

```
In [1]: from google.colab import drive
drive.mount('/content/MyDrive/')
```

Drive already mounted at /content/MyDrive/; to attempt to forcibly remount, call drive.mount("/content/MyDrive/", force_remount=True).

Following actions should be performed:

If for any column(s), the variance is equal to zero, then you need to remove those variable(s).

Check for null and unique values for test and train sets.

Apply label encoder.

Perform dimensionality reduction.

Predict your test_df values using XGBoost.

```
In [2]: import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import numpy as np
warnings.filterwarnings('ignore')
pd.set_option('display.max_rows',None)
pd.set_option('display.max_columns',None)
%matplotlib inline
```

```
In [3]: train = pd.read_csv('/content/MyDrive/MyDrive/Datasets/ML Task Datas/Task
1 Data/train.csv')
```

```
In [4]: 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 [5]: train.shape
```

```
Out[5]: (4209, 378)
```

```
In [6]: train.head()
```

```
Out[6]:
```

	ID	y	X0	X1	X2	X3	X4	X5	X6	X8	X10	X11	X12	X13	X14	X15	X16	X17
0	0	130.81	k	v	at	a	d	u	j	o	0	0	0	1	0	0	0	0
1	6	88.53	k	t	av	e	d	y	l	o	0	0	0	0	0	0	0	0
2	7	76.26	az	w	n	c	d	x	j	x	0	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	0
4	13	78.02	az	v	n	f	d	h	d	n	0	0	0	0	0	0	0	0

```
In [7]: train['y'].value_counts()
```

```
Out[7]: 91.88      7
        89.38      7
        89.06      7
        90.76      7
        89.19      6
        90.44      6
        90.38      6
        93.62      6
        91.62      6
        89.60      6
        90.39      5
        89.79      5
        97.96      5
        97.99      5
        93.83      5
        88.77      5
        98.16      5
        88.69      5
        90.80      5
        88.83      5
        88.10      5
        110.07     5
        108.43     5
        90.41      5
        99.48      5
        88.05      5
        110.58     5
        92.38      5
        100.68     5
        102.91     5
        107.90     5
        90.54      5
        91.38      5
        90.69      5
        88.53      5
        99.68      5
        89.94      5
        88.51      5
        92.22      5
        92.59      5
        87.71      5
        91.16      5
        88.38      5
        89.37      5
        107.13     4
        90.57      4
        105.29     4
        92.98      4
        90.18      4
        93.71      4
        95.71      4
        88.34      4
        111.02     4
        108.76     4
        89.89      4
        91.63      4
        108.37     4
        95.10      4
        87.28      4
        88.93      4
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99.10	1
86.34	1
107.79	1
91.89	1
89.77	1
102.48	1
72.94	1
114.66	1
93.15	1
93.94	1
106.55	1
123.47	1
80.20	1
109.47	1
97.68	1
86.19	1
119.22	1
121.06	1
93.10	1
112.22	1
94.24	1
78.91	1
113.55	1
92.52	1
86.95	1
114.30	1
154.16	1
100.67	1
98.36	1
114.55	1
80.44	1
121.60	1
89.13	1
78.88	1
107.26	1
104.21	1
86.90	1
109.07	1
91.31	1
91.06	1
134.08	1
85.96	1
76.33	1
97.21	1
125.75	1
119.20	1
98.54	1
105.24	1
76.10	1
101.57	1
94.69	1
93.18	1
96.77	1
104.10	1
112.41	1
104.00	1

91.83	1
99.53	1
136.96	1
121.10	1
102.17	1
106.51	1
112.82	1
98.92	1
110.75	1
103.39	1
105.94	1
94.38	1
110.39	1
105.59	1
93.56	1
95.96	1
92.27	1
113.09	1
101.89	1
125.84	1
111.32	1
126.97	1
101.30	1
109.29	1
77.16	1
107.81	1
112.07	1
101.27	1
96.47	1
99.59	1
124.64	1
114.40	1
119.89	1
75.42	1
99.41	1
110.97	1
113.52	1
73.79	1
93.36	1
91.71	1
118.02	1
110.92	1
84.20	1
113.70	1
115.21	1
75.05	1
83.49	1
97.58	1
103.10	1
75.73	1
119.88	1
111.14	1
116.67	1
106.37	1
76.78	1
107.42	1
101.35	1
114.87	1
117.32	1
105.79	1

88.27	1
106.27	1
75.79	1
75.26	1
118.06	1
88.02	1
113.82	1
92.09	1
85.92	1
92.30	1
91.67	1
107.82	1
85.23	1
105.95	1
105.80	1
103.72	1
91.10	1
95.94	1
129.16	1
105.51	1
134.04	1
114.89	1
109.87	1
111.03	1
104.34	1
88.17	1
76.96	1
80.53	1
111.09	1
74.10	1
96.61	1
167.45	1
73.15	1
100.63	1
94.26	1
106.65	1
91.90	1
110.29	1
118.61	1
99.60	1
89.55	1
114.10	1
101.25	1
108.30	1
95.76	1
135.29	1
107.15	1
106.84	1
78.01	1
123.17	1
84.85	1
98.39	1
76.18	1
83.98	1
123.24	1
108.48	1
97.70	1
150.89	1
94.16	1
160.87	1

98.58	1
90.37	1
121.27	1
92.96	1
116.00	1
112.48	1
100.81	1
89.70	1
103.01	1
73.59	1
100.16	1
109.68	1
97.89	1
88.41	1
107.28	1
122.72	1
95.24	1
133.36	1
87.82	1
114.56	1
109.26	1
76.86	1
139.08	1
87.37	1
78.45	1
134.21	1
106.09	1
152.32	1
112.57	1
86.60	1
99.24	1
96.05	1
99.83	1
106.03	1
100.92	1
96.14	1
122.51	1
118.14	1
110.17	1
88.01	1
109.03	1
87.56	1
115.64	1
120.95	1
82.21	1
78.22	1
125.46	1
100.53	1
104.45	1
119.39	1
88.67	1
109.74	1
98.02	1
114.50	1
89.30	1
112.99	1
89.57	1
119.75	1
98.98	1
112.27	1

109.71	1
104.49	1
133.50	1
95.80	1
114.60	1
121.50	1
125.76	1
132.86	1
98.07	1
91.00	1
104.77	1
104.60	1
139.61	1
114.52	1
77.62	1
109.55	1
91.14	1
96.81	1
96.59	1
105.17	1
133.55	1
94.76	1
117.29	1
107.04	1
91.66	1
97.67	1
101.94	1
94.31	1
106.66	1
116.82	1
94.03	1
107.69	1
81.96	1
117.06	1
87.41	1
110.42	1
116.57	1
86.72	1
81.08	1
86.15	1
125.26	1
127.27	1
127.19	1
86.83	1
76.80	1
96.28	1
127.06	1
73.45	1
102.50	1
106.33	1
75.82	1
93.32	1
101.13	1
119.03	1
94.18	1
112.00	1
119.87	1
128.35	1
101.79	1
110.15	1

```

93.58      1
103.45     1
96.17      1
118.78     1
72.11      1
106.83     1
117.60     1
75.51      1
112.06     1
103.47     1
-- --

```

```

In [8]: for column in train:
        if train[column].dtype == 'object':
            print(f'{column}:{train[column].unique()}')
            print(f'{column}:{train[column].nunique()}')

```

```

X0:['k' 'az' 't' 'al' 'o' 'w' 'j' 'h' 's' 'n' 'ay' 'f' 'x' 'y' 'aj' 'ak'
    'am'
    'z' 'q' 'at' 'ap' 'v' 'af' 'a' 'e' 'ai' 'd' 'aq' 'c' 'aa' 'ba' 'as' 'i'
    'r' 'b' 'ax' 'bc' 'u' 'ad' 'au' 'm' 'l' 'aw' 'ao' 'ac' 'g' 'ab']
X0:47
X1:['v' 't' 'w' 'b' 'r' 'l' 's' 'aa' 'c' 'a' 'e' 'h' 'z' 'j' 'o' 'u' 'p'
    'n'
    'i' 'y' 'd' 'f' 'm' 'k' 'g' 'q' 'ab']
X1:27
X2:['at' 'av' 'n' 'e' 'as' 'aq' 'r' 'ai' 'ak' 'm' 'a' 'k' 'ae' 's' 'f' '
    d'
    'ag' 'ay' 'ac' 'ap' 'g' 'i' 'aw' 'y' 'b' 'ao' 'al' 'h' 'x' 'au' 't' 'an
    '
    'z' 'ah' 'p' 'am' 'j' 'q' 'af' 'l' 'aa' 'c' 'o' 'ar']
X2:44
X3:['a' 'e' 'c' 'f' 'd' 'b' 'g']
X3:7
X4:['d' 'b' 'c' 'a']
X4:4
X5:['u' 'y' 'x' 'h' 'g' 'f' 'j' 'i' 'd' 'c' 'af' 'ag' 'ab' 'ac' 'ad' 'ae'
    '
    'ah' 'l' 'k' 'n' 'm' 'p' 'q' 's' 'r' 'v' 'w' 'o' 'aa']
X5:29
X6:['j' 'l' 'd' 'h' 'i' 'a' 'g' 'c' 'k' 'e' 'f' 'b']
X6:12
X8:['o' 'x' 'e' 'n' 's' 'a' 'h' 'p' 'm' 'k' 'd' 'i' 'v' 'j' 'b' 'q' 'w'
    'g'
    'y' 'l' 'f' 'u' 'r' 't' 'c']
X8:25

```

```

In [9]: y_train = train['y'].values
        y_train

```

```

Out[9]: array([130.81,  88.53,  76.26, ..., 109.22,  87.48, 110.85])

```

```

In [10]: test = pd.read_csv('/content/MyDrive/MyDrive/Datasets/ML Task Datas/Task
1 Data/test.csv')

```

In [11]: `test.head()`

Out[11]:

	ID	X0	X1	X2	X3	X4	X5	X6	X8	X10	X11	X12	X13	X14	X15	X16	X17	X18	
0	1	az	v	n	f	d	t	a	w	0	0	0	0	0	0	0	0	0	
1	2	t	b	ai	a	d	b	g	y	0	0	0	0	0	0	0	0	0	
2	3	az	v	as	f	d	a	j	j	0	0	0	0	1	0	0	0	0	
3	4	az	l	n	f	d	z	l	n	0	0	0	0	0	0	0	0	0	
4	5	w	s	as	c	d	y	i	m	0	0	0	0	1	0	0	0	0	

In [12]: `train.isnull().any().sum()`

Out[12]: 0

In [13]: `test.isnull().any().sum()`

Out[13]: 0

In [14]: `final_columns = list(set(train.columns) - set(['ID','y']))`

In [15]: `x_train = train[final_columns]`
`x_test = test[final_columns]`

In [16]: `x_train.head()`

Out[16]:

	X145	X65	X294	X285	X108	X39	X111	X320	X231	X259	X156	X235	X291	X161
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
1	0	0	0	1	0	0	1	0	0	0	1	0	0	0
2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3	0	0	0	0	1	0	1	0	0	0	0	0	1	0
4	0	0	0	0	1	0	1	0	0	0	0	0	0	0

In [17]: `x_test.head()`

Out[17]:

	X145	X65	X294	X285	X108	X39	X111	X320	X231	X259	X156	X235	X291	X161
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
2	0	0	0	1	0	0	1	0	0	0	0	0	0	0
3	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4	0	0	0	1	0	0	1	0	0	0	1	0	0	0

```
In [18]: for column in x_train:
          if x_train[column].any() == 0:
            print(f'{column} : {x_train[column].unique()}')
```

```
X235 : [0]
X289 : [0]
X297 : [0]
X347 : [0]
X11  : [0]
X293 : [0]
X93  : [0]
X107 : [0]
X268 : [0]
X290 : [0]
X233 : [0]
X330 : [0]
```

```
In [19]: for column in x_test:
          if x_test[column].any() == 0:
            print(f'{column} : {x_test[column].unique()}')
```

```
X296 : [0]
X369 : [0]
X257 : [0]
X295 : [0]
X258 : [0]
```

```
In [20]: for column in x_train:
          if x_train[column].any() == 1:
            print(f'{column} : {x_train[column].unique()}')
```



```
X145 : [0 1]
X65 : [0 1]
X294 : [0 1]
X285 : [1 0]
X108 : [0 1]
X39 : [0 1]
X111 : [1 0]
X320 : [0 1]
X231 : [0 1]
X259 : [0 1]
X156 : [1 0]
X291 : [0 1]
X161 : [0 1]
X271 : [0 1]
X99 : [0 1]
X42 : [0 1]
X63 : [0 1]
X174 : [0 1]
X256 : [0 1]
X47 : [0 1]
X167 : [0 1]
X313 : [0 1]
X248 : [0 1]
X376 : [0 1]
X49 : [0 1]
X344 : [0 1]
X68 : [1 0]
X229 : [0 1]
X100 : [0 1]
X352 : [0 1]
X162 : [0 1]
X113 : [0 1]
X284 : [0 1]
X34 : [0 1]
X200 : [0 1]
X354 : [1 0]
X178 : [0 1]
X220 : [1 0]
X46 : [1 0]
X337 : [0 1]
X211 : [0 1]
X255 : [0 1]
X314 : [0 1]
X326 : [0 1]
X6 : ['j' 'l' 'd' 'h' 'i' 'a' 'g' 'c' 'k' 'e' 'f' 'b']
X213 : [0 1]
X117 : [0 1]
X104 : [0 1]
X123 : [0 1]
X292 : [0 1]
X50 : [0 1]
X339 : [0 1]
X239 : [0 1]
X212 : [0 1]
X105 : [0 1]
X181 : [0 1]
X265 : [0 1]
X357 : [0 1]
X377 : [1 0]
X317 : [0 1]
```

```

X48 : [0 1]
X232 : [0 1]
X353 : [0 1]
X270 : [0 1]
X78 : [0 1]
X252 : [0 1]
X210 : [0 1]
X245 : [0 1]
X214 : [0 1]
X182 : [0 1]
X375 : [0 1]
X168 : [0 1]
X52 : [0 1]
X319 : [0 1]
X141 : [0 1]
X312 : [0 1]
X56 : [0 1]
X76 : [0 1]
X202 : [0 1]
X22 : [0 1]
X336 : [0 1]
X186 : [0 1]
X139 : [0 1]
X380 : [0 1]
X368 : [0 1]
X69 : [0 1]
X218 : [0 1]
X298 : [0 1]
X243 : [0 1]
X90 : [0 1]
X286 : [0 1]
X190 : [0 1]
X143 : [0 1]
X372 : [0 1]
X5 : ['u' 'y' 'x' 'h' 'g' 'f' 'j' 'i' 'd' 'c' 'af' 'ag' 'ab' 'ac' 'ad' '
ae'
      'ah' 'l' 'k' 'n' 'm' 'p' 'q' 's' 'r' 'v' 'w' 'o' 'aa']
X83 : [0 1]
X219 : [0 1]
X57 : [0 1]
X114 : [1 0]
X36 : [0 1]
X32 : [0 1]
X84 : [0 1]
X321 : [0 1]
X122 : [0 1]
X329 : [1 0]
X234 : [1 0]
X142 : [1 0]
X23 : [0 1]
X275 : [1 0]
X338 : [0 1]
X197 : [0 1]
X3 : ['a' 'e' 'c' 'f' 'd' 'b' 'g']
X12 : [0 1]
X343 : [0 1]
X91 : [0 1]
X153 : [0 1]
X158 : [0 1]
X236 : [0 1]

```

```
X204 : [1 0]
X31 : [1 0]
X135 : [0 1]
X192 : [0 1]
X1 : ['v' 't' 'w' 'b' 'r' 'l' 's' 'aa' 'c' 'a' 'e' 'h' 'z' 'j' 'o' 'u' '
p' 'n'
      'i' 'y' 'd' 'f' 'm' 'k' 'g' 'q' 'ab']
X16 : [0 1]
X146 : [0 1]
X276 : [0 1]
X33 : [0 1]
X35 : [1 0]
X17 : [0 1]
X365 : [0 1]
X323 : [0 1]
X129 : [0 1]
X277 : [0 1]
X208 : [0 1]
X217 : [0 1]
X345 : [0 1]
X165 : [0 1]
X306 : [1 0]
X209 : [1 0]
X66 : [0 1]
X242 : [0 1]
X19 : [0 1]
X73 : [0 1]
X136 : [1 0]
X124 : [0 1]
X70 : [1 0]
X128 : [1 0]
X94 : [0 1]
X370 : [0 1]
X154 : [0 1]
X283 : [0 1]
X262 : [1 0]
X88 : [0 1]
X364 : [0 1]
X241 : [0 1]
X307 : [0 1]
X359 : [0 1]
X367 : [0 1]
X92 : [0 1]
X223 : [0 1]
X40 : [0 1]
X222 : [0 1]
X384 : [0 1]
X309 : [0 1]
X260 : [0 1]
X82 : [0 1]
X350 : [0 1]
X64 : [0 1]
X134 : [0 1]
X112 : [0 1]
X163 : [0 1]
X58 : [1 0]
X331 : [0 1]
X304 : [0 1]
X308 : [0 1]
X195 : [0 1]
```

```
X378 : [0 1]
X180 : [0 1]
X95 : [0 1]
X335 : [0 1]
X299 : [0 1]
X61 : [0 1]
X272 : [0 1]
X184 : [1 0]
X140 : [0 1]
X89 : [0 1]
X194 : [1 0]
X166 : [0 1]
X254 : [0 1]
X10 : [0 1]
X133 : [0 1]
X205 : [0 1]
X296 : [0 1]
X373 : [0 1]
X53 : [0 1]
X334 : [1 0]
X244 : [0 1]
X282 : [0 1]
X203 : [0 1]
X4 : ['d' 'b' 'c' 'a']
X355 : [0 1]
X273 : [1 0]
X383 : [0 1]
X281 : [0 1]
X318 : [0 1]
X175 : [0 1]
X249 : [0 1]
X263 : [1 0]
X41 : [0 1]
X189 : [1 0]
X96 : [0 1]
X148 : [0 1]
X305 : [0 1]
X115 : [0 1]
X362 : [0 1]
X62 : [0 1]
X199 : [0 1]
X361 : [1 0]
X13 : [1 0]
X363 : [0 1]
X160 : [0 1]
X71 : [0 1]
X74 : [1 0]
X215 : [0 1]
X150 : [1 0]
X45 : [0 1]
X155 : [0 1]
X37 : [1 0]
X300 : [0 1]
X358 : [0 1]
X87 : [0 1]
X207 : [0 1]
X81 : [0 1]
X38 : [0 1]
X341 : [0 1]
X187 : [1 0]
```

```
X0 : ['k' 'az' 't' 'al' 'o' 'w' 'j' 'h' 's' 'n' 'ay' 'f' 'x' 'y' 'aj' 'a  
k' 'am'  
'z' 'q' 'at' 'ap' 'v' 'af' 'a' 'e' 'ai' 'd' 'aq' 'c' 'aa' 'ba' 'as' 'i'  
'r' 'b' 'ax' 'bc' 'u' 'ad' 'au' 'm' 'l' 'aw' 'ao' 'ac' 'g' 'ab']  
X54 : [0 1]  
X302 : [0 1]  
X169 : [0 1]  
X119 : [1 0]  
X266 : [1 0]  
X138 : [0 1]  
X18 : [1 0]  
X103 : [0 1]  
X51 : [0 1]  
X288 : [0 1]  
X356 : [0 1]  
X237 : [1 0]  
X191 : [0 1]  
X278 : [0 1]  
X59 : [0 1]  
X77 : [0 1]  
X230 : [0 1]  
X24 : [0 1]  
X240 : [0 1]  
X55 : [0 1]  
X328 : [0 1]  
X227 : [0 1]  
X102 : [0 1]  
X67 : [0 1]  
X360 : [0 1]  
X164 : [0 1]  
X349 : [0 1]  
X125 : [0 1]  
X131 : [1 0]  
X132 : [0 1]  
X147 : [0 1]  
X27 : [0 1]  
X98 : [0 1]  
X274 : [0 1]  
X86 : [0 1]  
X206 : [0 1]  
X316 : [1 0]  
X340 : [0 1]  
X152 : [0 1]  
X348 : [0 1]  
X60 : [0 1]  
X221 : [0 1]  
X224 : [0 1]  
X228 : [0 1]  
X173 : [0 1]  
X351 : [0 1]  
X183 : [0 1]  
X264 : [0 1]  
X43 : [0 1]  
X120 : [1 0]  
X267 : [0 1]  
X311 : [0 1]  
X144 : [1 0]  
X127 : [0 1]  
X2 : ['at' 'av' 'n' 'e' 'as' 'aq' 'r' 'ai' 'ak' 'm' 'a' 'k' 'ae' 's' 'f'  
'd']
```

```

    'ag' 'ay' 'ac' 'ap' 'g' 'i' 'aw' 'y' 'b' 'ao' 'al' 'h' 'x' 'au' 't' 'an
    ,
    'z' 'ah' 'p' 'am' 'j' 'q' 'af' 'l' 'aa' 'c' 'o' 'ar']
X172 : [0 1]
X382 : [0 1]
X287 : [0 1]
X26  : [0 1]
X346 : [0 1]
X226 : [0 1]
X279 : [0 1]
X85  : [1 0]
X332 : [0 1]
X198 : [0 1]
X238 : [0 1]
X110 : [0 1]
X333 : [0 1]
X310 : [0 1]
X201 : [0 1]
X80  : [0 1]
X101 : [0 1]
X371 : [0 1]
X327 : [1 0]
X369 : [0 1]
X225 : [0 1]
X14  : [0 1]
X30  : [0 1]
X28  : [0 1]
X179 : [1 0]
X324 : [1 0]
X196 : [0 1]
X151 : [0 1]
X157 : [0 1]
X106 : [0 1]
X159 : [0 1]
X176 : [0 1]
X20  : [0 1]
X315 : [0 1]
X109 : [0 1]
X21  : [1 0]
X15  : [0 1]
X342 : [0 1]
X97  : [0 1]
X126 : [0 1]
X216 : [0 1]
X44  : [0 1]
X116 : [1 0]
X325 : [0 1]
X171 : [0 1]
X301 : [0 1]
X177 : [0 1]
X253 : [0 1]
X79  : [0 1]
X322 : [0 1]
X257 : [0 1]
X366 : [0 1]
X246 : [0 1]
X250 : [0 1]
X170 : [1 0]
X379 : [0 1]
X118 : [1 0]

```

```
X374 : [0 1]
X295 : [0 1]
X247 : [0 1]
X280 : [0 1]
X130 : [0 1]
X251 : [0 1]
X8 : ['o' 'x' 'e' 'n' 's' 'a' 'h' 'p' 'm' 'k' 'd' 'i' 'v' 'j' 'b' 'q' 'w'
      ' ' 'g'
      'y' 'l' 'f' 'u' 'r' 't' 'c']
X261 : [0 1]
X75 : [0 1]
X137 : [1 0]
X185 : [0 1]
X258 : [0 1]
X29 : [0 1]
X205 : [0 1]
```

```
In [21]: for column in x_test:
          if x_test[column].any() == 1:
            print(f'{column} : {x_test[column].unique()}')
```



```
X145 : [0 1]
X65 : [0 1]
X294 : [0 1]
X285 : [0 1]
X108 : [0 1]
X39 : [0 1]
X111 : [1 0]
X320 : [0 1]
X231 : [0 1]
X259 : [0 1]
X156 : [0 1]
X235 : [0 1]
X291 : [0 1]
X161 : [0 1]
X271 : [0 1]
X99 : [0 1]
X42 : [0 1]
X63 : [0 1]
X174 : [0 1]
X289 : [0 1]
X256 : [1 0]
X47 : [0 1]
X167 : [0 1]
X313 : [0 1]
X248 : [0 1]
X376 : [0 1]
X49 : [0 1]
X344 : [0 1]
X68 : [0 1]
X229 : [0 1]
X100 : [0 1]
X352 : [0 1]
X162 : [1 0]
X113 : [0 1]
X284 : [0 1]
X34 : [0 1]
X200 : [0 1]
X354 : [0 1]
X178 : [0 1]
X220 : [1 0]
X46 : [1 0]
X337 : [0 1]
X211 : [0 1]
X255 : [0 1]
X314 : [0 1]
X326 : [0 1]
X6 : ['a' 'g' 'j' 'l' 'i' 'd' 'f' 'h' 'c' 'k' 'e' 'b']
X213 : [0 1]
X117 : [0 1]
X104 : [0 1]
X123 : [0 1]
X292 : [0 1]
X50 : [0 1]
X339 : [0 1]
X239 : [0 1]
X212 : [0 1]
X105 : [0 1]
X181 : [0 1]
X265 : [0 1]
X357 : [0 1]
```

```
X297 : [0 1]
X377 : [0 1]
X317 : [0 1]
X48 : [0 1]
X232 : [1 0]
X353 : [0 1]
X270 : [0 1]
X78 : [0 1]
X252 : [0 1]
X210 : [0 1]
X245 : [0 1]
X214 : [0 1]
X182 : [0 1]
X375 : [0 1]
X168 : [0 1]
X52 : [0 1]
X319 : [0 1]
X141 : [0 1]
X312 : [0 1]
X56 : [0 1]
X76 : [1 0]
X202 : [0 1]
X22 : [0 1]
X336 : [0 1]
X186 : [0 1]
X139 : [0 1]
X380 : [0 1]
X368 : [0 1]
X69 : [0 1]
X218 : [1 0]
X298 : [0 1]
X243 : [0 1]
X347 : [0 1]
X90 : [0 1]
X286 : [1 0]
X190 : [0 1]
X143 : [0 1]
X372 : [0 1]
X5 : ['t' 'b' 'a' 'z' 'y' 'x' 'h' 'g' 'f' 'j' 'i' 'd' 'c' 'af' 'ag' 'ab'
      'ac'
      'ad' 'ae' 'ah' 'l' 'k' 'n' 'm' 'p' 'q' 's' 'r' 'v' 'w' 'o' 'aa']
X83 : [0 1]
X219 : [0 1]
X57 : [0 1]
X114 : [1 0]
X36 : [0 1]
X32 : [0 1]
X84 : [0 1]
X321 : [0 1]
X11 : [0 1]
X122 : [0 1]
X329 : [0 1]
X234 : [0 1]
X142 : [0 1]
X23 : [0 1]
X275 : [0 1]
X338 : [0 1]
X197 : [0 1]
X3 : ['f' 'a' 'c' 'e' 'd' 'g' 'b']
X12 : [0 1]
```

```
X343 : [0 1]
X91 : [0 1]
X153 : [0 1]
X158 : [1 0]
X236 : [0 1]
X204 : [1 0]
X31 : [1 0]
X135 : [0 1]
X192 : [0 1]
X1 : ['v' 'b' 'l' 's' 'aa' 'r' 'a' 'i' 'p' 'c' 'o' 'm' 'z' 'e' 'h' 'w' '
g' 'k'
'y' 't' 'u' 'd' 'j' 'q' 'n' 'f' 'ab']
X16 : [0 1]
X146 : [0 1]
X276 : [1 0]
X33 : [0 1]
X35 : [1 0]
X17 : [0 1]
X365 : [0 1]
X323 : [0 1]
X129 : [0 1]
X277 : [0 1]
X208 : [0 1]
X217 : [0 1]
X345 : [0 1]
X165 : [0 1]
X306 : [0 1]
X209 : [1 0]
X66 : [0 1]
X242 : [0 1]
X19 : [0 1]
X73 : [0 1]
X136 : [0 1]
X124 : [0 1]
X70 : [1 0]
X128 : [1 0]
X94 : [0 1]
X370 : [0 1]
X154 : [0 1]
X293 : [0 1]
X283 : [0 1]
X262 : [0 1]
X88 : [0 1]
X364 : [0 1]
X241 : [0 1]
X307 : [0 1]
X359 : [0 1]
X367 : [0 1]
X92 : [0 1]
X223 : [1 0]
X40 : [0 1]
X222 : [0 1]
X384 : [0 1]
X309 : [0 1]
X260 : [0 1]
X82 : [0 1]
X350 : [1 0]
X64 : [0 1]
X134 : [0 1]
X112 : [0 1]
```

```
X163 : [0 1]
X58 : [0 1]
X331 : [0 1]
X304 : [1 0]
X308 : [0 1]
X195 : [0 1]
X378 : [1 0]
X180 : [0 1]
X95 : [0 1]
X335 : [0 1]
X299 : [0 1]
X61 : [1 0]
X272 : [1 0]
X184 : [0 1]
X140 : [0 1]
X89 : [0 1]
X194 : [1 0]
X166 : [1 0]
X254 : [0 1]
X10 : [0 1]
X133 : [0 1]
X205 : [0 1]
X373 : [0 1]
X53 : [0 1]
X334 : [1 0]
X244 : [0 1]
X282 : [0 1]
X203 : [0 1]
X4 : ['d' 'b' 'a' 'c']
X355 : [0 1]
X273 : [1 0]
X383 : [0 1]
X281 : [0 1]
X318 : [0 1]
X175 : [0 1]
X249 : [0 1]
X263 : [0 1]
X41 : [0 1]
X189 : [0 1]
X96 : [1 0]
X148 : [1 0]
X305 : [0 1]
X115 : [0 1]
X362 : [0 1]
X62 : [0 1]
X199 : [0 1]
X361 : [1 0]
X13 : [0 1]
X363 : [1 0]
X160 : [0 1]
X71 : [0 1]
X74 : [1 0]
X215 : [0 1]
X150 : [1 0]
X45 : [0 1]
X155 : [0 1]
X37 : [1 0]
X300 : [0 1]
X358 : [1 0]
X87 : [0 1]
```

```
X207 : [0 1]
X81 : [0 1]
X93 : [0 1]
X38 : [0 1]
X341 : [0 1]
X187 : [0 1]
X0 : ['az' 't' 'w' 'y' 'x' 'f' 'ap' 'o' 'ay' 'al' 'h' 'z' 'aj' 'd' 'v' '
ak'
      'ba' 'n' 'j' 's' 'af' 'ax' 'at' 'aq' 'av' 'm' 'k' 'a' 'e' 'ai' 'i' 'ag'
      'b' 'am' 'aw' 'as' 'r' 'ao' 'u' 'l' 'c' 'ad' 'au' 'bc' 'g' 'an' 'ae' 'p
      'bb']
X54 : [1 0]
X302 : [0 1]
X169 : [0 1]
X119 : [0 1]
X266 : [0 1]
X138 : [0 1]
X18 : [0 1]
X103 : [0 1]
X51 : [0 1]
X288 : [0 1]
X356 : [0 1]
X237 : [0 1]
X191 : [0 1]
X278 : [0 1]
X59 : [0 1]
X107 : [0 1]
X77 : [0 1]
X230 : [0 1]
X24 : [0 1]
X240 : [0 1]
X55 : [0 1]
X328 : [1 0]
X227 : [0 1]
X102 : [0 1]
X67 : [0 1]
X360 : [0 1]
X164 : [0 1]
X349 : [0 1]
X125 : [0 1]
X131 : [0 1]
X132 : [1 0]
X147 : [0 1]
X27 : [1 0]
X98 : [1 0]
X274 : [0 1]
X86 : [0 1]
X206 : [0 1]
X316 : [0 1]
X340 : [0 1]
X152 : [0 1]
X348 : [1 0]
X60 : [0 1]
X221 : [0 1]
X224 : [0 1]
X228 : [0 1]
X173 : [0 1]
X351 : [0 1]
X183 : [0 1]
```

```
X264 : [0 1]
X43 : [1 0]
X120 : [0 1]
X267 : [0 1]
X311 : [0 1]
X144 : [1 0]
X127 : [0 1]
X2 : ['n' 'ai' 'as' 'ae' 's' 'b' 'e' 'ak' 'm' 'a' 'aq' 'ag' 'r' 'k' 'aj'
      'ay'
      'ao' 'an' 'ac' 'af' 'ax' 'h' 'i' 'f' 'ap' 'p' 'au' 't' 'z' 'y' 'aw' 'd'
      'at' 'g' 'am' 'j' 'x' 'ab' 'w' 'q' 'ah' 'ad' 'al' 'av' 'u']
X172 : [0 1]
X382 : [0 1]
X287 : [0 1]
X26 : [0 1]
X346 : [0 1]
X226 : [0 1]
X279 : [1 0]
X85 : [0 1]
X332 : [0 1]
X198 : [0 1]
X238 : [0 1]
X110 : [0 1]
X333 : [0 1]
X310 : [0 1]
X201 : [0 1]
X80 : [1 0]
X101 : [1 0]
X371 : [0 1]
X327 : [0 1]
X225 : [0 1]
X14 : [0 1]
X30 : [0 1]
X28 : [1 0]
X179 : [1 0]
X324 : [0 1]
X196 : [0 1]
X151 : [0 1]
X157 : [1 0]
X106 : [0 1]
X159 : [0 1]
X176 : [0 1]
X20 : [0 1]
X315 : [0 1]
X109 : [0 1]
X21 : [0 1]
X15 : [0 1]
X342 : [0 1]
X97 : [0 1]
X126 : [0 1]
X268 : [0 1]
X216 : [0 1]
X44 : [0 1]
X116 : [0 1]
X325 : [0 1]
X171 : [0 1]
X301 : [0 1]
X177 : [0 1]
X290 : [0 1]
X253 : [0 1]
```

```
X233 : [0 1]
X79 : [0 1]
X322 : [0 1]
X366 : [0 1]
X246 : [1 0]
X250 : [1 0]
X170 : [0 1]
X379 : [0 1]
X118 : [0 1]
X374 : [0 1]
X247 : [0 1]
X280 : [0 1]
X130 : [0 1]
X251 : [0 1]
X8 : ['w' 'y' 'j' 'n' 'm' 's' 'a' 'v' 'r' 'o' 't' 'h' 'c' 'k' 'p' 'u' 'd'
      ' ' 'g'
      'b' 'q' 'e' 'l' 'f' 'i' 'x']
X261 : [0 1]
X75 : [0 1]
X137 : [0 1]
X185 : [1 0]
X29 : [1 0]
X385 : [0 1]
X330 : [0 1]
```

In [22]: `final_columns`


```
Out[22]: ['X145',  
          'X65',  
          'X294',  
          'X285',  
          'X108',  
          'X39',  
          'X111',  
          'X320',  
          'X231',  
          'X259',  
          'X156',  
          'X235',  
          'X291',  
          'X161',  
          'X271',  
          'X99',  
          'X42',  
          'X63',  
          'X174',  
          'X289',  
          'X256',  
          'X47',  
          'X167',  
          'X313',  
          'X248',  
          'X376',  
          'X49',  
          'X344',  
          'X68',  
          'X229',  
          'X100',  
          'X352',  
          'X162',  
          'X113',  
          'X284',  
          'X34',  
          'X200',  
          'X354',  
          'X178',  
          'X220',  
          'X46',  
          'X337',  
          'X211',  
          'X255',  
          'X314',  
          'X326',  
          'X6',  
          'X213',  
          'X117',  
          'X104',  
          'X123',  
          'X292',  
          'X50',  
          'X339',  
          'X239',  
          'X212',  
          'X105',  
          'X181',  
          'X265',  
          'X357',
```

'X297',
'X377',
'X317',
'X48',
'X232',
'X353',
'X270',
'X78',
'X252',
'X210',
'X245',
'X214',
'X182',
'X375',
'X168',
'X52',
'X319',
'X141',
'X312',
'X56',
'X76',
'X202',
'X22',
'X336',
'X186',
'X139',
'X380',
'X368',
'X69',
'X218',
'X298',
'X243',
'X347',
'X90',
'X286',
'X190',
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'X275',
'X338',
'X197',
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'X12',
'X343',
'X91',

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'X236',
'X204',
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'X1',
'X16',
'X146',
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'X129',
'X277',
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'X331',
'X304',

'X308',
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'X215',
'X150',
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'X37',
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'X87',
'X207',
'X81',
'X93',

'X38',
'X341',
'X187',
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'X54',
'X302',
'X169',
'X119',
'X266',
'X138',
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'X24',
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'X55',
'X328',
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'X102',
'X67',
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'X164',
'X349',
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'X132',
'X147',
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'X351',
'X183',
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'X144',
'X127',
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'X382',
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'X26',
'X346',
'X226',
'X279',
'X85',
'X332',
'X198',
'X238',
'X110',
'X333',
'X310',
'X201',
'X80',
'X101',
'X371',
'X327',
'X369',
'X225',
'X14',
'X30',
'X28',
'X179',
'X324',
'X196',
'X151',
'X157',
'X106',
'X159',
'X176',
'X20',
'X315',
'X109',
'X21',
'X15',
'X342',
'X97',
'X126',
'X268',
'X216',
'X44',
'X116',
'X325',
'X171',
'X301',
'X177',
'X290',
'X253',
'X233',
'X79',
'X322',
'X257',
'X366',
'X246',
'X250',
'X170',
'X379',
'X118',

```
'X374',
'X295',
'X247',
'X280',
'X130',
'X251',
'X8',
'X261',
'X75',
'X137',
'X185',
'X258',
'X29',
'X385',
'X330'
```

```
In [23]: for column in final_columns:
          check = len(np.unique(x_train[column]))
          if check == 1:
              x_train.drop(column,axis=1)
              x_test.drop(column,axis=1)
          if check > 2: # Column is categorical; hence mapping to ordinal measure of value
              mapit = lambda x: sum([ord(digit) for digit in x])
              x_train[column] = x_train[column].apply(mapit)
              x_test[column] = x_test[column].apply(mapit)
```

```
In [24]: x_train.head()
```

Out[24]:

	X145	X65	X294	X285	X108	X39	X111	X320	X231	X259	X156	X235	X291	X161
0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
1	0	0	0	1	0	0	1	0	0	0	1	0	0	0
2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3	0	0	0	0	1	0	1	0	0	0	0	0	1	0
4	0	0	0	0	1	0	1	0	0	0	0	0	0	0

```
In [25]: for column in x_train:
          print(f'{column} : {x_train[column].unique()}')
```



```
X145 : [0 1]
X65 : [0 1]
X294 : [0 1]
X285 : [1 0]
X108 : [0 1]
X39 : [0 1]
X111 : [1 0]
X320 : [0 1]
X231 : [0 1]
X259 : [0 1]
X156 : [1 0]
X235 : [0]
X291 : [0 1]
X161 : [0 1]
X271 : [0 1]
X99 : [0 1]
X42 : [0 1]
X63 : [0 1]
X174 : [0 1]
X289 : [0]
X256 : [0 1]
X47 : [0 1]
X167 : [0 1]
X313 : [0 1]
X248 : [0 1]
X376 : [0 1]
X49 : [0 1]
X344 : [0 1]
X68 : [1 0]
X229 : [0 1]
X100 : [0 1]
X352 : [0 1]
X162 : [0 1]
X113 : [0 1]
X284 : [0 1]
X34 : [0 1]
X200 : [0 1]
X354 : [1 0]
X178 : [0 1]
X220 : [1 0]
X46 : [1 0]
X337 : [0 1]
X211 : [0 1]
X255 : [0 1]
X314 : [0 1]
X326 : [0 1]
X6 : [106 108 100 104 105 97 103 99 107 101 102 98]
X213 : [0 1]
X117 : [0 1]
X104 : [0 1]
X123 : [0 1]
X292 : [0 1]
X50 : [0 1]
X339 : [0 1]
X239 : [0 1]
X212 : [0 1]
X105 : [0 1]
X181 : [0 1]
X265 : [0 1]
X357 : [0 1]
```

```
X297 : [0]
X377 : [1 0]
X317 : [0 1]
X48 : [0 1]
X232 : [0 1]
X353 : [0 1]
X270 : [0 1]
X78 : [0 1]
X252 : [0 1]
X210 : [0 1]
X245 : [0 1]
X214 : [0 1]
X182 : [0 1]
X375 : [0 1]
X168 : [0 1]
X52 : [0 1]
X319 : [0 1]
X141 : [0 1]
X312 : [0 1]
X56 : [0 1]
X76 : [0 1]
X202 : [0 1]
X22 : [0 1]
X336 : [0 1]
X186 : [0 1]
X139 : [0 1]
X380 : [0 1]
X368 : [0 1]
X69 : [0 1]
X218 : [0 1]
X298 : [0 1]
X243 : [0 1]
X347 : [0]
X90 : [0 1]
X286 : [0 1]
X190 : [0 1]
X143 : [0 1]
X372 : [0 1]
X5 : [117 121 120 104 103 102 106 105 100 99 199 200 195 196 197 198 20
1 108
107 110 109 112 113 115 114 118 119 111 194]
X83 : [0 1]
X219 : [0 1]
X57 : [0 1]
X114 : [1 0]
X36 : [0 1]
X32 : [0 1]
X84 : [0 1]
X321 : [0 1]
X11 : [0]
X122 : [0 1]
X329 : [1 0]
X234 : [1 0]
X142 : [1 0]
X23 : [0 1]
X275 : [1 0]
X338 : [0 1]
X197 : [0 1]
X3 : [97 101 99 102 100 98 103]
X12 : [0 1]
```

```
X343 : [0 1]
X91 : [0 1]
X153 : [0 1]
X158 : [0 1]
X236 : [0 1]
X204 : [1 0]
X31 : [1 0]
X135 : [0 1]
X192 : [0 1]
X1 : [118 116 119 98 114 108 115 194 99 97 101 104 122 106 111 117 11
2 110
105 121 100 102 109 107 103 113 195]
X16 : [0 1]
X146 : [0 1]
X276 : [0 1]
X33 : [0 1]
X35 : [1 0]
X17 : [0 1]
X365 : [0 1]
X323 : [0 1]
X129 : [0 1]
X277 : [0 1]
X208 : [0 1]
X217 : [0 1]
X345 : [0 1]
X165 : [0 1]
X306 : [1 0]
X209 : [1 0]
X66 : [0 1]
X242 : [0 1]
X19 : [0 1]
X73 : [0 1]
X136 : [1 0]
X124 : [0 1]
X70 : [1 0]
X128 : [1 0]
X94 : [0 1]
X370 : [0 1]
X154 : [0 1]
X293 : [0]
X283 : [0 1]
X262 : [1 0]
X88 : [0 1]
X364 : [0 1]
X241 : [0 1]
X307 : [0 1]
X359 : [0 1]
X367 : [0 1]
X92 : [0 1]
X223 : [0 1]
X40 : [0 1]
X222 : [0 1]
X384 : [0 1]
X309 : [0 1]
X260 : [0 1]
X82 : [0 1]
X350 : [0 1]
X64 : [0 1]
X134 : [0 1]
X112 : [0 1]
```

```
X163 : [0 1]
X58 : [1 0]
X331 : [0 1]
X304 : [0 1]
X308 : [0 1]
X195 : [0 1]
X378 : [0 1]
X180 : [0 1]
X95 : [0 1]
X335 : [0 1]
X299 : [0 1]
X61 : [0 1]
X272 : [0 1]
X184 : [1 0]
X140 : [0 1]
X89 : [0 1]
X194 : [1 0]
X166 : [0 1]
X254 : [0 1]
X10 : [0 1]
X133 : [0 1]
X205 : [0 1]
X296 : [0 1]
X373 : [0 1]
X53 : [0 1]
X334 : [1 0]
X244 : [0 1]
X282 : [0 1]
X203 : [0 1]
X4 : [100 98 99 97]
X355 : [0 1]
X273 : [1 0]
X383 : [0 1]
X281 : [0 1]
X318 : [0 1]
X175 : [0 1]
X249 : [0 1]
X263 : [1 0]
X41 : [0 1]
X189 : [1 0]
X96 : [0 1]
X148 : [0 1]
X305 : [0 1]
X115 : [0 1]
X362 : [0 1]
X62 : [0 1]
X199 : [0 1]
X361 : [1 0]
X13 : [1 0]
X363 : [0 1]
X160 : [0 1]
X71 : [0 1]
X74 : [1 0]
X215 : [0 1]
X150 : [1 0]
X45 : [0 1]
X155 : [0 1]
X37 : [1 0]
X300 : [0 1]
X358 : [0 1]
```

```
X87 : [0 1]
X207 : [0 1]
X81 : [0 1]
X93 : [0]
X38 : [0 1]
X341 : [0 1]
X187 : [1 0]
X0 : [107 219 116 205 111 119 106 104 115 110 218 102 120 121 203 204 20
6 122
    113 213 209 118 199 97 101 202 100 210 99 194 195 212 105 114 98 217
    197 117 214 109 108 216 208 196 103]
X54 : [0 1]
X302 : [0 1]
X169 : [0 1]
X119 : [1 0]
X266 : [1 0]
X138 : [0 1]
X18 : [1 0]
X103 : [0 1]
X51 : [0 1]
X288 : [0 1]
X356 : [0 1]
X237 : [1 0]
X191 : [0 1]
X278 : [0 1]
X59 : [0 1]
X107 : [0]
X77 : [0 1]
X230 : [0 1]
X24 : [0 1]
X240 : [0 1]
X55 : [0 1]
X328 : [0 1]
X227 : [0 1]
X102 : [0 1]
X67 : [0 1]
X360 : [0 1]
X164 : [0 1]
X349 : [0 1]
X125 : [0 1]
X131 : [1 0]
X132 : [0 1]
X147 : [0 1]
X27 : [0 1]
X98 : [0 1]
X274 : [0 1]
X86 : [0 1]
X206 : [0 1]
X316 : [1 0]
X340 : [0 1]
X152 : [0 1]
X348 : [0 1]
X60 : [0 1]
X221 : [0 1]
X224 : [0 1]
X228 : [0 1]
X173 : [0 1]
X351 : [0 1]
X183 : [0 1]
X264 : [0 1]
```

```
X43 : [0 1]
X120 : [1 0]
X267 : [0 1]
X311 : [0 1]
X144 : [1 0]
X127 : [0 1]
X2 : [213 215 110 101 212 210 114 202 204 109 97 107 198 115 102 100 20
0 218
196 209 103 105 216 121 98 208 205 104 120 214 116 207 122 201 112 206
106 113 199 108 194 99 111 211]
X172 : [0 1]
X382 : [0 1]
X287 : [0 1]
X26 : [0 1]
X346 : [0 1]
X226 : [0 1]
X279 : [0 1]
X85 : [1 0]
X332 : [0 1]
X198 : [0 1]
X238 : [0 1]
X110 : [0 1]
X333 : [0 1]
X310 : [0 1]
X201 : [0 1]
X80 : [0 1]
X101 : [0 1]
X371 : [0 1]
X327 : [1 0]
X369 : [0 1]
X225 : [0 1]
X14 : [0 1]
X30 : [0 1]
X28 : [0 1]
X179 : [1 0]
X324 : [1 0]
X196 : [0 1]
X151 : [0 1]
X157 : [0 1]
X106 : [0 1]
X159 : [0 1]
X176 : [0 1]
X20 : [0 1]
X315 : [0 1]
X109 : [0 1]
X21 : [1 0]
X15 : [0 1]
X342 : [0 1]
X97 : [0 1]
X126 : [0 1]
X268 : [0]
X216 : [0 1]
X44 : [0 1]
X116 : [1 0]
X325 : [0 1]
X171 : [0 1]
X301 : [0 1]
X177 : [0 1]
X290 : [0]
X253 : [0 1]
```

```
X233 : [0]
X79 : [0 1]
X322 : [0 1]
X257 : [0 1]
X366 : [0 1]
X246 : [0 1]
X250 : [0 1]
X170 : [1 0]
X379 : [0 1]
X118 : [1 0]
X374 : [0 1]
X295 : [0 1]
X247 : [0 1]
X280 : [0 1]
X130 : [0 1]
X251 : [0 1]
X8 : [111 120 101 110 115 97 104 112 109 107 100 105 118 106 98 113 11
9 103
121 108 102 117 114 116 99]
X261 : [0 1]
X75 : [0 1]
X137 : [1 0]
X185 : [0 1]
X258 : [0 1]
X29 : [0 1]
X385 : [0 1]
X232 : [0 1]
```

```
In [26]: for column in x_test:
          print(f'{column} : {x_test[column].unique()}')
```



```
X145 : [0 1]
X65 : [0 1]
X294 : [0 1]
X285 : [0 1]
X108 : [0 1]
X39 : [0 1]
X111 : [1 0]
X320 : [0 1]
X231 : [0 1]
X259 : [0 1]
X156 : [0 1]
X235 : [0 1]
X291 : [0 1]
X161 : [0 1]
X271 : [0 1]
X99 : [0 1]
X42 : [0 1]
X63 : [0 1]
X174 : [0 1]
X289 : [0 1]
X256 : [1 0]
X47 : [0 1]
X167 : [0 1]
X313 : [0 1]
X248 : [0 1]
X376 : [0 1]
X49 : [0 1]
X344 : [0 1]
X68 : [0 1]
X229 : [0 1]
X100 : [0 1]
X352 : [0 1]
X162 : [1 0]
X113 : [0 1]
X284 : [0 1]
X34 : [0 1]
X200 : [0 1]
X354 : [0 1]
X178 : [0 1]
X220 : [1 0]
X46 : [1 0]
X337 : [0 1]
X211 : [0 1]
X255 : [0 1]
X314 : [0 1]
X326 : [0 1]
X6 : [ 97 103 106 108 105 100 102 104 99 107 101 98]
X213 : [0 1]
X117 : [0 1]
X104 : [0 1]
X123 : [0 1]
X292 : [0 1]
X50 : [0 1]
X339 : [0 1]
X239 : [0 1]
X212 : [0 1]
X105 : [0 1]
X181 : [0 1]
X265 : [0 1]
X357 : [0 1]
```

```
X297 : [0 1]
X377 : [0 1]
X317 : [0 1]
X48 : [0 1]
X232 : [1 0]
X353 : [0 1]
X270 : [0 1]
X78 : [0 1]
X252 : [0 1]
X210 : [0 1]
X245 : [0 1]
X214 : [0 1]
X182 : [0 1]
X375 : [0 1]
X168 : [0 1]
X52 : [0 1]
X319 : [0 1]
X141 : [0 1]
X312 : [0 1]
X56 : [0 1]
X76 : [1 0]
X202 : [0 1]
X22 : [0 1]
X336 : [0 1]
X186 : [0 1]
X139 : [0 1]
X380 : [0 1]
X368 : [0 1]
X69 : [0 1]
X218 : [1 0]
X298 : [0 1]
X243 : [0 1]
X347 : [0 1]
X90 : [0 1]
X286 : [1 0]
X190 : [0 1]
X143 : [0 1]
X372 : [0 1]
X5 : [116 98 97 122 121 120 104 103 102 106 105 100 99 199 200 195 19
6 197
198 201 108 107 110 109 112 113 115 114 118 119 111 194]
X83 : [0 1]
X219 : [0 1]
X57 : [0 1]
X114 : [1 0]
X36 : [0 1]
X32 : [0 1]
X84 : [0 1]
X321 : [0 1]
X11 : [0 1]
X122 : [0 1]
X329 : [0 1]
X234 : [0 1]
X142 : [0 1]
X23 : [0 1]
X275 : [0 1]
X338 : [0 1]
X197 : [0 1]
X3 : [102 97 99 101 100 103 98]
X12 : [0 1]
```

```
X343 : [0 1]
X91 : [0 1]
X153 : [0 1]
X158 : [1 0]
X236 : [0 1]
X204 : [1 0]
X31 : [1 0]
X135 : [0 1]
X192 : [0 1]
X1 : [118 98 108 115 194 114 97 105 112 99 111 109 122 101 104 119 10
3 107
121 116 117 100 106 113 110 102 195]
X16 : [0 1]
X146 : [0 1]
X276 : [1 0]
X33 : [0 1]
X35 : [1 0]
X17 : [0 1]
X365 : [0 1]
X323 : [0 1]
X129 : [0 1]
X277 : [0 1]
X208 : [0 1]
X217 : [0 1]
X345 : [0 1]
X165 : [0 1]
X306 : [0 1]
X209 : [1 0]
X66 : [0 1]
X242 : [0 1]
X19 : [0 1]
X73 : [0 1]
X136 : [0 1]
X124 : [0 1]
X70 : [1 0]
X128 : [1 0]
X94 : [0 1]
X370 : [0 1]
X154 : [0 1]
X293 : [0 1]
X283 : [0 1]
X262 : [0 1]
X88 : [0 1]
X364 : [0 1]
X241 : [0 1]
X307 : [0 1]
X359 : [0 1]
X367 : [0 1]
X92 : [0 1]
X223 : [1 0]
X40 : [0 1]
X222 : [0 1]
X384 : [0 1]
X309 : [0 1]
X260 : [0 1]
X82 : [0 1]
X350 : [1 0]
X64 : [0 1]
X134 : [0 1]
X112 : [0 1]
```

```
X163 : [0 1]
X58 : [0 1]
X331 : [0 1]
X304 : [1 0]
X308 : [0 1]
X195 : [0 1]
X378 : [1 0]
X180 : [0 1]
X95 : [0 1]
X335 : [0 1]
X299 : [0 1]
X61 : [1 0]
X272 : [1 0]
X184 : [0 1]
X140 : [0 1]
X89 : [0 1]
X194 : [1 0]
X166 : [1 0]
X254 : [0 1]
X10 : [0 1]
X133 : [0 1]
X205 : [0 1]
X296 : [0]
X373 : [0 1]
X53 : [0 1]
X334 : [1 0]
X244 : [0 1]
X282 : [0 1]
X203 : [0 1]
X4 : [100 98 97 99]
X355 : [0 1]
X273 : [1 0]
X383 : [0 1]
X281 : [0 1]
X318 : [0 1]
X175 : [0 1]
X249 : [0 1]
X263 : [0 1]
X41 : [0 1]
X189 : [0 1]
X96 : [1 0]
X148 : [1 0]
X305 : [0 1]
X115 : [0 1]
X362 : [0 1]
X62 : [0 1]
X199 : [0 1]
X361 : [1 0]
X13 : [0 1]
X363 : [1 0]
X160 : [0 1]
X71 : [0 1]
X74 : [1 0]
X215 : [0 1]
X150 : [1 0]
X45 : [0 1]
X155 : [0 1]
X37 : [1 0]
X300 : [0 1]
X358 : [1 0]
```

```
X87 : [0 1]
X207 : [0 1]
X81 : [0 1]
X93 : [0 1]
X38 : [0 1]
X341 : [0 1]
X187 : [0 1]
X0 : [219 116 119 121 120 102 209 111 218 205 104 122 203 100 118 204 19
5 110
    106 115 199 217 213 210 215 109 107 97 101 202 105 200 98 206 216 212
    114 208 117 108 99 197 214 103 207 198 112 196]
X54 : [1 0]
X302 : [0 1]
X169 : [0 1]
X119 : [0 1]
X266 : [0 1]
X138 : [0 1]
X18 : [0 1]
X103 : [0 1]
X51 : [0 1]
X288 : [0 1]
X356 : [0 1]
X237 : [0 1]
X191 : [0 1]
X278 : [0 1]
X59 : [0 1]
X107 : [0 1]
X77 : [0 1]
X230 : [0 1]
X24 : [0 1]
X240 : [0 1]
X55 : [0 1]
X328 : [1 0]
X227 : [0 1]
X102 : [0 1]
X67 : [0 1]
X360 : [0 1]
X164 : [0 1]
X349 : [0 1]
X125 : [0 1]
X131 : [0 1]
X132 : [1 0]
X147 : [0 1]
X27 : [1 0]
X98 : [1 0]
X274 : [0 1]
X86 : [0 1]
X206 : [0 1]
X316 : [0 1]
X340 : [0 1]
X152 : [0 1]
X348 : [1 0]
X60 : [0 1]
X221 : [0 1]
X224 : [0 1]
X228 : [0 1]
X173 : [0 1]
X351 : [0 1]
X183 : [0 1]
X264 : [0 1]
```

```
X43 : [1 0]
X120 : [0 1]
X267 : [0 1]
X311 : [0 1]
X144 : [1 0]
X127 : [0 1]
X2 : [110 202 212 198 115 98 101 204 109 97 210 200 114 107 203 218 20
8 207
196 199 217 104 105 102 209 112 214 116 122 121 216 100 213 103 206 106
120 195 119 113 201 197 205 215 117]
X172 : [0 1]
X382 : [0 1]
X287 : [0 1]
X26 : [0 1]
X346 : [0 1]
X226 : [0 1]
X279 : [1 0]
X85 : [0 1]
X332 : [0 1]
X198 : [0 1]
X238 : [0 1]
X110 : [0 1]
X333 : [0 1]
X310 : [0 1]
X201 : [0 1]
X80 : [1 0]
X101 : [1 0]
X371 : [0 1]
X327 : [0 1]
X369 : [0]
X225 : [0 1]
X14 : [0 1]
X30 : [0 1]
X28 : [1 0]
X179 : [1 0]
X324 : [0 1]
X196 : [0 1]
X151 : [0 1]
X157 : [1 0]
X106 : [0 1]
X159 : [0 1]
X176 : [0 1]
X20 : [0 1]
X315 : [0 1]
X109 : [0 1]
X21 : [0 1]
X15 : [0 1]
X342 : [0 1]
X97 : [0 1]
X126 : [0 1]
X268 : [0 1]
X216 : [0 1]
X44 : [0 1]
X116 : [0 1]
X325 : [0 1]
X171 : [0 1]
X301 : [0 1]
X177 : [0 1]
X290 : [0 1]
X253 : [0 1]
```

```

X233 : [0 1]
X79 : [0 1]
X322 : [0 1]
X257 : [0]
X366 : [0 1]
X246 : [1 0]
X250 : [1 0]
X170 : [0 1]
X379 : [0 1]
X118 : [0 1]
X374 : [0 1]
X295 : [0]
X247 : [0 1]
X280 : [0 1]
X130 : [0 1]
X251 : [0 1]
X8 : [119 121 106 110 109 115 97 118 114 111 116 104 99 107 112 117 10
0 103
98 113 101 108 102 105 120]
X261 : [0 1]
X75 : [0 1]
X137 : [0 1]
X185 : [1 0]
X258 : [0]
X29 : [1 0]
X385 : [0 1]
X330 : [0 1]

```

```
In [27]: print(x_train.shape)
print(x_test.shape)
```

```
(4209, 376)
(4209, 376)
```

```
In [28]: from sklearn.decomposition import PCA
```

```
In [29]: pca = PCA(n_components=12, random_state=42)
pca_result_train = pca.fit_transform(x_train)
pca_result_test = pca.transform(x_test)
```

```
In [30]: pca_result_train.shape
```

```
Out[30]: (4209, 12)
```

```
In [31]: pca_result_train
```

```
Out[31]: array([[ -49.08156207,  -4.90948084, -17.25085325, ...,   1.65804364,
         0.93267605,   1.67862179],
        [ -48.94680383,  -7.22674339, -13.7631947 , ...,  -0.21433019,
         0.10894959,   0.44951744],
        [  92.62761708,  31.9940341 , -26.17503456, ...,  -0.62191997,
         2.9257745 ,  -0.52731228],
        ...,
        [  89.47970814,  20.44554421,  48.11999819, ...,  -1.27198028,
        -0.28729176,   2.00800645],
        [  96.97110845,  31.50977186,  49.20059282, ...,   0.14367419,
        -0.97966118,   0.99163929],
        [-17.21024322, -14.22166025,  55.38091289, ...,  -0.28904652,
        -0.31659612,   0.69153517]])
```

```
In [32]: pca_result_test.shape
```

```
Out[32]: (4209, 12)
```

```
In [33]: pca_result_test
```

```
Out[33]: array([[ 9.22615149e+01,  3.29260839e+01, -3.01130736e+01, ...,
                  -4.11415384e-01,  3.62099259e+00, -1.20765447e+00],
                 [-3.48622379e+01,  6.87132606e+00, -3.74760829e+01, ...,
                  6.09258749e-01, -6.95883560e-01, -4.24997683e-01],
                 [ 4.36560426e+01, -5.05939489e+01, -6.10591086e+01, ...,
                  -3.20454986e-01,  2.60157704e+00, -1.53755611e+00],
                 ...,
                 [-2.52437784e+01, -2.63794193e+01,  5.40742341e+01, ...,
                  6.03523601e-01,  2.61085024e-02,  3.67074531e-02],
                 [ 4.53823778e+01, -6.38062446e+01,  3.58666036e+01, ...,
                  -9.15192421e-01, -6.72283868e-01,  5.15242071e-01],
                 [-4.23807477e+01, -2.52862351e+01,  6.10815522e+01, ...,
                  -2.98845912e-01, -9.77091159e-01,  5.35374019e-02]])
```



```
In [34]: import xgboost as xgb
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split

x_train, x_valid, y_train, y_valid = train_test_split(pca_result_train, y_train, test_size=0.2, random_state=42)

d_train = xgb.DMatrix(x_train, label=y_train)
d_valid = xgb.DMatrix(x_valid, label=y_valid)
d_test = xgb.DMatrix(pca_result_test)

params = {}
params['objective'] = 'reg:linear'
params['eta'] = 0.02
params['max_depth'] = 4

def xgb_r2_score(preds, dtrain):
    labels = dtrain.get_label()
    return 'r2', r2_score(labels, preds)

watchlist = [(d_train, 'train'), (d_valid, 'valid')]

clf = xgb.train(params, d_train, 1000, watchlist, early_stopping_rounds=50, feval=xgb_r2_score, maximize=True, verbose_eval=10)
```

```
[12:08:41] WARNING: /workspace/src/objective/regression_obj.cu:152: reg:
linear is now deprecated in favor of reg:squarederror.
[0]      train-rmse:98.997      valid-rmse:98.8888      train-r2:-59.497
3      valid-r2:-61.8269
Multiple eval metrics have been passed: 'valid-r2' will be used for earl
y stopping.
```

Will train until valid-r2 hasn't improved in 50 rounds.

```
[10]      train-rmse:81.1441      valid-rmse:81.0785      train-r2:-39.644
9      valid-r2:-41.234
[20]      train-rmse:66.5975      valid-rmse:66.5561      train-r2:-26.378
4      valid-r2:-27.4595
[30]      train-rmse:54.7579      valid-rmse:54.7343      train-r2:-17.509
1      valid-r2:-18.2473
[40]      train-rmse:45.1393      valid-rmse:45.1353      train-r2:-11.577
7      valid-r2:-12.0883
[50]      train-rmse:37.3456      valid-rmse:37.3617      train-r2:-7.6093
5      valid-r2:-7.96819
[60]      train-rmse:31.0514      valid-rmse:31.0861      train-r2:-4.9518
8      valid-r2:-5.20845
[70]      train-rmse:25.9851      valid-rmse:26.036      train-r2:-3.1681
2      valid-r2:-3.35513
[80]      train-rmse:21.9407      valid-rmse:22.0043      train-r2:-1.9716
3      valid-r2:-2.11076
[90]      train-rmse:18.7349      valid-rmse:18.8212      train-r2:-1.1666
7      valid-r2:-1.27586
[100]     train-rmse:16.2205      valid-rmse:16.3378      train-r2:-0.6241
37      valid-r2:-0.714901
[110]     train-rmse:14.2833      valid-rmse:14.4261      train-r2:-0.2593
68      valid-r2:-0.33705
[120]     train-rmse:12.8104      valid-rmse:12.9734      train-r2:-0.0130
25      valid-r2:-0.081329
[130]     train-rmse:11.6932      valid-rmse:11.8977      train-r2:0.15596
4      valid-r2:0.090555
[140]     train-rmse:10.8648      valid-rmse:11.1162      train-r2:0.27132
3      valid-r2:0.206105
[150]     train-rmse:10.2498      valid-rmse:10.5498      train-r2:0.35148
2      valid-r2:0.284944
[160]     train-rmse:9.79656      valid-rmse:10.1523      train-r2:0.40756
7      valid-r2:0.337814
[170]     train-rmse:9.46108      valid-rmse:9.87251      train-r2:0.44744
8      valid-r2:0.37381
[180]     train-rmse:9.21733      valid-rmse:9.67623      train-r2:0.47555
1      valid-r2:0.398462
[190]     train-rmse:9.03398      valid-rmse:9.53771      train-r2:0.49620
8      valid-r2:0.415561
[200]     train-rmse:8.89359      valid-rmse:9.4412      train-r2:0.51174
4      valid-r2:0.427329
[210]     train-rmse:8.7876      valid-rmse:9.37318      train-r2:0.52331
3      valid-r2:0.43555
[220]     train-rmse:8.70611      valid-rmse:9.32554      train-r2:0.53211
4      valid-r2:0.441273
[230]     train-rmse:8.64641      valid-rmse:9.29463      train-r2:0.53850
8      valid-r2:0.444972
[240]     train-rmse:8.58776      valid-rmse:9.27254      train-r2:0.54474
8      valid-r2:0.447607
[250]     train-rmse:8.54477      valid-rmse:9.25633      train-r2:0.54929
4      valid-r2:0.449536
[260]     train-rmse:8.50271      valid-rmse:9.23949      train-r2:0.55372
1      valid-r2:0.451537
```

[270]	train-rmse:8.46907	valid-rmse:9.23072	train-r2:0.55724
5	valid-r2:0.452578		
[280]	train-rmse:8.43572	valid-rmse:9.22021	train-r2:0.56072
5	valid-r2:0.453824		
[290]	train-rmse:8.40091	valid-rmse:9.2157	train-r2:0.56434
3	valid-r2:0.454358		
[300]	train-rmse:8.35915	valid-rmse:9.20918	train-r2:0.56866
3	valid-r2:0.45513		
[310]	train-rmse:8.33132	valid-rmse:9.20759	train-r2:0.57153
1	valid-r2:0.455318		
[320]	train-rmse:8.30079	valid-rmse:9.20364	train-r2:0.57466
5	valid-r2:0.455785		
[330]	train-rmse:8.27292	valid-rmse:9.20077	train-r2:0.57751
6	valid-r2:0.456124		
[340]	train-rmse:8.24105	valid-rmse:9.19946	train-r2:0.58076
5	valid-r2:0.45628		
[350]	train-rmse:8.21671	valid-rmse:9.19534	train-r2:0.58323
7	valid-r2:0.456766		
[360]	train-rmse:8.18569	valid-rmse:9.19412	train-r2:0.58637
8	valid-r2:0.45691		
[370]	train-rmse:8.1599	valid-rmse:9.19491	train-r2:0.58898
1	valid-r2:0.456817		
[380]	train-rmse:8.13284	valid-rmse:9.19476	train-r2:0.59170
2	valid-r2:0.456835		
[390]	train-rmse:8.11046	valid-rmse:9.19456	train-r2:0.59394
6	valid-r2:0.456858		
[400]	train-rmse:8.08979	valid-rmse:9.19321	train-r2:0.59601
4	valid-r2:0.457019		
[410]	train-rmse:8.07264	valid-rmse:9.19141	train-r2:0.59772
5	valid-r2:0.45723		
[420]	train-rmse:8.05014	valid-rmse:9.19086	train-r2:0.59996
4	valid-r2:0.457296		
[430]	train-rmse:8.02558	valid-rmse:9.19075	train-r2:0.6024
	valid-r2:0.457309		
[440]	train-rmse:7.99939	valid-rmse:9.1889	train-r2:0.60499
1	valid-r2:0.457527		
[450]	train-rmse:7.96601	valid-rmse:9.18797	train-r2:0.60828
2	valid-r2:0.457637		
[460]	train-rmse:7.93561	valid-rmse:9.18077	train-r2:0.61126
6	valid-r2:0.458487		
[470]	train-rmse:7.91534	valid-rmse:9.18291	train-r2:0.61324
9	valid-r2:0.458234		
[480]	train-rmse:7.89394	valid-rmse:9.18507	train-r2:0.61533
7	valid-r2:0.457979		
[490]	train-rmse:7.86493	valid-rmse:9.1824	train-r2:0.61815
9	valid-r2:0.458294		
[500]	train-rmse:7.8499	valid-rmse:9.17959	train-r2:0.61961
7	valid-r2:0.458625		
[510]	train-rmse:7.82427	valid-rmse:9.17666	train-r2:0.62209
7	valid-r2:0.458971		
[520]	train-rmse:7.80373	valid-rmse:9.17654	train-r2:0.62407
9	valid-r2:0.458986		
[530]	train-rmse:7.77102	valid-rmse:9.16803	train-r2:0.62722
4	valid-r2:0.459989		
[540]	train-rmse:7.75224	valid-rmse:9.16647	train-r2:0.62902
3	valid-r2:0.460172		
[550]	train-rmse:7.73213	valid-rmse:9.16732	train-r2:0.63094
5	valid-r2:0.460072		
[560]	train-rmse:7.71066	valid-rmse:9.16704	train-r2:0.63299
3	valid-r2:0.460104		

```
[570] train-rmse:7.6855      valid-rmse:9.16534      train-r2:0.63538
3      valid-r2:0.460305
[580] train-rmse:7.66554    valid-rmse:9.16722      train-r2:0.63727
4      valid-r2:0.460084
[590] train-rmse:7.64728    valid-rmse:9.16532      train-r2:0.639
valid-r2:0.460307
Stopping. Best iteration:
[543] train-rmse:7.74141    valid-rmse:9.16477      train-r2:0.63005
9      valid-r2:0.460372
```

```
In [35]: p_test = clf.predict(d_test)
```

```
In [36]: p_test
```

```
Out[36]: array([ 79.5967 ,  96.046646,  81.54838 , ...,  98.65591 , 106.82803 ,
 95.50673 ], dtype=float32)
```

```
In [37]: Predicted_Data = pd.DataFrame()
Predicted_Data['y'] = p_test
Predicted_Data.head()
```

```
Out[37]:
```

	y
0	79.596703
1	96.046646
2	81.548378
3	77.346794
4	109.739365

```
In [ ]:
```