

# Real Estate Capstone Project By Muzamil

## Project Task: Week 1

### Data Import and Preparation:

#### Import data.

```
In [1]: import pandas as pd
        fpd.set_option('display.max_rows',None)
        pd.set_option('display.max_columns',None)

In [2]: df_train=pd.read_csv('train.csv')
        df_combined=df_train.append(df_test, ignore_index=True)

In [3]: df_train.head()
```

	UID	BLOCKID	SUMLEVEL	COUNTYID	STATEID	state	state_ab	city	place	type	primary	zip_code	area_code	lat	lon
0	267822	NaN	140	53	36	New York	NY	Hamilton	Hamilton	City	tract	13346	315	42.840812	-75.5011
1	246444	NaN	140	141	18	Indiana	IN	South Bend	Roseland	City	tract	46616	574	41.701441	-86.2664
2	245683	NaN	140	63	18	Indiana	IN	Danville	Danville	City	tract	46122	317	39.792202	-86.5151
3	279653	NaN	140	127	72	Puerto Rico	PR	San Juan	Guaynabo	Urban	tract	927	787	18.396103	-66.1041
4	247218	NaN	140	161	20	Kansas	KS	Manhattan	Manhattan	City	tract	66502	785	39.195573	-96.5691

```
In [4]: df_test.head()
```

	UID	BLOCKID	SUMLEVEL	COUNTYID	STATEID	state	state_ab	city	place	type	primary	zip_code	area_code	lat	lon
0	255504	NaN	140	163	26	Michigan	MI	Detroit	Dearborn Heights	City	CDP	tract	48239	313	4
1	252676	NaN	140	1	23	Maine	ME	Auburn	Auburn	City	tract	44210	207	4	
2	276314	NaN	140	15	42	Pennsylvania	PA	Pine City	Millerton	Borough	City	tract	14871	607	4
3	248614	NaN	140	231	21	Kentucky	KY	Monticello	Monticello	City	tract	42633	606	3	
4	286685	NaN	140	355	48	Texas	TX	Corpus Christi	Edroy	Town	tract	78410	361	2	

```
In [5]: df_train.shape
Out[5]: (27321, 80)

In [6]: df_test.shape
Out[6]: (11709, 80)

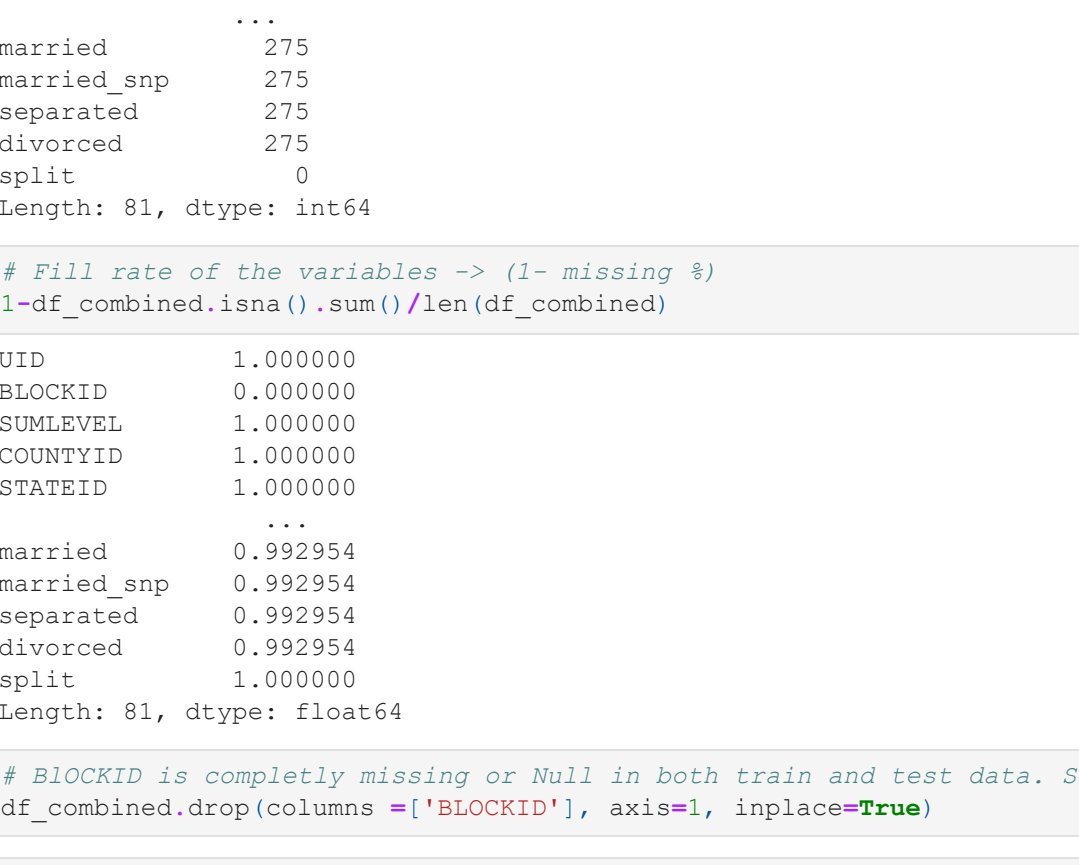
Figure out the primary key and look for the requirement of indexing.
```

```
In [7]: len(set(df_train['UID']).intersection(set(df_test['UID'])))
Out[7]: 123

So here 123 common UID in train and test data.
```

```
In [8]: df_train.dtypes
Out[8]: UID          int64
        BLOCKID   float64
        SUMLEVEL   int64
        COUNTYID   int64
        STATEID    float64
        pct_own     float64
        married     float64
        married_snp float64
        separated   float64
        divorced    float64
        split        dtype: object
        Length: 80, dtype: object

In [9]: df_train.dtypes.value_counts().plot(kind='bar')
Out[9]: <AxesSubplot>
```



```
In [10]: df_train.describe(include='O')
Out[10]:
```

	state	state_ab	city	place	type	primary
count	27321	27321	27321	27321	27321	27321
unique	52	52	6916	9912	6	1
top	California	CA	Chicago	New York City	City	tract
freq	2926	2926	294	490	15237	27321

Gauge the fill rate of the variables and devise plans for missing value treatment. Please explain explicitly the reason for the treatment chosen for each variable.

```
In [11]: #This flag will help us split the data back later
        df_train['split']=='Train'
        df_test['split']=='Test'

In [12]: df_combined=df_train.append(df_test, ignore_index=True)
        df_combined.head()
```

	UID	BLOCKID	SUMLEVEL	COUNTYID	STATEID	state	state_ab	city	place	type	primary	zip_code	area_code	lat	lon
0	267822	NaN	140	53	36	New York	NY	Hamilton	Hamilton	City	tract	13346	315	42.840812	-75.5011
1	246444	NaN	140	141	18	Indiana	IN	South Bend	Roseland	City	tract	46616	574	41.701441	-86.2664
2	245683	NaN	140	63	18	Indiana	IN	Danville	Danville	City	tract	46122	317	39.792202	-86.5151
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4	247218	NaN	140	161	20	Kansas	KS	Manhattan	Manhattan	City	tract	66502	785	39.195573	-96.5691

```
In [13]: df_combined.shape
Out[13]: (39030, 81)

In [14]: df_combined.isna().sum()
Out[14]: UID          0
        BLOCKID  39030
        SUMLEVEL  0
        COUNTYID  0
        STATEID  0
        married    275
        married_snp 275
        separated  275
        divorced   270
        split       0
        Length: 81, dtype: int64

In [15]: # Fill rate of the variables -> (1 - missing %)
        df_combined.isna().sum()/(len(df_combined))
Out[15]: UID          1.000000
        BLOCKID  1.000000
        SUMLEVEL  1.000000
        COUNTYID  1.000000
        STATEID  1.000000
        married    0.992954
        married_snp 0.992954
        separated  0.992954
        divorced   0.992954
        split       1.000000
        Length: 81, dtype: float64

In [16]: #<div>df_combined</div> is missing or Null in both train and test data. So we will drop BLOCKID feature.
        df_combined.drop(columns=['BLOCKID'], axis=1, inplace=True)

In [17]: df_combined.isna().sum()/(len(df_combined))*100
Out[17]: UID          0.000000
        SUMLEVEL  0.000000
        COUNTYID  0.000000
        STATEID  0.000000
        state     0.000000
        married   0.704586
        married_snp 0.704586
        separated  0.704586
        divorced   0.704586
        split      0.000000
        Length: 80, dtype: float64

In [18]: # Missing value greater than zero
        col_check=df_combined.isna().sum() to frame().reset_index()
        null_col=col_check[col_check[0]>0][0]['index'].tolist()
        null_col
```

'rent_mean',
'rent_median',
'rent_stddev',
'rent_sample_weight',
'rent_samples',
'rent_gt_10',
'rent_gt_15',
'rent_gt_20',
'rent_gt_25',
'rent_gt_30',
'rent_gt_35',
'rent_gt_40',
'rent_gt_50',
'hi_mean',
'hi_median',
'hi_stddev',
'hi_sample_weight',
'hi_samples',
'family_mean',
'family_median',
'family_stddev',
'family_sample_weight',
'family_samples',
'hc_mortgage_mean',
'hc_mortgage_median',
'hc_mortgage_stddev',
'hc_mortgage_sample_weight',
'hc_mortgage_samples',
'hc_mean',
'hc_median',
'hc_stddev',
'hc_samples',
'hc_sample_weight',
'home_equity_second_mortgage',
'second_mortgage',
'home_equity',
'debt',
'second_mortgage_cdf',
'debt_cdf',
'hs_degree',
'hs_degree_male',
'hs_degree_female',
'male_age_mean',
'male_age_median',
'male_age_stddev',
'male_age_sample_weight',
'male_age_samples',
'female_age_mean',
'female_age_median',
'female_age_stddev',
'female_age_sample_weight',
'female_age_samples',
'pct_own',
'married',
'married_snp',
'separated',
'divorced'

```
In [19]: #If the feature have less than 8 unique value then I am considering as categorical else it will be continuous
        for i in null_col:
            if df_combined[i].nunique()>8: #Continuous data
                df_combined[i].fillna(df_combined[i].mode()[0],inplace=True) #Bco median is not impacted by outlier
            else:df_combined[i].fillna(df_combined[i].mode()[0],inplace=True) #Categorical data

        rent_mean
        rent_median
        rent_stddev
        rent_sample_weight
        rent_samples
        rent_gt_10
        rent_gt_15
        rent_gt_20
        rent_gt_25
        rent_gt_30
        rent_gt_35
        rent_gt_40
        rent_gt_50
        hi_mean
        hi_median
        hi_stddev
        hi_sample_weight
        hi_samples
        family_mean
        family_median
        family_stddev
        family_sample_weight
        family_samples
        hc_mortgage_mean
        hc_mortgage_median
        hc_mortgage_stddev
        hc_mortgage_sample_weight
        hc_mortgage_samples
        hc_mean
        hc_median
        hc_stddev
        hc_samples
        hc_sample_weight
        home_equity_second_mortgage
        second_mortgage
        home_equity
        debt
        second_mortgage_cdf
        debt_cdf
        hs_degree
        hs_degree_male
        hs_degree_female
        male_age_mean
        male_age_median
        male_age_stddev
        male_age_sample_weight
        male_age_samples
        female_age_mean
        female_age_median
        female_age_stddev
        female_age_sample_weight
        female_age_samples
        pct_own
        married
        married_snp
        separated
        divorced

In [20]: df_combined.isna().sum()/(len(df_combined))*100
Out[20]: UID          0.0
        SUMLEVEL  0.0
        COUNTYID  0.0
        STATEID  0.0
        state     0.0
        married   0.0
        married_snp 0.0
        separated  0.0
        divorced   0.0
        split      0.0
        Length: 80, dtype: float64

In [21]: df_combined.shape
Out[21]: (39030, 80)

In [22]: # Drop duplicate observations
        df_combined.drop_duplicates(inplace=True)
        df_combined.shape
Out[22]: (38838, 80)

In [23]: # As we have seen above we have 123 unique UID which are common in both train and test data.
        #So duplicate UID removing them.
        df_combined.drop_duplicates(subset=['UID'],inplace=True)
        df_combined.shape
Out[23]: (38715, 80)
```

### Exploratory Data Analysis (EDA):

**Perform debt analysis. You may take the following steps:**

- Explore the top 2,500 locations where the percentage of households with a 'second mortgage' is the highest and percent ownership is above 10 percent. Visualize using geo-map. You may keep the upper limit for the percent of households with a second mortgage to 50 percent

```
In [24]: top_2500_loc=df_train[(df_train['second_mortgage']<0.50) &
                             (df_train['pct_own']>0.10) ].sort_values(by='second_mortgage', ascending=False).head(2500)

In [25]: top_2500_loc=top_2500_loc[['state','city','state_ab','place','lat','lng']]
        top_2500_loc.head()
```

	state	city	state_ab	place	lat	lng
11980	Massachusetts	Worcester	MA	Worcester City	42.254262	-71.800347
26018	New York	Corona	NY	Harbor Hills	40.751809	-73.853582
7829	Maryland	Glen Burnie	MD	Glen Burnie	39.127273	-76.635265
2077	Florida	Tampa	FL	Egypt Lake-Ito	28.029063	-82.495395
1701	Illinois	Chicago	IL	Lincolnwood	41.967289	-87.652434

```
In [26]: !pip install geopandas
import warnings
warnings.filterwarnings('ignore')

Collecting geopandas
  Downloading geopandas-0.12.2-py3-none-any.whl (1.1 MB)
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Requirement already satisfied: numpy=>1.8.5 in c:\users\muzamilkhan\anaconda3\lib\site-packages (from geopandas)
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```



```
very low 38350
low 348
medium 12
high 4
very high 1
Name: pop_bins, dtype: int64
```

a. Analyze the married, separated, and divorced population for these population brackets

```
In [43]: df_combined.groupby(by='pop_bins')[['married','separated','divorced']].count()
```

Out[43]:

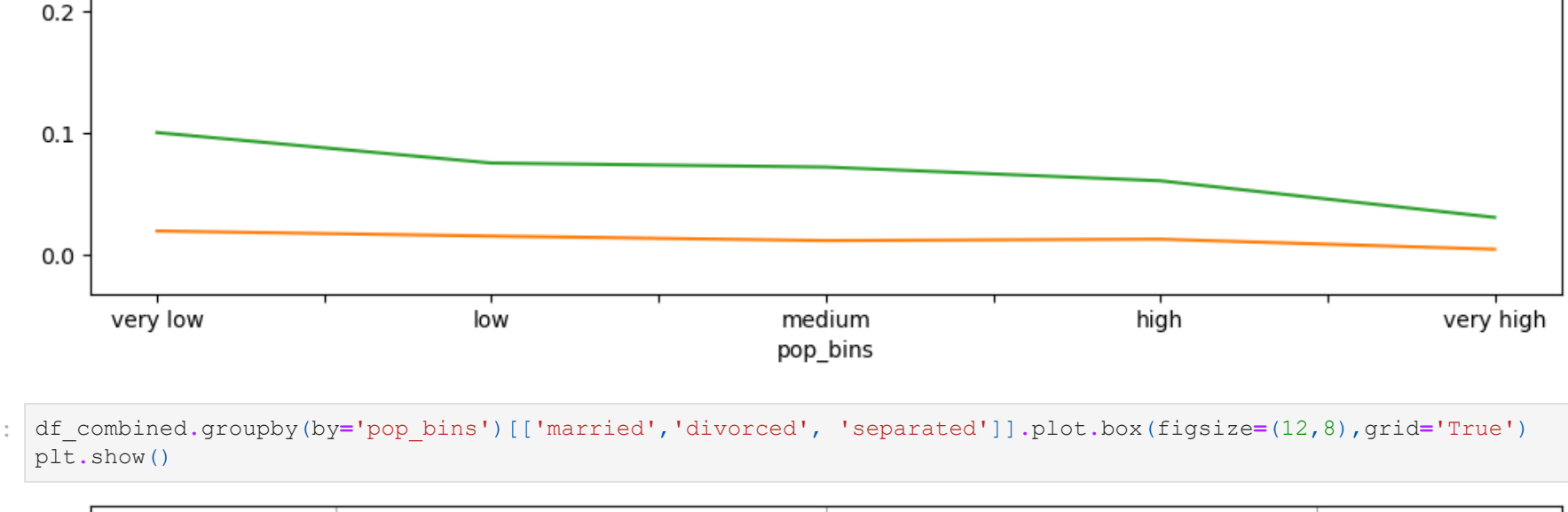
pop_bins	married	separated	divorced
very low	38350	38350	38350
low	348	348	348
medium	12	12	12
high	4	4	4
very high	1	1	1

```
In [44]: df_combined.groupby(by='pop_bins')[['married','separated','divorced']].agg(['mean','median'])
```

Out[44]:

	married	separated	divorced
	mean	median	mean
pop_bins			
very low	0.508000	0.526210	0.019127
low	0.589247	0.601815	0.014929
medium	0.617047	0.605765	0.01203
high	0.629132	0.675095	0.012372
very high	0.734740	0.734740	0.004050

b. Visualize using appropriate chart type



```
In [51]: df_combined.groupby(by='pop_bins')[['married','divorced','separated']].plot.box(figsize=(12,8),grid=True)
```

Out[51]:

