EDA

In [2]:

```
import warnings

warnings.filterwarnings("ignore")

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


from matplotlib.ticker import PercentFormatter
plt.rcParams.update({ "figure.figsize" : (8, 5),"axes.facecolor" : "white", "axes.edge
plt.rcParams["figure.facecolor"]= "w"
pd.plotting.register_matplotlib_converters()
pd.set_option('display.float_format', lambda x: '%.3f' % x)
```

In [3]:

```
df = pd.read_csv("data/eda.csv")

df.head()
```

Out[3]:

	id	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	
0	7129300520	3.000	1.000	1180.000	5650.000	1.000	NaN	(
1	6414100192	3.000	2.250	2570.000	7242.000	2.000	0.000	(
2	5631500400	2.000	1.000	770.000	10000.000	1.000	0.000	(
3	2487200875	4.000	3.000	1960.000	5000.000	1.000	0.000	(
4	1954400510	3.000	2.000	1680.000	8080.000	1.000	0.000	(

5 rows × 23 columns

In [4]:

```
df.yr_renovated.isna().sum()
```

Out[4]:

```
np.int64(3848)
```

In [5]:

```
df.columns
```

Out[5]:

```
Index(['id', 'bedrooms', 'bathrooms', 'sqft_living', 'sqft_lot', 'floor
s',
       'waterfront', 'view', 'condition', 'grade', 'sqft_above',
       'sqft_basement', 'yr_built', 'yr_renovated', 'zipcode', 'lat', 'l
ong',
       'sqft_living15', 'sqft_lot15', 'date', 'price', 'house_id', 'id.
1'],
      dtype='object')
```

In [6]:

```
missing_values = df.isnull().sum()
missing_values[missing_values > 0]
```

Out[6]:

```
waterfront       2391
view               63
sqft_basement     452
yr_renovated     3848
dtype: int64
```

In [7]:

```
df['yr_renovated'].fillna(0, inplace = True)
df['waterfront'].fillna(0, inplace = True)
df['sqft_basement'].fillna(0, inplace = True)
df['view'].fillna(df['view'].mode()[0], inplace = True )

df.isnull().sum().sum()
```

Out[7]:

```
np.int64(0)
```

In [8]:

```
df['bedrooms'].describe()
```

Out[8]:

```
count   21597.000
mean        3.373
std         0.926
min         1.000
25%         3.000
50%         3.000
75%         4.000
max        33.000
Name: bedrooms, dtype: float64
```

In [9]:

```
df = df[df['bedrooms'] < 10]
```

In [10]:

```
df['bedrooms'].describe()
```

Out[10]:

```
count   21592.000
mean        3.371
std         0.899
min         1.000
25%         3.000
50%         3.000
75%         4.000
max         9.000
Name: bedrooms, dtype: float64
```

In [11]:

```
df['yr_renovated'].describe()
```

Out[11]:

```
count   21592.000
mean      686.815
std      3638.414
min         0.000
25%         0.000
50%         0.000
75%         0.000
max     20150.000
Name: yr_renovated, dtype: float64
```

In [12]:

```
(df.yr_renovated/10).astype('int')
```

Out[12]:

```
0           0
1        1991
2           0
3           0
4           0
         ...
21592       0
21593       0
21594       0
21595       0
21596       0
Name: yr_renovated, Length: 21592, dtype: int64
```

In [13]:

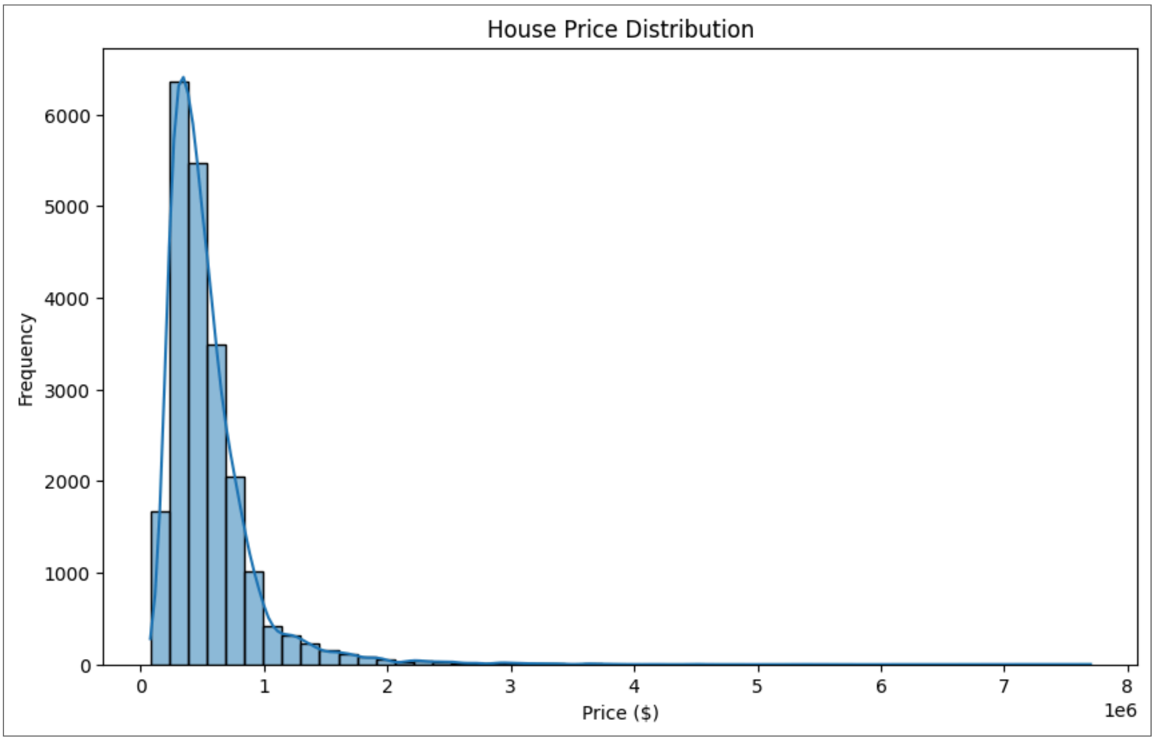
```
df['yr_renovated'] = (df.yr_renovated/10).astype('int')
df.yr_renovated
```

Out[13]:

```
0           0
1        1991
2           0
3           0
4           0
         ...
21592       0
21593       0
21594       0
21595       0
21596       0
Name: yr_renovated, Length: 21592, dtype: int64
```

In [14]:

```
plt.figure(figsize = (10,6))
sns.histplot(df['price'], bins = 50, kde =True)
plt.xlabel("Price ($)")
plt.ylabel("Frequency")
plt.title("House Price Distribution")
plt.show()
```

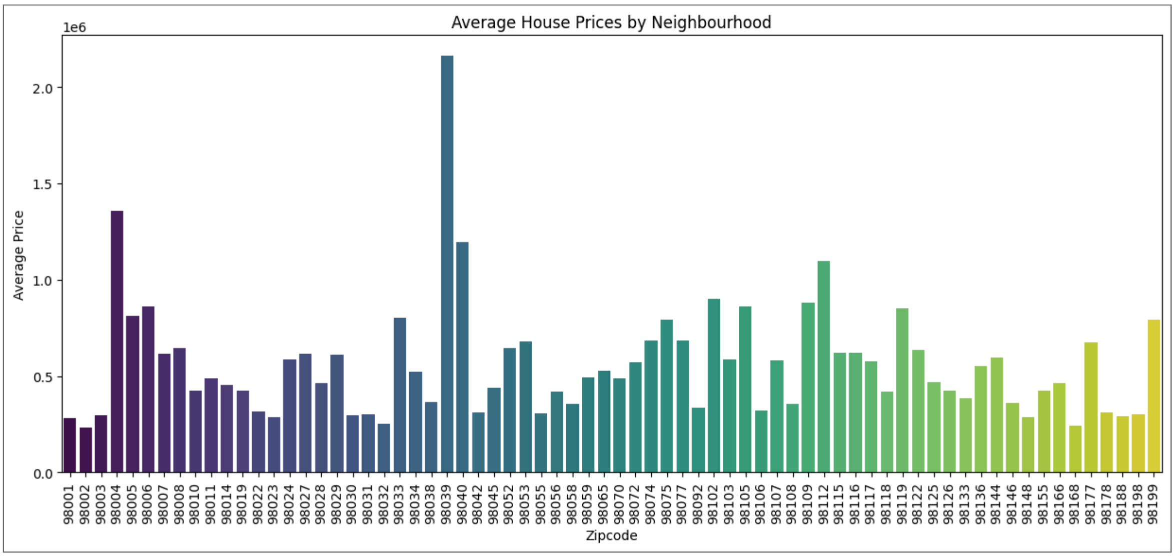


In [ ]:

```
df_grouped = df.groupby("zipcode")["price"].mean().sort_values(ascending=False)

plt.figure(figsize=(15,6))
sns.barplot(x=df_grouped.index, y=df_grouped.values, palette="viridis")
plt.xticks(rotation=90)
plt.xlabel("Zipcode")
plt.ylabel("Average Price")
plt.title("Average House Prices by Neighbourhood")
plt.show


#find the most profitable areas
```

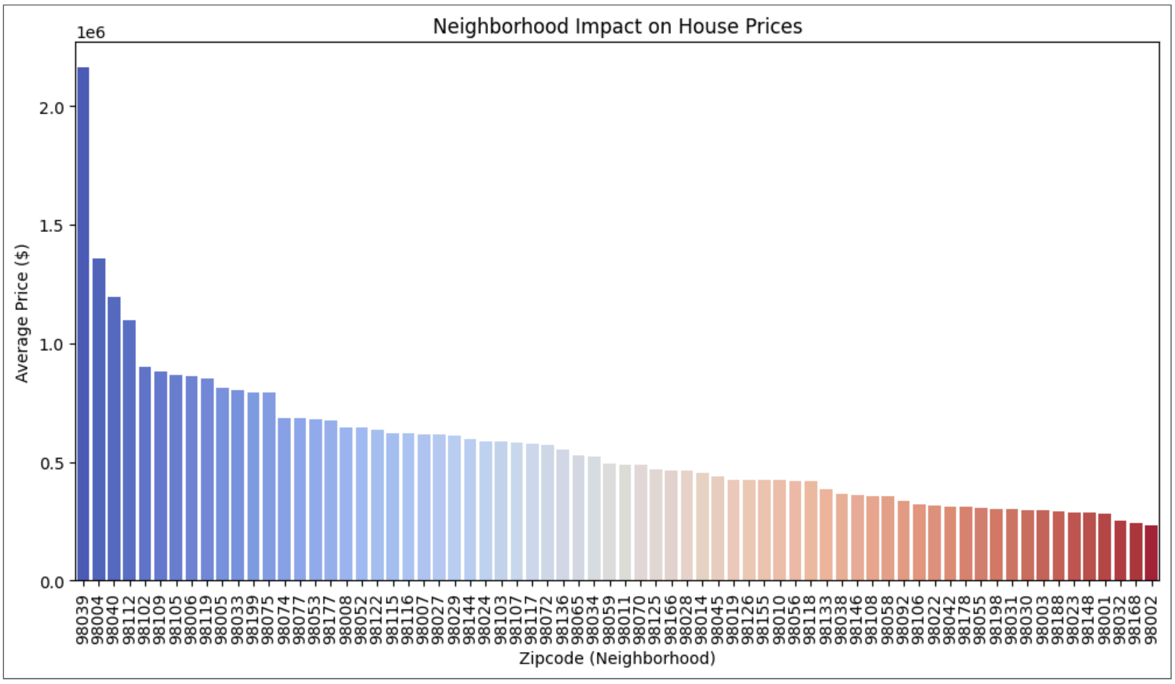
Out[ ]:

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



In [22]:

```
plt.figure(figsize=(12, 6))
sns.barplot(x=avg_price_by_zip.index, y=avg_price_by_zip.values, palette="coolwarm", o
plt.xlabel("Zipcode (Neighborhood)")
plt.ylabel("Average Price ($)")
plt.title("Neighborhood Impact on House Prices")
plt.xticks(rotation=90)
plt.show()
```

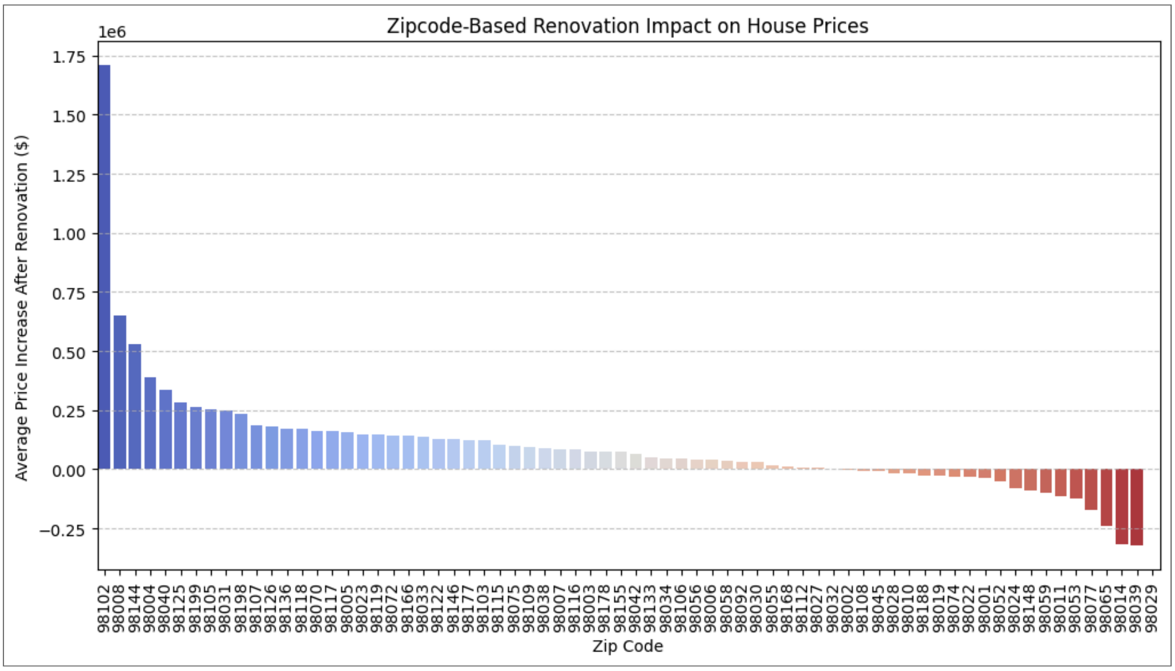


In [ ]:

In [19]:

```
# Convert the 'date' column to datetime format
df['date'] = pd.to_datetime(df['date'])

# Replace NaN values in 'yr_renovated' with 0
df['yr_renovated'].fillna(0, inplace=True)
```

```python
# Create a new column to indicate whether a house is renovated or not
df['renovated'] = df['yr_renovated'] > 0

# Group by zipcode and renovation status and calculate mean prices
renovation_by_zipcode = df.groupby(["zipcode", "renovated"])['price'].mean().unstack()

# Calculate the price difference between renovated and non-renovated houses
renovation_by_zipcode["price_difference"] = renovation_by_zipcode[True] - renovation_by

# Sort zipcodes by the highest renovation price difference
renovation_by_zipcode_sorted = renovation_by_zipcode.sort_values(by="price_difference",

# Plot the results
plt.figure(figsize=(12,6))
sns.barplot(x=renovation_by_zipcode_sorted.index.astype(str),
            y=renovation_by_zipcode_sorted["price_difference"],
            palette="coolwarm")
plt.xticks(rotation=90)
plt.xlabel("Zip Code")
plt.ylabel("Average Price Increase After Renovation ($)")
plt.title("Zipcode-Based Renovation Impact on House Prices")
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.show()

# Display top 5 zip codes with highest renovation impact
renovation_by_zipcode_sorted.head(5)
```



Out[19]:

renovated	False	True	price_difference
zipcode			
98102	833891.980	2542500.000	1708608.020
98008	629517.348	1280857.143	651339.795
98144	559186.078	1088904.304	529718.226
98004	1322726.059	1711535.714	388809.655
98040	1160232.870	1497084.483	336851.613

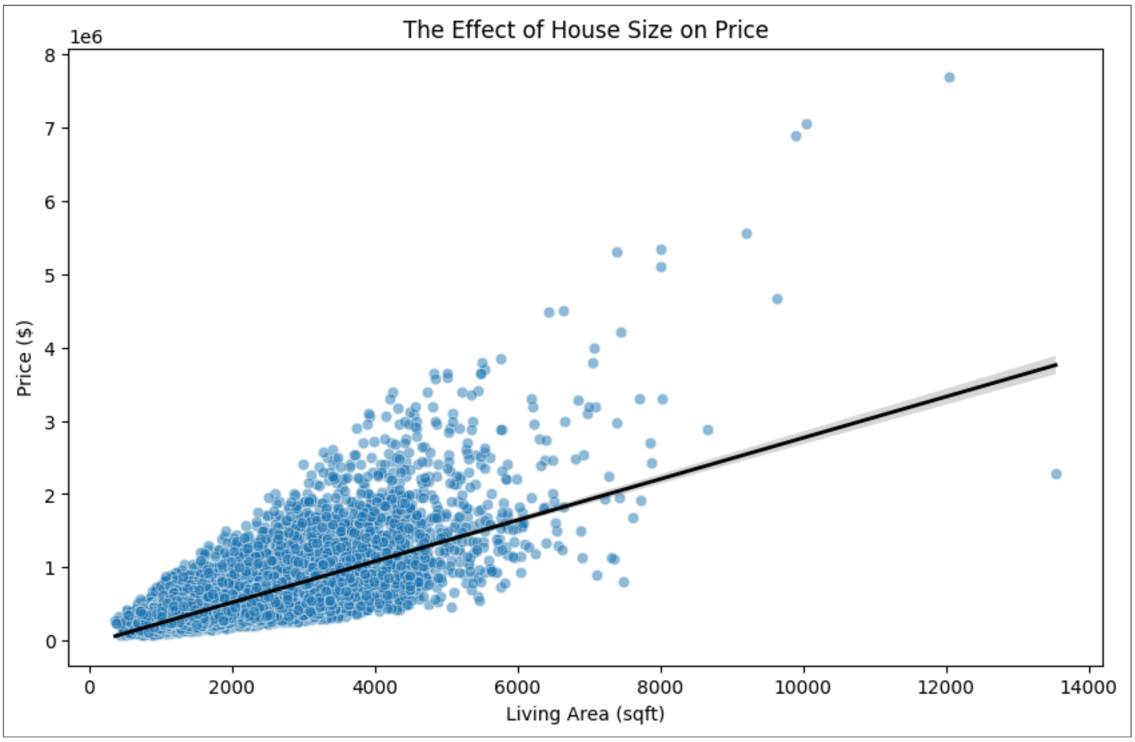
In [20]:

```python
min_price = df['price'].min()
max_price = df['price'].max()
avg_price = df['price'].mean()

min_year_built = df['yr_built'].min()
max_year_built = df['yr_built'].max()


print(f"Minimum House Price: ${min_price:,.0f}")
print(f"Maximum House Price: ${max_price:,.0f}")
print(f"Average House Price: ${avg_price:,.0f}\n")

print(f"Oldest House Built in : {min_year_built}")
print(f"Newest House Built in : {max_year_built}")
```

```
Minimum House Price: $78,000
Maximum House Price: $7,700,000
Average House Price: $540,254

Oldest House Built in : 1900
Newest House Built in : 2015
```

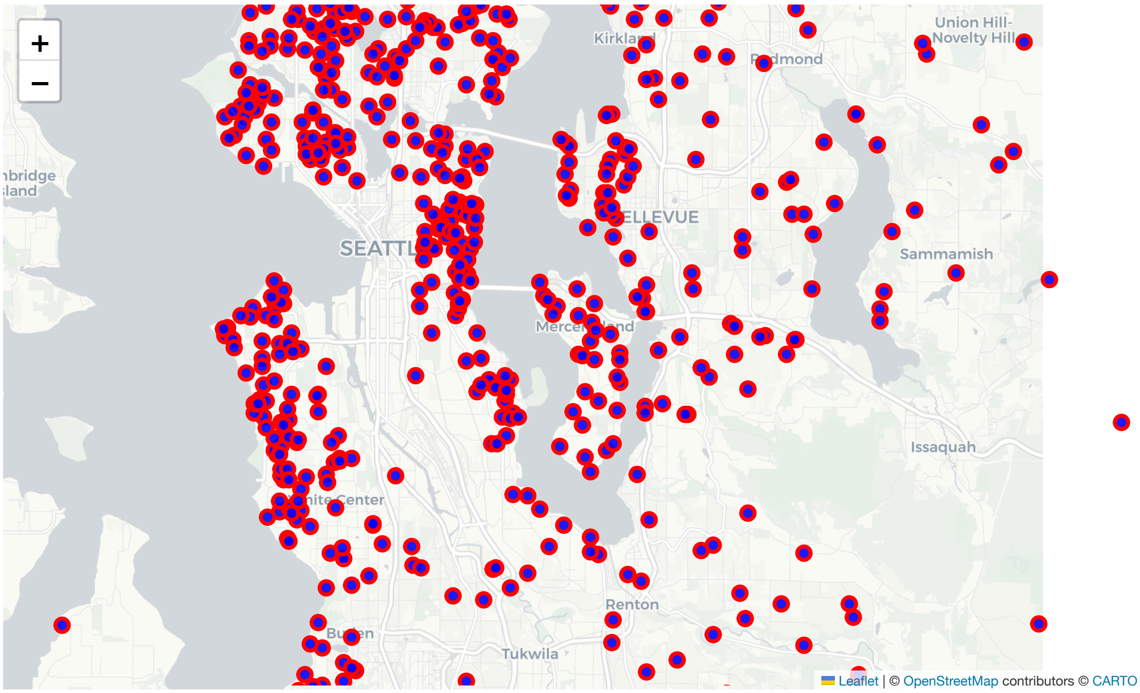
In [23]:

```python
# 📌 Scatter Plot with Trend Line for House Size vs Price

plt.figure(figsize=(10,6))

# Scatter plot
sns.scatterplot(x=df["sqft_living"], y=df["price"], alpha=0.5)

# Add a regression line (trend line)
sns.regplot(x=df["sqft_living"], y=df["price"], scatter=False, color="black", line_kws=

plt.xlabel("Living Area (sqft)")
plt.ylabel("Price ($)")
plt.title("The Effect of House Size on Price")

plt.show()
```



In [26]:

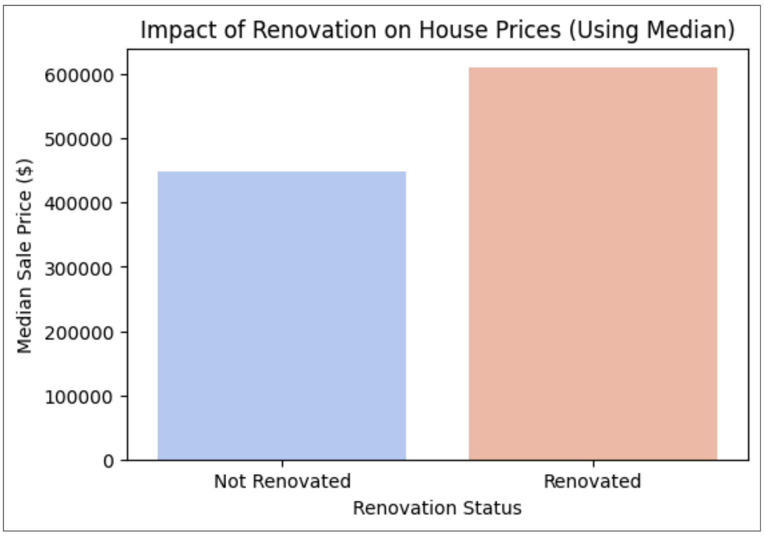
```
import folium
from IPython.display import display

# 📌 Load and filter the dataset
renovated_houses = df[df['yr_renovated'] > 0]

# Check if there are any renovated houses
if renovated_houses.empty:
    print("No renovated houses found in the dataset.")
else:
    # Define the map center based on the mean latitude and longitude of renovated house
    map_center = [renovated_houses['lat'].mean(), renovated_houses['long'].mean()]
    house_map = folium.Map(location=map_center, zoom_start=11, tiles="cartodb positron'

    # Add CircleMarkers (scatter points) for renovated houses
    for idx, row in renovated_houses.iterrows():
        folium.CircleMarker(
            location=[row['lat'], row['long']],
            radius=5,  # Slightly larger point size
            color="red",
            fill=True,
            fill_color="blue",
            fill_opacity=0.9,
        ).add_to(house_map)

    # Display the map in Jupyter Notebook
    display(house_map)

    # Save map as an HTML file
    house_map.save("renovated_houses_map.html")
```



In [27]:

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

# Convert 'date' to datetime format if exists
if 'date' in df.columns:
    df['date'] = pd.to_datetime(df['date'])
```

```
# Ensure 'yr_renovated' is numeric and fill NaN values with 0
df['yr_renovated'].fillna(0, inplace=True)

# Create a renovation flag (True if renovated, False otherwise)
df['renovated'] = df['yr_renovated'] > 0

# 📌 Compute median price instead of mean
renovated_prices_median = df.groupby('renovated')['price'].median()

# 📊 Visualization
plt.figure(figsize=(6, 4))
sns.barplot(x=renovated_prices_median.index, y=renovated_prices_median.values, palette=
plt.xticks(ticks=[0, 1], labels=["Not Renovated", "Renovated"])
plt.xlabel("Renovation Status")
plt.ylabel("Median Sale Price ($)")
plt.title("Impact of Renovation on House Prices (Using Median)")

plt.show()

# Display median prices
renovated_prices_median
```

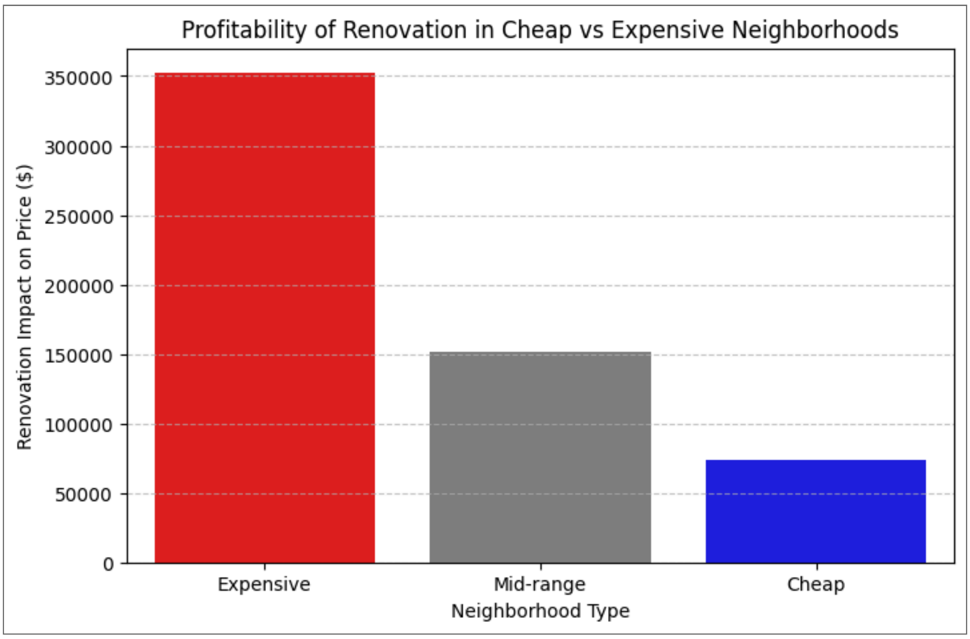


Out[27]:

```
renovated
False    449000.000
True     610000.000
Name: price, dtype: float64
```

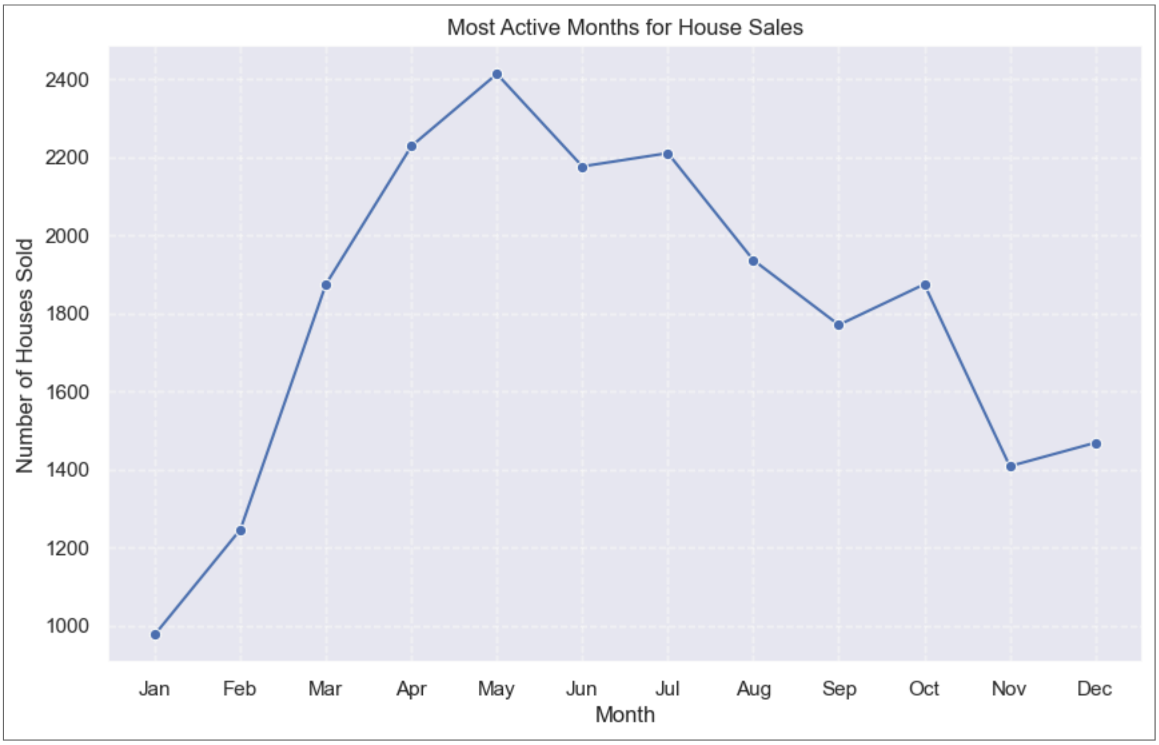
In [29]:

```
import seaborn as sns
import matplotlib.pyplot as plt

# Sıralama işlemi
renovation_impact_sorted = renovation_impact.sort_values(by="price_difference", ascend

# Görselleştirme
plt.figure(figsize=(8, 5))
sns.barplot(
    x=renovation_impact_sorted.index,
    y=renovation_impact_sorted["price_difference"],
    palette={"Cheap": "blue", "Mid-range": "gray", "Expensive": "red"}
)
plt.xlabel("Neighborhood Type")
plt.ylabel("Renovation Impact on Price ($)")
plt.title("Profitability of Renovation in Cheap vs Expensive Neighborhoods")
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.show()
```



In [30]:

```
# 📌 Satış Sayılarını Tekrar Hesaplayalım ve Grafiği Düzelterek Çizelim

# 'date' sütununu datetime formatına çevirelim
df['date'] = pd.to_datetime(df['date'], errors='coerce')

# Satış aylarını belirleyelim
df['month'] = df['date'].dt.month

# Her ayın toplam satış sayısını hesaplayalım
monthly_sales_count = df.groupby('month').size()

# 📊 Line Chart: En Çok Satış Yapılan Aylar

sns.set_theme(style="darkgrid")  # Seaborn teması

plt.figure(figsize=(10, 6))

# Line plot çizelim (Aylık satış sayıları)
sns.lineplot(x=monthly_sales_count.index, y=monthly_sales_count.values, marker="o", co

plt.xlabel("Month")
plt.ylabel("Number of Houses Sold")
plt.title("Most Active Months for House Sales")
plt.xticks(ticks=range(1, 13), labels=["Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul",
plt.grid(True, linestyle="--", alpha=0.5)

plt.show()
```


Most Active Months for House Sales
Number of Houses Sold
2400
2200
2000
1800
1600
1400
1200
1000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month