```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

sns.set(color_codes=True)
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
data_df = pd.read_csv('/content/raw_house_data.csv')
```

```
data_df
```

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitchen
0	21530491	5300000.0	85637	-110.378200	31.356362	2154.00	5272.00	1941	13	10.0	10500.0	0.0	Refrig
1	21529082	4200000.0	85646	-111.045371	31.594213	1707.00	10422.36	1997	2	2.0	7300.0	0.0	Garba
2	3054672	4200000.0	85646	-111.040707	31.594844	1707.00	10482.00	1997	2	3.0	NaN	NaN	Garba
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	Dishwa Sink, P
4	21306357	3411450.0	85750	-110.813768	32.285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	Garba Refri
...	...	...	...	...	...	...	...	...	...	...	...	...	
4995	21810382	495000.0	85641	-110.661829	31.907917	4.98	2017.00	2005	5	3.0	3601.0	3.0	Dishwa Si Dis
4996	21908591	550000.0	85750	-110.858556	32.316373	1.42	4822.01	1990	4	3.0	2318.0	3.0	Dishwa S Rai
4997	21832452	475000.0	85192	-110.755428	32.964708	12.06	1000.00	1969	3	2.0	1772.0	0.0	Ele Island,

Next steps: Generate code with data_df | View recommended plots | New interactive sheet

```
data_df.columns
```

```
Index(['MLS', 'sold_price', 'zipcode', 'longitude', 'latitude', 'lot_acres',
       'taxes', 'year_built', 'bedrooms', 'bathrooms', 'sqrt_ft', 'garage',
       'kitchen_features', 'fireplaces', 'floor_covering', 'HOA'],
      dtype='object')
```

```
data_df.dtypes
```

	0
MLS	int64
sold_price	float64
zipcode	int64
longitude	float64
latitude	float64
lot_acres	float64
taxes	float64
year_built	int64
bedrooms	int64
bathrooms	float64
sqrt_ft	float64
garage	float64
kitchen_features	object
fireplaces	object
floor_covering	object
HOA	object

```
data_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   MLS               5000 non-null   int64
 1   sold_price        5000 non-null   float64
 2   zipcode           5000 non-null   int64
 3   longitude         5000 non-null   float64
 4   latitude          5000 non-null   float64
 5   lot_acres         4990 non-null   float64
 6   taxes             5000 non-null   float64
 7   year_built        5000 non-null   int64
 8   bedrooms          5000 non-null   int64
 9   bathrooms         4994 non-null   float64
 10  sqrt_ft           4944 non-null   float64
 11  garage            4993 non-null   float64
 12  kitchen_features  4967 non-null   object
 13  fireplaces        5000 non-null   object
 14  floor_covering    4999 non-null   object
 15  HOA               4438 non-null   object
dtypes: float64(8), int64(4), object(4)
memory usage: 625.1+ KB
```

```
data_df.shape
```

```
(5000, 16)
```

```
#data_df= data_df.dropna()
data_df.count()
```

	0
MLS	5000
sold_price	5000
zipcode	5000
longitude	5000
latitude	5000
lot_acres	4990
taxes	5000
year_built	5000
bedrooms	5000
bathrooms	4994
sqrt_ft	4944
garage	4993
kitchen_features	4967
fireplaces	5000
floor_covering	4999
HOA	4438

```
data_df.isnull().sum()
```

	0
MLS	0
sold_price	0
zipcode	0
longitude	0
latitude	0
lot_acres	10
taxes	0
year_built	0
bedrooms	0
bathrooms	6
sqrt_ft	56
garage	7
kitchen_features	33
fireplaces	0
floor_covering	1
HOA	562

```
# conversion
data_df['bathrooms'] = pd.to_numeric(data_df['bathrooms'], errors='coerce')
data_df['sqrt_ft'] = pd.to_numeric(data_df['sqrt_ft'], errors='coerce')
data_df['garage'] = pd.to_numeric(data_df['garage'], errors='coerce')
data_df['fireplaces'] = pd.to_numeric(data_df['fireplaces'], errors='coerce')
data_df['HOA'] = pd.to_numeric(data_df['HOA'], errors='coerce')
```

```
# Handle missing values
#data_df['bathrooms'].fillna(data_df['bathrooms'].median(), inplace=True)
data_df['bathrooms'].fillna(0, inplace=True)
```

```
data_df['sqrt_ft'].fillna(0, inplace=True)
data_df['garage'].fillna(0, inplace=True)
data_df['fireplaces'].fillna(0, inplace=True)
data_df['lot_acres'].fillna(0, inplace=True)
data_df['kitchen_features'].fillna('Unknown', inplace=True)
data_df['floor_covering'].fillna('Unkonwn', inplace=True)
data_df['HOA'].fillna(0, inplace=True)
```

```
<ipython-input-12-2f5b70cc8eaa>:3: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['bathrooms'].fillna(0, inplace=True)
<ipython-input-12-2f5b70cc8eaa>:4: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['sqrt_ft'].fillna(0, inplace=True)
<ipython-input-12-2f5b70cc8eaa>:5: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['garage'].fillna(0, inplace=True)
<ipython-input-12-2f5b70cc8eaa>:6: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['fireplaces'].fillna(0, inplace=True)
<ipython-input-12-2f5b70cc8eaa>:7: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['lot_acres'].fillna(0, inplace=True)
<ipython-input-12-2f5b70cc8eaa>:8: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['kitchen_features'].fillna('Unknown', inplace=True)
<ipython-input-12-2f5b70cc8eaa>:9: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignm
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['floor_covering'].fillna('Unkonwn', inplace=True)
<ipython-input-12-2f5b70cc8eaa>:10: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assign
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting valu

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].me


  data_df['HOA'].fillna(0, inplace=True)
```

```
data_df
```

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitchen
0	21530491	5300000.0	85637	-110.378200	31.356362	2154.00	5272.00	1941	13	10.0	10500.0	0.0	Refrig
1	21529082	4200000.0	85646	-111.045371	31.594213	1707.00	10422.36	1997	2	2.0	7300.0	0.0	Garba
2	3054672	4200000.0	85646	-111.040707	31.594844	1707.00	10482.00	1997	2	3.0	0.0	0.0	Garba
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	Dishwa Sink, P
4	21306357	3411450.0	85750	-110.813768	32.285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	Garba Refri
...	...	...	...	...	...	...	...	...	...	...	...	...	
4995	21810382	495000.0	85641	-110.661829	31.907917	4.98	2017.00	2005	5	3.0	3601.0	3.0	Dishwa Si Dis
4996	21908591	550000.0	85750	-110.858556	32.316373	1.42	4822.01	1990	4	3.0	2318.0	3.0	Dishwa Ra
4997	21832452	475000.0	85192	-110.755428	32.964708	12.06	1000.00	1969	3	2.0	1772.0	0.0	Ele Island,

Next steps: Generate code with data_df | View recommended plots | New interactive sheet

```
data_df = data_df.drop_duplicates()
```

```
data_df.duplicated().sum()
```

```
0
```

```
data_df.shape
```

```
(5000, 16)
```

```
data_df
```

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitchen
0	21530491	5300000.0	85637	-110.378200	31.356362	2154.00	5272.00	1941	13	10.0	10500.0	0.0	Refrig
1	21529082	4200000.0	85646	-111.045371	31.594213	1707.00	10422.36	1997	2	2.0	7300.0	0.0	Garba
2	3054672	4200000.0	85646	-111.040707	31.594844	1707.00	10482.00	1997	2	3.0	0.0	0.0	Garba
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	Dishwa Sink, P
4	21306357	3411450.0	85750	-110.813768	32.285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	Garba Refri
...	...	...	...	...	...	...	...	...	...	...	...	...	
4995	21810382	495000.0	85641	-110.661829	31.907917	4.98	2017.00	2005	5	3.0	3601.0	3.0	Dishwa Si Dis
4996	21908591	550000.0	85750	-110.858556	32.316373	1.42	4822.01	1990	4	3.0	2318.0	3.0	Dishwa Ra
4997	21832452	475000.0	85192	-110.755428	32.964708	12.06	1000.00	1969	3	2.0	1772.0	0.0	Ele Island,

Next steps: Generate code with data_df | View recommended plots | New interactive sheet

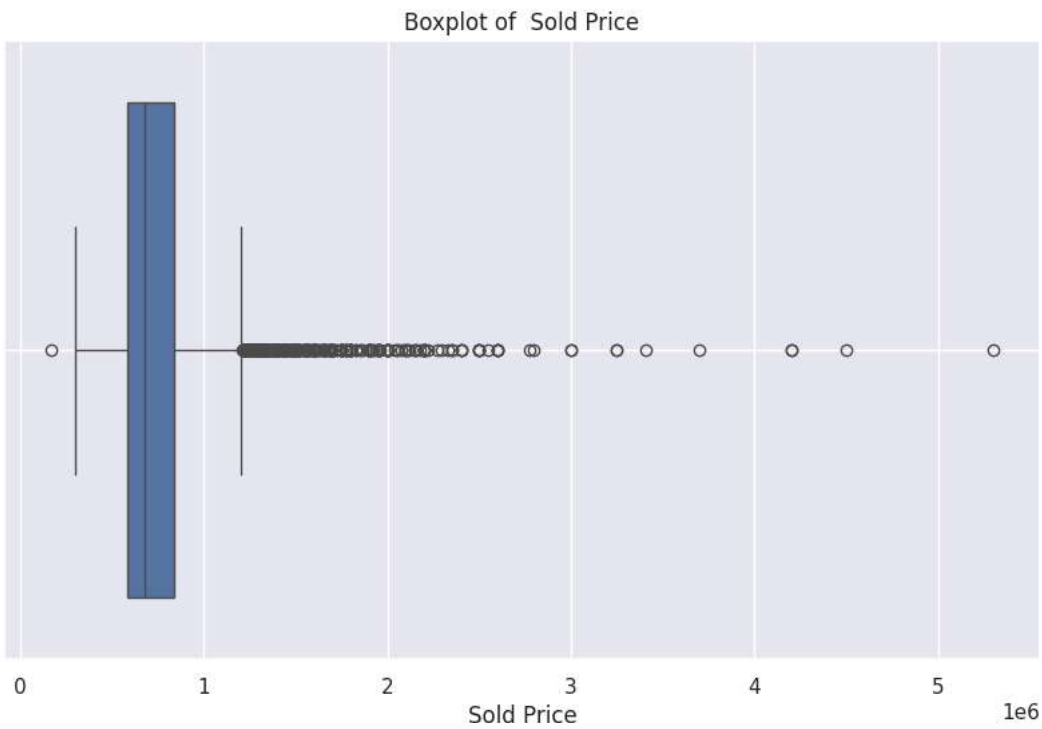
```
data_df.isnull().sum()
```

	0
MLS	0
sold_price	0
zipcode	0
longitude	0
latitude	0
lot_acres	0
taxes	0
year_built	0
bedrooms	0
bathrooms	0
sqrt_ft	0
garage	0
kitchen_features	0
fireplaces	0
floor_covering	0
HOA	0

```
data_df.to_csv('/content/Cleaned_data.csv',index=False)
```

```
plt.figure(figsize=(10,6))
sns.boxplot(x=data_df['sold_price'])
plt.title('Boxplot of  Sold Price')
plt.xlabel('Sold Price')
```

```
plt.grid(True)
plt.show()
```



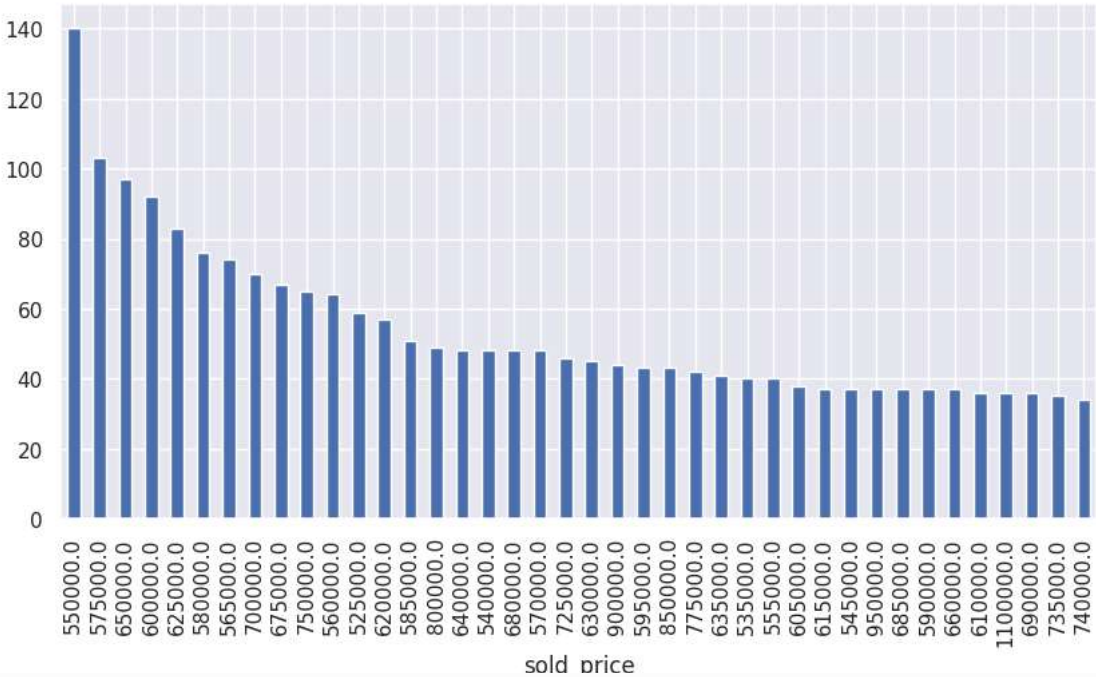

```
#Identifying outliers numerically using IQR method

Q1 = data_df['sold_price'].quantile(0.25)
Q3 = data_df['sold_price'].quantile(0.75)
IQR = Q3 - Q1
```

```
print(IQR)
```

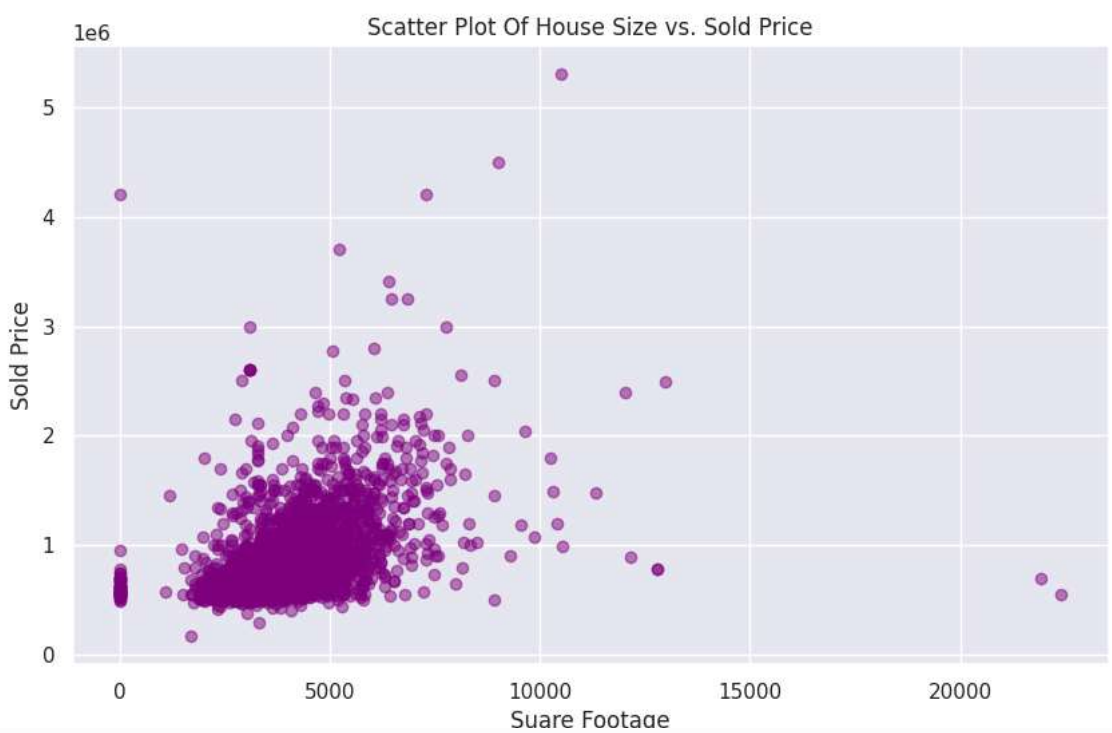
```
250000.0
```

```
data_df.sold_price.value_counts().nlargest(40).plot(kind='bar', figsize=(10,5))
```

```
<Axes: xlabel='sold_price'>
```

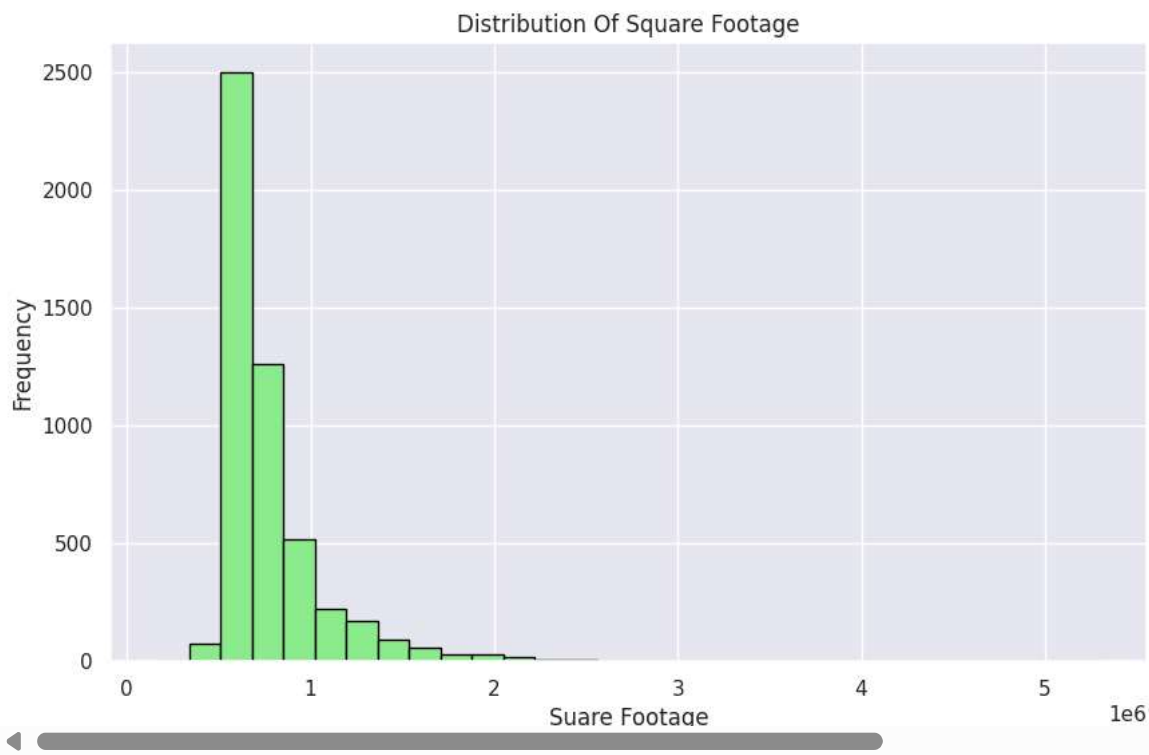


```
plt.figure(figsize=(10,6))
plt.scatter(data_df['sqrt_ft'],data_df['sold_price'], alpha=0.5, color='purple')
plt.title('Scatter Plot Of House Size vs. Sold Price')
plt.xlabel('Suare Footage')
plt.ylabel('Sold Price')
plt.grid(True)
plt.show()
```

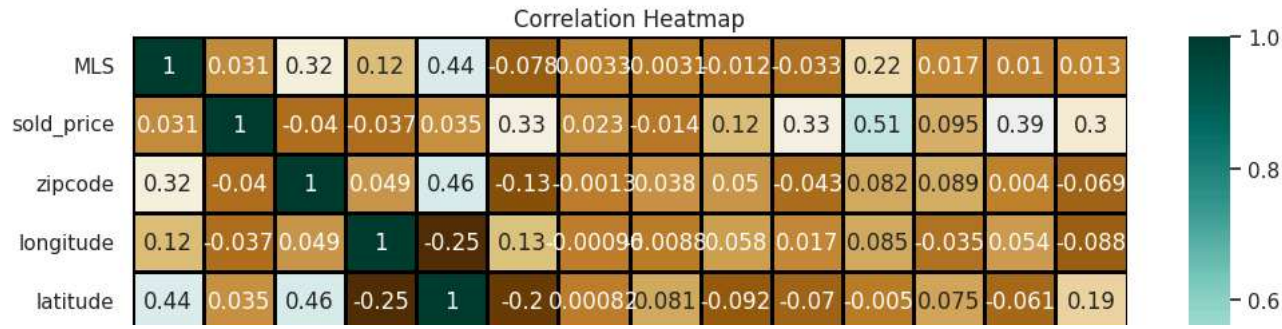



```
plt.figure(figsize=(10,6))
plt.hist(data_df['sold_price'], bins=30, color='pink', edgecolor= 'black' )
plt.title('Distribution Of Sold Prices')
plt.xlabel('Sold Price')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()
```

```
plt.figure(figsize=(10,6))
plt.hist(data_df['sold_price'], bins=30, color='lightgreen', edgecolor= 'black' )
plt.title('Distribution Of Square Footage')
plt.xlabel('Suare Footage')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()
```




```
# Select only numeric columns
numeric_df = data_df.select_dtypes(include=[float, int])

# Compute the correlation matrix
correlation_matrix = numeric_df.corr()
plt.figure(figsize=(12,8))
sns.heatmap(correlation_matrix, cmap="BrBG", annot =True, linewidths=1, linecolor='black')
plt.title('Correlation Heatmap')
plt.show()
```




```
sns.pairplot(data_df)
```

```
<seaborn.axisgrid.PairGrid at 0x7d54504f7760>
```