In [8]:
```
#importing required packages
#modelues for EDA steps
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [9]:
```
train = pd.read_csv('Housing_dataset_train.csv')
```

In [10]:
```
test = pd.read_csv('Housing_dataset_test.csv')
```

In [11]:
```
sub = pd.read_csv('Sample_submission.csv')
```

In [12]:
```
train.head()
```

Out[12]:

	ID	loc	title	bedroom	bathroom	parking_space	price
0	3583	Katsina	Semi-detached duplex	2.0	2.0	1.0	1149999.565
1	2748	Ondo	Apartment	NaN	2.0	4.0	1672416.689
2	9261	Ekiti	NaN	7.0	5.0	NaN	3364799.814
3	2224	Anambra	Detached duplex	5.0	2.0	4.0	2410306.756
4	10300	Kogi	Terrace duplex	NaN	5.0	6.0	2600700.898

In [13]:
```
train.shape
```

Out[13]:
```
(14000, 7)
```

In [14]:
```
test.shape
```

Out[14]:
```
(6000, 6)
```

In [15]:
```
sub.shape
```

Out[15]:
```
(6000, 1)
```

In [16]:
```
sub.head()
```

Out[16]:

	ID
0	845
1	1924
2	10718
3	12076
4	12254

In [17]:
```
train.columns
```

Out[17]:
```
Index(['ID', 'loc', 'title', 'bedroom', 'bathroom', 'parking_space', 'price'], dty
pe='object')
```

In [18]:
```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14000 entries, 0 to 13999
Data columns (total 7 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   ID             14000 non-null  int64  
 1   loc            12187 non-null  object 
 2   title          12278 non-null  object 
 3   bedroom        12201 non-null  float64
 4   bathroom       12195 non-null  float64
 5   parking_space  12189 non-null  float64
 6   price          14000 non-null  float64
dtypes: float64(4), int64(1), object(2)
memory usage: 765.8+ KB
```

In [19]:
```
train.describe()
```

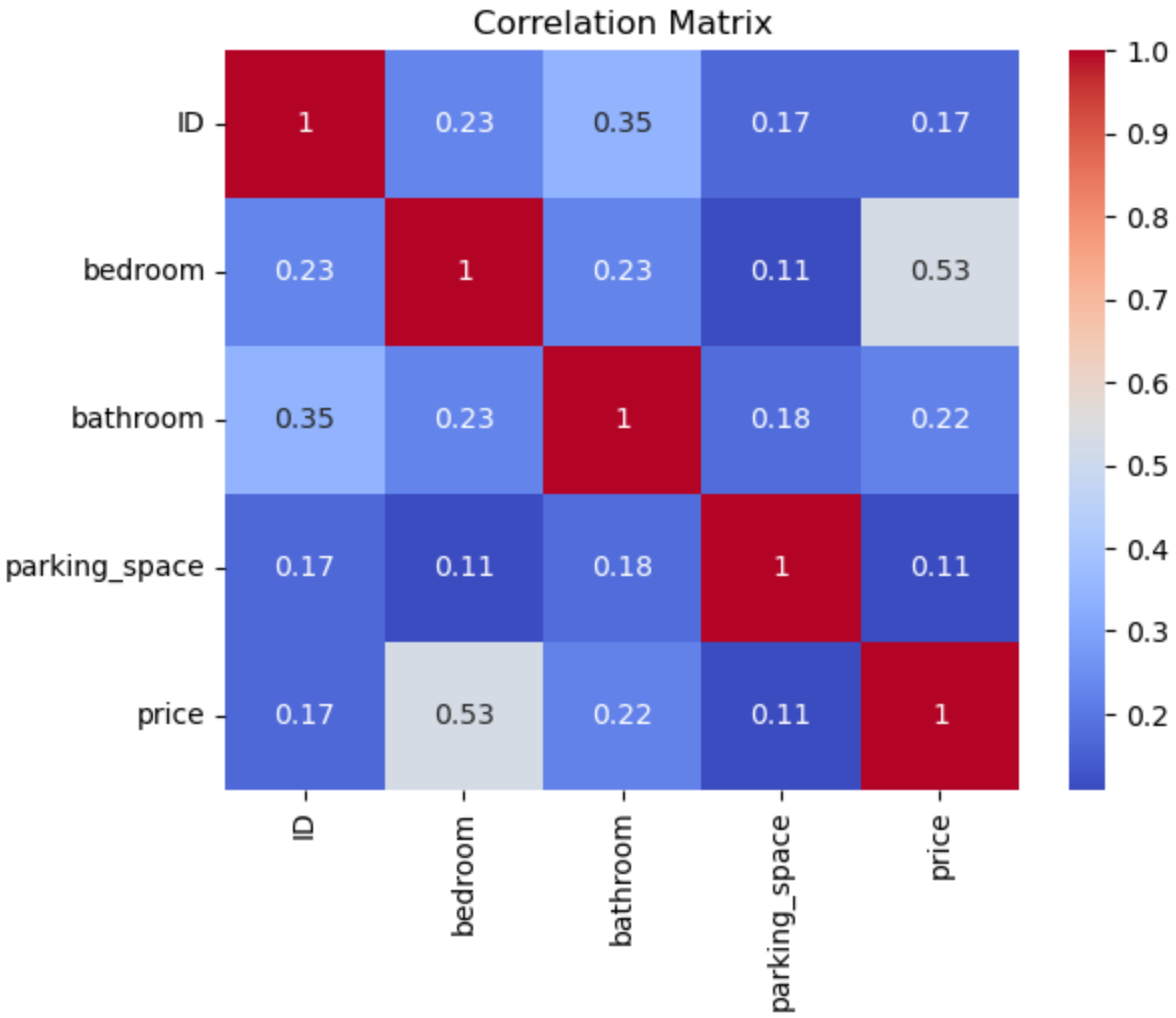
Out[19]:

	ID	bedroom	bathroom	parking_space	price
count	14000.000000	12201.000000	12195.000000	12189.000000	1.400000e+04
mean	4862.700357	4.308171	3.134235	3.169825	2.138082e+06
std	3818.348214	2.441165	2.035950	1.599415	1.083057e+06
min	0.000000	1.000000	1.000000	1.000000	4.319673e+05
25%	1672.750000	2.000000	1.000000	2.000000	1.393990e+06
50%	3527.000000	4.000000	2.000000	3.000000	1.895223e+06
75%	8011.250000	6.000000	5.000000	4.000000	2.586699e+06
max	12999.000000	9.000000	7.000000	6.000000	1.656849e+07

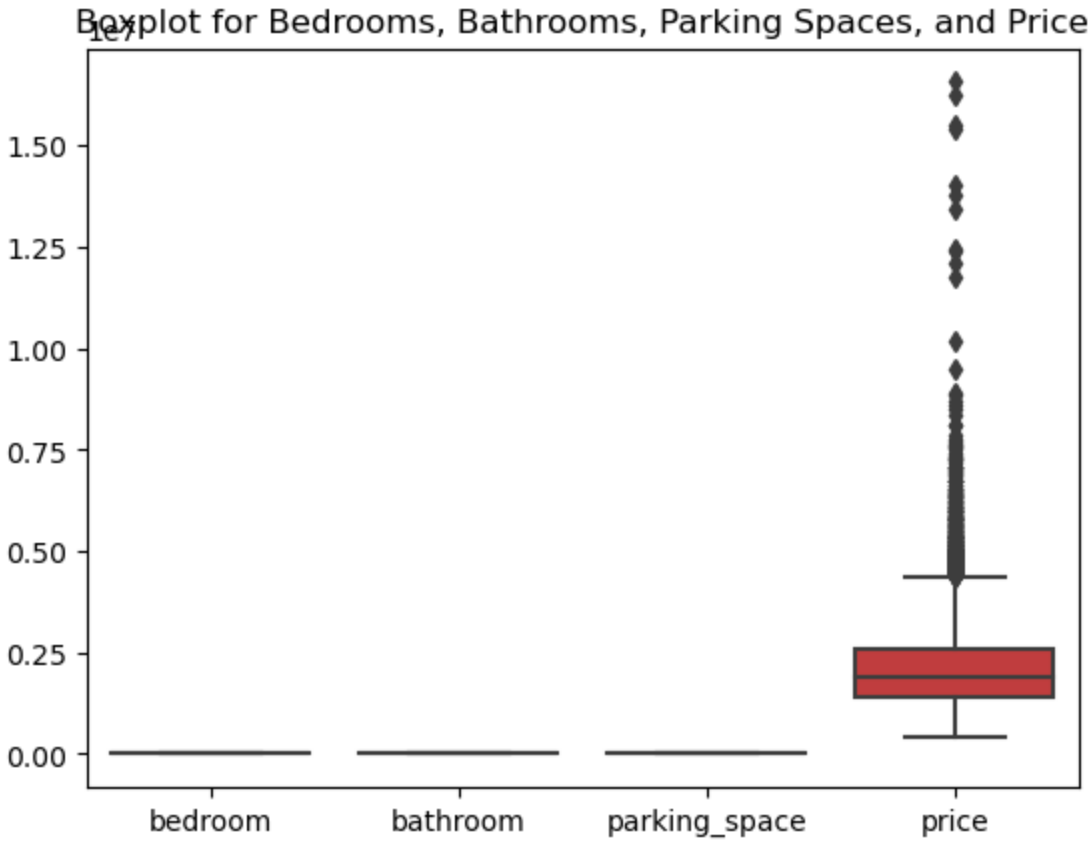
In [20]:
```
print(train.isnull().sum())
```

```
ID                0
loc            1813
title          1722
bedroom        1799
bathroom       1805
parking_space  1811
price             0
dtype: int64
```

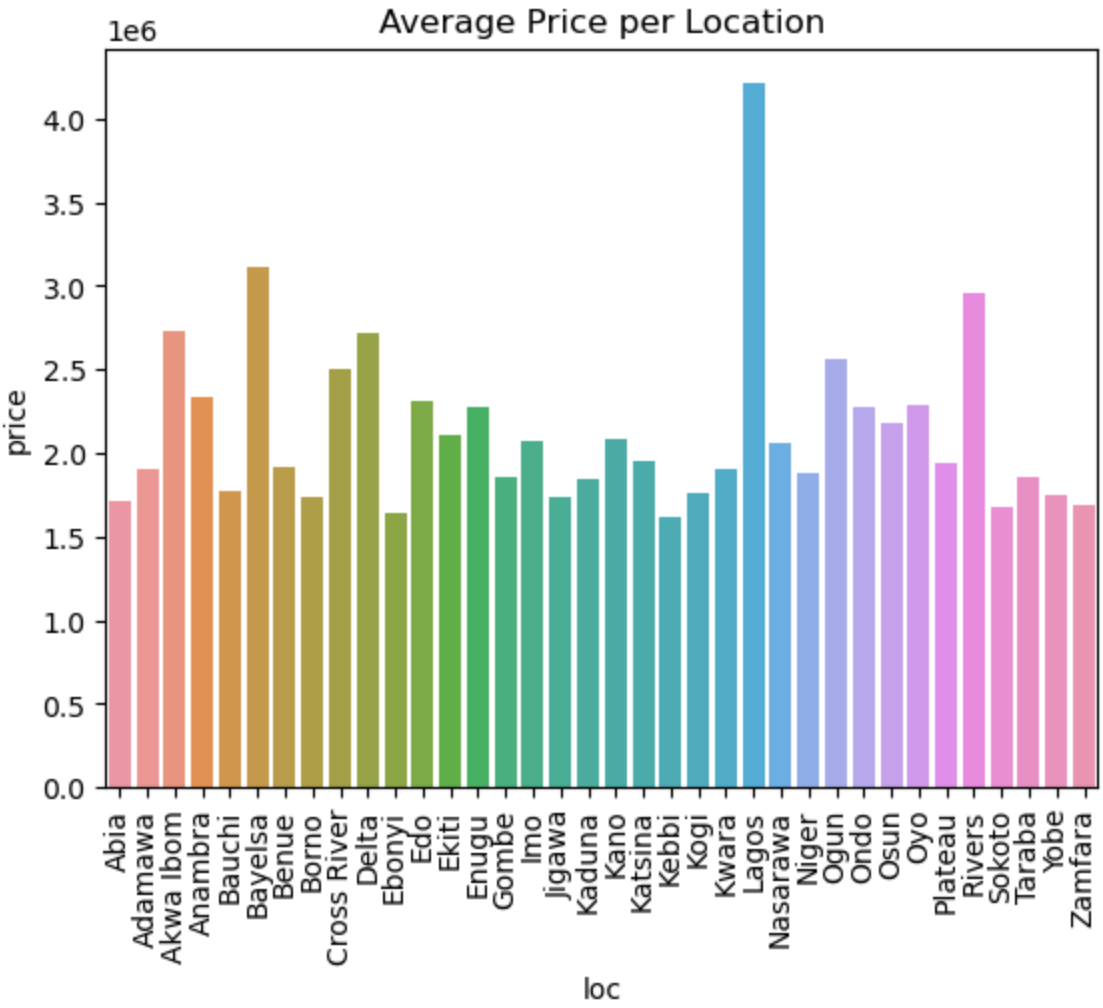
In [21]:
```
correlation_matrix = train.corr()
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
```



In [23]:
```
# Boxplot to identify outliers
sns.boxplot(data=train[['bedroom', 'bathroom', 'parking_space', 'price']])
plt.title('Boxplot for Bedrooms, Bathrooms, Parking Spaces, and Price')
plt.show()
```



In [24]:
```
# Location-based analysis: Average price per location
average_price_per_location = train.groupby('loc')['price'].mean().reset_index()
sns.barplot(x='loc', y='price', data=average_price_per_location)
plt.xticks(rotation=90)
plt.title('Average Price per Location')
plt.show()
```



In [30]:
```
from collections import Counter

# Drop rows with NaN values in the 'title' column
train_cleaned = train.dropna(subset=['title'])

# Assuming the title column contains strings separated by spaces
title_words = ' '.join(train_cleaned['title']).split()
title_word_count = Counter(title_words)
top_keywords = title_word_count.most_common(10)
# Convert the top_keywords list to a DataFrame
top_keywords_df = pd.DataFrame(top_keywords, columns=['Keyword', 'Frequency'])
print("Top Keywords in Titles:")
top_keywords_df
```

```
Top Keywords in Titles:
```

Out[30]:

	Keyword	Frequency
0	duplex	3877
1	Flat	1372
2	Apartment	1331
3	Townhouse	1327
4	Mansion	1322
5	Detached	1312
6	Penthouse	1306
7	Semi-detached	1299
8	Bungalow	1293
9	Terrace	1266

In [13]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
```

In [14]:
```
train.drop(columns=['ID'], inplace=True)
```

In [17]:
```
# Impute missing numerical values with the median
train['bedroom'].fillna(train['bedroom'].median(), inplace=True)
train['bathroom'].fillna(train['bathroom'].median(), inplace=True)
train['parking_space'].fillna(train['parking_space'].median(), inplace=True)
```

In [18]:
```
# Impute missing numerical values with the median
test['bedroom'].fillna(test['bedroom'].median(), inplace=True)
test['bathroom'].fillna(test['bathroom'].median(), inplace=True)
test['parking_space'].fillna(test['parking_space'].median(), inplace=True)
```

In [19]:
```
# Impute missing categorical values with the most frequent category
train['loc'].fillna(train['loc'].mode()[0], inplace=True)
train['title'].fillna(train['title'].mode()[0], inplace=True)
```

In [20]:
```
# Impute missing categorical values with the most frequent category
test['loc'].fillna(test['loc'].mode()[0], inplace=True)
test['title'].fillna(test['title'].mode()[0], inplace=True)
```

In [21]:
```
# Create a new feature 'total_rooms'
train['total_rooms'] = train['bedroom'] + train['bathroom'] + train['parking_space'
test['total_rooms'] = test['bedroom'] + test['bathroom'] + test['parking_space']
```

In [22]:
```
# Encode categorical features 'loc' and 'title'
train = pd.get_dummies(train, columns=['loc', 'title'], drop_first=True)
test = pd.get_dummies(test, columns=['loc', 'title'], drop_first=True)
```

In [23]:
```
# Separate the target variable 'price' from the features
X = train.drop(columns=['price'])
y = train['price']
```

In [24]:
```
# Split the data into training and testing sets (adjust test_size as needed)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_sta

# Scale the numerical features (optional, but can help some models)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

In [25]:
```
# Train a simple linear regression model (you can use other regression models too)
model = LinearRegression()
model.fit(X_train_scaled, y_train)
```

Out[25]:
```
▾ LinearRegression

LinearRegression()
```

In [26]:
```
# Make predictions on the test set
y_pred = model.predict(X_test_scaled)

# Evaluate the model's performance
mse = mean_squared_error(y_test, y_pred)
print(f"Mean Squared Error: {mse}")
```

```
Mean Squared Error: 391573101800.7244
```

In [27]:
```
import numpy as np

# Calculate Root Mean Squared Error (RMSE)
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
print(f"Root Mean Squared Error (RMSE): {rmse}")
```

```
Root Mean Squared Error (RMSE): 625758.021762985
```

In [32]:
```
X.shape, test.shape
```

Out[32]:
```
((14000, 48), (6000, 49))
```

In [33]:
```
test.drop(columns=['ID'], inplace=True)
```

In [35]:
```
y_test_pred = model.predict(test)
```

```
C:\Users\owner\anaconda3\lib\site-packages\sklearn\base.py:432: UserWarning: X has f
eature names, but LinearRegression was fitted without feature names
  warnings.warn(
```

In [39]:
```
y_test_pred
```

Out[39]:
```
array([5444810.38907182, 4494452.60695437, 5262698.02684896, ...,
       5663871.22443377, 6462048.71538496, 7589808.28648462])
```

In [37]:
```
# Create a DataFrame for submission
submission_df = pd.DataFrame({
    'ID': sub['ID'],
    'Price': y_test_pred
})
```

In [38]:
```
submission_df.head()
```

Out[38]:

	ID	Price
0	845	5.444810e+06
1	1924	4.494453e+06
2	10718	5.262698e+06
3	12076	9.899264e+06
4	12254	6.690124e+06

In [40]:
```
# Save the submission DataFrame to a CSV file
submission_df.to_csv('submission2.csv', index=False)
```

In [48]:
```
from sklearn.model_selection import train_test_split
from catboost import CatBoostRegressor

# Assuming you have already preprocessed your data and defined X and y

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_sta

# Initialize the CatBoostRegressor
cat_model = CatBoostRegressor(iterations=1000, learning_rate=0.05, loss_function='R

# Fit the model using the training data
cat_model.fit(X_train, y_train, eval_set=(X_test, y_test), plot=True)
```

```
MetricVisualizer(layout=Layout(align_self='stretch', height='500px'))
```

Out[48]:
```
<catboost.core.CatBoostRegressor at 0x28e3da94eb0>
```

In [49]:
```
predictions = cat_model.predict(X_test)
```

In [51]:
```
# Calculate the mean squared error
mse = np.sqrt(mean_squared_error(y_test, predictions))

print(f"Mean Squared Error: {mse}")
```

```
Mean Squared Error: 573929.2887263661
```

In [52]:
```
predictions = cat_model.predict(test)
```

In [54]:
```
# Create a DataFrame for submission
submission_df = pd.DataFrame({
    'ID': sub['ID'],
```

```
    'price': predictions
})
```

In [55]:
```
# Save the submission DataFrame to a CSV file
submission_df.to_csv('submission_cat.csv', index=False)
```