Data cleaning

First we import the necessary libraries that we will use for the exploratory analysis and data cleaning.

```
#Import libraries
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

We import the data and print it

```
df=pd.read_csv('Anyinssan Nava Sánchez - raw_house_data.xlsx - Anyinssan Nava Sánchez - raw_house_data.csv.csv') #read csv
df
```

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitchen_features	firepla
0	21530491	5300000.0	85637	-110.378200	31.356362	2154.00	5272.00	1941	13	10	10500	0	Dishwasher, Freezer, Refrigerator, Oven	
1	21529082	4200000.0	85646	-111.045371	31.594213	1707.00	10422.36	1997	2	2	7300	0	Dishwasher, Garbage Disposal	
2	3054672	4200000.0	85646	-111.040707	31.594844	1707.00	10482.00	1997	2	3	None	None	Dishwasher, Garbage Disposal, Refrigerator	
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5	9019	4	Dishwasher, Double Sink, Pantry: Butler, Refri...	
													Dishwasher	

```
df.shape
```

```
(5000, 16)
```

```
df.columns #check the names of 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')
```

```
df.describe()
```

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	fireplaces
count	5.000000e+03	5.000000e+03	5000.000000	5000.000000	5000.000000	4990.000000	5.000000e+03	5000.00000	5000.000000	4975.000000
mean	2.127070e+07	7.746262e+05	85723.025600	-110.912107	32.308512	4.661317	9.402828e+03	1992.32800	3.933800	1.885226
std	2.398508e+06	3.185556e+05	38.061712	0.120629	0.178028	51.685230	1.729385e+05	65.48614	1.245362	1.136578
min	3.042851e+06	1.690000e+05	85118.000000	-112.520168	31.356362	0.000000	0.000000e+00	0.00000	1.000000	0.000000
25%	2.140718e+07	5.850000e+05	85718.000000	-110.979260	32.277484	0.580000	4.803605e+03	1987.00000	3.000000	1.000000
50%	2.161469e+07	6.750000e+05	85737.000000	-110.923420	32.318517	0.990000	6.223760e+03	1999.00000	4.000000	2.000000
75%	2.180480e+07	8.350000e+05	85749.000000	-110.859078	32.394334	1.757500	8.082830e+03	2006.00000	4.000000	3.000000
max	2.192856e+07	5.300000e+06	86323.000000	-109.454637	34.927884	2154.000000	1.221508e+07	2019.00000	36.000000	9.000000

```
a=df.columns.values.tolist()    ###check
b=ddf.columns.values.tolist()
for i in a:
    if i not in b:
        print(i)
```

```
bathrooms
sqrt_ft
garage
kitchen_features
floor_covering
HOA
```

```
df['bathrooms'].value_counts()
```

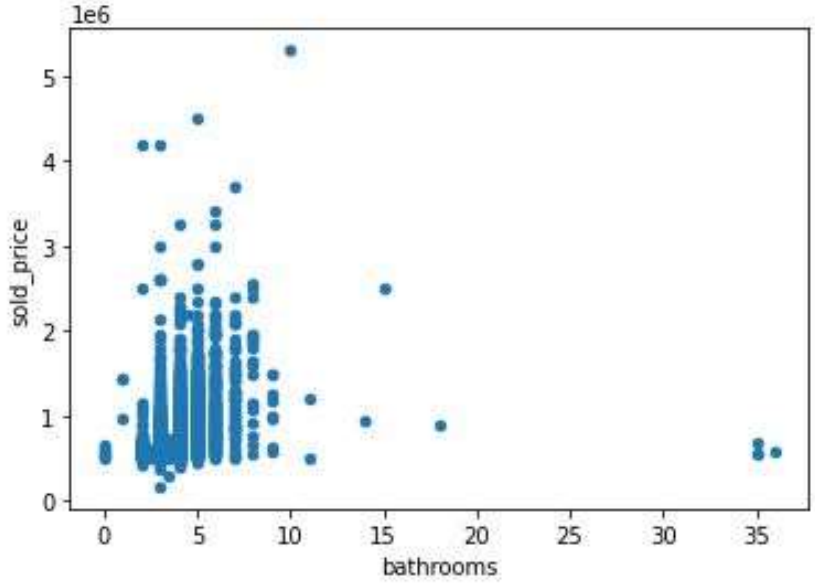
```
3       1993
4       1842
5        654
6        207
2        189
7         58
8         19
9          8
3.5        7
None       6
1          3
2.5        3
35         3
11         2
10         1
14         1
18         1
4.5        1
15         1
36         1
Name: bathrooms, dtype: int64
```

```
df['bathrooms'].value_counts()
```

```
3       1993
4       1842
5        654
6        207
2        189
7         58
8         19
9          8
3.5        7
None       6
1          3
2.5        3
35         3
11         2
10         1
14         1
18         1
4.5        1
15         1
36         1
Name: bathrooms, dtype: int64
```

```
df.plot(kind='scatter',x='bathrooms',y='sold_price')
```

```
<AxesSubplot:xlabel='bathrooms', ylabel='sold_price'>
```

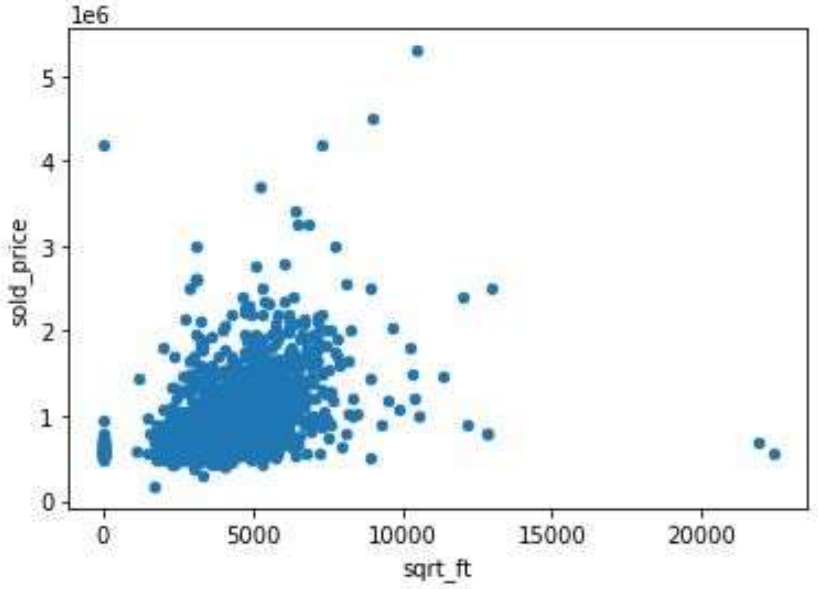


```
df['sqrt_ft'].value_counts() #do the same bo
```

```
None    50
3541    50
3052    25
3420    18
3002    16
        ..
4362     1
5586     1
5117     1
3793     1
1772     1
Name: sqrt_ft, Length: 2362, dtype: int64
```

```
df.plot(kind='scatter',x='sqrt_ft',y='sold_price')
```

```
<AxesSubplot:xlabel='sqrt_ft', ylabel='sold_price'>
```

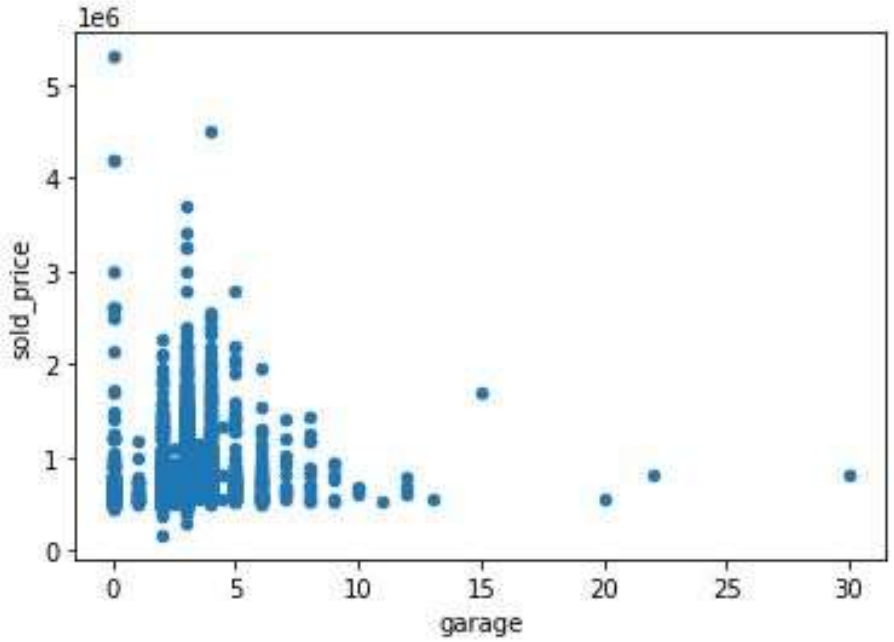


```
df['garage'].value_counts()
```

```
3       2792
2       1336
4        383
0        184
5         88
6         61
2.5       48
1         30
3.5       16
8         14
7         13
None       7
9          6
4.5        4
12         3
10         3
15         1
22         1
30         1
11         1
20         1
13         1
Name: garage, dtype: int64
```

```
df.plot(kind='scatter',x='garage',y='sold_price')
```

```
<AxesSubplot:xlabel='garage', ylabel='sold_price'>
```

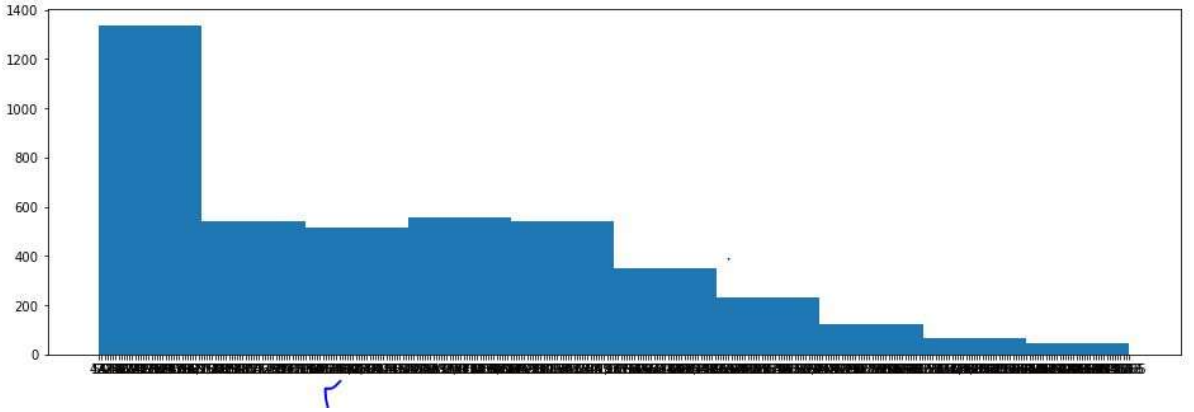


```
#procedure for HOA
df['HOA'].value_counts()
```

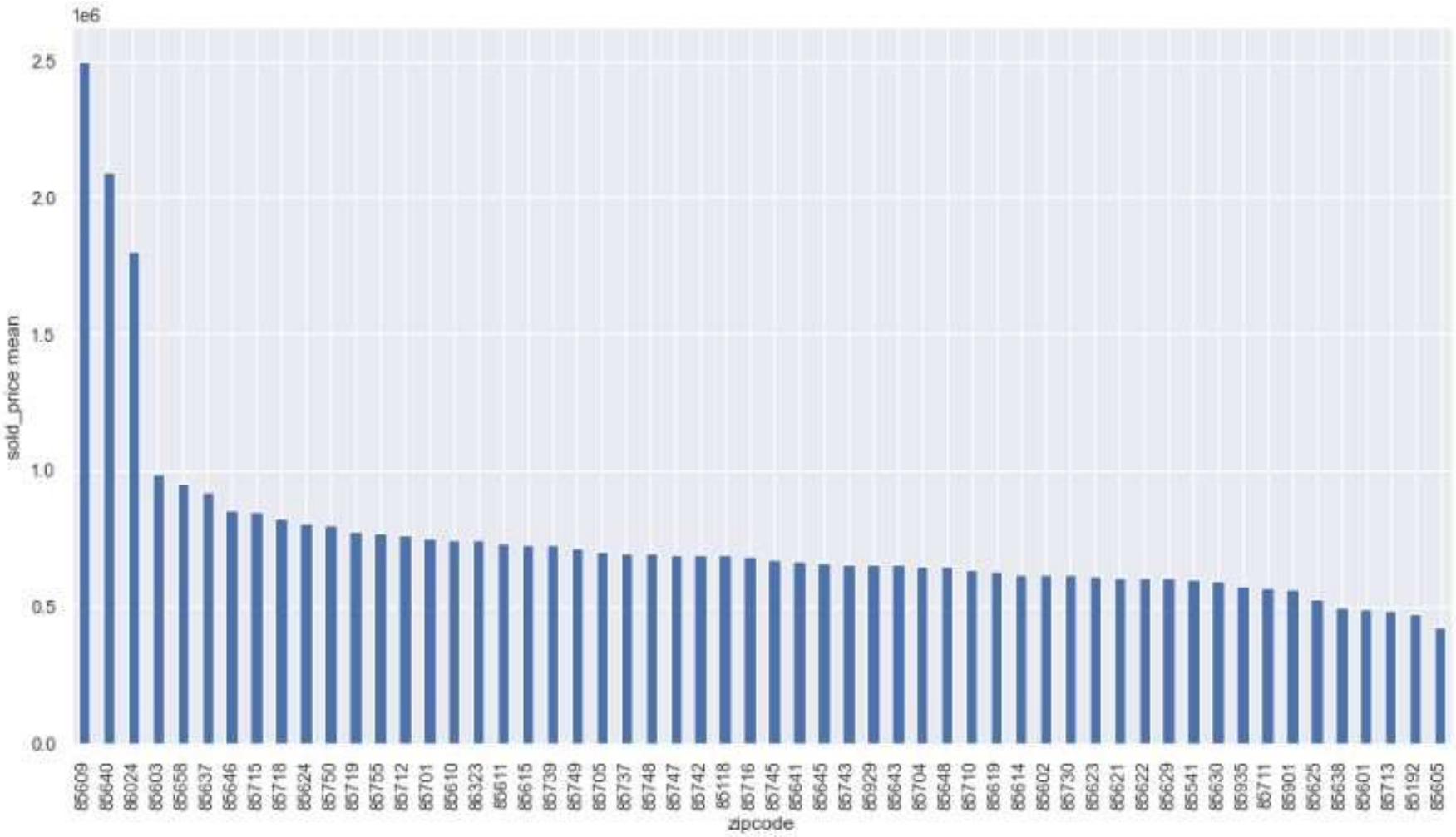
```
0          731
None       498
5          119
100        107
50          84
          ...
162          1
166.66       1
43.71        1
203          1
78.65        1
Name: HOA, Length: 375, dtype: int64
```

```
#Because the None data is many for the total data, a histogram can
#be used to see the most repeated value and replace it with that data.
plt.figure(figsize=(16,5))
plt.hist(df[df['HOA']!='None']['HOA'])
```

```
(array([1336.,  539.,  516.,  555.,  543.,  348.,  230.,  124.,   68.,
         46.]),
 array([  0. ,  37.3,  74.6, 111.9, 149.2, 186.5, 223.8, 261.1, 298.4,
        335.7, 373. ]),
 <BarContainer object of 10 artists>)
```




MLS 1 0.045 0.31 0.11 0.43 -0.099 0.0036 -0.0053 0.083 0.0059 -0.029 0.00034 -0.057 0.0089
sold_price 0.045 1 -0.037 -0.063 0.067 0.18 0.025 0.02 0.17 0.44 0.59 0.14 0.39 0.34
zipcode 0.31 -0.037 1 0.09 0.45 -0.17 -0.0021 0.018 0.14 -0.028 0.018 0.039 -0.017 -0.087
longitude 0.11 -0.063 0.09 1 -0.25 0.14 -0.00074 0.0029 0.081 0.012 0.055 -0.0023 0.048 -0.085
latitude 0.43 0.067 0.45 -0.25 1 -0.25 3.3e-05 0.057 -0.02 -0.018 -0.076 -0.00013 -0.082 0.19
lot_acres -0.099 0.18 -0.17 0.14 -0.25 1 -0.00061 -0.051 0.00047 0.024 0.088 0.058 0.07 -0.071
taxes 0.0036 0.025 -0.0021 -0.00074 3.3e-05 -0.00061 1 -0.00073 0.0066 0.01 0.041 0.0045 0.023 0.021
year_built -0.0053 0.02 0.018 0.0029 0.057 -0.051 -0.00073 1 -0.024 0.0022 0.015 0.062 -0.021 0.028
bedrooms 0.083 0.17 0.14 0.081 -0.02 0.00047 0.0066 -0.024 1 0.46 0.5 0.18 0.21 -0.2
bathrooms 0.0059 0.44 -0.028 0.012 -0.018 0.024 0.01 0.0022 0.46 1 0.64 0.21 0.28 0.063
sqrt_ft -0.029 0.59 0.018 0.055 -0.076 0.088 0.041 0.015 0.5 0.64 1 0.25 0.43 0.049
garage 0.00034 0.14 0.039 -0.0023 -0.00013 0.058 0.0045 0.062 0.18 0.21 0.25 1 0.074 -0.049
fireplaces -0.057 0.39 -0.017 0.048 -0.082 0.07 0.023 -0.021 0.21 0.28 0.43 0.074 1 0.024
HOA 0.0089 0.34 -0.087 -0.085 0.19 -0.071 0.021 0.028 -0.2 0.063 0.049 -0.049 0.024 1
MLS
sold_price
zipcode
longitude
latitude
lot_acres
taxes
year_built
bedrooms
bathrooms
sqrt_ft
garage
fireplaces
HOA
1.0
0.8
0.6
0.4
0.2
0.0
−0.2


1e6
2.5
2.0
1.5
1.0
0.5
0.0
sold_price mean
85609
85640
86024
85603
85658
85637
85646
85715
85718
85624
85750
85719
85755
85712
85701
85610
86323
85611
85615
85739
85749
85705
85737
85748
85747
85742
85118
85716
85745
85641
85645
85743
85929
85643
85704
85648
85710
85619
85614
85602
85730
85623
85621
85622
85629
85541
85630
85935
85711
85901
85625
85638
85601
85713
85192
85605
zipcode

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4782 entries, 3 to 4998
Data columns (total 18 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4782 non-null   int64  
 1   sold_price        4782 non-null   float64
 2   zipcode           4782 non-null   int64  
 3   longitude         4782 non-null   float64
 4   latitude          4782 non-null   float64
 5   lot_acres         4782 non-null   float64
 6   taxes             4782 non-null   float64
 7   year_built        4782 non-null   int64  
 8   bedrooms          4782 non-null   int64  
 9   bathrooms         4782 non-null   float64
 10  sqrt_ft           4782 non-null   float64
 11  garage            4782 non-null   float64
 12  kitchen_features  4782 non-null   object 
 13  fireplaces        4782 non-null   float64
 14  floor_covering    4782 non-null   object 
 15  HOA               4782 non-null   float64
```

handling NaNs Values

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

```
MLS                 0
sold_price          0
zipcode             0
longitude           0
latitude            0
lot_acres          10
taxes               0
year_built          0
bedrooms            0
bathrooms           0
sqrt_ft             0
garage              0
kitchen_features    0
fireplaces         19
floor_covering      0
HOA                 0
dtype: int64
```

```
df.head()
```

atitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitchen_features	fireplaces	floor_covering	HOA	kitchen_vectors	floor_vectors
645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	Dishwasher, Double Sink, Pantry: Butler, Refri...	4.0	Ceramic Tile, Laminate, Wood	0.0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, ...	[0.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 0.0, ...
285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	Dishwasher, Garbage Disposal, Refrigerator, Mi...	5.0	Carpet, Concrete	55.0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ...	[0.0, 1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ...
339090	1.67	27802.84	1999	3	4.0	6842.0	3.0	Dishwasher, Garbage Disposal, Refrigerator, Mi...	5.0	Natural Stone, Wood, Other	422.0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ...	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 0.0, ...
261069	2.10	19038.42	2001	9	8.0	12025.0	4.0	Dishwasher, Garbage Disposal, Oven	6.0	Carpet, Natural Stone, Wood, Other	0.0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ...	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 1.0, ...
331603	1.07	21646.00	2011	6	8.0	8921.0	4.0	Compactor, Dishwasher, Freezer, Garbage Dispos...	5.0	Carpet, Natural Stone, Wood	220.0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, ...	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 0.0, ...

Thanks for your attention