LONDON HOUSING DATASET ANALYSIS

This dataset is primarily centered around the housing market of London. It contains a lot of additional relevant data:

• Monthly average house prices

• Yearly number of houses sold

• Monthly number of crimes committed

The data used here is from year 1995 to 2019 of each different area.

This data is available as a CSV file, downloaded from Kaggle.

I will analyze this data using the Pandas DataFrame.

Here, random sets of questions are given for which I have to find correct results.

In [51]:

```
import pandas as pd
```

In [52]:

```
data = pd.read_csv(r'C:\Users\harsh\Desktop\Projects\Python\London Housing Dataset Analysis\London Housing Data.csv
```

In [53]:

```
data
```

Out[53]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1/1/1995	city of london	91449	E09000001	17.0	NaN
1	2/1/1995	city of london	82203	E09000001	7.0	NaN
2	3/1/1995	city of london	79121	E09000001	14.0	NaN
3	4/1/1995	city of london	77101	E09000001	7.0	NaN
4	5/1/1995	city of london	84409	E09000001	10.0	NaN
...	...	...	...	...	...	...
13544	9/1/2019	england	249942	E92000001	64605.0	NaN
13545	10/1/2019	england	249376	E92000001	68677.0	NaN
13546	11/1/2019	england	248515	E92000001	67814.0	NaN
13547	12/1/2019	england	250410	E92000001	NaN	NaN
13548	1/1/2020	england	247355	E92000001	NaN	NaN

13549 rows × 6 columns

In [54]:

```
data.count()
```

Out[54]:

```
date             13549
area             13549
average_price    13549
code             13549
houses_sold      13455
no_of_crimes      7439
dtype: int64
```

In [55]:

```
data.isnull().sum()
```

Out[55]:

```
date                0
area                0
average_price       0
code                0
houses_sold        94
no_of_crimes     6110
dtype: int64
```

In [56]:

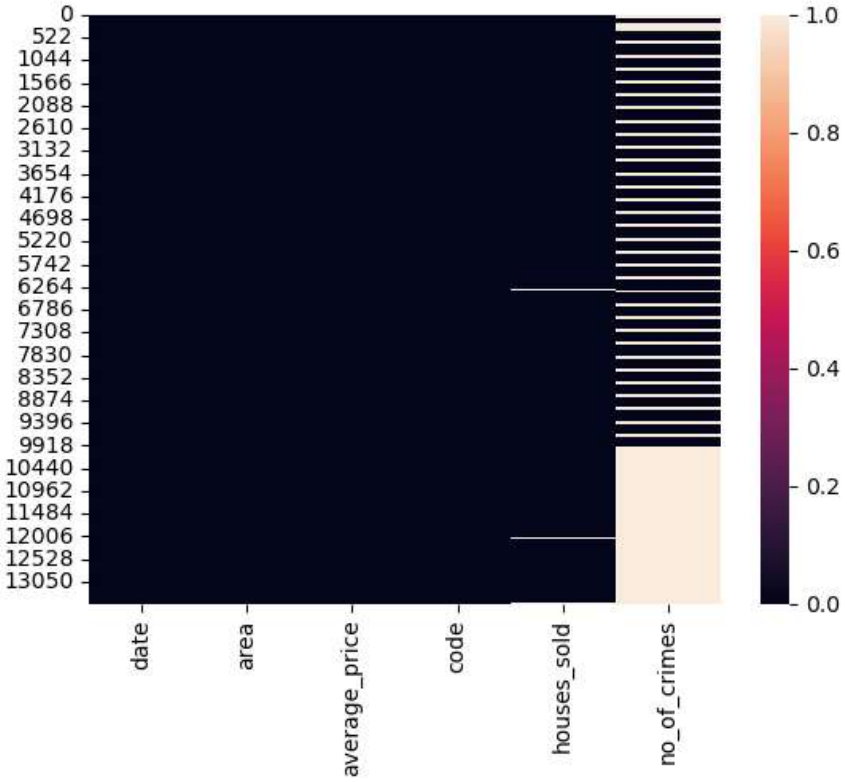
```
import seaborn as sns
```

In [57]:

```
import matplotlib.pyplot as plt
```

In [58]:

```
sns.heatmap(data.isnull())
plt.show()
```



Q1) Convert the datatype of "Date" column of Date-Time format.

In [59]:

```
data.head()
```

Out[59]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1/1/1995	city of london	91449	E09000001	17.0	NaN
1	2/1/1995	city of london	82203	E09000001	7.0	NaN
2	3/1/1995	city of london	79121	E09000001	14.0	NaN
3	4/1/1995	city of london	77101	E09000001	7.0	NaN
4	5/1/1995	city of london	84409	E09000001	10.0	NaN

In [60]:

```
data.dtypes
```

Out[60]:

```
date              object
area              object
average_price      int64
code              object
houses_sold      float64
no_of_crimes     float64
dtype: object
```

In [61]:

```
data.date = pd.to_datetime(data.date)
```

In [62]:

```
data.head()
```

Out[62]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1995-01-01	city of london	91449	E09000001	17.0	NaN
1	1995-02-01	city of london	82203	E09000001	7.0	NaN
2	1995-03-01	city of london	79121	E09000001	14.0	NaN
3	1995-04-01	city of london	77101	E09000001	7.0	NaN
4	1995-05-01	city of london	84409	E09000001	10.0	NaN

In [63]:

```
data.dtypes
```

Out[63]:

```
date             datetime64[ns]
area                     object
average_price             int64
code                     object
houses_sold             float64
no_of_crimes            float64
dtype: object
```

Q2-A) Add a new column "year" in the dataframe, which contains years only.

In [64]:

```
data.head()
```

Out[64]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1995-01-01	city of london	91449	E09000001	17.0	NaN
1	1995-02-01	city of london	82203	E09000001	7.0	NaN
2	1995-03-01	city of london	79121	E09000001	14.0	NaN
3	1995-04-01	city of london	77101	E09000001	7.0	NaN
4	1995-05-01	city of london	84409	E09000001	10.0	NaN

In [65]:

```
data['Year'] = data.date.dt.year
```

In [66]:

```
data
```

Out[66]:

	date	area	average_price	code	houses_sold	no_of_crimes	Year
0	1995-01-01	city of london	91449	E09000001	17.0	NaN	1995
1	1995-02-01	city of london	82203	E09000001	7.0	NaN	1995
2	1995-03-01	city of london	79121	E09000001	14.0	NaN	1995
3	1995-04-01	city of london	77101	E09000001	7.0	NaN	1995
4	1995-05-01	city of london	84409	E09000001	10.0	NaN	1995
...	...	...	...	...	...	...	...
13544	2019-09-01	england	249942	E92000001	64605.0	NaN	2019
13545	2019-10-01	england	249376	E92000001	68677.0	NaN	2019
13546	2019-11-01	england	248515	E92000001	67814.0	NaN	2019
13547	2019-12-01	england	250410	E92000001	NaN	NaN	2019
13548	2020-01-01	england	247355	E92000001	NaN	NaN	2020

13549 rows × 7 columns

Q2-B) Add a new column "month" as 2nd column in the dataframe, which contains month only.

In [67]:

```
data.head()
```

Out[67]:

	date	area	average_price	code	houses_sold	no_of_crimes	Year
0	1995-01-01	city of london	91449	E09000001	17.0	NaN	1995
1	1995-02-01	city of london	82203	E09000001	7.0	NaN	1995
2	1995-03-01	city of london	79121	E09000001	14.0	NaN	1995
3	1995-04-01	city of london	77101	E09000001	7.0	NaN	1995
4	1995-05-01	city of london	84409	E09000001	10.0	NaN	1995

In [68]:

```
data.insert(1, 'month', data.date.dt.month)
```

In [69]:

```
data
```

Out[69]:

	date	month	area	average_price	code	houses_sold	no_of_crimes	Year
0	1995-01-01	1	city of london	91449	E09000001	17.0	NaN	1995
1	1995-02-01	2	city of london	82203	E09000001	7.0	NaN	1995
2	1995-03-01	3	city of london	79121	E09000001	14.0	NaN	1995
3	1995-04-01	4	city of london	77101	E09000001	7.0	NaN	1995
4	1995-05-01	5	city of london	84409	E09000001	10.0	NaN	1995
...	...	...	...	...	...	...	...	...
13544	2019-09-01	9	england	249942	E92000001	64605.0	NaN	2019
13545	2019-10-01	10	england	249376	E92000001	68677.0	NaN	2019
13546	2019-11-01	11	england	248515	E92000001	67814.0	NaN	2019
13547	2019-12-01	12	england	250410	E92000001	NaN	NaN	2019
13548	2020-01-01	1	england	247355	E92000001	NaN	NaN	2020

13549 rows × 8 columns

Q3) Remove the columns 'year' and 'month' from the dataframe.

In [70]:

```
data
```

Out[70]:

	date	month	area	average_price	code	houses_sold	no_of_crimes	Year
0	1995-01-01	1	city of london	91449	E09000001	17.0	NaN	1995
1	1995-02-01	2	city of london	82203	E09000001	7.0	NaN	1995
2	1995-03-01	3	city of london	79121	E09000001	14.0	NaN	1995
3	1995-04-01	4	city of london	77101	E09000001	7.0	NaN	1995
4	1995-05-01	5	city of london	84409	E09000001	10.0	NaN	1995
...	...	...	...	...	...	...	...	...
13544	2019-09-01	9	england	249942	E92000001	64605.0	NaN	2019
13545	2019-10-01	10	england	249376	E92000001	68677.0	NaN	2019
13546	2019-11-01	11	england	248515	E92000001	67814.0	NaN	2019
13547	2019-12-01	12	england	250410	E92000001	NaN	NaN	2019
13548	2020-01-01	1	england	247355	E92000001	NaN	NaN	2020

13549 rows × 8 columns

In [71]:

```
data.drop(['month','Year'], axis = 1, inplace = True)
```

In [72]:

```
data
```

Out[72]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1995-01-01	city of london	91449	E09000001	17.0	NaN
1	1995-02-01	city of london	82203	E09000001	7.0	NaN
2	1995-03-01	city of london	79121	E09000001	14.0	NaN
3	1995-04-01	city of london	77101	E09000001	7.0	NaN
4	1995-05-01	city of london	84409	E09000001	10.0	NaN
...	...	...	...	...	...	...
13544	2019-09-01	england	249942	E92000001	64605.0	NaN
13545	2019-10-01	england	249376	E92000001	68677.0	NaN
13546	2019-11-01	england	248515	E92000001	67814.0	NaN
13547	2019-12-01	england	250410	E92000001	NaN	NaN
13548	2020-01-01	england	247355	E92000001	NaN	NaN

13549 rows × 6 columns

Q4) Show all the records where 'No. of Crimes' is 0. And, how many such records are there ?

In [73]:

```
data.head(2)
```

Out[73]:

	date	area	average_price	code	houses_sold	no_of_crimes
0	1995-01-01	city of london	91449	E09000001	17.0	NaN
1	1995-02-01	city of london	82203	E09000001	7.0	NaN

In [77]:

```
data[data.no_of_crimes == 0]
```

Out[77]:

	date	area	average_price	code	houses_sold	no_of_crimes
72	2001-01-01	city of london	284262	E09000001	24.0	0.0
73	2001-02-01	city of london	198137	E09000001	37.0	0.0
74	2001-03-01	city of london	189033	E09000001	44.0	0.0
75	2001-04-01	city of london	205494	E09000001	38.0	0.0
76	2001-05-01	city of london	223459	E09000001	30.0	0.0
...	...	...	...	...	...	...
178	2009-11-01	city of london	397909	E09000001	11.0	0.0
179	2009-12-01	city of london	411955	E09000001	16.0	0.0
180	2010-01-01	city of london	464436	E09000001	20.0	0.0
181	2010-02-01	city of london	490525	E09000001	9.0	0.0
182	2010-03-01	city of london	498241	E09000001	15.0	0.0

104 rows × 6 columns

In [78]:

```
len(data[data.no_of_crimes == 0])
```

Out[78]:

104

Q5) What is the maximum & minimum 'average_price' per year in England?

In [79]:

```
data['Year'] = data.date.dt.year
```

In [81]:

```
data.head(2)
```

Out[81]:

	date	area	average_price	code	houses_sold	no_of_crimes	Year
0	1995-01-01	city of london	91449	E09000001	17.0	NaN	1995
1	1995-02-01	city of london	82203	E09000001	7.0	NaN	1995

In [84]:

```
df1 = data[data.area == "england"]
df1
```

Out[84]:

	date	area	average_price	code	houses_sold	no_of_crimes	Year
13248	1995-01-01	england	53203	E92000001	47639.0	NaN	1995
13249	1995-02-01	england	53096	E92000001	47880.0	NaN	1995
13250	1995-03-01	england	53201	E92000001	67025.0	NaN	1995
13251	1995-04-01	england	53591	E92000001	56925.0	NaN	1995
13252	1995-05-01	england	53678	E92000001	64192.0	NaN	1995
...	...	...	...	...	...	...	...
13544	2019-09-01	england	249942	E92000001	64605.0	NaN	2019
13545	2019-10-01	england	249376	E92000001	68677.0	NaN	2019
13546	2019-11-01	england	248515	E92000001	67814.0	NaN	2019
13547	2019-12-01	england	250410	E92000001	NaN	NaN	2019
13548	2020-01-01	england	247355	E92000001	NaN	NaN	2020

301 rows × 7 columns

In [86]:

```
df1.groupby('Year')
```

Out[86]:

```
<pandas.core.groupby.generic.DataFrameGroupBy object at 0x000002A57BD018B0>
```

In [89]:

```
df1.groupby('Year').average_price.max()
```

Out[89]:

```
Year
1995     53901
1996     55755
1997     61564
1998     65743
1999     75071
2000     84191
2001     95992
2002    119982
2003    138985
2004    160330
2005    167244
2006    182031
2007    194764
2008    191750
2009    174136
2010    180807
2011    177335
2012    180129
2013    188544
2014    203639
2015    219582
2016    231922
2017    242628
2018    248620
2019    250410
2020    247355
Name: average_price, dtype: int64
```

In [90]:

```
df1.groupby('Year').average_price.min()
```

Out[90]:

```
Year
1995     52788
1996     52333
1997     55789
1998     61659
1999     65522
2000     75219
2001     84245
2002     96215
2003    121610
2004    139719
2005    158572
2006    166544
2007    181824
2008    165795
2009    159340
2010    174458
2011    173046
2012    174161
2013    176816
2014    188265
2015    202856
2016    220361
2017    231593
2018    240428
2019    243281
2020    247355
Name: average_price, dtype: int64
```

Q6) What is the maximum & minimum No. of Crimes recorded per area?

In [93]:

```
data.groupby("area").no_of_crimes.max().sort_values(ascending = True)
```

Out[93]:

```
area
city of london              10.0
kingston upon thames      1379.0
sutton                    1425.0
richmond upon thames      1551.0
merton                    1623.0
harrow                    1763.0
bexley                    1914.0
havering                  1956.0
barking and dagenham      2049.0
redbridge                 2560.0
bromley                   2637.0
hammersmith and fulham    2645.0
kensington and chelsea    2778.0
enfield                   2798.0
lewisham                  2813.0
hounslow                  2817.0
hillingdon                2819.0
greenwich                 2853.0
barnet                    2893.0
brent                     2937.0
waltham forest            2941.0
wandsworth                3051.0
haringey                  3199.0
croydon                   3263.0
tower hamlets             3316.0
islington                 3384.0
ealing                    3401.0
hackney                   3466.0
newham                    3668.0
southwark                 3821.0
camden                    4558.0
lambeth                   4701.0
westminster               7461.0
east midlands                NaN
east of england              NaN
england                      NaN
inner london                 NaN
london                       NaN
north east                   NaN
north west                   NaN
outer london                 NaN
south east                   NaN
south west                   NaN
west midlands                NaN
yorks and the humber         NaN
Name: no_of_crimes, dtype: float64
```

In [94]:

```
data.groupby("area").no_of_crimes.min().sort_values(ascending = True)
```

Out[94]:

```
area
city of london               0.0
kingston upon thames       692.0
richmond upon thames       700.0
sutton                     787.0
merton                     819.0
bexley                     860.0
harrow                     937.0
havering                  1130.0
barking and dagenham      1217.0
hammersmith and fulham    1323.0
kensington and chelsea    1347.0
bromley                   1441.0
hillingdon                1445.0
redbridge                 1487.0
greenwich                 1513.0
hounslow                  1529.0
haringey                  1536.0
waltham forest            1575.0
wandsworth                1582.0
enfield                   1635.0
tower hamlets             1646.0
lewisham                  1675.0
barnet                    1703.0
brent                     1850.0
hackney                   1870.0
ealing                    1871.0
islington                 1871.0
croydon                   2031.0
camden                    2079.0
newham                    2130.0
southwark                 2267.0
lambeth                   2381.0
westminster               3504.0
east midlands                NaN
east of england              NaN
england                      NaN
inner london                 NaN
london                       NaN
north east                   NaN
north west                   NaN
outer london                 NaN
south east                   NaN
south west                   NaN
west midlands                NaN
yorks and the humber         NaN
Name: no_of_crimes, dtype: float64
```

Q7) Show the total count of records of each area, where average price is less than 100000.

In [95]:

```
data[data.average_price < 100000].area.value_counts()
```

Out[95]:

```
north east              112
north west              111
yorks and the humber    110
east midlands            96
west midlands            94
england                  87
barking and dagenham     85
south west               78
east of england          76
newham                   72
bexley                   64
waltham forest           64
lewisham                 62
havering                 60
south east               59
greenwich                59
croydon                  57
enfield                  54
sutton                   54
hackney                  53
redbridge                52
southwark                48
tower hamlets            47
outer london             46
hillingdon               44
lambeth                  41
hounslow                 41
brent                    40
london                   39
merton                   35
haringey                 33
bromley                  33
inner london             31
ealing                   31
kingston upon thames     30
harrow                   30
wandsworth               26
barnet                   25
islington                19
city of london           11
Name: area, dtype: int64
```