In [1]:
```python
import pandas as pd
```

In [2]:
```python
data = pd.read_csv(r"C:\Users\Manas Ranjan Kar\Downloads\5. London Housing Data.csv")
```

In [3]:
```python
data
```

Out[3]:

	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 [4]:
```python
data.count()
```

Out[4]:
```
date             13549
area             13549
average_price    13549
code             13549
houses_sold      13455
no_of_crimes      7439
dtype: int64
```

In [5]:
```python
data.count().sum()
```

Out[5]:
```
75090
```

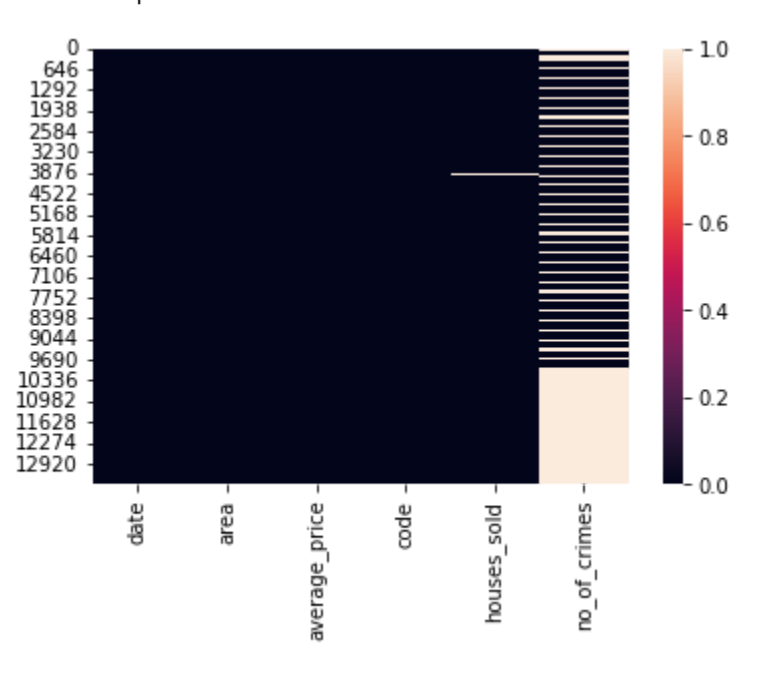
In [7]:
```python
data.isnull().sum()
```

Out[7]:
```
date                0
area                0
average_price       0
code                0
houses_sold        94
no_of_crimes     6110
dtype: int64
```

In [9]:
```python
import seaborn as sns
import matplotlib.pyplot as plt
```

In [10]:
```python
sns.heatmap(data.isnull())
```

Out[10]:
```
<AxesSubplot:>
```



In [11]:
```python
# Q.1-> Convert the datatype of 'date' column to Date-Time format
```

In [12]:
```python
data.head()
```

Out[12]:

	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 [14]:
```python
data.dtypes
```

Out[14]:
```
date              object
area              object
average_price      int64
code              object
houses_sold      float64
no_of_crimes     float64
dtype: object
```

In [15]:
```python
data.date = pd.to_datetime(data.date)   # comand to change datatype of 'date' column to Date-Time format
```

In [17]:
```python
data.dtypes
```

Out[17]:
```
date             datetime64[ns]
area                     object
average_price             int64
code                     object
houses_sold             float64
no_of_crimes            float64
dtype: object
```

In [18]:
```python
# Q.2-> Add a new column 'year' in dataframe, which contains years only.
```

In [19]:
```python
data.head()
```

Out[19]:

	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 [47]:
```python
data["year"] = data.date.dt.year
#data["month"] = data.date.dt.month
```

In [48]:
```python
data
```

Out[48]:

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

13549 rows × 8 columns

In [49]:
```python
# Q.3-> add a new column'day' as 2nd column in the dataframe, which contains month only
```

In [51]:
```python
data.insert(1,"month",data.date.dt.month) # comand -> df.insert(index,"new_column_name",new_column_values)
```

In [52]:
```python
data
```

Out[52]:

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

13549 rows × 9 columns

In [42]:
```python
# Q.4 -> Remove the column'year' and 'month' and 'day' from the dataframe
# Comand -> data.drop(['year','month','day'], axis=1,inplace = True)
```

In [53]:
```python
data.drop(['year','month','day'], axis=1,inplace = True) # Axis =1 (Column Axis) , Axis = 0 (Row Axis)
```

In [55]:
```python
data
```

Out[55]:

	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

In [56]:
```python
# Q.5-> Show all the records where 'No. of crimes'is 0. And, how many such records are there?
```

In [58]:
```python
data.head()
```

Out[58]:

	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 [60]:
```python
data[data.no_of_crimes == 0]
```

Out[60]:

	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 [61]:
```python
len(data[data.no_of_crimes == 0])
```

Out[61]:
```
104
```

In [62]:
```python
#Q.6 -> What is the maximum and minimum 'average_price' per year in england
```

In [63]:
```python
data["year"] = data.date.dt.year
```

In [64]:
```python
data
```

Out[64]:

	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

In [69]:
```python
df1 = data[data.area == 'england']
```

In [70]:
```python
df1
```

Out[70]:

	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 [74]:
```python
#df1.groupby("year").average_price.max()
df1.groupby("year").average_price.min()
```

Out[74]:
```
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
```

In [75]:
```python
# Q.7 - What is the Maximum and minimum No. of crimes recorded per area ?
```

In [76]:
```python
data.head()
```

Out[76]:

	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 [78]:
```python
#data.groupby("area").no_of_crimes.max()
data.groupby("area").no_of_crimes.min()
```

Out[78]:
```
area
barking and dagenham      1217.0
barnet                    1703.0
bexley                     860.0
brent                     1850.0
bromley                   1441.0
camden                    2079.0
city of london               0.0
croydon                   2031.0
ealing                    1871.0
east midlands                NaN
east of england              NaN
enfield                   1635.0
england                      NaN
greenwich                 1513.0
hackney                   1870.0
hammersmith and fulham    1323.0
haringey                  1536.0
harrow                     937.0
havering                  1130.0
hillingdon                1445.0
hounslow                  1529.0
inner london                 NaN
islington                 1871.0
kensington and chelsea    1347.0
kingston upon thames       692.0
lambeth                   2381.0
lewisham                  1675.0
london                       NaN
merton                     819.0
newham                    2130.0
north east                   NaN
north west                   NaN
outer london                 NaN
redbridge                 1487.0
richmond upon thames       700.0
south east                   NaN
south west                   NaN
southwark                 2267.0
sutton                     787.0
tower hamlets             1646.0
waltham forest            1575.0
wandsworth                1582.0
west midlands                NaN
westminster               3504.0
yorks and the humber         NaN
Name: no_of_crimes, dtype: float64
```

In [82]:
```python
data.groupby("area").no_of_crimes.max().sort_values(ascending=True)
```

Out[82]:
```
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 [83]:
```python
# Q.8 -> Show the total count of records of each area, where average price is less than 100000.
```

In [84]:
```python
data.head()
```

Out[84]:

	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 [88]:
```python
data[data.average_price < 100000].area.value_counts()
```

Out[88]:
```
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
sutton                   54
enfield                  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
bromley                  33
haringey                 33
ealing                   31
inner london             31
harrow                   30
kingston upon thames     30
wandsworth               26
barnet                   25
islington                19
city of london           11
Name: area, dtype: int64
```

In [ ]: