In [1]:

```
import pandas as pd                     # Pandas used to manipulate the dataset
import numpy as np                      # numpy is used to manipulate the Numerical and dimentional manipulation of
import math
import seaborn as sns                   # for visualization purpose using this seaborn
import matplotlib.pyplot as plt                 # for visualization purpose using this Matplotlib
%matplotlib inline
from sklearn.model_selection import train_test_split   # SCIKIT Learn is used to perform machine learning(Here
from sklearn.preprocessing import LabelEncoder
print("Libraries Loaded...")
```

```
Libraries Loaded...
```

In [2]:

```
train = pd.read_csv("train.csv")      # reading CSV file using pandas
train.head()
```

Out[2]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | NaN | 0 | 8 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [3]:

```
test  = pd.read_csv("test.csv")       # reading  CSV file using pandas
test.head()
```

Out[3]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | age | SQBescolari | SQBage | SQBhogar_total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_2f6873615 | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 4 | 0 | 16 | 9 |
| 1 | ID_1c78846d2 | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 41 | 256 | 1681 | 9 |
| 2 | ID_e5442cf6a | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 41 | 289 | 1681 | 9 |
| 3 | ID_a8db26a79 | NaN | 0 | 14 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 59 | 256 | 3481 | 1 |
| 4 | ID_a62966799 | 175000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 18 | 121 | 324 | 1 |

5 rows × 142 columns

In [4]:

```
train_df=pd.DataFrame(train)
train_df.head()
```

Out[4]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | NaN | 0 | 8 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

# Relevent Features used to predict the data

features=['rooms','v14a','refrig','abastaguano','sanitario1','lugar1','lugar2','lugar3','lugar4','lugar5','lugar6','area1','area2']

In [5]:

```
test_df=pd.DataFrame(test)
test_df.head()
```

Out[5]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | age | SQBescolari | SQBage | SQBhogar_total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_2f6873615 | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 4 | 0 | 16 | 9 |
| 1 | ID_1c78846d2 | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 41 | 256 | 1681 | 9 |
| 2 | ID_e5442cf6a | NaN | 0 | 5 | 0 | 1 | 1 | 0 | NaN | 1 | ... | 41 | 289 | 1681 | 9 |
| 3 | ID_a8db26a79 | NaN | 0 | 14 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 59 | 256 | 3481 | 1 |
| 4 | ID_a62966799 | 175000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 18 | 121 | 324 | 1 |

5 rows × 142 columns

# Understand the type of data

In [6]:

```
train_df.shape
```

Out[6]:

```
(9557, 143)
```

In [7]:

```
test_df.shape
```

Out[7]:

```
(23856, 142)
```

In [8]:

```
#train_df.info(verbose = True)
```

# Q1. Identify the output variable.

# "Target Column in the csv file Is the Output variable"

# Q7. Count how many null values are existing in columns

In [9]:

```
for i in train_df.columns:
    if train_df[i].isna().sum() >1:
        print('Total null values in\t',i,'= ',train_df[i].isna().sum())   # Summing all the null values
```

```
Total null values in     v2a1 =  6860
Total null values in     v18q1 =  7342
Total null values in     rez_esc =  7928
Total null values in     meaneduc =  5
Total null values in     SQBmeaned =  5
```

# Total number of missing values in the dataset

In [10]:

```
print("Total null values in the dataset",' = ',train_df.isna().sum().sum()) # Summing all the null values in wh
```

```
Total null values in the dataset  =  22140
```

# Missing Data Handlining

In [11]:

```
v2a1_mean=int(train_df['v2a1'].mean())
print("Mean value for v2a1 column = ", v2a1_mean)
print("\n\t\t\t\tReplacing the missing values with mean values of the column")
train_df['v2a1'].fillna(value=v2a1_mean,inplace=True)     # Replacing the missing values with mean values of the
train_df.head()
```

```
Mean value for v2a1 column =  165231

                                Replacing the missing values with mean values of the column
```

Out[11]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | NaN | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [12]:

```
v18q1_mean=int(train_df['v18q1'].mean())
print("Mean value for v18q1 column = ", v18q1_mean)
print("\n\t\t\t\tReplacing the missing values with mean values of the column")
train_df['v18q1'].fillna(value=v18q1_mean,inplace=True)     # Replacing the missing values with mean values of t
train_df.head()
```

```
Mean value for v18q1 column =  1

                                Replacing the missing values with mean values of the column
```

Out[12]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [13]:

```
rez_esc_mean=int(train_df['rez_esc'].mean())
print("Mean value for rez_esc column = ", rez_esc_mean)
print("\n\t\t\t\tReplacing the missing values with mean values of the column")
train_df['rez_esc'].fillna(value=rez_esc_mean,inplace=True)     # Replacing the missing values with mean values
train_df.head()
```

```
Mean value for rez_esc column =  0

                                Replacing the missing values with mean values of the column
```

Out[13]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [14]:

```
meaneduc_mean=int(train_df['meaneduc'].mean())
print("Mean value for meaneduc column = ", meaneduc_mean)
print("\n\t\t\t\tReplacing the missing values with mean values of the column")
train_df['meaneduc'].fillna(value=meaneduc_mean,inplace=True)     # Replacing the missing values with mean value
train_df.head()
```

```
Mean value for meaneduc column =  9

                                Replacing the missing values with mean values of the column
```

Out[14]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [15]:

```
SQBmeaned_mean=int(train_df['SQBmeaned'].mean())
print("Mean value for SQBmeaned column = ", SQBmeaned_mean)
print("\n\t\t\t\tReplacing the missing values with mean values of the column")
train_df['SQBmeaned'].fillna(value=SQBmeaned_mean,inplace=True)     # Replacing the missing values with mean va
train_df.head()
```

```
Mean value for SQBmeaned column =  102

                                Replacing the missing values with mean values of the column
```

Out[15]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

# Check For Missing Data That Was filled or not

In [16]:

```
for i in train_df.columns:
    if train_df[i].isna().sum() >1:
        print('Total null values in\t',i,'= ',train_df[i].isna().sum())   # Summing all the null values
else:
    print("There is no null value (or) Values are replaced with the mean values of tye column")
```

```
There is no null value (or) Values are replaced with the mean values of tye column
```

# Q4. Check whether all members of the house have the same poverty level.

In [66]:

```
print("House Id with different Poverty Level : ", train_df.groupby('idhogar')['Target'].unique().head())
```

```
House Id with different Poverty Level :  idhogar
001ff74ca    [4]
003123ec2    [2]
004616164    [2]
004983866    [3]
005905417    [2]
Name: Target, dtype: object
```

# Enable Encoding method for the catagorical data

In [17]:

```
for i in train_df.columns:
    if train_df[i].dtype == 'object':
        print(i,'= ',train_df[i].dtype)
```

```
Id =  object
idhogar =  object
dependency =  object
edjefe =  object
edjefa =  object
```

In [67]:

```
idhog_=list(train_df["idhogar"].unique())
for temp in idhog_:
    (temp,'=',list(train_df["idhogar"]).count(temp))
```

In [19]:

```
dep_=list(train_df["dependency"].unique())
for temp in dep_:
    print(temp,'=',list(train_df["dependency"]).count(temp))
```

```
no = 1747
8 = 378
yes = 2192
3 = 236
.5 = 1497
.25 = 260
2 = 730
.66666669 = 487
.33333334 = 598
1.5 = 713
.40000001 = 84
.75 = 98
1.25 = 18
.2 = 90
2.5 = 77
1.2 = 11
4 = 100
1.3333334 = 84
2.25 = 13
.22222222 = 11
5 = 24
.83333331 = 11
.80000001 = 18
6 = 7
3.5 = 18
1.6666666 = 8
.2857143 = 9
1.75 = 11
.71428573 = 12
.16666667 = 7
.60000002 = 8
```

In [20]:

```
ED1=train_df["edjefe"].unique()
for temp in ED1:
    print(temp,'=',list(train_df["edjefe"]).count(temp))
```

```
10 = 111
12 = 113
no = 3762
11 = 751
9 = 486
15 = 285
4 = 137
6 = 1845
8 = 257
17 = 202
7 = 234
16 = 134
14 = 208
5 = 222
21 = 43
2 = 194
19 = 14
yes = 123
3 = 307
18 = 19
13 = 103
20 = 7
```

In [21]:

```
ED2=train_df["edjefa"].unique()
for temp in ED2:
    print(temp,'=',list(train_df["edjefa"]).count(temp))
```

```
no = 6230
11 = 399
4 = 136
10 = 96
9 = 237
15 = 188
7 = 179
14 = 120
13 = 52
8 = 217
17 = 76
6 = 947
5 = 176
3 = 152
16 = 113
19 = 4
yes = 69
21 = 5
12 = 72
2 = 84
20 = 2
18 = 3
```

In [22]:

```
le_Id = LabelEncoder()
#le_idhogar =  LabelEncoder()
le_dependency =  LabelEncoder()
le_edjefe =  LabelEncoder()
le_edjefa =  LabelEncoder()
```

In [23]:

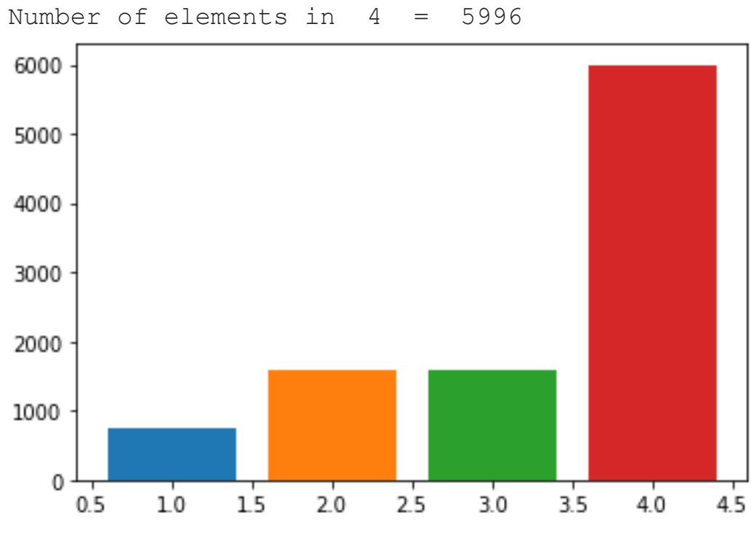
```
#train_df['ID']=le_Id.fit_transform(train_df['ID'])
train_df['dependency']=le_dependency.fit_transform(train_df['dependency'])
train_df['edjefe']=le_edjefe.fit_transform(train_df['edjefe'])
train_df['edjefa']=le_edjefa.fit_transform(train_df['edjefa'])

dummy=pd.get_dummies(train_df['v2a1'])
```

# Q3. Check if there are any biases in your dataset.

In [24]:

```
val= list(train_df[['Target']] .values)
uniq=list(np.unique(train_df['Target']))              # This is unique values in the target column
#print("Unique Values in TARGET colimn are : ", uniq,'\n')
valu=[]
for j in uniq:
    valu.append(val.count(j))
    print('Number of elements in ',j,' = ',val.count(j))
    plt.bar(j,valu)
```

```
Number of elements in  1  =  755
Number of elements in  2  =  1597
Number of elements in  3  =  1209
Number of elements in  4  =  5996
```



In [ ]:

In [ ]:

In [25]:

```
'''correlation= train_df.corr()
print(correlation['v2a1'].values>-0.5)
correlation'''
```

Out[25]:

```
"correlation= train_df.corr()\nprint(correlation['v2a1'].values>-0.5)\ncorrelation"
```

In [ ]:

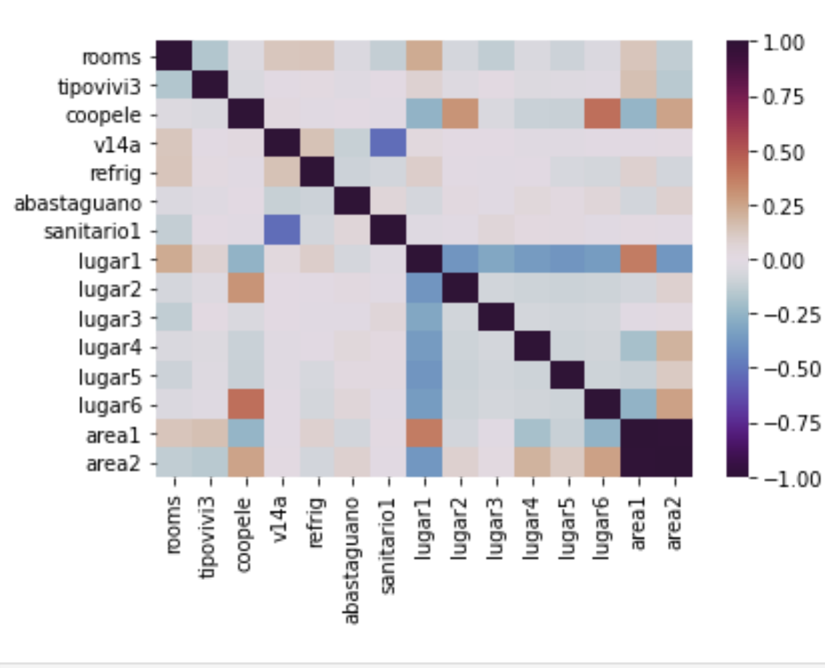
In [ ]:

In [26]:

```
sns.heatmap(train_df[['rooms','tipovivi3','coopele','v14a','refrig','abastaguano','sanitario1','lugar1','lugar2
```

Out[26]:

```
<AxesSubplot:>
```



In [40]:

```
#features=['rooms','v14a','refrig','abastaguano','sanitario1','lugar1','lugar2','lugar3','lugar4','lugar5','lug
x_train=train_df.drop(['Target','Id','idhogar'],axis=1) # Assigning feartures
x_train.head()
```

Out[40]:

| | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | r4h2 | ... | age | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | 1 | ... | 43 | 100 | 1849 | 1 | 100 |
| 1 | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | 1 | ... | 67 | 144 | 4489 | 1 | 144 |
| 2 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | 0 | ... | 92 | 121 | 8464 | 1 | 0 |
| 3 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | 2 | ... | 17 | 81 | 289 | 16 | 121 |
| 4 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | 2 | ... | 37 | 121 | 1369 | 16 | 121 |

5 rows × 140 columns

In [41]:

```
y_train=train_df[['Target']]              # Assigning target variable
y_train.head()
```

Out[41]:

| | Target |
|---|---|
| 0 | 4 |
| 1 | 4 |
| 2 | 4 |
| 3 | 4 |
| 4 | 4 |

In [42]:

```
x_train,x_test,y_train,y_test=train_test_split(x_train,y_train,test_size=0.3,random_state=123)
print("Train & test data splitted successfully")
```

```
Train & test data splitted successfully
```

In [ ]:

In [43]:

```
train_df.head()
```

Out[43]:

| | Id | v2a1 | hacdor | rooms | hacapo | v14a | refrig | v18q | v18q1 | r4h1 | ... | SQBescolari | SQBage | SQBhogar_total | SQBedjefe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ID_279628684 | 190000.0 | 0 | 3 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 100 | 1849 | 1 | 100 |
| 1 | ID_f29eb3ddd | 135000.0 | 0 | 4 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 144 | 4489 | 1 | 144 |
| 2 | ID_68de51c94 | 165231.0 | 0 | 8 | 0 | 1 | 1 | 0 | 1.0 | 0 | ... | 121 | 8464 | 1 | 0 |
| 3 | ID_d671db89c | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 81 | 289 | 16 | 121 |
| 4 | ID_d56d6f5f5 | 180000.0 | 0 | 5 | 0 | 1 | 1 | 1 | 1.0 | 0 | ... | 121 | 1369 | 16 | 121 |

5 rows × 143 columns

In [44]:

```
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(6689, 140)
(2868, 140)
(6689, 1)
(2868, 1)
```

In [45]:

```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
lr=LinearRegression(normalize=True)
lr.fit(x_train,y_train)
print(math.sqrt( mean_squared_error (y_train , lr.predict (x_train))))
print(math.sqrt( mean_squared_error (y_test , lr.predict (x_test ))))
print('R2 Value/Coefficient of Determination: {}'.format( lr.score (x_test , y_test )))
predictions=lr.predict(x_train)
print('Predicted_data = ',predictions[:5])
```

```
0.8106221160734605
0.8082601001146387
R2 Value/Coefficient of Determination: 0.3523738002461617
Predicted_data =  [[3.2109375]
 [3.5625   ]
 [2.6953125]
 [3.703125 ]
 [3.46875  ]]
```

# Q9. Predict the accuracy using random forest classifier.

# Prediction and Acuracy valuvation

In [46]:

```
from sklearn.ensemble import RandomForestClassifier
classifier=RandomForestClassifier(random_state=123)
classifier.fit(x_train,y_train.values.ravel())
```

Out[46]:

```
RandomForestClassifier(random_state=123)
```

In [47]:

```
y_pred_test = classifier.predict(x_test)
y_pred_test
```

Out[47]:

```
array([1, 4, 4, ..., 4, 4, 2], dtype=int64)
```

In [48]:

```
classifier.score(x_test,y_test)
```

Out[48]:

```
0.9079497907949791
```

# Q10. Check the accuracy using random forest with cross validation.

In [54]:

```
# Accuracy rate
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
print("Accuracy Score : ",accuracy_score(y_test, y_pred_test))
```

```
Accuracy Score :  0.9079497907949791
```

In [52]:

```
print( classification_report(y_test,y_pred_test))
```

```
              precision    recall  f1-score   support

           1       0.93      0.70      0.80       223
           2       0.91      0.82      0.86       468
           3       0.95      0.70      0.81       359
           4       0.90      1.00      0.95      1818

    accuracy                           0.91      2868
   macro avg       0.92      0.81      0.85      2868
weighted avg       0.91      0.91      0.90      2868
```

In [53]:

```
# View confusion matrix for test data and predictions
cm=confusion_matrix(y_test, y_pred_test)
cm
```

Out[53]:

```
array([[ 156,   21,    1,   45],
       [   9,  385,   10,   64],
       [   1,   14,  252,   92],
       [   1,    3,    3, 1811]], dtype=int64)
```

In [55]:

```
print(predictions.var())
```

```
0.3451027003042477
```

In [56]:

```
print(y_pred_test.var())
```

```
0.8904561029315937
```

# Q5 Check if there is a house without a family head

In [57]:

```
# parentesco1, =1 if household head
#tamhog,estadocivil3,parentesco1
yes=(list(train['parentesco1'].values)).count(0)
no=(list(train['parentesco1'].values)).count(1)
print('Total house without family head : ',yes)
```

```
Total house without family head :  6584
```

In [ ]: