In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
df_train=pd.read_csv("P:\\Data Science with ML\\Datasets\\Machine-Learning--Projects
```

In [3]:
```
df_test=pd.read_csv("P:\\Data Science with ML\\Datasets\\Machine-Learning--Projects\
```

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

Out[4]:

	ID	y	X0	X1	X2	X3	X4	X5	X6	X8	...	X375	X376	X377	X378	X379	X380	X382
0	0	130.81	k	v	at	a	d	u	j	o	...	0	0	1	0	0	0	0
1	6	88.53	k	t	av	e	d	y	l	o	...	1	0	0	0	0	0	0
2	7	76.26	az	w	n	c	d	x	j	x	...	0	0	0	0	0	0	1
3	9	80.62	az	t	n	f	d	x	l	e	...	0	0	0	0	0	0	0
4	13	78.02	az	v	n	f	d	h	d	n	...	0	0	0	0	0	0	0

5 rows × 378 columns

In [5]:
```
df_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4209 entries, 0 to 4208
Columns: 378 entries, ID to X385
dtypes: float64(1), int64(369), object(8)
memory usage: 12.1+ MB
```

In [6]:
```
df_train.describe().T
```

Out[6]:

	count	mean	std	min	25%	50%	75%	max
ID	4209.0	4205.960798	2437.608688	0.00	2095.00	4220.00	6314.00	8417.00
y	4209.0	100.669318	12.679381	72.11	90.82	99.15	109.01	265.32
X10	4209.0	0.013305	0.114590	0.00	0.00	0.00	0.00	1.00
X11	4209.0	0.000000	0.000000	0.00	0.00	0.00	0.00	0.00
X12	4209.0	0.075077	0.263547	0.00	0.00	0.00	0.00	1.00
...	...	...	...	...	...	...	...	...
X380	4209.0	0.008078	0.089524	0.00	0.00	0.00	0.00	1.00
X382	4209.0	0.007603	0.086872	0.00	0.00	0.00	0.00	1.00
X383	4209.0	0.001663	0.040752	0.00	0.00	0.00	0.00	1.00

	count	mean	std	min	25%	50%	75%	max
X384	4209.0	0.000475	0.021796	0.00	0.00	0.00	0.00	1.00
X385	4209.0	0.001426	0.037734	0.00	0.00	0.00	0.00	1.00

370 rows × 8 columns

In [7]:
```
df_train.isnull().sum()
```

Out[7]:
```
ID      0
y       0
X0      0
X1      0
X2      0
       ..
X380    0
X382    0
X383    0
X384    0
X385    0
Length: 378, dtype: int64
```

In [9]:
```
#check zero Variance in train data
#def zero_var_colums(df):
    #var_df=pd.DataFrame(df.var(),columns=['Variance'])
    #return(list(var_df[var_df.Variance==0].index))
df_train.var().sort_values().head(15)
```

Out[9]:
```
X289    0.000000
X330    0.000000
X268    0.000000
X347    0.000000
X107    0.000000
X235    0.000000
X233    0.000000
X290    0.000000
X11     0.000000
X297    0.000000
X293    0.000000
X93     0.000000
X257    0.000238
X207    0.000238
X280    0.000238
dtype: float64
```

In [10]:
```
df_train=df_train.drop(['X289','X330','X268','X347','X107','X235','X233','X290','X11
```

In [11]:
```
# dropping those columns which zero variance
df_train=df_train.drop(['X11','X93','X107','X233','X235','X268','X289','X290','X293'
```

In [11]:
```
df_train.shape
```

Out[11]:
```
(4209, 363)
```

In [12]:
```
df_train.head()
```

Out[12]:

	ID	y	X0	X1	X2	X3	X4	X5	X6	X8	...	X375	X376	X377	X378	X379	X380	X382
0	0	130.81	k	v	at	a	d	u	j	o	...	0	0	1	0	0	0	0
1	6	88.53	k	t	av	e	d	y	l	o	...	1	0	0	0	0	0	0
2	7	76.26	az	w	n	c	d	x	j	x	...	0	0	0	0	0	0	1
3	9	80.62	az	t	n	f	d	x	l	e	...	0	0	0	0	0	0	0
4	13	78.02	az	v	n	f	d	h	d	n	...	0	0	0	0	0	0	0

5 rows × 363 columns

In [13]:
```
df_train['X0'].value_counts()
```

Out[13]:
```
z     360
ak    349
y     324
ay    313
t     306
x     300
o     269
f     227
n     195
w     182
j     181
az    175
aj    151
s     106
ap    103
h      75
d      73
al     67
v      36
af     35
ai     34
m      34
e      32
ba     27
at     25
a      21
ax     19
aq     18
am     18
i      18
u      17
aw     16
l      16
ad     14
au     11
k      11
b      11
as     10
r      10
bc      6
ao      4
c       3
q       2
aa      2
g       1
ac      1
ab      1
Name: X0, dtype: int64
```

In [14]:
```
def transform_X0(df):
    x0_grp=df.groupby('X0').aggregate(func='count')['ID'].reset_index()
    df['X0'].replace(to_replace=x0_grp[x0_grp['ID']<100]['X0'].values
                              ,value='OT'
                              ,inplace=True)
```

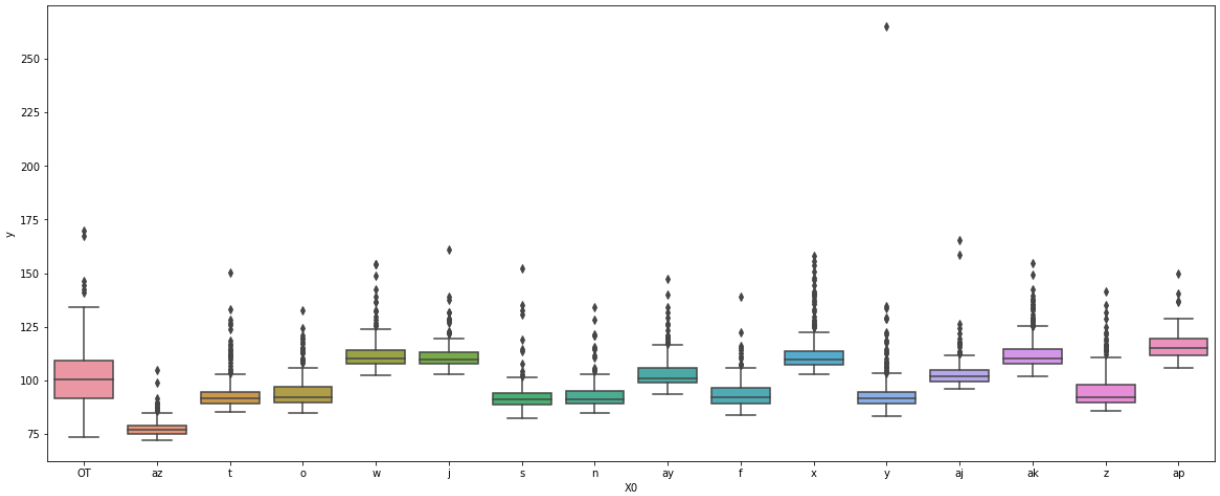
In [15]:
```
transform_X0(df_train)
```

In [16]:
```
df_train['X0'].value_counts()
```

Out[16]:
```
OT    668
z     360
ak    349
y     324
ay    313
t     306
x     300
o     269
f     227
n     195
w     182
j     181
az    175
aj    151
s     106
ap    103
Name: X0, dtype: int64
```

In [17]:
```
plt.figure(figsize=(20,8))
sns.boxplot(x=df_train['X0'],y=df_train['y'])
```

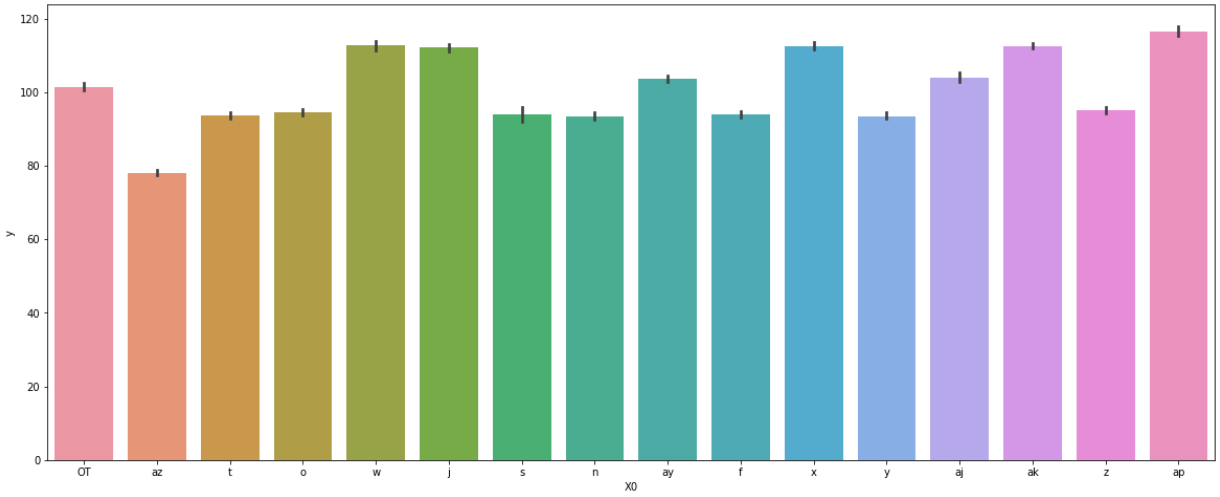
Out[17]:
```
<AxesSubplot:xlabel='X0', ylabel='y'>
```



In [18]:
```
df_train.drop(labels=((df_train[df_train['X0']=='y']['y'].sort_values(ascending=Fals
```

In [19]:
```
plt.figure(figsize=(20,8))
sns.barplot(x=df_train['X0'],y=df_train['y'])
```

Out[19]:
```
<AxesSubplot:xlabel='X0', ylabel='y'>
```



In [20]:
```
df_train['X1'].value_counts()
```

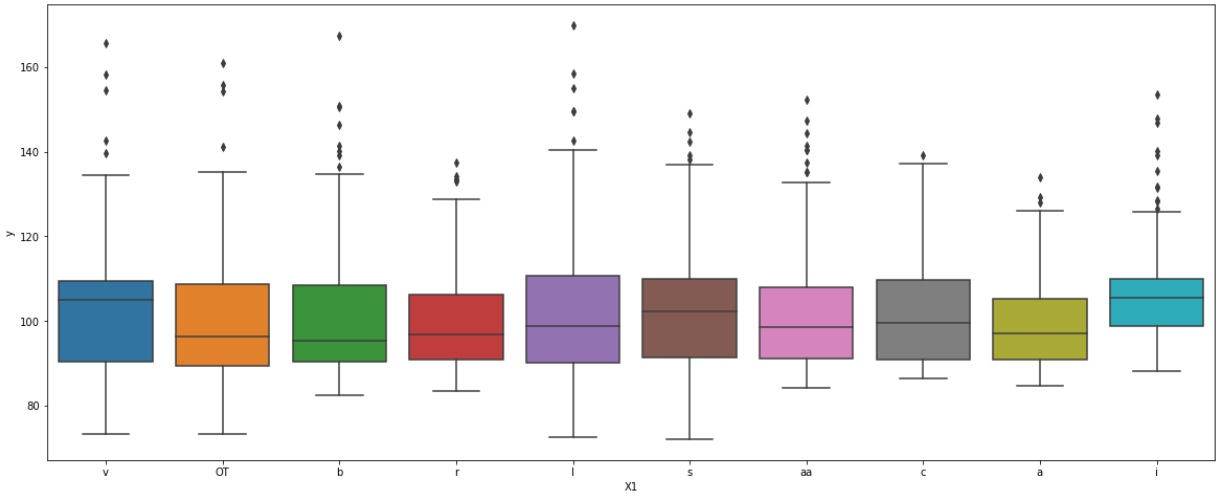
Out[20]:
```
aa    833
s     598
b     592
l     590
v     408
r     250
i     203
a     143
c     121
o      82
w      52
z      46
u      37
e      33
m      32
t      31
h      29
f      23
y      23
j      22
n      19
k      17
p       9
g       6
q       3
d       3
ab      3
Name: X1, dtype: int64
```

In [21]:
```
def transform_X1(df):
    x1_grp=df.groupby('X1').aggregate(func='count')['ID'].reset_index()
    df['X1'].replace(to_replace=x1_grp[x1_grp['ID']<100]['X1'].values
                                ,value='OT'
                                ,inplace=True)
```

In [22]:
```
transform_X1(df_train)
```

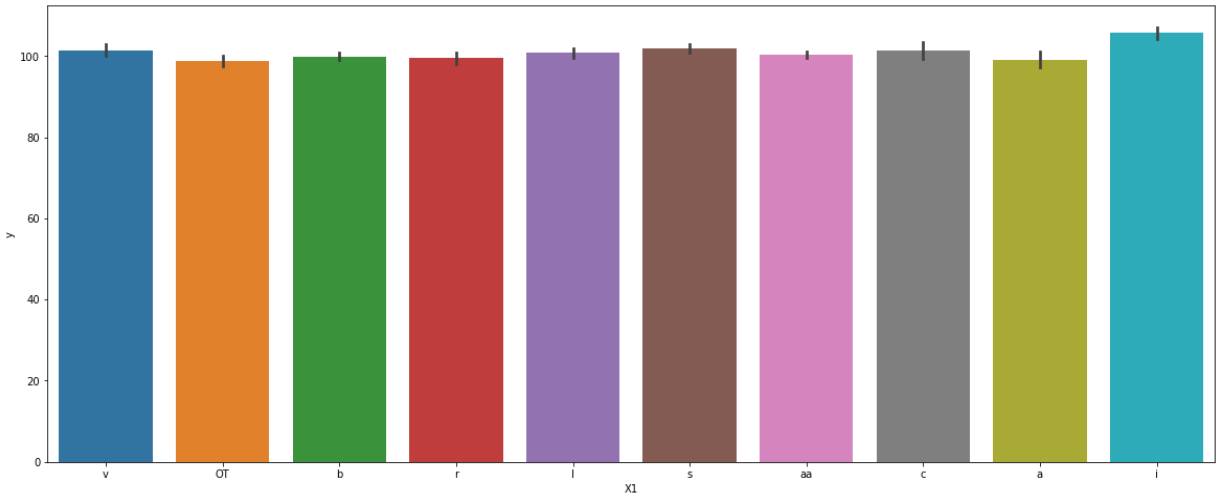
In [23]:
```
plt.figure(figsize=(20,8))
sns.boxplot(x=df_train['X1'],y=df_train['y'])
```

Out[23]:
```
<AxesSubplot:xlabel='X1', ylabel='y'>
```



In [24]:
```
plt.figure(figsize=(20,8))
sns.barplot(x=df_train['X1'],y=df_train['y'])
```

Out[24]: <AxesSubplot:xlabel='X1', ylabel='y'>

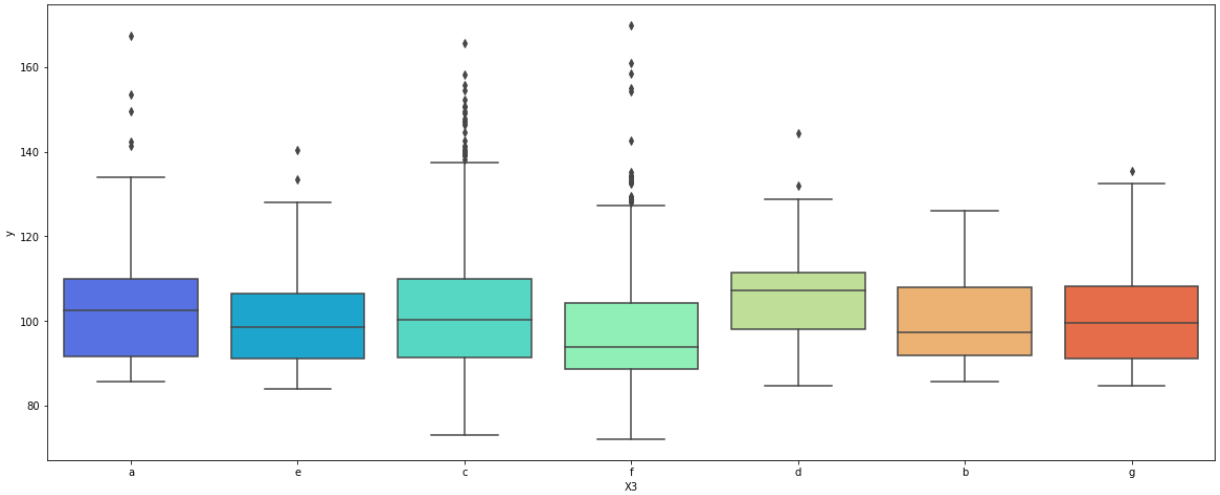


In [25]:
```
df_train['X3'].value_counts()
```

Out[25]:
```
c    1942
f    1075
a     440
d     290
g     241
e     163
b      57
Name: X3, dtype: int64
```

In [26]:
```
plt.figure(figsize=(20,8))
sns.boxplot(x=df_train['X3'],y=df_train['y'],palette='rainbow')
```

Out[26]: <AxesSubplot:xlabel='X3', ylabel='y'>



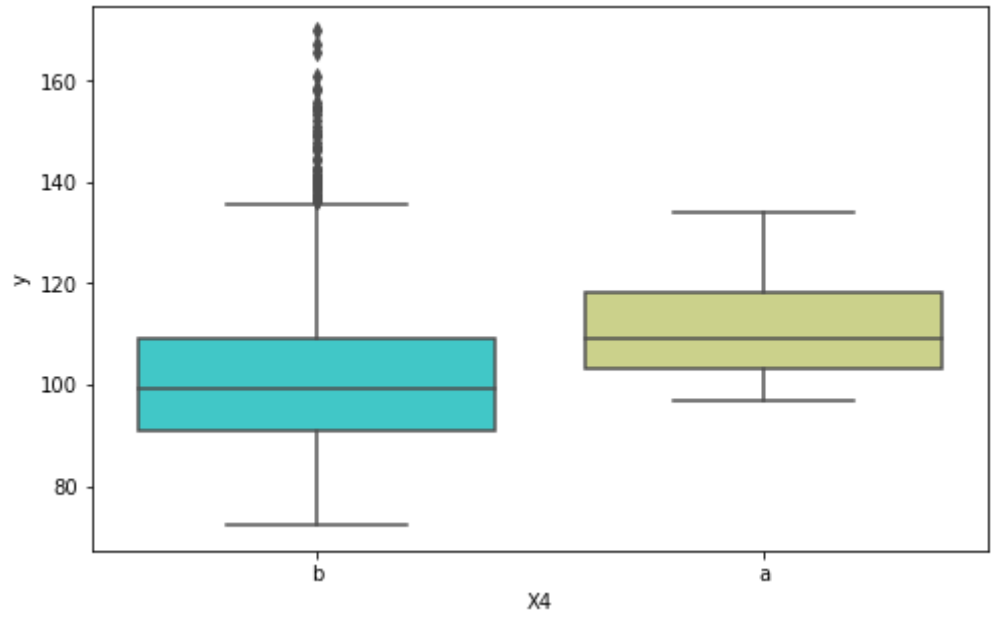
In [27]:
```
df_train['X4'].value_counts()
```

Out[27]:
```
d    4204
a       2
b       1
c       1
Name: X4, dtype: int64
```

In [28]:
```
df_train['X4']=df_train['X4'].replace({'b':'a','c':'a','d':'b'})
```

In [29]:
```
plt.figure(figsize=(8,5))
sns.boxplot(x=df_train['X4'],y=df_train['y'],palette='rainbow')
```

Out[29]:
```
<AxesSubplot:xlabel='X4', ylabel='y'>
```



In [30]:
```
df_train['X5'].value_counts()
```

Out[30]:
```
v     231
w     231
q     220
r     215
s     214
d     214
n     212
```

```
p     208
m     208
i     207
ae    205
ag    203
ac    200
ab    197
l     195
af    188
ad    185
k     177
c     131
j     125
aa    112
ah     97
o      20
f       7
x       2
g       1
y       1
u       1
h       1
Name: X5, dtype: int64
```

In [31]:
```
def transform_X5(df):
    x5_grp=df.groupby('X5').aggregate(func='count')['ID'].reset_index()
    df['X5'].replace(to_replace=x5_grp[x5_grp['ID']<100]['X5'].values
                             ,value='OT'
                             ,inplace=True)
```

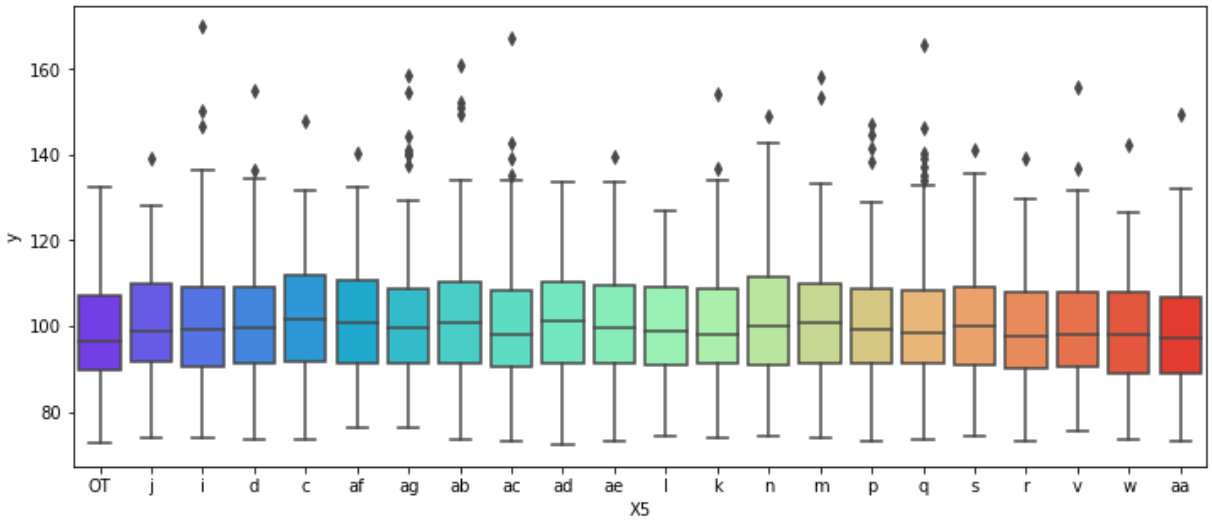
In [32]:
```
transform_X5(df_train)
```

In [33]:
```
df_train['X5'].value_counts()
```

Out[33]:
```
w     231
v     231
q     220
r     215
s     214
d     214
n     212
p     208
m     208
i     207
ae    205
ag    203
ac    200
ab    197
l     195
af    188
ad    185
k     177
c     131
OT    130
j     125
aa    112
Name: X5, dtype: int64
```

In [34]:
```
plt.figure(figsize=(12,5))
sns.boxplot(x=df_train['X5'],y=df_train['y'],palette='rainbow')
```

Out[34]:
```
<AxesSubplot:xlabel='X5', ylabel='y'>
```



In [35]:
```
df_train['X6'].value_counts()
```

Out[35]:
```
g    1042
j    1039
d     625
i     488
l     477
a     206
h     190
k      43
c      38
b      28
f      20
e      12
Name: X6, dtype: int64
```

In [36]:
```
df_train['X8'].value_counts()
```

Out[36]:
```
j    277
s    255
f    243
n    242
i    237
e    225
r    219
a    210
w    196
v    194
b    190
k    176
o    163
m    155
g    130
u    119
t    118
q    117
h    117
y    116
x    105
d    103
l    101
c    100
p    100
Name: X8, dtype: int64
```

In [37]:
```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder
```

```
columns=df_train.select_dtypes(include="object").columns
```

In [38]:
```
X=df_train.drop(['ID','y'],axis=1)
y=df_train[['y']]
```

In [39]:
```
def transform_labels(df,x):
    columns=df.select_dtypes(include="object").columns
    le=LabelEncoder()
    for i in columns:
        le.fit(x[i])
        x[i]=le.transform(x[i])
```

In [40]:
```
transform_labels(df_train,X)
```

In [41]:
```
X.head()
```

Out[41]:

	X0	X1	X2	X3	X4	X5	X6	X8	X10	X12	...	X375	X376	X377	X378	X379	X380	X382
0	0	9	17	0	1	0	9	14	0	0	...	0	0	1	0	0	0	0
1	0	0	19	4	1	0	11	14	0	0	...	1	0	0	0	0	0	0
2	5	0	34	2	1	0	9	23	0	0	...	0	0	0	0	0	0	1
3	5	0	34	5	1	0	11	4	0	0	...	0	0	0	0	0	0	0
4	5	9	34	5	1	0	3	13	0	0	...	0	0	0	0	0	0	0

5 rows × 361 columns

In [42]:
```
df_test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4209 entries, 0 to 4208
Columns: 377 entries, ID to X385
dtypes: int64(369), object(8)
memory usage: 12.1+ MB
```

In [43]:
```
df_test.head()
```

Out[43]:

	ID	X0	X1	X2	X3	X4	X5	X6	X8	X10	...	X375	X376	X377	X378	X379	X380	X382
0	1	az	v	n	f	d	t	a	w	0	...	0	0	0	1	0	0	0
1	2	t	b	ai	a	d	b	g	y	0	...	0	0	1	0	0	0	0
2	3	az	v	as	f	d	a	j	j	0	...	0	0	0	1	0	0	0
3	4	az	l	n	f	d	z	l	n	0	...	0	0	0	1	0	0	0
4	5	w	s	as	c	d	y	i	m	0	...	1	0	0	0	0	0	0

5 rows × 377 columns

In [45]:
```
#def zero_var_colums(df):
    #var_df=pd.DataFrame(df.var(),columns=['Variance'])
    #return(list(var_df[var_df.Variance==0].index))
#zero_var_colums(df_test)



df_test.var().sort_values().head(15)
```

Out[45]:
```
X295    0.000000
X369    0.000000
X296    0.000000
X257    0.000000
X258    0.000000
X278    0.000238
X233    0.000238
X280    0.000238
X290    0.000238
X293    0.000238
X330    0.000238
X235    0.000238
X288    0.000238
X210    0.000238
X297    0.000238
dtype: float64
```

In [46]:
```
df_test.drop(['X295','X369','X296','X257','X258','X278','X233','X280','X290','X293',
```

In [47]:
```
transform_X0(df_test)
```

In [48]:
```
transform_X1(df_test)
```

In [49]:
```
transform_X5(df_test)
```

In [50]:
```
X_test1=df_test.drop(['ID'],axis=1)
```

In [51]:
```
transform_labels(df_test,X_test1)
```

In [52]:
```
X_test1.head()
```

Out[52]:

	X0	X1	X2	X3	X4	X5	X6	X8	X10	X11	...	X375	X376	X377	X378	X379	X380	X382
0	5	9	34	5	3	0	0	22	0	0	...	0	0	0	1	0	0	0
1	11	3	8	0	3	0	6	24	0	0	...	0	0	1	0	0	0	0
2	5	9	17	5	3	0	9	9	0	0	...	0	0	0	1	0	0	0
3	5	6	34	5	3	0	11	13	0	0	...	0	0	0	1	0	0	0
4	12	8	17	2	3	0	8	12	0	0	...	1	0	0	0	0	0	0

5 rows × 361 columns

In [53]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_sta
```

In [54]:
```
from sklearn.decomposition import PCA
pc=PCA(n_components=0.95)
pc.fit(X_train)
X_train=pc.transform(X_train)
X_test=pc.transform(X_test)
X_test1=pc.transform(X_test1)
```

In [55]:
```
pc.components_
```

Out[55]:
```
array([[-4.25450753e-02,  3.71504395e-02,  9.93627724e-01, ...,
        -9.31298942e-05, -7.20599995e-06, -1.99369349e-05],
       [ 4.38929120e-03, -5.36670128e-03,  6.55311134e-02, ...,
         1.92453067e-04,  3.64150704e-05,  2.56209915e-04],
       [ 2.05976434e-02, -2.61846223e-02, -1.54345719e-02, ...,
         1.08146422e-05, -2.37078471e-05, -1.77575136e-04],
       ...,
       [ 3.33117532e-02, -1.83753087e-01,  2.18746289e-03, ...,
         8.23887860e-05,  1.80662190e-04,  5.94784782e-04],
       [ 3.91566198e-02,  1.30193146e-02, -1.73516736e-02, ...,
         5.38944699e-04,  1.57544229e-04, -5.71908098e-04],
       [ 7.10504755e-02, -9.65532265e-02, -1.22691205e-02, ...,
         1.59891938e-03,  5.28979201e-05, -3.40748095e-04]])
```

In [56]:
```
pc.explained_variance_
```

Out[56]:
```
array([119.78524835,  49.68485394,  40.04402493,  28.17031354,
         9.36077629,   7.85660411,   4.07826049,   2.23087707,
         1.63060743,   1.29010309,   1.26791744])
```

In [57]:
```
pc.explained_variance_ratio_
```

Out[57]:
```
array([0.43030348, 0.17848246, 0.14384979, 0.10119597, 0.03362663,
       0.02822321, 0.0146503 , 0.00801396, 0.00585762, 0.00463443,
       0.00455473])
```

In [58]:
```
from sklearn import svm
from sklearn.metrics import r2_score, mean_squared_error
from xgboost import XGBRegressor
xgbr= XGBRegressor(random_state=42)
```

In [59]:
```
model = xgbr.fit(X_train,y_train)
```

In [60]:
```
ypred_test = model.predict(X_test)
ypred_test
```

Out[60]:
```
array([100.99419 , 101.231316, 107.688   , 105.37767 ,  91.34555 ,
       102.887566, 100.04225 , 110.02699 , 115.707535,  95.04412 ,
        93.3165  ,  90.10474 ,  95.111336,  94.79391 , 101.465164,
       114.22748 ,  76.06961 ,  93.79366 , 100.53496 , 100.28454 ,
       112.3369  , 105.844666, 118.7009  , 115.39442 ,  93.31118 ,
       107.466995,  93.783745,  91.09463 , 104.02201 ,  95.40309 ,
        93.65064 ,  82.50751 ,  93.79172 ,  96.44883 , 107.52754 ,
        96.002396,  95.48173 , 111.72134 , 106.514244,  97.405525,
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107.31294 ,  98.77034 , 106.26067 ,  94.93544 , 101.08556 ,
 88.001976, 106.59395 ], dtype=float32)
```

In [61]:
```
ypred_train = model.predict(X_train)
ypred_train
```

Out[61]:
```
array([121.61863 , 105.48161 ,  91.68057 , ..., 108.94938 ,  99.92531 ,
       105.008804], dtype=float32)
```

In [62]:
```
print(r2_score(ypred_train, y_train))
```

```
0.9016925733694292
```

In [63]:
```
print(mean_squared_error(ypred_train, y_train))
```

```
11.697073995477288
```

In [64]:
```
df_test_prediction=model.predict(X_test1)
df_test_prediction
```

Out[64]:
```
array([111.800644,  99.86678 ,  97.033104, ..., 104.33736 , 100.37338 ,
       106.952415], dtype=float32)
```

In [ ]:

In [ ]:

In [ ]: