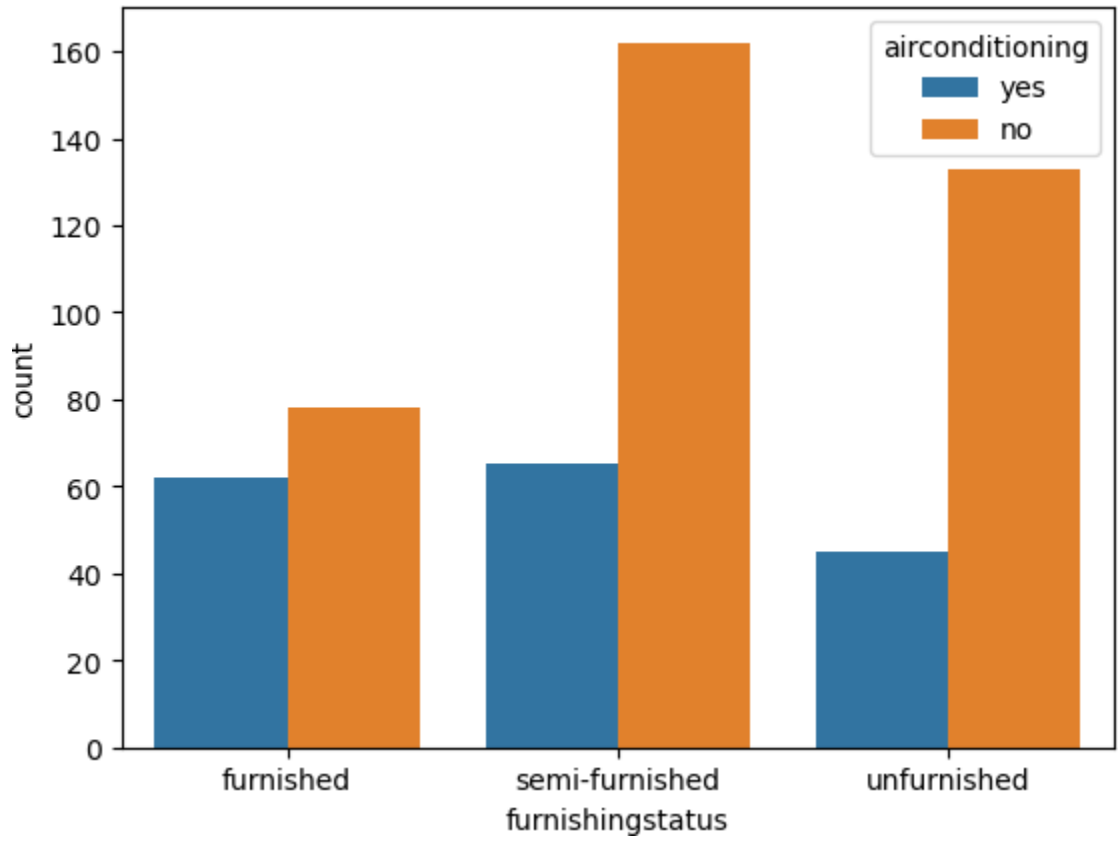

In [17]:
```
sns.barplot(data = df, x = 'furnishingstatus', y = 'price')
```

Out[17]: <Axes: xlabel='furnishingstatus', ylabel='price'>



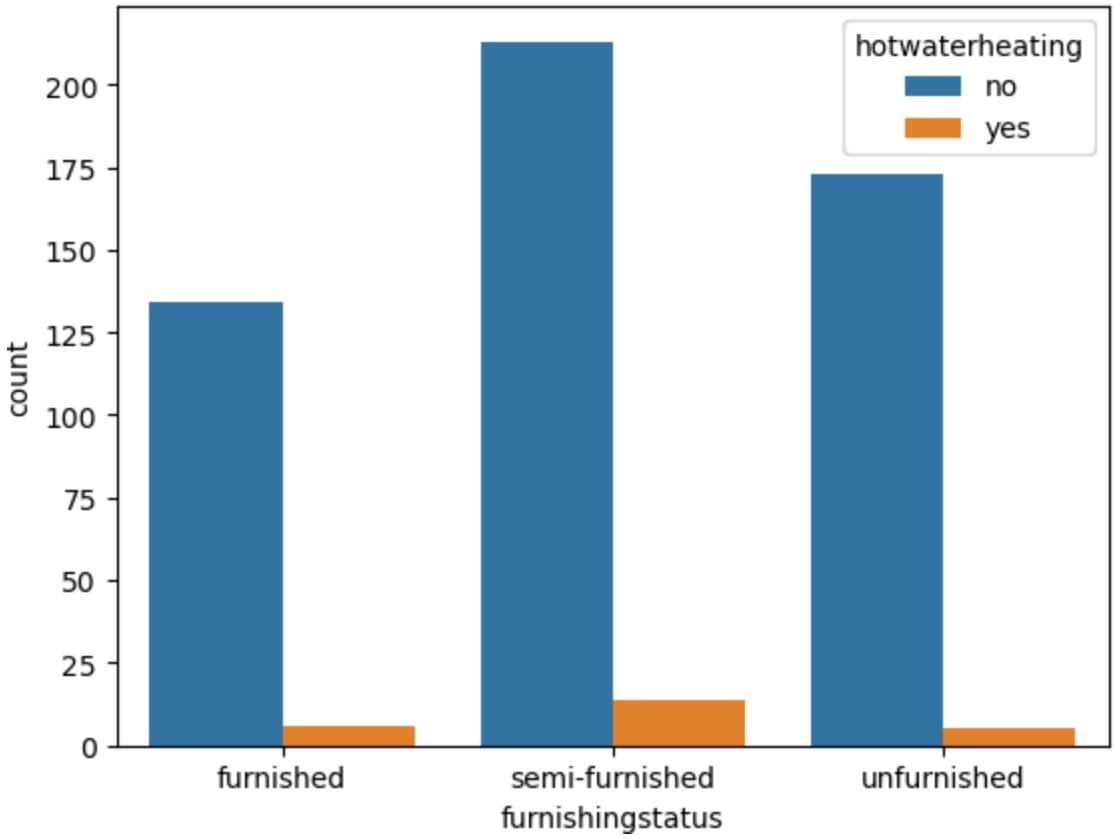

In [18]:
```
sns.countplot(x = df['furnishingstatus'], hue = df['airconditioning'])
```

Out[18]:
```
<Axes: xlabel='furnishingstatus', ylabel='count'>
```




In [19]:
```
sns.countplot(x = df['furnishingstatus'], hue = df['hotwaterheating'])
```

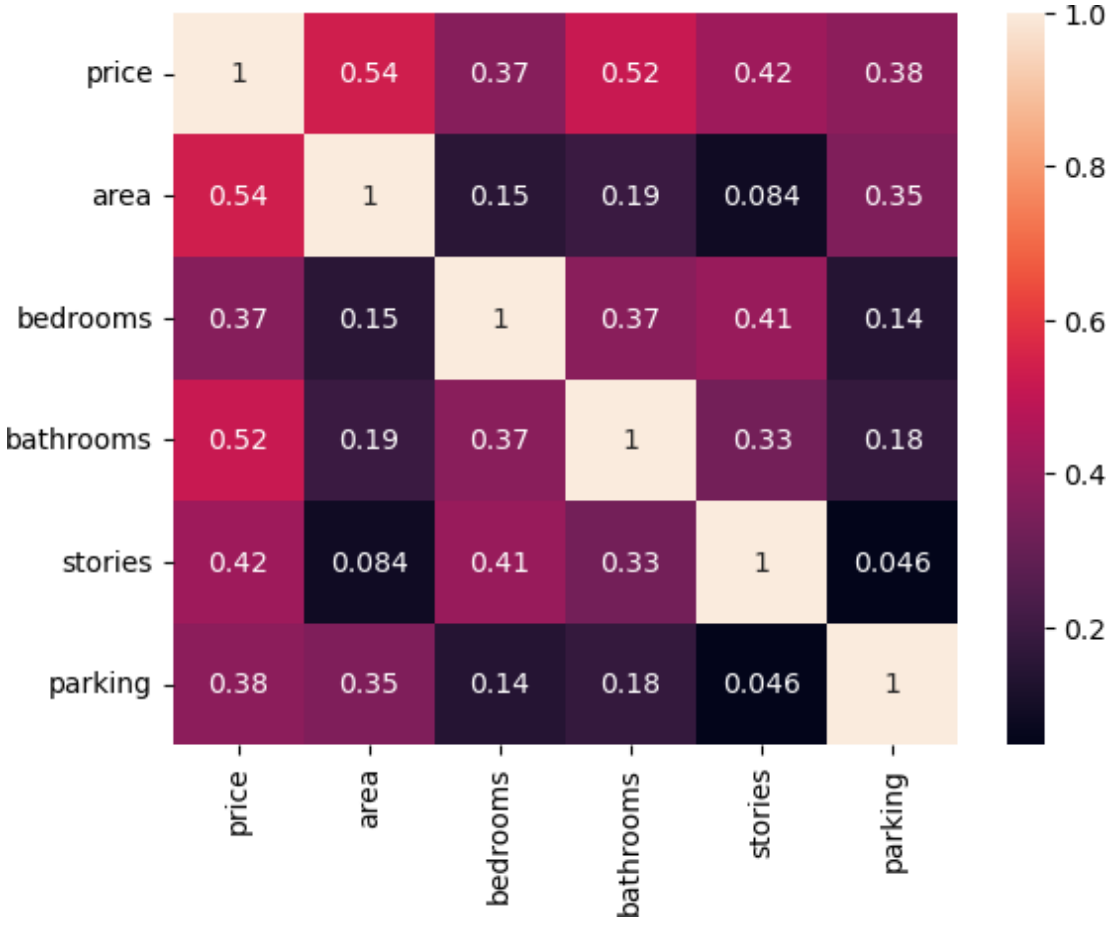
Out[19]:
```
<Axes: xlabel='furnishingstatus', ylabel='count'>
```




**multivariate analysis**

In [20]:
```
sns.heatmap(df.corr(numeric_only=True), annot = True)
```

Out[20]:
```
<Axes: >
```



# 4. Perform descriptive statistics on the dataset.

In [21]:
```
df.describe()
```

Out[21]:

| | price | area | bedrooms | bathrooms | stories | parking |
|---|---|---|---|---|---|---|
| **count** | 5.450000e+02 | 545.000000 | 545.000000 | 545.000000 | 545.000000 | 545.000000 |
| **mean** | 4.766729e+06 | 5150.541284 | 2.965138 | 1.286239 | 1.805505 | 0.693578 |
| **std** | 1.870440e+06 | 2170.141023 | 0.738064 | 0.502470 | 0.867492 | 0.861586 |
| **min** | 1.750000e+06 | 1650.000000 | 1.000000 | 1.000000 | 1.000000 | 0.000000 |
| **25%** | 3.430000e+06 | 3600.000000 | 2.000000 | 1.000000 | 1.000000 | 0.000000 |
| **50%** | 4.340000e+06 | 4600.000000 | 3.000000 | 1.000000 | 2.000000 | 0.000000 |
| **75%** | 5.740000e+06 | 6360.000000 | 3.000000 | 2.000000 | 2.000000 | 1.000000 |
| **max** | 1.330000e+07 | 16200.000000 | 6.000000 | 4.000000 | 4.000000 | 3.000000 |

# 5. Handle the Missing values.

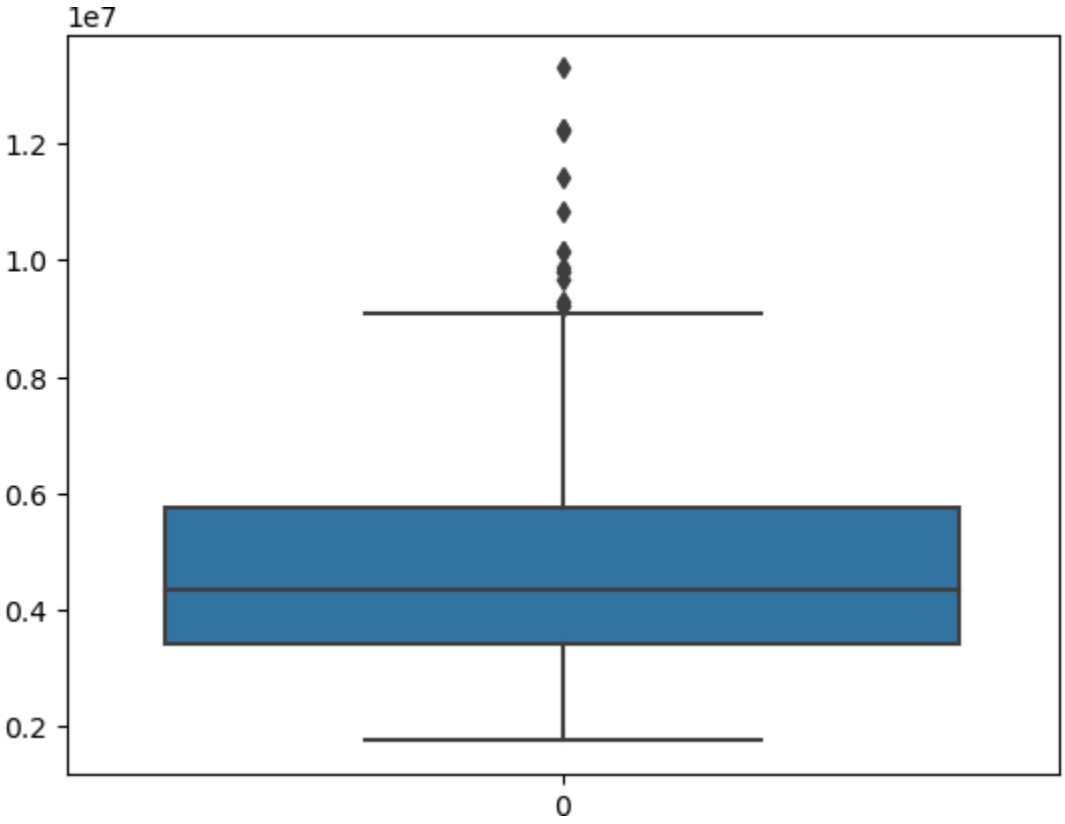
In [22]:
```
df.isnull().sum()
```

Out[22]:
```
price             0
area              0
bedrooms          0
bathrooms         0
stories           0
mainroad          0
guestroom         0
basement          0
hotwaterheating   0
airconditioning   0
parking           0
furnishingstatus  0
dtype: int64
```

# 6. Find the outliers and replace the outliers

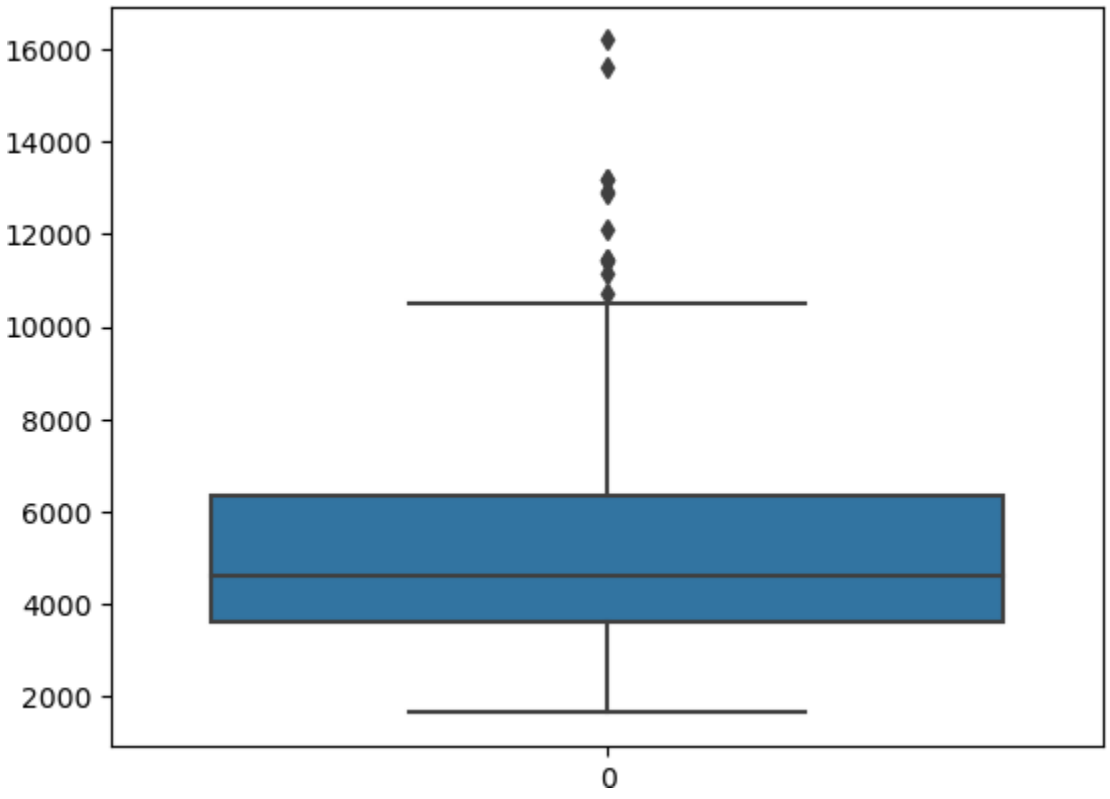
In [23]:
```
sns.boxplot(df['price'])
```

Out[23]:
```
<Axes: >
```



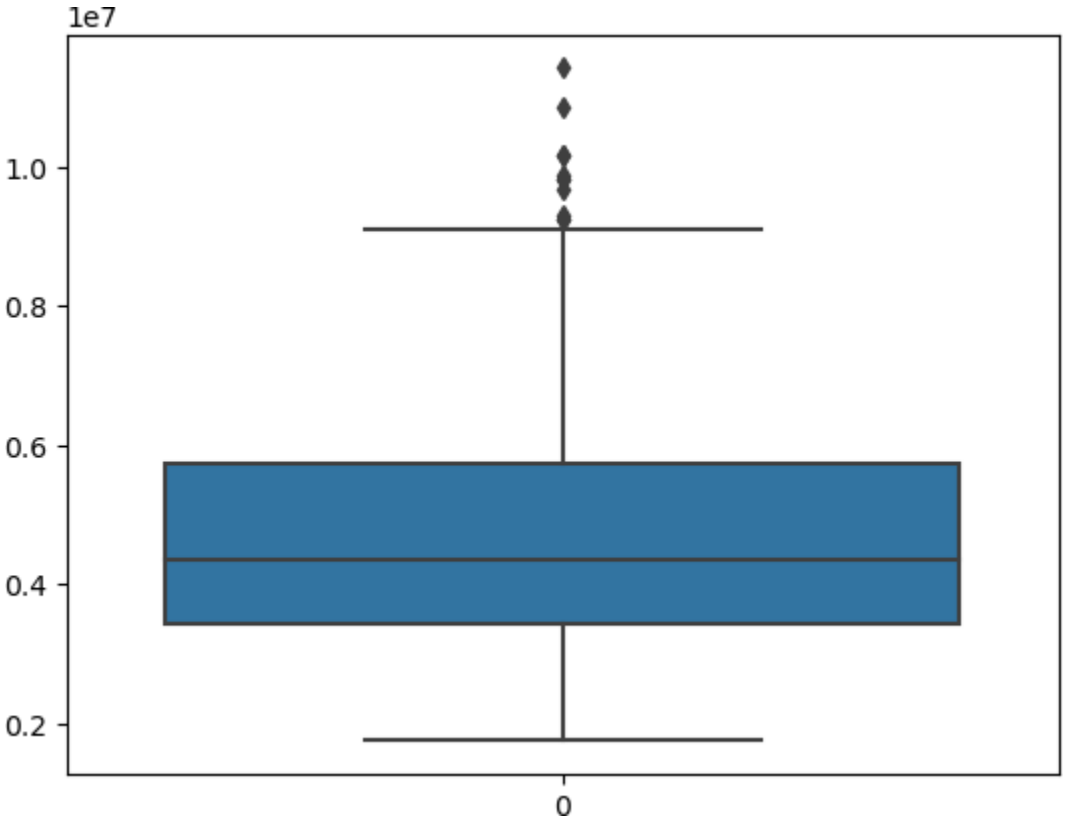

In [24]:
```
sns.boxplot(df['area'])
```

Out[24]:
```
<Axes: >
```



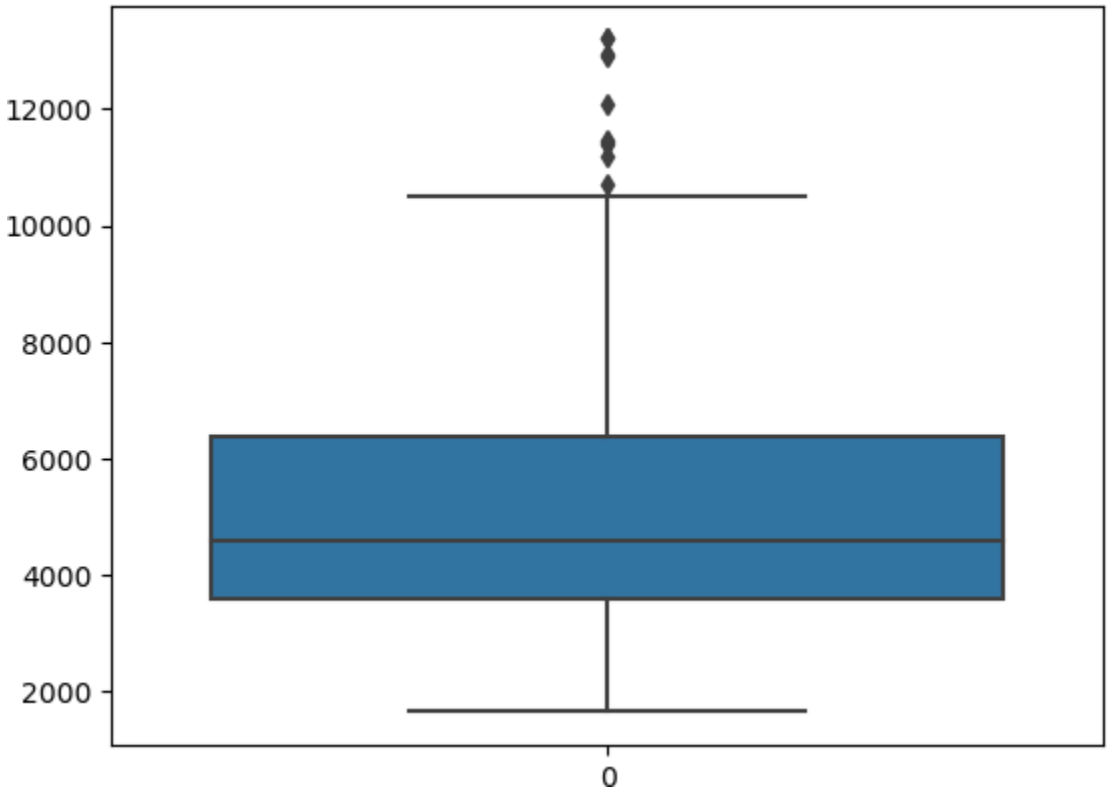

In [25]:
```
median_age = df['price'].median()
df["price"] = np.where(df["price"] >12000000, median_age, df['price'])
sns.boxplot(df['price'])
```

Out[25]:
```
<Axes: >
```




In [26]:
```
median_area = df['area'].median()
df["area"] = np.where(df["area"] > 14000, median_area, df['area'])
sns.boxplot(df['area'])
```

Out[26]:
```
<Axes: >
```




# 7. Check for Categorical columns and perform encoding.

In [27]:
```
from sklearn.preprocessing import OneHotEncoder
```

In [28]:
```
encoding = pd.get_dummies(df, columns = ['mainroad', 'guestroom', 'basement','hotwaterhe
                                         'airconditioning', 'furnishingstatus'])
```

In [29]:
```
encoding.head()
```

Out[29]:

| | price | area | bedrooms | bathrooms | stories | parking | mainroad_no | mainroad_yes | guestroom_no | gues |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 4340000.0 | 7420.0 | 4 | 2 | 3 | 2 | 0 | 1 | 1 | |
| **1** | 4340000.0 | 8960.0 | 4 | 4 | 4 | 3 | 0 | 1 | 1 | |
| **2** | 4340000.0 | 9960.0 | 3 | 2 | 2 | 2 | 0 | 1 | 1 | |
| **3** | 4340000.0 | 7500.0 | 4 | 2 | 2 | 3 | 0 | 1 | 1 | |
| **4** | 11410000.0 | 7420.0 | 4 | 1 | 2 | 2 | 0 | 1 | 0 | |

# 8. Split the data into dependent and independent variables

In [30]:
```
df.columns
```

Out[30]:
```
Index(['price', 'area', 'bedrooms', 'bathrooms', 'stories', 'mainroad',
       'guestroom', 'basement', 'hotwaterheating', 'airconditioning',
       'parking', 'furnishingstatus'],
      dtype='object')
```

In [65]:
```
# independent variables
X = encoding.drop(['price'], axis = 1)
X.head()
```

Out[65]:

| | area | bedrooms | bathrooms | stories | parking | mainroad_no | mainroad_yes | guestroom_no | guestroom_yes | b |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 7420.0 | 4 | 2 | 3 | 2 | 0 | 1 | 1 | 0 | |
| **1** | 8960.0 | 4 | 4 | 4 | 3 | 0 | 1 | 1 | 0 | |
| **2** | 9960.0 | 3 | 2 | 2 | 2 | 0 | 1 | 1 | 0 | |
| **3** | 7500.0 | 4 | 2 | 2 | 3 | 0 | 1 | 1 | 0 | |
| **4** | 7420.0 | 4 | 1 | 2 | 2 | 0 | 1 | 0 | 1 | |

In [66]:
```
# dependent variables
y = df[['price']]
y.head()
```

Out[66]:

| | price |
|---|---|
| **0** | 4340000.0 |
| **1** | 4340000.0 |
| **2** | 4340000.0 |
| **3** | 4340000.0 |
| **4** | 11410000.0 |

# 9. Scaling the independent variables

In [67]:
```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
x_std = scaler.fit_transform(X)
```

In [68]:
```
x_std
```

Out[68]:
```
array([[ 1.11756482,  1.40341936,  1.42181174, ...,  1.70084013,
        -0.84488844, -0.6964292 ],
       [ 1.8623093 ,  1.40341936,  5.40580863, ...,  1.70084013,
        -0.84488844, -0.6964292 ],
       [ 2.34590961,  0.04727831,  1.42181174, ..., -0.58794474,
         1.18358821, -0.6964292 ],
       ...,
       [-0.72011635, -1.30886273, -0.57018671, ..., -0.58794474,
        -0.84488844,  1.43589615],
       [-1.06347257,  0.04727831, -0.57018671, ...,  1.70084013,
        -0.84488844, -0.6964292 ],
       [-0.60888828,  0.04727831, -0.57018671, ..., -0.58794474,
        -0.84488844,  1.43589615]])
```

# 10. Split the data into training and testing

In [69]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33, random_state=0
```

# 11. Build the Model

In [70]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

In [71]:
```
lr = LinearRegression()
```

In [ ]:
```

```

# 12. Train the Model

In [72]:
```
lr.fit( X_train, y_train )
```

Out[72]:
```
▾ LinearRegression
LinearRegression()
```

In [73]:
```
print("Value of the coefficients: \n", lr.coef_)
print("-------------------------------------------------------------")
print("Value of the intercept: \n", lr.intercept_)
```

```
Value of the coefficients:
 [[ 2.60781675e+02  9.30932038e+04  8.20605321e+05  3.96961106e+05
   1.00796216e+05 -3.10469714e+05  3.10469714e+05 -3.32132424e+05
   3.32132424e+05 -1.72635846e+05  1.72635846e+05 -7.33905647e+05
```

```
   7.33905647e+05 -4.83024979e+05   4.83024979e+05   1.04827468e+05
   1.38634062e+05 -2.43461530e+05]]
--------------------------------------------------
Value of the intercept:
 [2156139.9017023]
```

# 13. Test the Model

In [74]:
```
Y_pred = lr.predict(X_test)
```

# 14. Measure the performance using Metrics.

In [81]:
```
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
```

In [82]:
```
print("MSE",mean_squared_error(y_test,Y_pred))
print("----------------------------------------------------")
print("RMSE",np.sqrt(mean_squared_error(y_test,Y_pred)))
print("----------------------------------------------------")
print("R-Square",  r2_score(y_test,Y_pred))
```

```
MSE 1326521791171.129
--------------------------------------------------
RMSE 1151747.2774750236
--------------------------------------------------
R-Square 0.5718914765881087
```

In [ ]:
```

```