Import and read the document

In [2]:
```
#Import libraries
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [3]:
```
print (os.getcwd()) #check the directory
```

```
C:\Users\Consultant\machine learning
```

In [4]:
```
os.chdir("C:/Users/Consultant/Documents/machine-learning") #change the directory
print (os.getcwd())
```

```
C:\Users\Consultant\Documents\machine-learning
```

In [5]:
```
df=pd.read_csv('Anyinssan Nava Sánchez - raw_house_data.xlsx - Anyinssan Nava Sánchez - raw_house_data.csv.csv')
df
```

Out[5]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	ki
0	21530491	5300000.0	85637	-110.378200	31.356362	2154.00	5272.00	1941	13	10	10500	0	
1	21529082	4200000.0	85646	-111.045371	31.594213	1707.00	10422.36	1997	2	2	7300	0	
2	3054672	4200000.0	85646	-111.040707	31.594844	1707.00	10482.00	1997	2	3	None	None	
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5	9019	4	

In [6]:
```
df.shape
```

Out[6]:
```
(5000, 16)
```

In [7]:
```
df.columns #check the names of columns
```

Out[7]:
```
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')
```

In [8]:
```
df.describe()
```

Out[8]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	firep
count	5.000000e+03	5.000000e+03	5000.000000	5000.000000	5000.000000	4990.000000	5.000000e+03	5000.00000	5000.000000	4975.00
mean	2.127070e+07	7.746262e+05	85723.025600	-110.912107	32.308512	4.661317	9.402828e+03	1992.32800	3.933800	1.88
std	2.398508e+06	3.185556e+05	38.061712	0.120629	0.178028	51.685230	1.729385e+05	65.48614	1.245362	1.13
min	3.042851e+06	1.690000e+05	85118.000000	-112.520168	31.356362	0.000000	0.000000e+00	0.00000	1.000000	0.00
25%	2.140718e+07	5.850000e+05	85718.000000	-110.979260	32.277484	0.580000	4.803605e+03	1987.00000	3.000000	1.00
50%	2.161469e+07	6.750000e+05	85737.000000	-110.923420	32.318517	0.990000	6.223760e+03	1999.00000	4.000000	2.00
75%	2.180480e+07	8.350000e+05	85749.000000	-110.859078	32.394334	1.757500	8.082830e+03	2006.00000	4.000000	3.00
max	2.192856e+07	5.300000e+06	86323.000000	-109.454637	34.927884	2154.000000	1.221508e+07	2019.00000	36.000000	9.00

In [9]:
```
ddf=df.describe()
ddf
```

Out[9]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	firep
count	5.000000e+03	5.000000e+03	5000.000000	5000.000000	5000.000000	4990.000000	5.000000e+03	5000.00000	5000.000000	4975.00
mean	2.127070e+07	7.746262e+05	85723.025600	-110.912107	32.308512	4.661317	9.402828e+03	1992.32800	3.933800	1.88
std	2.398508e+06	3.185556e+05	38.061712	0.120629	0.178028	51.685230	1.729385e+05	65.48614	1.245362	1.13
min	3.042851e+06	1.690000e+05	85118.000000	-112.520168	31.356362	0.000000	0.000000e+00	0.00000	1.000000	0.00
25%	2.140718e+07	5.850000e+05	85718.000000	-110.979260	32.277484	0.580000	4.803605e+03	1987.00000	3.000000	1.00
50%	2.161469e+07	6.750000e+05	85737.000000	-110.923420	32.318517	0.990000	6.223760e+03	1999.00000	4.000000	2.00
75%	2.180480e+07	8.350000e+05	85749.000000	-110.859078	32.394334	1.757500	8.082830e+03	2006.00000	4.000000	3.00
max	2.192856e+07	5.300000e+06	86323.000000	-109.454637	34.927884	2154.000000	1.221508e+07	2019.00000	36.000000	9.00

In [10]:
```
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
```

In [11]:
```
df['bathrooms'].unique()
```

Out[11]:
```
array(['10', '2', '3', '5', '6', '4', '8', '7', '15', '4.5', '1', '9',
       '11', '18', '14', '3.5', 'None', '35', '2.5', '36'], dtype=object)
```

In [12]:
```
df['sqrt_ft'].unique()
```

Out[12]:
```
array(['10500', '7300', 'None', ..., '2106', '3601', '1772'], dtype=object)
```

In [13]:
```
df['garage'].unique()
```

Out[13]:
```
array(['0', 'None', '4', '3', '5', '2', '6', '15', '8', '7', '4.5', '3.5',
       '2.5', '1', '9', '22', '30', '12', '10', '11', '20', '13'],
      dtype=object)
```

In [14]:
```
df['HOA'].unique()
```

Out[14]:
```
array(['0', 'None', '55', '422', '220', '421', '141.67', '357', '148',
       '20,000', '142', '173', '167', '123', '300', '194', '1,717', '342',
       '240', '437', '112', '199', '178', '550', '258', '188', '169',
       '124', '320', '213', '153', '105', '159', '193', '69', '208', '50',
       '168', '191', '79', '157', '323', '1,100', '250', '158', '127',
       '149', '83', '118', '219', '88', '180', '259', '128', '117', '48',
       '130', '132', '135', '152', '33', '143', '5', '157.33', '129',
       '171', '273', '162', '131', '134', '211', '203', '190', '145',
       '83.33', '63', '177.34', '57', '115', '166', '184', '164', '125',
       '216', '195', '106', '214', '238', '212.88', '4', '30', '150',
       '19', '160', '138', '141', '146', '1,270', '15', '95', '19,480',
       '116', '311', '94', '21', '295', '57.33', '243', '23', '34', '215',
       '41', '18', '110', '233', '322', '43', '232', '100', '133', '4.16',
       '202', '700', '121', '40', '51', '179', '58', '102', '175', '97',
       '25', '139', '120', '137', '53', '2,000', '242', '49.43', '333',
       '270', '84', '8', '165', '506', '63.98', '35', '64', '258.08',
       '108', '187', '186', '1,600', '212', '12', '209', '107', '45',
       '52', '42', '145.83', '22', '96', '93', '122', '200', '241', '161',
       '37.5', '119.66', '155', '299', '154', '170', '221', '303', '140',
       '425', '172', '68', '75', '71', '44', '37', '6', '285', '67',
       '54.16', '9', '113', '17', '192', '1,010', '78', '609', '26',
       '213.88', '16', '54', '11', '39', '144', '56', '156', '263', '92',
       '119', '60', '76', '70', '516', '141.66', '343', '72', '126', '80',
       '247', '193.5', '20', '114', '43.75', '73', '317', '36.02',
       '1,290', '147', '32', '10', '332.66', '43.01', '198', '332.67',
       '69.16', '33.33', '16.67', '205', '58.33', '174', '249', '38',
       '66', '40.55', '2', '43.71', '103', '13', '185', '111', '98',
       '166.66', '8.33', '74', '49', '59', '89', '85', '62', '66.67',
       '151', '225.21', '65', '86', '109', '101', '81', '24', '77',
       '1,769', '50.42', '47', '73.72', '149.5', '188.33', '257', '73.33',
       '269', '4.17', '99', '225', '390', '40.77', '3', '194.51', '6.25',
       '55.58', '7', '87', '90', '53.34', '1,000', '275.08', '123.44',
       '267', '183', '136', '16.66', '97.66', '39.59', '58.36', '40.78',
       '62.5', '290', '330', '46', '36', '41.08', '5.5', '176', '1',
       '226', '15.41', '283', '82', '91', '252', '14', '275', '29', '324',
       '325', '87.66', '42.38', '5,900', '350', '233.33', '83.34',
       '8,333', '765', '68.66', '253', '15.45', '5.25', '88.33', '1,200',
       '60.5', '31', '189', '487.88', '20.83', '328', '168.92', '14.58',
       '368', '57.5', '61', '46.95', '750', '84.75', '34.17', '8.34',
       '5.41', '66.66', '45.9', '337', '202.75', '149.04', '134.5',
       '2.08', '35.83', '212.38', '10.83', '41.61', '925', '132.66',
```

```
       '41.66', '500', '99.66', '18.75', '177', '234', '28', '104', '294',
       '38.55', '63.33', '11.08', '210', '112.38', '5.4', '36.66',
       '78.65'], dtype=object)
```

In [15]:
```
df.isnull().sum()   ##check null values
```

Out[15]:
```
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         25
floor_covering      0
HOA                 0
dtype: int64
```

In [16]:
```
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         5000 non-null   object 
 10  sqrt_ft           5000 non-null   object 
 11  garage            5000 non-null   object 
 12  kitchen_features  5000 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    5000 non-null   object 
 15  HOA               5000 non-null   object 
dtypes: float64(6), int64(4), object(6)
memory usage: 625.1+ KB
```

modify object variables that should be numeric

In [17]:
```
df['bathrooms'].value_counts() ###reminder of the number of nones for the bathroom feature:6
```

Out[17]:
```
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
```

In [18]:
```
df['bathrooms']=np.where(df['bathrooms']=='None',0,df['bathrooms']) #change the nones to zeros to be able to gra
df['bathrooms'].value_counts()
```

Out[18]:
```
3      1993
4      1842
5       654
6       207
2       189
7        58
8        19
9         8
3.5       7
0         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
```

In [19]:
```
df.info() #bathrooms is an object so , the axis x appears in disorder
```

```
<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         5000 non-null   object 
 10  sqrt_ft           5000 non-null   object 
 11  garage            5000 non-null   object 
 12  kitchen_features  5000 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    5000 non-null   object 
 15  HOA               5000 non-null   object 
dtypes: float64(6), int64(4), object(6)
memory usage: 625.1+ KB
```

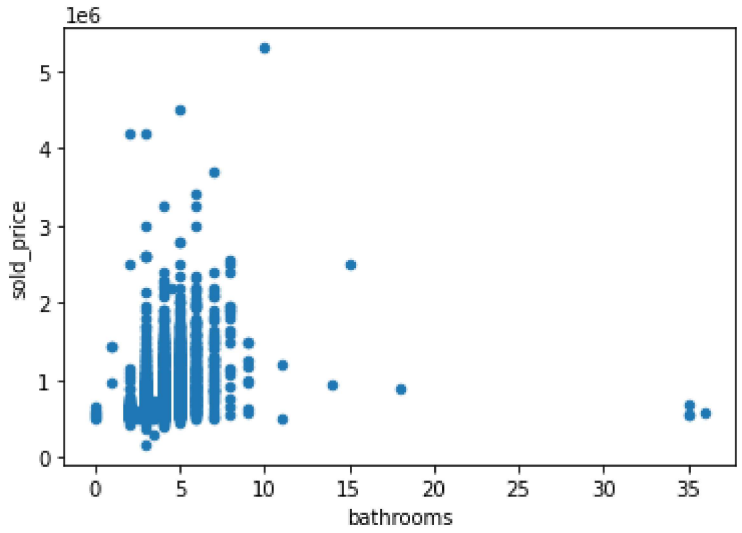
In [20]:
```
df['bathrooms']=df['bathrooms'].astype(float)
df.info()
```

```
<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         5000 non-null   float64
 10  sqrt_ft           5000 non-null   object 
 11  garage            5000 non-null   object 
 12  kitchen_features  5000 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    5000 non-null   object 
 15  HOA               5000 non-null   object 
dtypes: float64(7), int64(4), object(5)
memory usage: 625.1+ KB
```

scatter plot

In [21]:
```
df.plot(kind='scatter',x='bathrooms',y='sold_price')  ##check the relationship between the variables
```

Out[21]:
```
<AxesSubplot:xlabel='bathrooms', ylabel='sold_price'>
```



In [22]:
```
#So apparently there is no relationship between bathrooms and the variable 'y'
#so it would be better if we delete that data
#now let's do the same for the other variables
#df['sqrt_ft'].value_counts()
df = df.drop(df[df['bathrooms']==0].index)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4994 entries, 0 to 4999
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4994 non-null   int64  
 1   sold_price        4994 non-null   float64
 2   zipcode           4994 non-null   int64  
 3   longitude         4994 non-null   float64
 4   latitude          4994 non-null   float64
 5   lot_acres         4984 non-null   float64
 6   taxes             4994 non-null   float64
 7   year_built        4994 non-null   int64  
 8   bedrooms          4994 non-null   int64  
 9   bathrooms         4994 non-null   float64
 10  sqrt_ft           4994 non-null   object 
 11  garage            4994 non-null   object 
 12  kitchen_features  4994 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    4994 non-null   object 
 15  HOA               4994 non-null   object 
dtypes: float64(7), int64(4), object(5)
memory usage: 663.3+ KB
```

In [23]:
```
df['sqrt_ft'].value_counts() #do the same bathroom procedure for sqrt_ft
```

Out[23]:
```
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
```

In [24]:
```
df['sqrt_ft']=np.where(df['sqrt_ft']=='None',0,df['sqrt_ft'])
df['sqrt_ft'].value_counts()
```

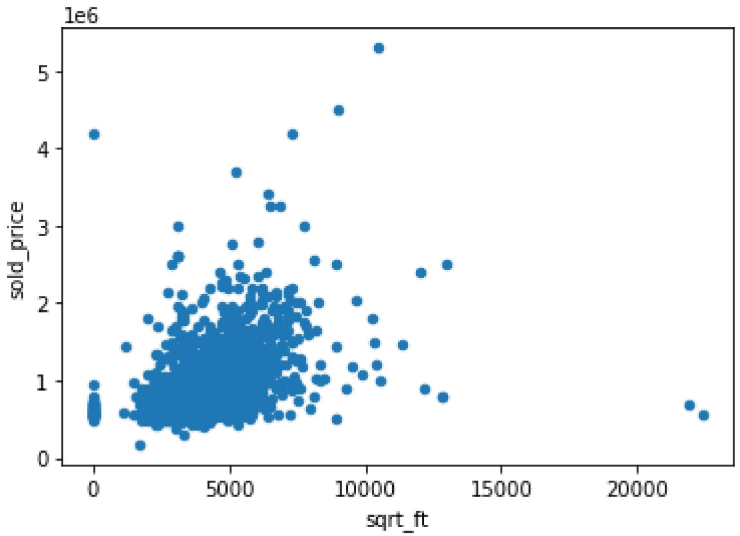
Out[24]:
```
0       50
3541    50
3052    25
3420    18
3002    16
        ..
4362     1
5586     1
5117     1
3793     1
1772     1
Name: sqrt_ft, Length: 2362, dtype: int64
```

In [25]:
```
df['sqrt_ft']=df['sqrt_ft'].astype(float)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4994 entries, 0 to 4999
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4994 non-null   int64  
 1   sold_price        4994 non-null   float64
 2   zipcode           4994 non-null   int64  
 3   longitude         4994 non-null   float64
 4   latitude          4994 non-null   float64
 5   lot_acres         4984 non-null   float64
 6   taxes             4994 non-null   float64
 7   year_built        4994 non-null   int64  
 8   bedrooms          4994 non-null   int64  
 9   bathrooms         4994 non-null   float64
 10  sqrt_ft           4994 non-null   float64
 11  garage            4994 non-null   object 
 12  kitchen_features  4994 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    4994 non-null   object 
 15  HOA               4994 non-null   object 
dtypes: float64(8), int64(4), object(4)
memory usage: 663.3+ KB
```

In [26]:
```
df.plot(kind='scatter',x='sqrt_ft',y='sold_price')
```

Out[26]:
```
<AxesSubplot:xlabel='sqrt_ft', ylabel='sold_price'>
```



In [27]:
```
#it seems that there is no relationship, but there cannot be zero sqrt,
#so we are going to impute the mode so as not to delete so many rows
```

In [28]:
```
#df.groupby('sqrt_ft')['sold_price'].mean().sort_values(ascending = False).plot.bar()
#plt.show()
```

In [29]:
```
#df['sqrt_ft'].value_counts()
mode=df['sqrt_ft'].mode()[0]
df['sqrt_ft']=np.where(df['sqrt_ft']==0,df['sqrt_ft'].replace(mode),df['sqrt_ft']) #we replace the values of the
# we can have 0 sqrt_ft for a space
```

In [30]:
```
#do the same bathroom procedure for garage
```

In [31]:
```
df['garage'].value_counts()
```

Out[31]:
```
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
```

In [32]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4994 entries, 0 to 4999
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4994 non-null   int64  
 1   sold_price        4994 non-null   float64
 2   zipcode           4994 non-null   int64  
 3   longitude         4994 non-null   float64
 4   latitude          4994 non-null   float64
 5   lot_acres         4984 non-null   float64
 6   taxes             4994 non-null   float64
 7   year_built        4994 non-null   int64  
 8   bedrooms          4994 non-null   int64  
 9   bathrooms         4994 non-null   float64
 10  sqrt_ft           4994 non-null   float64
 11  garage            4994 non-null   object 
 12  kitchen_features  4994 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    4994 non-null   object 
 15  HOA               4994 non-null   object 
dtypes: float64(8), int64(4), object(4)
memory usage: 663.3+ KB
```

In [33]:
```
df['garage']=np.where(df['garage']=='None',0,df['garage'])
df['garage'].value_counts()
```

Out[33]:
```
3      2792
2      1336
4       383
0       184
5        88
6        61
2.5      48
1        30
3.5      16
8        14
7        13
0         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
```

In [34]:
```
df['garage']=df['garage'].astype(float)
df.info()
```

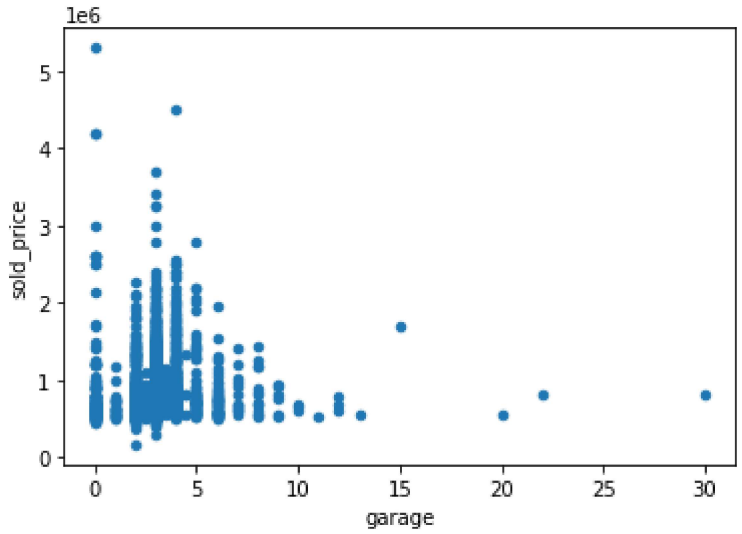
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4994 entries, 0 to 4999
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4994 non-null   int64  
 1   sold_price        4994 non-null   float64
 2   zipcode           4994 non-null   int64  
 3   longitude         4994 non-null   float64
 4   latitude          4994 non-null   float64
 5   lot_acres         4984 non-null   float64
 6   taxes             4994 non-null   float64
 7   year_built        4994 non-null   int64  
 8   bedrooms          4994 non-null   int64  
 9   bathrooms         4994 non-null   float64
 10  sqrt_ft           4994 non-null   float64
 11  garage            4994 non-null   float64
 12  kitchen_features  4994 non-null   object 
 13  fireplaces        4975 non-null   float64
 14  floor_covering    4994 non-null   object 
 15  HOA               4994 non-null   object 
dtypes: float64(9), int64(4), object(3)
memory usage: 663.3+ KB
```

In [35]:
```
df['garage'].value_counts()
```

Out[35]:
```
3.0     2792
2.0     1336
4.0      383
0.0      191
5.0       88
6.0       61
2.5       48
1.0       30
3.5       16
8.0       14
7.0       13
9.0        6
4.5        4
12.0       3
10.0       3
15.0       1
22.0       1
30.0       1
11.0       1
20.0       1
13.0       1
Name: garage, dtype: int64
```

In [36]:
```
df.plot(kind='scatter',x='garage',y='sold_price')
```

Out[36]: <AxesSubplot:xlabel='garage', ylabel='sold_price'>



In [37]:
```
#apparently there is a relationship, so then these values cannot be
#arbitrarily replaced, but at the same time there are few observations,
#so I think it is better to delete them
df = df.drop(df[df['garage']==0].index)
df.info()
```

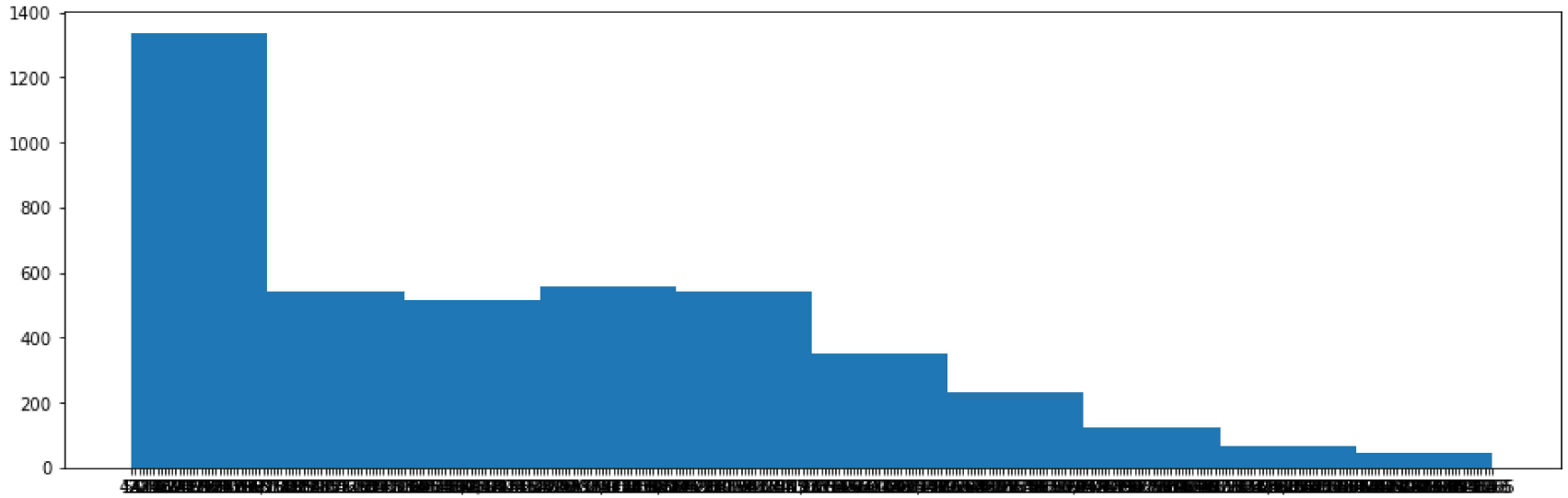
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4803 entries, 3 to 4998
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4803 non-null   int64  
 1   sold_price        4803 non-null   float64
 2   zipcode           4803 non-null   int64  
 3   longitude         4803 non-null   float64
 4   latitude          4803 non-null   float64
 5   lot_acres         4793 non-null   float64
 6   taxes             4803 non-null   float64
 7   year_built        4803 non-null   int64  
 8   bedrooms          4803 non-null   int64  
 9   bathrooms         4803 non-null   float64
 10  sqrt_ft           4803 non-null   float64
 11  garage            4803 non-null   float64
 12  kitchen_features  4803 non-null   object 
 13  fireplaces        4784 non-null   float64
 14  floor_covering    4803 non-null   object 
 15  HOA               4803 non-null   object 
dtypes: float64(9), int64(4), object(3)
memory usage: 637.9+ KB
```

In [38]:
```
#procedure for HOA
df['HOA'].value_counts()
```

Out[38]:
```
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
```

In [39]:
```
#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'])
```

Out[39]:
```
(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>)
```



In [40]:
```
df['HOA']=np.where(df['HOA']=='None',0,df['HOA'])
```

In [41]:
```
df['HOA'].value_counts()
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4803 entries, 3 to 4998
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4803 non-null   int64  
 1   sold_price        4803 non-null   float64
 2   zipcode           4803 non-null   int64  
 3   longitude         4803 non-null   float64
 4   latitude          4803 non-null   float64
 5   lot_acres         4793 non-null   float64
 6   taxes             4803 non-null   float64
 7   year_built        4803 non-null   int64  
 8   bedrooms          4803 non-null   int64  
 9   bathrooms         4803 non-null   float64
 10  sqrt_ft           4803 non-null   float64
 11  garage            4803 non-null   float64
 12  kitchen_features  4803 non-null   object 
 13  fireplaces        4784 non-null   float64
 14  floor_covering    4803 non-null   object 
 15  HOA               4803 non-null   object 
dtypes: float64(9), int64(4), object(3)
memory usage: 637.9+ KB
```

In [42]:
```
df['HOA']=df['HOA'].str.replace(',','.')
#df['HOA']=np.where(df['HOA']=='None',0,df['HOA'])
df['HOA']=df['HOA'].astype('float')
```

In [43]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4803 entries, 3 to 4998
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   MLS               4803 non-null   int64  
 1   sold_price        4803 non-null   float64
 2   zipcode           4803 non-null   int64  
 3   longitude         4803 non-null   float64
 4   latitude          4803 non-null   float64
 5   lot_acres         4793 non-null   float64
 6   taxes             4803 non-null   float64
 7   year_built        4803 non-null   int64  
 8   bedrooms          4803 non-null   int64  
 9   bathrooms         4803 non-null   float64
 10  sqrt_ft           4803 non-null   float64
 11  garage            4803 non-null   float64
 12  kitchen_features  4803 non-null   object 
 13  fireplaces        4784 non-null   float64
 14  floor_covering    4803 non-null   object 
 15  HOA               4305 non-null   float64
dtypes: float64(10), int64(4), object(2)
memory usage: 637.9+ KB
```

In [44]:
```
df['HOA']=np.where(df['HOA'].isnull(),0,df['HOA'])
```

In [64]:
```
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
 16  kitchen_vectors   4782 non-null   object 
 17  floor_vectors     4782 non-null   object 
dtypes: float64(10), int64(4), object(4)
memory usage: 709.8+ KB
```

In [46]:
```
#With this we finsh the process for these variables
```

handling NaNs Values

In [47]:
```
df.isnull().sum()           #there are very few so I decided to eliminate them
```

Out[47]:
```
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
```

In [48]:
```
df=df.dropna()
```

In [49]:
```
df.isnull().sum()
```

Out[49]:
```
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
dtype: int64
```

In [50]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 4782 entries, 3 to 4998
Data columns (total 16 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
dtypes: float64(10), int64(4), object(2)
memory usage: 635.1+ KB
```

handling categorical variables

In [51]:
```
df.describe()
```

Out[51]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bath
count	4.782000e+03	4.782000e+03	4782.000000	4782.000000	4782.000000	4782.000000	4.782000e+03	4782.000000	4782.000000	4782.0
mean	2.138991e+07	7.728091e+05	85724.498327	-110.913257	32.317169	2.737066	9.551398e+03	1993.933292	3.899624	3.8
std	1.898486e+06	2.987144e+05	36.319366	0.117324	0.166950	14.939447	1.768330e+05	59.852681	0.867482	1.1
min	3.047349e+06	1.690000e+05	85118.000000	-112.520168	31.361562	0.000000	0.000000e+00	0.000000	1.000000	1.0
25%	2.140806e+07	5.871250e+05	85718.000000	-110.980234	32.283876	0.590000	4.856648e+03	1989.000000	3.000000	3.0
50%	2.161509e+07	6.797500e+05	85737.000000	-110.922933	32.320090	0.990000	6.280395e+03	2000.000000	4.000000	4.0
75%	2.180485e+07	8.400000e+05	85750.000000	-110.859118	32.398420	1.670000	8.144557e+03	2006.000000	4.000000	4.0
max	2.192856e+07	4.500000e+06	86323.000000	-109.454637	34.927884	636.670000	1.221508e+07	2019.000000	10.000000	36.0

In [59]:

```
# Join every single characteristic into one list
feature = df["kitchen_features"]
kitchen_chars = []
kitchen_vectors = []

for i in feature:
  description = i.lower().split(",")
  kitchen_chars += description

# Check the unique characteristics on the list
print(np.unique(kitchen_chars))

# Create a vector with all the unique values
values = []

for i in kitchen_chars:
  if ':' in i:
    aux = i.split(':')[0]
    values.append(aux) #Just keep the general feature
    #print(f"Saving {aux}")
  else:
    values.append(i)
    #print(f"Saving {i}")

values = np.unique(values)  #These labels should be given to the programming team as additional data

for i in feature:
  vectorz = np.zeros(len(values))
  description = i.lower().split(",")

  for j in description:
    if ':' in j:
      j = j.split(':')[0]

    for k in range(len(values)):
      if values[k] == j:
        vectorz[k] = 1

  kitchen_vectors.append(vectorz)

# Create the column with the encoded vectors
df['kitchen_vectors'] = kitchen_vectors
```

```
#print(kitchen_vectors)
```

```
[' appliance color: almond' ' appliance color: black'
 ' appliance color: other' ' appliance color: stainless'
 ' appliance color: white' ' black' ' built in' ' butch block'
 ' convection' ' countertops: brazilian granite'
 ' countertops: brazillian slate' ' countertops: butcher block on isl'
 ' countertops: butcherblock/concret' ' countertops: caesar stone'
 ' countertops: caesarstone' ' countertops: carrera marble'
 ' countertops: ceasarstone' ' countertops: ceaserstone'
 ' countertops: ceramic' ' countertops: ceramic tile'
 ' countertops: chisled edge granite' ' countertops: colored concrete'
 ' countertops: combo' ' countertops: composite granite'
 ' countertops: concrete' ' countertops: concrete/wood'
 ' countertops: conrete/stone' ' countertops: corain'
 ' countertops: corian' ' countertops: corion' ' countertops: corrian'
 ' countertops: custom concrete' ' countertops: custom tile'
 ' countertops: custom tile &granite' ' countertops: dekton / granite'
 ' countertops: fascination quartzi' ' countertops: formica'
 ' countertops: ganite' ' countertops: garnite'
 ' countertops: gas / black' ' countertops: graniet'
```

In [60]:
```
values
```

Out[60]:
```
array([' appliance color', ' black', ' built in', ' butch block',
       ' convection', ' countertops', ' desk', ' dishwasher',
       ' double sink', ' electric', ' electric oven', ' electric range',
       ' freezer', ' garbage disposal', ' gas cooktop', ' gas range',
       ' ge', ' indoor grill', ' island', ' lazy susan', ' microwave',
       ' missing', ' oven', ' pantry', ' prep sink', ' refrigerator',
       ' reverse osmosis', ' stainless', ' tile', ' warming drawer',
       ' water purifier', ' wet bar', ' wine cooler', '# of ovens',
       'compactor', 'convection oven', 'desk', 'dishwasher',
       'double sink', 'electric range', 'freezer', 'garbage disposal',
       'gas range', 'island', 'microwave', 'none', 'oven', 'pantry',
       'quartzite', 'refrigerator', 'wet bar'], dtype='<U17')
```

In [61]:
```
df
```

Out[61]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitc
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	
4	21306357	3411450.0	85750	-110.813768	32.285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	Re
5	21528016	3250000.0	85718	-110.910593	32.339090	1.67	27802.84	1999	3	4.0	6842.0	3.0	Re
6	21610478	2400000.0	85712	-110.883315	32.261069	2.10	19038.42	2001	9	8.0	12025.0	4.0	D
7	21211741	2500000.0	85750	-110.861002	32.331603	1.07	21646.00	2011	6	8.0	8921.0	4.0	Fre
...	...	...	...	...	...	...	...	...	...	...	...	...	
4993	21908358	565000.0	85750	-110.820216	32.307646	0.83	4568.71	1986	4	3.0	2813.0	2.0	E
4994	21909379	535000.0	85718	-110.922291	32.317496	0.18	4414.00	2002	3	2.0	2106.0	2.0	E
4995	21810382	495000.0	85641	-110.661829	31.907917	4.98	2017.00	2005	5	3.0	3601.0	3.0	D
4996	21908591	550000.0	85750	-110.858556	32.316373	1.42	4822.01	1990	4	3.0	2318.0	3.0	E

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitc
4998	21900515	550000.0	85745	-111.055528	32.296871	1.01	5822.93	2009	4	4.0	3724.0	3.0	D

4782 rows × 18 columns

In [62]:

```
# Join every single characteristic into one list
feature = df["floor_covering"]
floor_chars = []
floor_vectors = []

for i in feature:
  description = i.lower().split(",")
  floor_chars += description

# Check the unique characteristics on the list
print(np.unique(floor_chars))

# Create a vector with all the unique values
values = []

for i in floor_chars:
  if ':' in i:
    aux = i.split(':')[0]
    values.append(aux) #Just keep the general feature
    #print(f"Saving {aux}")
  else:
    values.append(i)
    #print(f"Saving {i}")

values = np.unique(values)  #These labels should be given to the programming team as additional data

for i in feature:
  vectorz = np.zeros(len(values))
  description = i.lower().split(",")

  for j in description:
    if ':' in j:
      j = j.split(':')[0]

    for k in range(len(values)):
      if values[k] == j:
        vectorz[k] = 1

  floor_vectors.append(vectorz)

# Create the column with the encoded vectors
df['floor_vectors'] = floor_vectors
```

```
#print(kitchen_vectors)
```

```
[' ceramic tile' ' concrete' ' granite' ' indoor/outdoor' ' laminate'
 ' mexican tile' ' natural stone' ' other' ' other: 20 x 20 on diagonal'
 ' other: acrylic overlay' ' other: bamboo' ' other: brazilian pergo'
 ' other: brick' ' other: brick floor' ' other: brick in studio'
 ' other: brick inlayed' ' other: brick pavers' ' other: canterra stone'
 ' other: carpet bedrooms only' ' other: carpet- guest house'
 ' other: concrete tile' ' other: cork' ' other: custom saltillo'
 ' other: dyed concrete' ' other: egytian sandstone' ' other: eng wood'
 ' other: engineered wood' ' other: flagstone' ' other: gray saltillo'
 ' other: hardwood' ' other: high end laminate'
 ' other: itailian porclaine' ' other: italian tile' ' other: lime stone'
 ' other: limestone' ' other: lux vinyl' ' other: marble'
 ' other: marble-master bath' ' other: master bedroom/ tile'
 ' other: mesquite wood floors' ' other: new plank tile'
 ' other: new wood plank tile' ' other: organic wool carpet'
 ' other: parquet' ' other: pergo' ' other: plank tile'
 ' other: polished concrete' ' other: porcelain'
 ' other: porcelain plank tile' ' other: porcelain tile'
 ' other: porcelain tile 24x24' ' other: porcelain wood tile'
 ' other: porcelain-wood' ' other: porcelain/engineered'
 ' other: porclain tile' ' other: real polishd aggrgt' ' other: red brick'
 ' other: refinished brick' ' other: rojo concrete overla'
 ' other: saltillo' ' other: san marcos mex tile'
 ' other: scored concrete' ' other: see remarks' ' other: slate'
 ' other: slate tile' ' other: stained concrete' ' other: studio laminate'
 ' other: talavera floors' ' other: terrazzo' ' other: throughout home'
 ' other: tile bathrooms' ' other: tile/powder rm' ' other: travertine'
 ' other: travertine & slate' ' other: travertine accents'
 ' other: travertine entry' ' other: travertine tile'
 ' other: travertine/flagstone' ' other: travertine/marble'
 ' other: upg flooring' ' other: vinyl plank' ' other: vinyl planks'
 ' other: wood laminate' ' other: wood laminate water' ' other: wood like'
 ' other: wood plan laminate' ' vinyl' ' wood' 'carpet' 'ceramic tile'
 'concrete' 'laminate' 'mexican tile' 'natural stone' 'other'
 'other: 100% porcelain tile' 'other: brick' 'other: flagstone'
 'other: italian tile' 'other: luxury vinyl' 'other: none'
 'other: polish concrete' 'other: porcelain' 'other: porcelain tile'
 'other: porcelyn' 'other: quartzite' 'other: recycled porcelain'
 'other: saltillo tile' 'other: tbd' 'other: tile' 'other: tile-other'
 'other: travertine' 'wood']
```

In [66]:
```
df.head()
```

Out[66]:

	MLS	sold_price	zipcode	longitude	latitude	lot_acres	taxes	year_built	bedrooms	bathrooms	sqrt_ft	garage	kitcher
3	21919321	4500000.0	85646	-111.035925	31.645878	636.67	8418.58	1930	7	5.0	9019.0	4.0	D Dc Par
4	21306357	3411450.0	85750	-110.813768	32.285162	3.21	15393.00	1995	4	6.0	6396.0	3.0	D Refrige
5	21528016	3250000.0	85718	-110.910593	32.339090	1.67	27802.84	1999	3	4.0	6842.0	3.0	D Refrige
6	21610478	2400000.0	85712	-110.883315	32.261069	2.10	19038.42	2001	9	8.0	12025.0	4.0	D Disp
7	21211741	2500000.0	85750	-110.861002	32.331603	1.07	21646.00	2011	6	8.0	8921.0	4.0	C D Freeze

In [ ]: