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PYTN-07

Assignment 1

Preprocessing

In [1]:
```python
# Import Libraries
import math
import statistics
import numpy as np
import scipy.stats
import pandas as pd
import matplotlib.pyplot as plt
import datetime
import string
from sklearn.impute import KNNImputer
import statsmodels.api as sm
import seaborn as sns

%matplotlib inline

import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```python
# Membaca Dataset
df_nyc = pd.read_csv('nyc-rolling-sales.csv.zip', skipinitialspace=True)
df_nyc
```

Out[2]:

	Unnamed: 0	BOROUGH	NEIGHBORHOOD	BUILDING CLASS CATEGORY	TAX CLASS AT PRESENT	BLOCK	LOT	EASE-MENT	BUILDING CLASS AT PRESENT	ADDRESS	...	RESIDENTIAL UNITS	COMM
0	4	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	392	6	NaN	C2	153 AVENUE B	...	5	
1	5	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2	399	26	NaN	C7	234 EAST 4TH STREET	...	28	
2	6	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2	399	39	NaN	C7	197 EAST 3RD STREET	...	16	
3	7	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2B	402	21	NaN	C4	154 EAST 7TH STREET	...	10	
4	8	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	404	55	NaN	C2	301 EAST 10TH STREET	...	6	
...	...	...	...	...	...	...	...	...	...	...	...	...	
84543	8409	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	34	NaN	B9	37 QUAIL LANE	...	2	
84544	8410	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	78	NaN	B9	32 PHEASANT LANE	...	2	
84545	8411	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7351	60	NaN	B2	49 PITNEY AVENUE	...	2	
84546	8412	5	WOODROW	22 STORE BUILDINGS	4	7100	28	NaN	K6	2730 ARTHUR KILL ROAD	...	0	
84547	8413	5	WOODROW	35 INDOOR PUBLIC AND CULTURAL FACILITIES	4	7105	679	NaN	P9	155 CLAY PIT ROAD	...	0	

84548 rows × 22 columns

In [3]:
```python
df_nyc.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 84548 entries, 0 to 84547
Data columns (total 22 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   Unnamed: 0                      84548 non-null  int64
 1   BOROUGH                         84548 non-null  int64
 2   NEIGHBORHOOD                    84548 non-null  object
 3   BUILDING CLASS CATEGORY         84548 non-null  object
 4   TAX CLASS AT PRESENT            83810 non-null  object
 5   BLOCK                           84548 non-null  int64
 6   LOT                             84548 non-null  int64
 7   EASE-MENT                       0 non-null      float64
 8   BUILDING CLASS AT PRESENT       83810 non-null  object
 9   ADDRESS                         84548 non-null  object
 10  APARTMENT NUMBER                19052 non-null  object
 11  ZIP CODE                        84548 non-null  int64
 12  RESIDENTIAL UNITS               84548 non-null  int64
 13  COMMERCIAL UNITS                84548 non-null  int64
 14  TOTAL UNITS                     84548 non-null  int64
 15  LAND SQUARE FEET                84548 non-null  object
 16  GROSS SQUARE FEET               84548 non-null  object
 17  YEAR BUILT                      84548 non-null  int64
 18  TAX CLASS AT TIME OF SALE       84548 non-null  int64
 19  BUILDING CLASS AT TIME OF SALE  84548 non-null  object
 20  SALE PRICE                      84548 non-null  object
 21  SALE DATE                       84548 non-null  object
dtypes: float64(1), int64(10), object(11)
memory usage: 14.2+ MB
```

In [4]:
```python
def check_missing_value(a):
    print(a.isnull().sum().sort_values(ascending=False))

check_missing_value(df_nyc)
```

```
EASE-MENT                         84548
APARTMENT NUMBER                  65496
TAX CLASS AT PRESENT                738
BUILDING CLASS AT PRESENT           738
Unnamed: 0                            0
COMMERCIAL UNITS                      0
SALE PRICE                            0
BUILDING CLASS AT TIME OF SALE        0
TAX CLASS AT TIME OF SALE             0
YEAR BUILT                            0
GROSS SQUARE FEET                     0
LAND SQUARE FEET                      0
TOTAL UNITS                           0
ZIP CODE                              0
RESIDENTIAL UNITS                     0
BOROUGH                               0
ADDRESS                               0
LOT                                   0
BLOCK                                 0
BUILDING CLASS CATEGORY               0
NEIGHBORHOOD                          0
SALE DATE                             0
dtype: int64
```

In [5]:
```python
#Menghapus kolom yang tidak diperlukan

no = ['Unnamed: 0', 'EASE-MENT', 'ADDRESS', 'APARTMENT NUMBER', 'ZIP CODE']
df_nyc.drop(no, axis=1, inplace=True)
```

In [6]:
```python
#Mengubah Tipe Kolom

#Tipe kolom 'SALE PRICE' harus numerik dan missing value akan di-replace dengan NaN
df_nyc['SALE PRICE'] = pd.to_numeric(df_nyc['SALE PRICE'], errors='coerce')

# Tipe kolom 'LAND SQUARE FEET' dan 'GROSS SQUARE FEET' harus numerik
df_nyc['LAND SQUARE FEET'] = pd.to_numeric(df_nyc['LAND SQUARE FEET'], errors='coerce')
df_nyc['GROSS SQUARE FEET'] = pd.to_numeric(df_nyc['GROSS SQUARE FEET'], errors='coerce')

# Tipe kolom 'SALE DATE' harus datetime
df_nyc['SALE DATE'] = pd.to_datetime(df_nyc['SALE DATE'], errors='coerce')

# Tipe kolom dibawah harus caregorical
categorical = ['NEIGHBORHOOD', 'BUILDING CLASS CATEGORY', 'TAX CLASS AT PRESENT', 'BUILDING CLASS AT PRESENT',
         'BUILDING CLASS AT TIME OF SALE', 'TAX CLASS AT TIME OF SALE']
for col in categorical:
    df_nyc[col] = df_nyc[col].astype('category')
```

In [7]:
```python
df_nyc.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 84548 entries, 0 to 84547
Data columns (total 17 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   BOROUGH                         84548 non-null  int64
 1   NEIGHBORHOOD                    84548 non-null  category
 2   BUILDING CLASS CATEGORY         84548 non-null  category
 3   TAX CLASS AT PRESENT            83810 non-null  category
 4   BLOCK                           84548 non-null  int64
 5   LOT                             84548 non-null  int64
 6   BUILDING CLASS AT PRESENT       83810 non-null  category
 7   RESIDENTIAL UNITS               84548 non-null  int64
 8   COMMERCIAL UNITS                84548 non-null  int64
 9   TOTAL UNITS                     84548 non-null  int64
 10  LAND SQUARE FEET                58296 non-null  float64
 11  GROSS SQUARE FEET               56936 non-null  float64
 12  YEAR BUILT                      84548 non-null  int64
 13  TAX CLASS AT TIME OF SALE       84548 non-null  category
 14  BUILDING CLASS AT TIME OF SALE  84548 non-null  category
 15  SALE PRICE                      69987 non-null  float64
 16  SALE DATE                       84548 non-null  datetime64[ns]
dtypes: category(6), datetime64[ns](1), float64(3), int64(7)
memory usage: 7.8 MB
```

In [8]:
```python
df_nyc
```

Out[8]:

	BOROUGH	NEIGHBORHOOD	BUILDING CLASS CATEGORY	TAX CLASS AT PRESENT	BLOCK	LOT	BUILDING CLASS AT PRESENT	RESIDENTIAL UNITS	COMMERCIAL UNITS	TOTAL UNITS	LAND SQUARE FEET	GROSS SQUARE FEET
0	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	392	6	C2	5	0	5	1633.0	6440.0
1	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2	399	26	C7	28	3	31	4616.0	18690.0
2	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2	399	39	C7	16	1	17	2212.0	7803.0
3	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2B	402	21	C4	10	0	10	2272.0	6794.0
4	1	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	404	55	C2	6	0	6	2369.0	4615.0
...	...	...	...	...	...	...	...	...	...	...	...	...
84543	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	34	B9	2	0	2	2400.0	2575.0
84544	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	78	B9	2	0	2	2498.0	2377.0
84545	5	WOODROW	02 TWO FAMILY DWELLINGS	1	7351	60	B2	2	0	2	4000.0	1496.0
84546	5	WOODROW	22 STORE BUILDINGS	4	7100	28	K6	0	7	7	208033.0	64117.0
84547	5	WOODROW	35 INDOOR PUBLIC AND CULTURAL FACILITIES	4	7105	679	P9	0	1	1	10796.0	2400.0

84548 rows × 17 columns

In [9]:
```python
# Cek data duplikat
sum(df_nyc.duplicated())
```

Out[9]: 959

In [10]:
```python
# Hapus data duplikat
df_nyc = df_nyc.drop_duplicates(df_nyc.columns, keep='last')
```

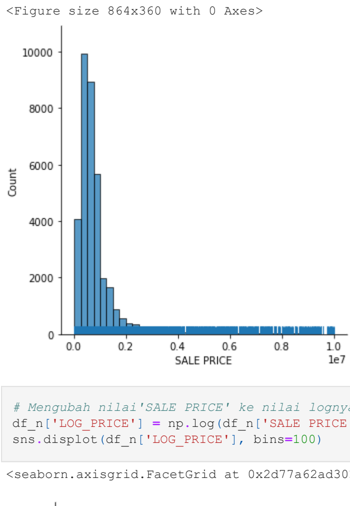
In [11]:
```python
sum(df_nyc.duplicated())
```

Out[11]: 0

In [12]:
```python
# Menghilangkan value yang berisi null
df_nyc = df_nyc[df_nyc['LAND SQUARE FEET'].notnull()]
df_nyc = df_nyc[df_nyc['GROSS SQUARE FEET'].notnull()]
df_nyc = df_nyc[df_nyc['SALE PRICE'].notnull()]
```

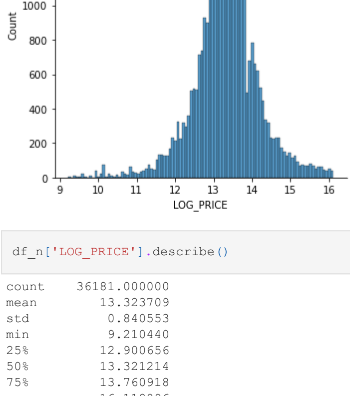
In [13]:
```python
#Melihat distribusi data
plt.figure(figsize=(12,5))
sns.displot(df_nyc['SALE PRICE'], bins=40, rug=True)
plt.show()
```

```
<Figure size 864x360 with 0 Axes>
```



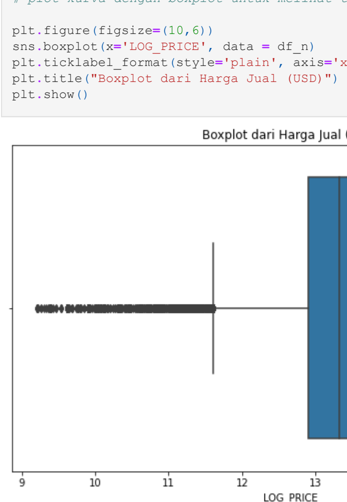
In [14]:
```python
#Menghilangkan outliers
df_n = df_nyc[(df_nyc['SALE PRICE'] > 10000) & (df_nyc['SALE PRICE'] < 10000000)]

plt.figure(figsize=(12,5))
sns.displot(df_n['SALE PRICE'], bins=40, rug=True)
plt.show()
```

```
<Figure size 864x360 with 0 Axes>
```



In [15]:
```python
# Mengubah nilai'SALE PRICE' ke nilai lognya
df_n['LOG_PRICE'] = np.log(df_n['SALE PRICE'])
sns.displot(df_n['LOG_PRICE'], bins=100)
```

Out[15]: <seaborn.axisgrid.FacetGrid at 0x2d77a62ad30>

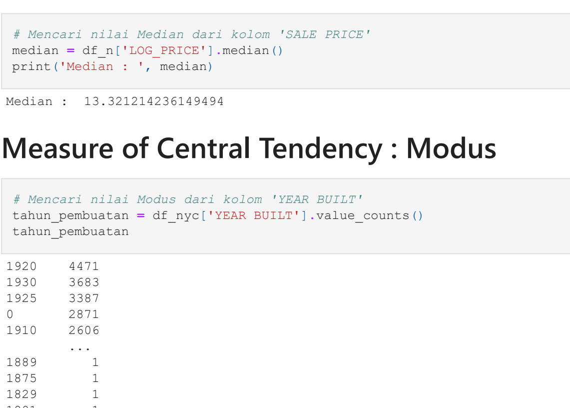


In [16]:
```python
df_n['LOG_PRICE'].describe()
```

Out[16]:
```
count    36181.000000
mean        13.323709
std          0.840553
min          9.210440
25%         12.900656
50%         13.321214
75%         13.760918
max         16.118096
Name: LOG_PRICE, dtype: float64
```

Data sudah berdistribusi normal sehingga data siap digunakan

In [17]:
```python
# plot kurva dengan boxplot untuk melihat tampilan lain dari data

plt.figure(figsize=(10,6))
sns.boxplot(x='LOG_PRICE', data = df_n)
plt.ticklabel_format(style='plain', axis='x')
plt.title("Boxplot dari Harga Jual (USD)")
plt.show()
```



Measure of Central Tendency : Mean

In [18]:
```python
# Mencari nilai Mean dari kolom 'SALE PRICE'
mean = df_n['LOG_PRICE'].mean()
print('Mean : ', mean)
```

```
Mean :  13.323709361183091
```

Measure of Central Tendency : Median

In [19]:
```python
# Mencari nilai Median dari kolom 'SALE PRICE'
median = df_n['LOG_PRICE'].median()
print('Median : ', median)
```

```
Median :  13.321214236149494
```

Measure of Central Tendency : Modus

In [20]:
```python
# Mencari nilai Modus dari kolom 'YEAR BUILT'
tahun_pembuatan = df_nyc['YEAR BUILT'].value_counts()
tahun_pembuatan
```

Out[20]:
```
1920    4471
1930    3683
1925    3387
0       2871
1910    2606
        ...
1889       1
1875       1
1829       1
1891       1
1851       1
Name: YEAR BUILT, Length: 151, dtype: int64
```

Diketahui bahwa modus dari 'YEAR BUILT' adalah tahun 1920

Measure of Spread : Range

In [21]:
```python
# Mencari Range dari kolom 'YEAR BUILT'
maxi = tahun_pembuatan.max()
print('Nilai maximal : ', maxi)
mini = tahun_pembuatan.min()
print('Nilai minimal : ', mini)
range = maxi - mini
print('Range : ', range)
```

```
Nilai maximal :  4471
Nilai minimal :  1
Range :  4470
```

Measure of Spread : Variance

In [22]:
```python
# Mencari variance dari kolom 'SALE PRICE'
variance = df_n['LOG_PRICE'].var()
print('Variance : ', variance)
```

```
Variance :  0.7065287124016151
```

Measure of Spread : Standard Deviation

In [23]:
```python
# Mencari standard deviation dari kolom 'SALE PRICE'
std = np.sqrt(variance)
print('Standard Deviation : ', std)
```

```
Standard Deviation :  0.8405526232197572
```

In [24]:
```python
# Cara lain
std1 = df_n['LOG_PRICE'].std()
print('Standard Deviation : ', std1)
```

```
Standard Deviation :  0.8405526232197572
```

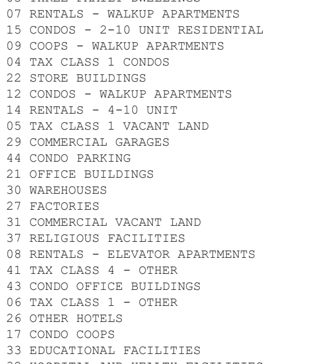
Probability Distribution

In [25]:
```python
# Import Libraries
%matplotlib inline
import matplotlib.pyplot as plt
from IPython.display import Math, Latex
from IPython.core.display import Image
import numpy as np

import seaborn as sns
sns.set(color_codes = True)
sns.set(rc={'figure.figsize':(5,5)})
```

In [26]:
```python
# Distribusi dari nilai log 'SALE PRICE'
print(df_n['LOG_PRICE'].skew())
sns.distplot(df_n['LOG_PRICE'], bins=100)
```

```
-0.26418219250538066
```

Out[26]: <AxesSubplot:xlabel='LOG_PRICE', ylabel='Density'>



In [27]:
```python
df_n['LOG_PRICE'].mean()
```

Out[27]: 13.323709361183091

Distribusi dari 'LOG_PRICE' adalah distribui normal karena memiliki kurva kerapatan berbentuk lonceng, simetris, berpusat di sekitar meannya, dengan penyebarannya ditentukan oleh deviasi standarnya yang menunjukkan bahwa data di dekat mean lebih sering terjadi daripada data yang jauh dari mean.

In [28]:
```python
df_n['BUILDING CLASS CATEGORY'].value_counts()
```

Out[28]:
```
01 ONE FAMILY DWELLINGS                         12543
02 TWO FAMILY DWELLINGS                          9736
10 COOPS - ELEVATOR APARTMENTS                   2834
13 CONDOS - ELEVATOR APARTMENTS                  2689
03 THREE FAMILY DWELLINGS                        2293
07 RENTALS - WALKUP APARTMENTS                   1608
15 CONDOS - 2-10 UNIT RESIDENTIAL                 778
09 COOPS - WALKUP APARTMENTS                      547
04 TAX CLASS 1 CONDOS                             543
22 STORE BUILDINGS                                429
12 CONDOS - WALKUP APARTMENTS                     370
14 RENTALS - 4-10 UNIT                            311
05 TAX CLASS 1 VACANT LAND                        225
29 COMMERCIAL GARAGES                             219
44 CONDO PARKING                                  160
21 OFFICE BUILDINGS                               148
30 WAREHOUSES                                     143
27 FACTORIES                                       94
31 COMMERCIAL VACANT LAND                          77
37 RELIGIOUS FACILITIES                            58
08 RENTALS - ELEVATOR APARTMENTS                   58
41 TAX CLASS 4 - OTHER                             36
43 CONDO OFFICE BUILDINGS                          32
06 TAX CLASS 1 - OTHER                             32
26 OTHER HOTELS                                    31
17 CONDO COOPS                                     31
33 EDUCATIONAL FACILITIES                          21
32 HOSPITAL AND HEALTH FACILITIES                  19
46 CONDO STORE BUILDINGS                           17
16 CONDOS - 2-10 UNIT WITH COMMERCIAL UNIT         15
35 INDOOR PUBLIC AND CULTURAL FACILITIES           14
23 LOFT BUILDINGS                                  11
47 CONDO NON-BUSINESS STORAGE                      11
38 ASYLUMS AND HOMES                               11
48 CONDO TERRACES/GARDENS/CABANAS                  10
11A CONDO-RENTALS                                   9
49 CONDO WAREHOUSES/FACTORY/INDUS                   7
42 CONDO CULTURAL/MEDICAL/EDUCATIONAL/ETC           2
28 COMMERCIAL CONDOS                                2
36 OUTDOOR RECREATIONAL FACILITIES                  2
34 THEATRES                                         2
11 SPECIAL CONDO BILLING LOTS                       1
45 CONDO HOTELS                                     1
39 TRANSPORTATION FACILITIES                        1
40 SELECTED GOVERNMENTAL FACILITIES                 0
25 LUXURY HOTELS                                    0
18 TAX CLASS 3 - UNTILITY PROPERTIES                0
Name: BUILDING CLASS CATEGORY, dtype: int64
```

In [29]:
```python
sum(df_n['BUILDING CLASS CATEGORY'].value_counts())
```

Out[29]: 36181

In [30]:
```python
# Menghitung Distribusi Peluang HOSPITAL AND HEALTH FACILITIES dari BUILDING CLASS CATEGORY
P_h = 19/36181
print('DIstribusi Peluang HOSPITAL AND HEALTH FACILITIES dari BUILDING CLASS CATEGORY adalah :', P_h)
```

```
DIstribusi Peluang HOSPITAL AND HEALTH FACILITIES dari BUILDING CLASS CATEGORY adalah : 0.0005251375031093668
```

Confidence Interval

In [31]:
```python
# Menghitung CI HOSPITAL AND HEALTH FACILITIES dari Building Class Category
```

In [32]:
```python
# Populasi Building Class Category
n = 36181

# Proporsi HOSPITAL AND HEALTH FACILITIES dari Building Class Category
P_h = 19/36181
P_h
```

Out[32]: 0.0005251375031093668

In [33]:
```python
# Standard Error
se_h = np.sqrt(P_h * (1-P_h)/n)
se_h
```

Out[33]: 0.00012044316858547533

In [34]:
```python
# Menghitung CI menggunakan rumus diatas dengan z-score adalah 1.96 untuk confidence interval 95%
z_score = 1.96
lcb = P_h - z_score*se_h #lower limit dari CI
ucb = P_h + z_score*se_h #Upper limit dari CI

lcb,ucb
```

Out[34]: (0.0002890688926818352, 0.0007612061135368985)

In [35]:
```python
# Cara lain
sm.stats.proportion_confint(n*P_h, n)
```

Out[35]: (0.0002890732304979491, 0.0007612017757207846)

Jadi, Convidence Interval HOSPITAL AND HEALTH FACILITIES dari Building Class Category adalah (0.0002890732304979491, 0.0007612017757207846)

Hypothesis Testing

In [36]:
```python
# Memperbaiki Kolom 'BOROUGH
df_n['BOROUGH'] = df_n['BOROUGH'].astype(str)
df_n['BOROUGH'] = df_n['BOROUGH'].str.replace('1','Manhattan')
df_n['BOROUGH'] = df_n['BOROUGH'].str.replace('2','Bronx')
df_n['BOROUGH'] = df_n['BOROUGH'].str.replace('3','Brooklyn')
df_n['BOROUGH'] = df_n['BOROUGH'].str.replace('4','Queens')
df_n['BOROUGH'] = df_n['BOROUGH'].str.replace('5','Staten Island')
```

In [37]:
```python
df_n
```

Out[37]:

	BOROUGH	NEIGHBORHOOD	BUILDING CLASS CATEGORY	TAX CLASS AT PRESENT	BLOCK	LOT	BUILDING CLASS AT PRESENT	RESIDENTIAL UNITS	COMMERCIAL UNITS	TOTAL UNITS	LAND SQUARE FEET	GROSS SQUARE FEET
0	Manhattan	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	392	6	C2	5	0	5	1633.0	6440.0
3	Manhattan	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2B	402	21	C4	10	0	10	2272.0	6794.0
4	Manhattan	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2A	404	55	C2	6	0	6	2369.0	4615.0
6	Manhattan	ALPHABET CITY	07 RENTALS - WALKUP APARTMENTS	2B	406	32	C4	8	0	8	1750.0	4226.0
172	Manhattan	ALPHABET CITY	14 RENTALS - 4-10 UNIT	2A	391	19	S3	3	1	4	1520.0	3360.0
...	...	...	...	...	...	...	...	...	...	...	...	...
84541	Staten Island	WOODROW	02 TWO FAMILY DWELLINGS	1	7317	126	B2	2	0	2	11088.0	2160.0
84543	Staten Island	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	34	B9	2	0	2	2400.0	2575.0
84544	Staten Island	WOODROW	02 TWO FAMILY DWELLINGS	1	7349	78	B9	2	0	2	2498.0	2377.0
84545	Staten Island	WOODROW	02 TWO FAMILY DWELLINGS	1	7351	60	B2	2	0	2	4000.0	1496.0
84547	Staten Island	WOODROW	35 INDOOR PUBLIC AND CULTURAL FACILITIES	4	7105	679	P9	0	1	1	10796.0	2400.0

36181 rows × 18 columns

In [38]:
```python
df_bor = df_n.groupby('BOROUGH', axis=0).sum()
df_bor
```

Out[38]:

BOROUGH	BLOCK	LOT	RESIDENTIAL UNITS	COMMERCIAL UNITS	TOTAL UNITS	LAND SQUARE FEET	GROSS SQUARE FEET	YEAR BUILT	SALE PRICE	LOG_PRICE
Bronx	20929685	1487147	10683	526	11212	13502440.0	12851539.0	8833109	2.923204e+09	63169.173827
Brooklyn	63463621	5690738	23744	1428	25375	23991850.0	24391594.0	26728528	1.562624e+10	203589.977077
Manhattan	876068	32354	7358	543	7894	2204614.0	10866383.0	1160509	2.638975e+09	9004.625369
Queens	85826759	579994	20866	3417	24275	40616295.0	26792130.0	20701090	8.010454e+09	142267.883682
Staten Island	16527557	402935	6651	478	7123	28930572.0	11450310.0	9640993	2.628729e+09	64033.468442

Berdasarkan dataset diatas, apakah total unit rata-rata per penjualan pada borough Brooklyn lebih besar secara signifikan daripada Queens

- H0 : tidak ada perbedaan secara signifikan pada total unit rata-rata per penjualan antara borough Brooklyn dan Queens
- H1 : Terdapat perbedaan secara signifikan pada total unit rata-rata per penjualan antara borough Brooklyn dan Queens

In [39]:
```python
Brooklyn = df_n[df_n['BOROUGH']=='Brooklyn']
Queens = df_n[df_n['BOROUGH']=='Queens']
```

In [40]:
```python
total_unit_Q = df_bor.iloc[-2, 4]
mu_Q = Queens['TOTAL UNITS'].mean()
std_Q = Queens['TOTAL UNITS'].std()
total_unit_Q, mu_Q, std_Q
```

Out[40]: (24275, 2.273152916939788, 29.12838869550192)

In [41]:
```python
total_unit_B = df_bor.iloc[-4, 4]
mu_B = Brooklyn['TOTAL UNITS'].mean()
std_B = Brooklyn['TOTAL UNITS'].std()
total_unit_B, mu_B, std_B
```

Out[41]: (25375, 1.6833620804033436, 4.370729519754011)

In [45]:
```python
from statsmodels.stats.weightstats import ztest
ztest, pval= ztest(Brooklyn['TOTAL UNITS'],Queens['TOTAL UNITS'])
print("pval: ",float(pval))
if pval<0.05:
    print("Karena p-value lebih rendah dari significance level yang kita tentukan yaitu 0.05. Jadi, kita Tolak
else:
    print("Karena p-value lebih besar sama dengan significance level yang kita tentukan yaitu 0.05. Jadi, kita
```

```
pval:  0.014389036830450569
Karena p-value lebih rendah dari significance level yang kita tentukan yaitu 0.05. Jadi, kita Tolak H0
```

Di sini p-value lebih rendah dari significance level yang kita tentukan yaitu 0.05. Jadi, kita reject the null hypothesis. Artinya, terdapat perbedaan yang signifikan pada total unit rata-rata per penjualan antara borough Brooklyn dan Queens