PROJECT–Computer hardware

February 2, 2023

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

[133]:
```python
df=pd.read_table('https://archive.ics.uci.edu/ml/machine-learning-databases/
  ↪cpu-performance/machine.
  ↪data',sep=',',header=None,names=['Vendors','Model','MYCT','MMIN','MMAX','CACH','CHMIN','CHM
```

[134]:
```python
df.head()
```

[134]:
```
    Vendors    Model  MYCT  MMIN   MMAX  CACH  CHMIN  CHMAX  PRP  ERP
0   adviser    32/60   125   256   6000   256     16    128  198  199
1    amdahl   470v/7    29  8000  32000    32      8     32  269  253
2    amdahl  470v/7a    29  8000  32000    32      8     32  220  253
3    amdahl  470v/7b    29  8000  32000    32      8     32  172  253
4    amdahl  470v/7c    29  8000  16000    32      8     16  132  132
```

[148]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 209 entries, 0 to 208
Data columns (total 10 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   Vendors  209 non-null    object
 1   Model    209 non-null    object
 2   MYCT     209 non-null    int64
 3   MMIN     209 non-null    int64
 4   MMAX     209 non-null    int64
 5   CACH     209 non-null    int64
 6   CHMIN    209 non-null    int64
 7   CHMAX    209 non-null    int64
 8   PRP      209 non-null    int64
 9   ERP      209 non-null    int64
dtypes: int64(8), object(2)
```

```
memory usage: 16.5+ KB
```

[149]:
```
df.isna().sum()
```

[149]:
```
Vendors    0
Model      0
MYCT       0
MMIN       0
MMAX       0
CACH       0
CHMIN      0
CHMAX      0
PRP        0
ERP        0
dtype: int64
```

1 EDA

[150]:
```
df.head()
```

[150]:
```
   Vendors    Model  MYCT  MMIN   MMAX  CACH  CHMIN  CHMAX  PRP  ERP
0  adviser    32/60   125   256   6000   256     16    128  198  199
1   amdahl   470v/7    29  8000  32000    32      8     32  269  253
2   amdahl  470v/7a    29  8000  32000    32      8     32  220  253
3   amdahl  470v/7b    29  8000  32000    32      8     32  172  253
4   amdahl  470v/7c    29  8000  16000    32      8     16  132  132
```

[151]:
```
df.isna().sum()
```

[151]:
```
Vendors    0
Model      0
MYCT       0
MMIN       0
MMAX       0
CACH       0
CHMIN      0
CHMAX      0
PRP        0
ERP        0
dtype: int64
```

[145]:
```
df['ERP'].unique()
```

[145]:
```
array([ 199,  253,  132,  290,  381,  749, 1238,   23,   24,   70,  117,
         15,   64,   29,   22,  124,   35,   39,   40,   45,   28,   21,
         27,  102,   74,  138,  136,   44,   30,   41,   54,   18,   36,
         38,   34,   19,   72,   56,   42,   75,  113,  157,   20,   33,
         47,   25,   52,   50,   53,   73,   32,  175,   57,  181,   82,
        171,  361,  350,  220,   17,   26,   31,   76,   59,   65,  101,
        116,  128,   37,   46,   80,   88,   86,   95,  107,  119,  120,
         48,  126,  266,  270,  426,  151,  267,  603,   62,   78,  142,
        281,  190,   67,   43,   99,   81,  149,  183,  275,  382,  182,
        227,  341,  360,  919,  978], dtype=int64)
```

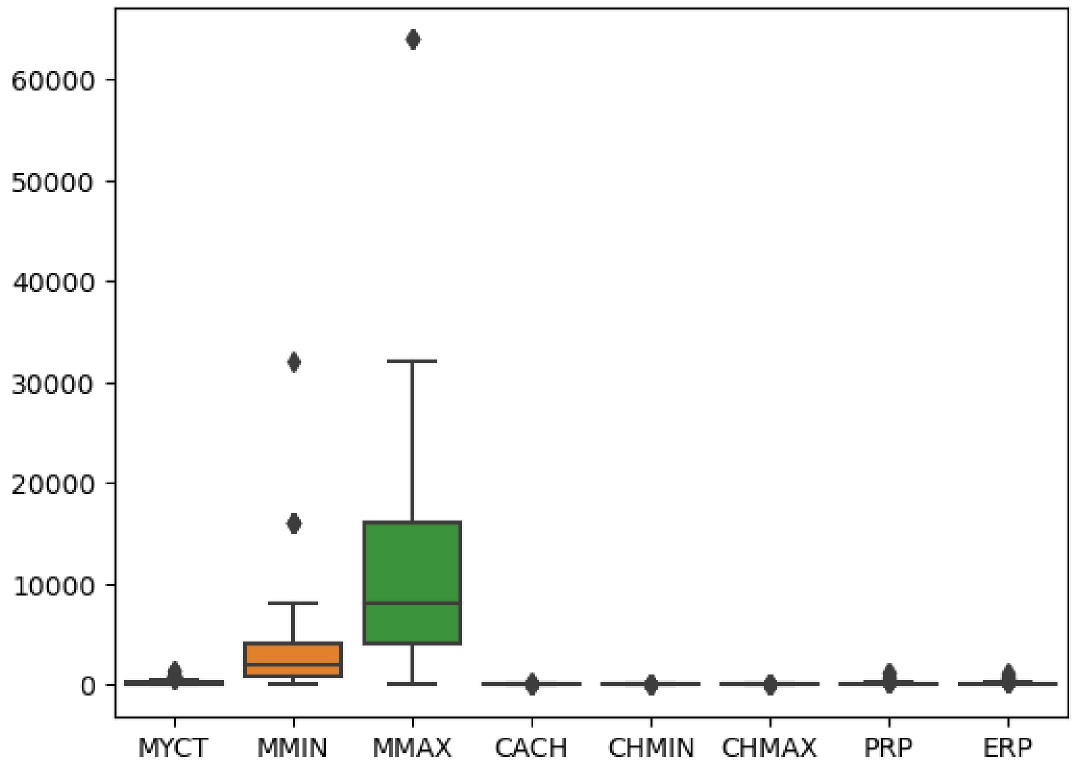
[162]:
```
df.replace([np.inf, -np.inf], np.nan, inplace=True)
```

[147]:
```
from sklearn.impute import SimpleImputer
```

[167]:
```
si=SimpleImputer(missing_values=np.nan,strategy='mean')
df[['CHMAX']]=si.fit_transform(df[['CHMAX']])
```

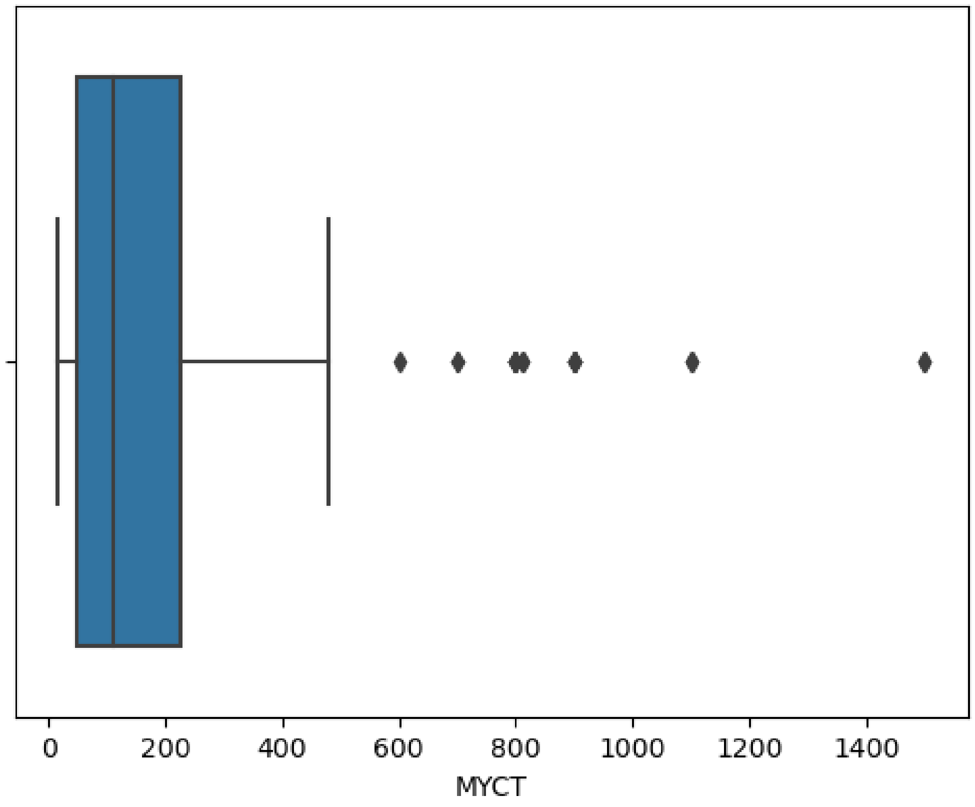
[152]:
```
sns.boxplot(data=df)
```

[152]:
```
<AxesSubplot:>
```



[153]:
```
sns.boxplot(x='MYCT',data=df)
```

[153]:
```
<AxesSubplot:xlabel='MYCT'>
```



```
[154]: colname=df.select_dtypes(['int64']).columns
```

```
[155]: df[colname]
```

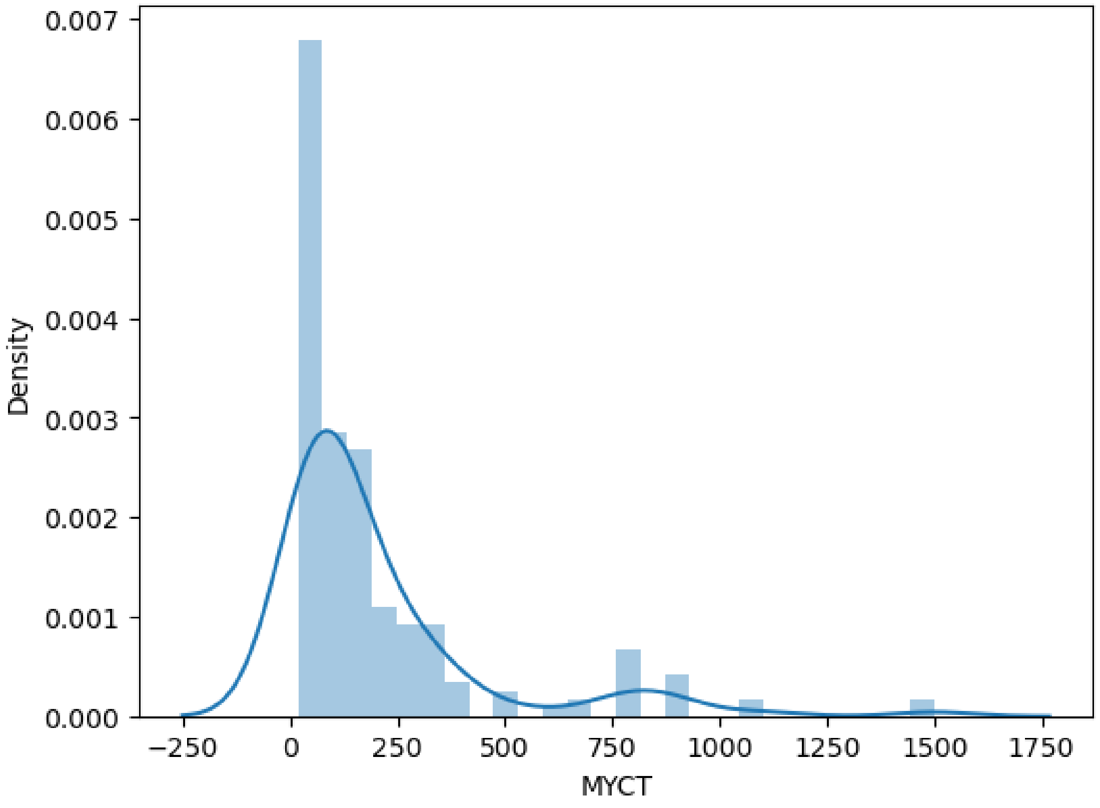
```
[155]:      MYCT  MMIN   MMAX  CACH  CHMIN  CHMAX  PRP  ERP
       0     125   256   6000   256     16    128  198  199
       1      29  8000  32000    32      8     32  269  253
       2      29  8000  32000    32      8     32  220  253
       3      29  8000  32000    32      8     32  172  253
       4      29  8000  16000    32      8     16  132  132
       ..    …     …      …     …      …    …    …    …
       204   124  1000   8000     0      1      8   42   37
       205    98  1000   8000    32      2      8   46   50
       206   125  2000   8000     0      2     14   52   41
       207   480   512   8000    32      0      0   67   47
       208   480  1000   4000     0      0      0   45   25

       [209 rows x 8 columns]
```

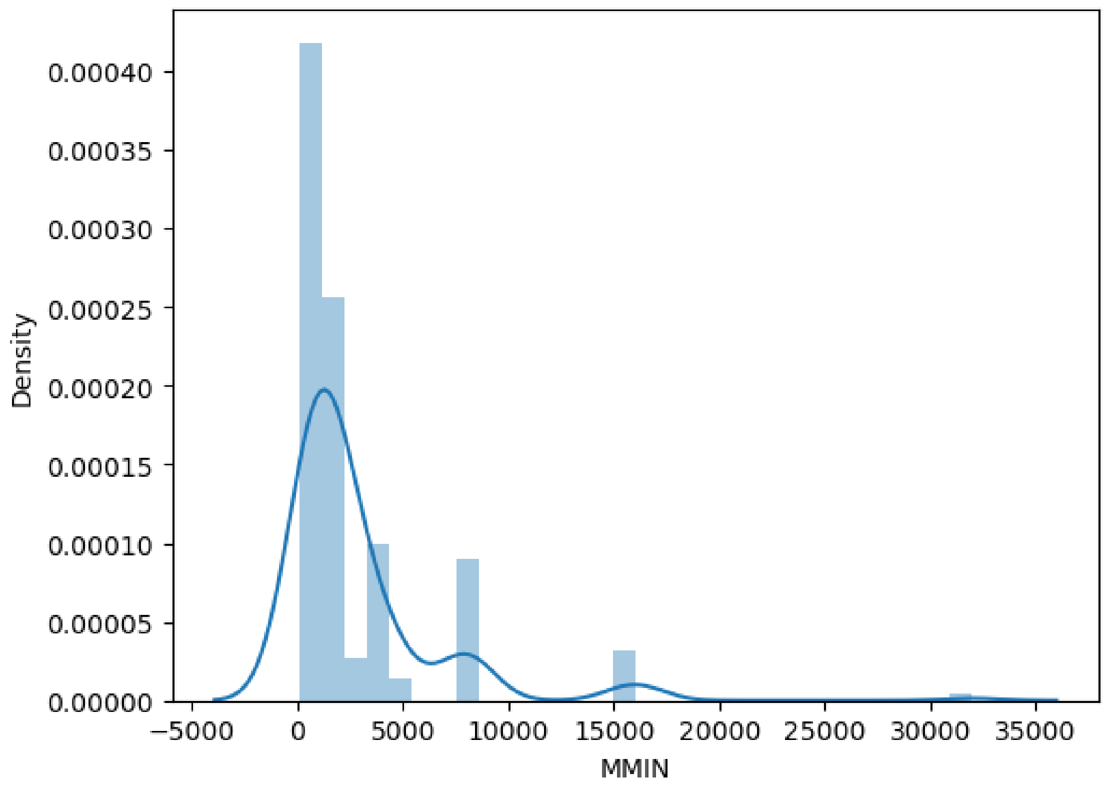
```
[156]: from scipy.stats import skew
```

[157]:
```
for i in df[colname]:
    print(i)
    print(skew(df[i]))
    sns.distplot(df[i])
    plt.show()
```

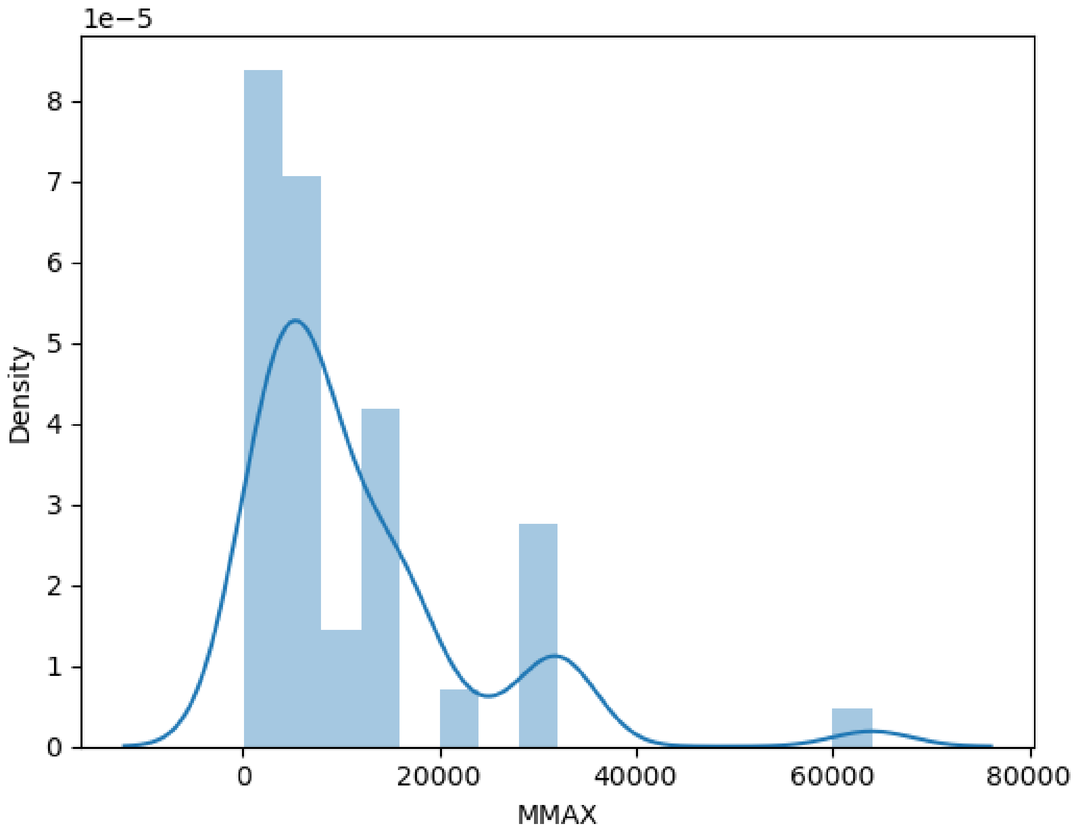
```
MYCT
2.5258570096766686
```



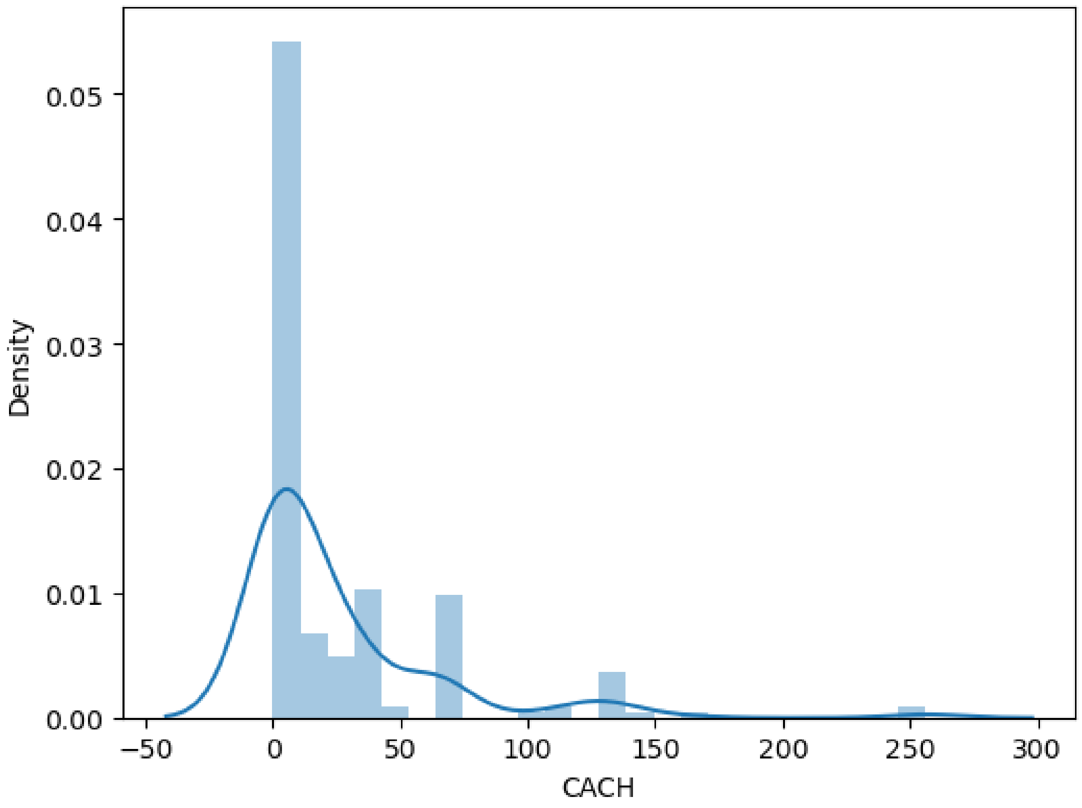
```
MMIN
3.4906489998203925
```



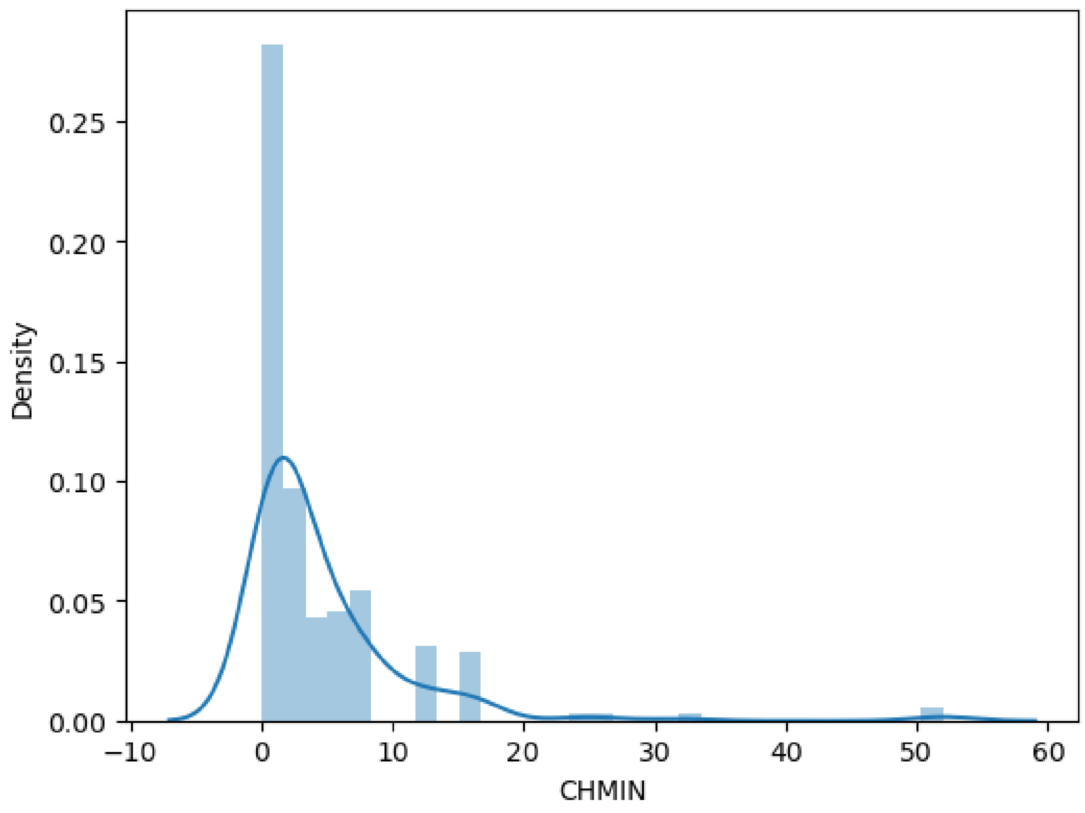
```
MMAX
2.1252682972972194
```



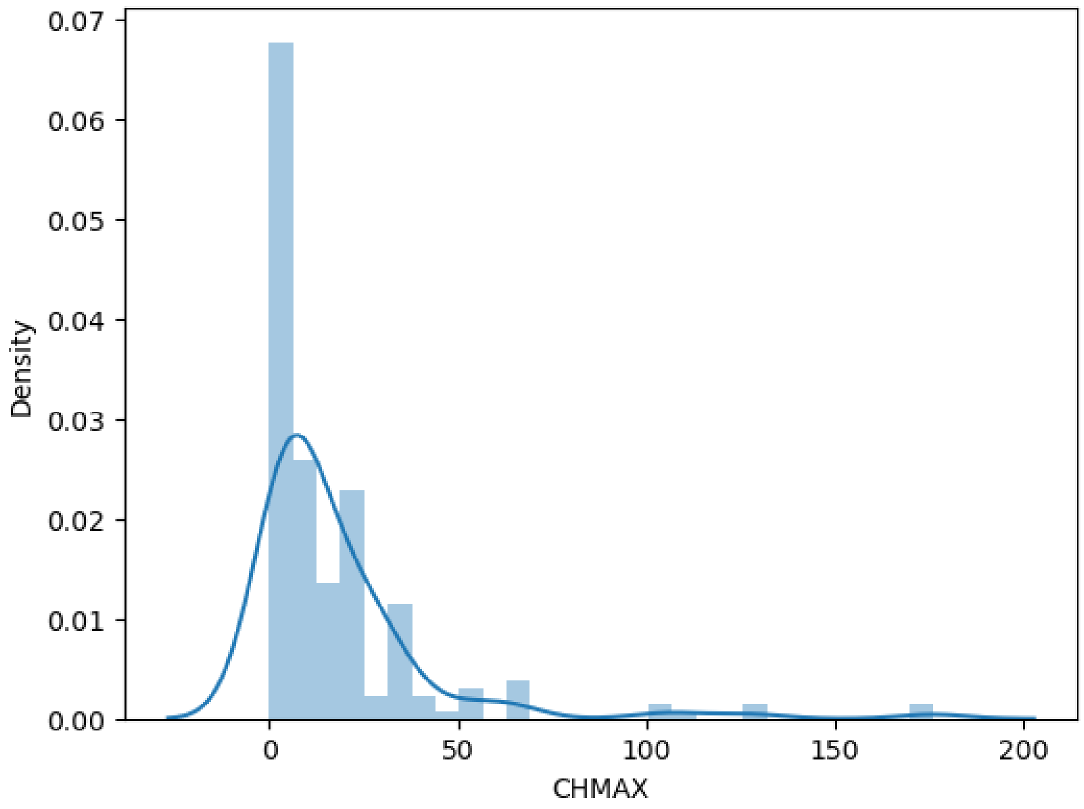
```
CACH
2.8044632567259247
```



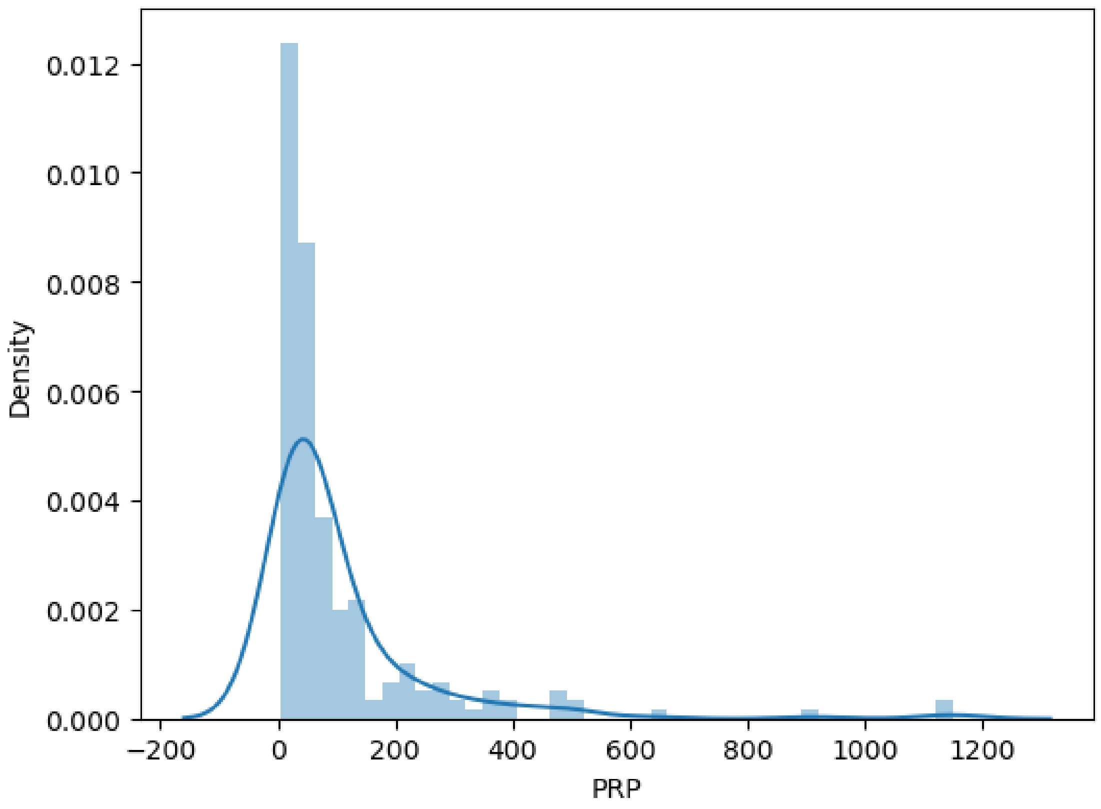
```
CHMIN
3.998370744836009
```



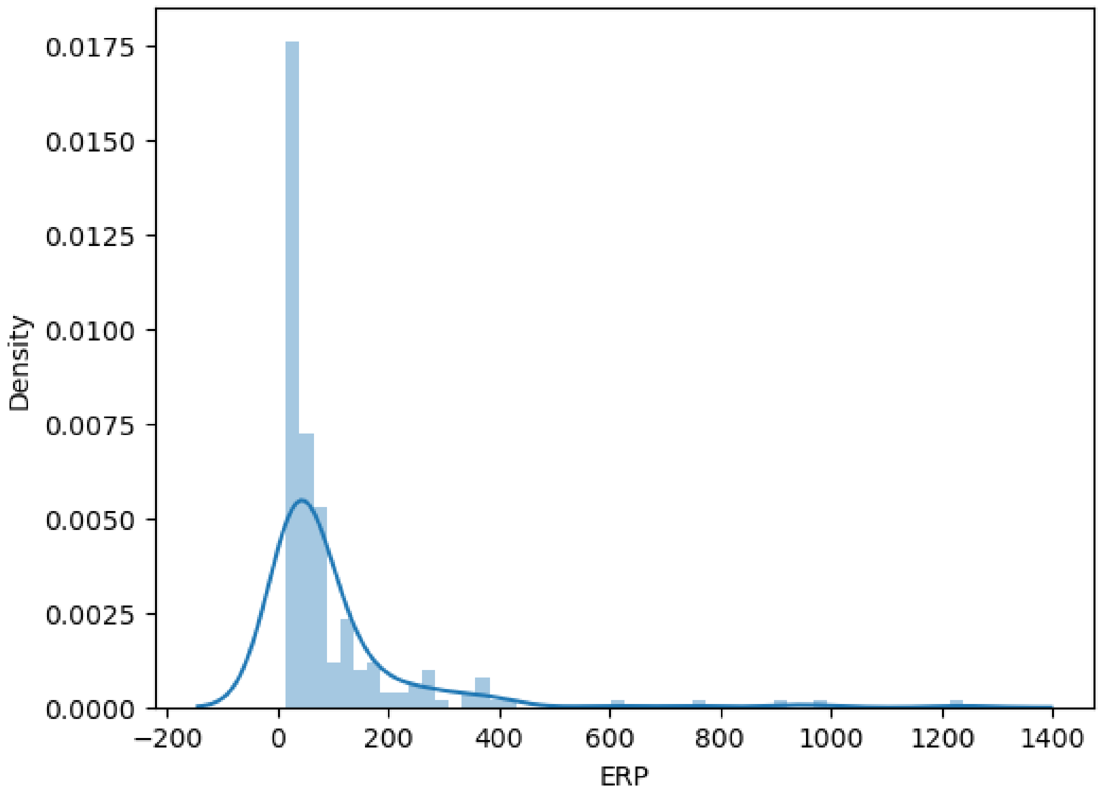
```
CHMAX
3.570045822323458
```



```
PRP
3.864819547035671
```



```
ERP
4.273072105948175
```



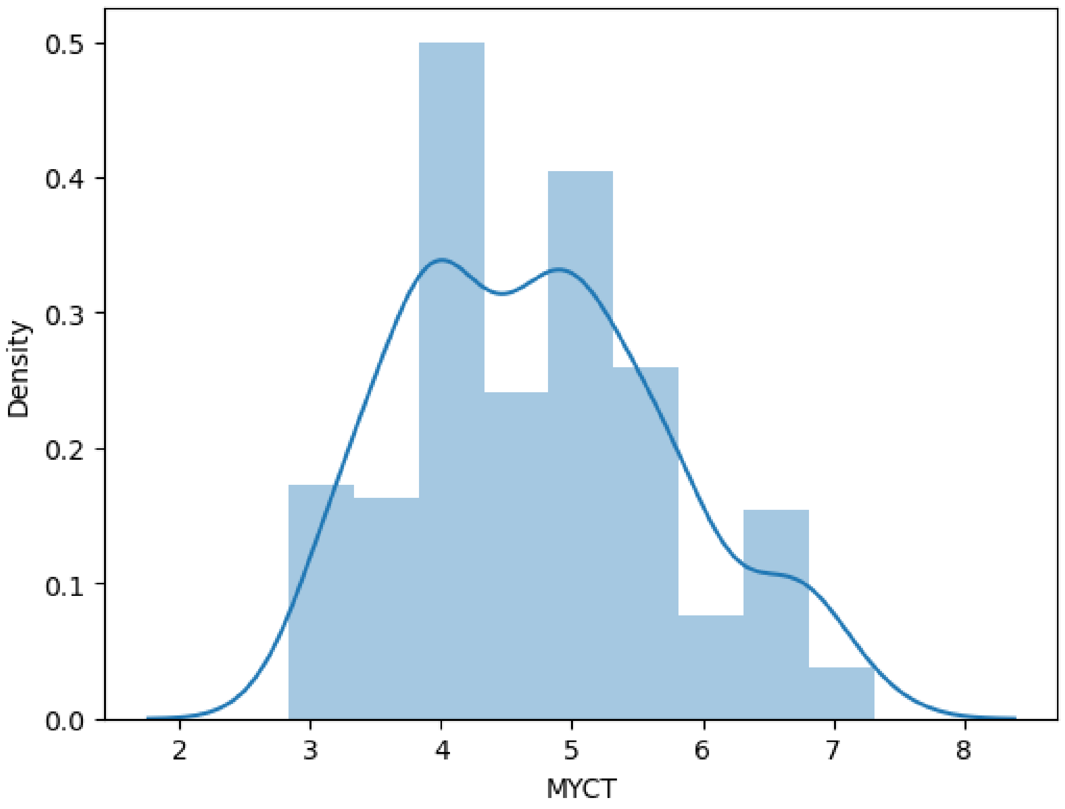
```
[158]: df.corr().style.background_gradient()
```

```
[158]: <pandas.io.formats.style.Styler at 0x2428479b910>
```

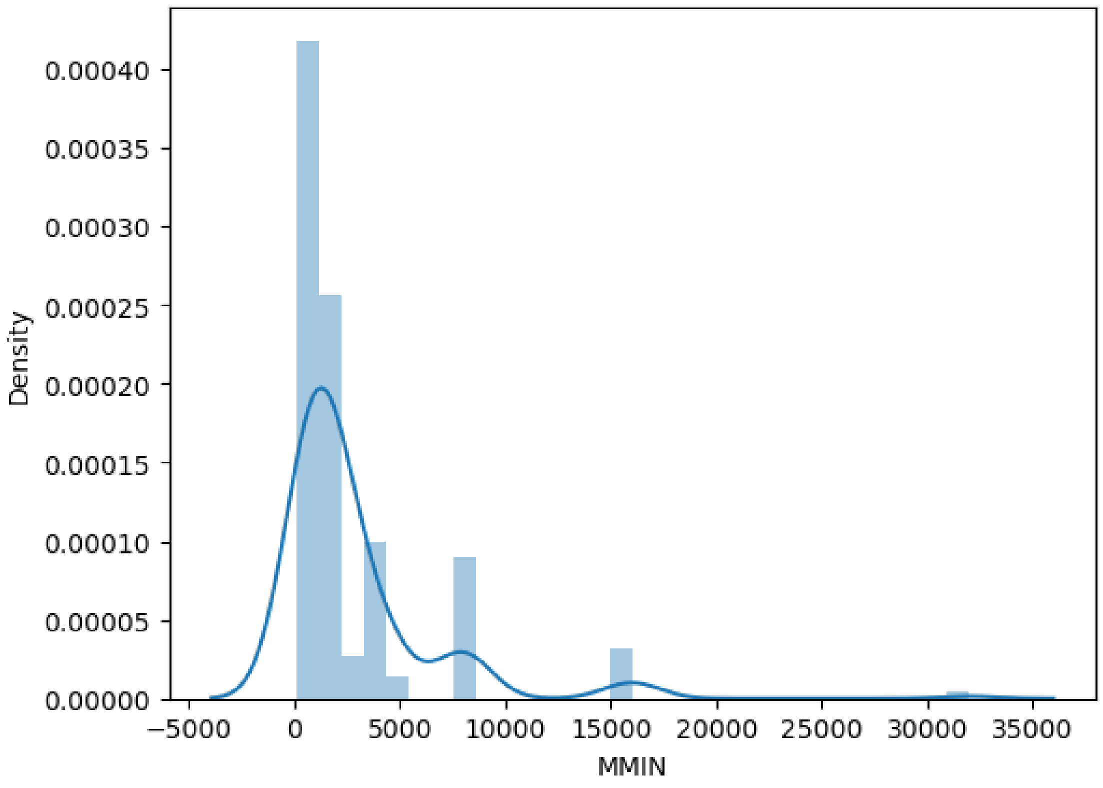
```
[160]: df[['MYCT','CACH','CHMIN','CHMAX']]=np.log(df[['MYCT','CACH','CHMIN','CHMAX']])
```

```
[168]: for i in df[colname]:
           print(i)
           print(skew(df[i]))
           sns.distplot(df[i])
           plt.show()
```

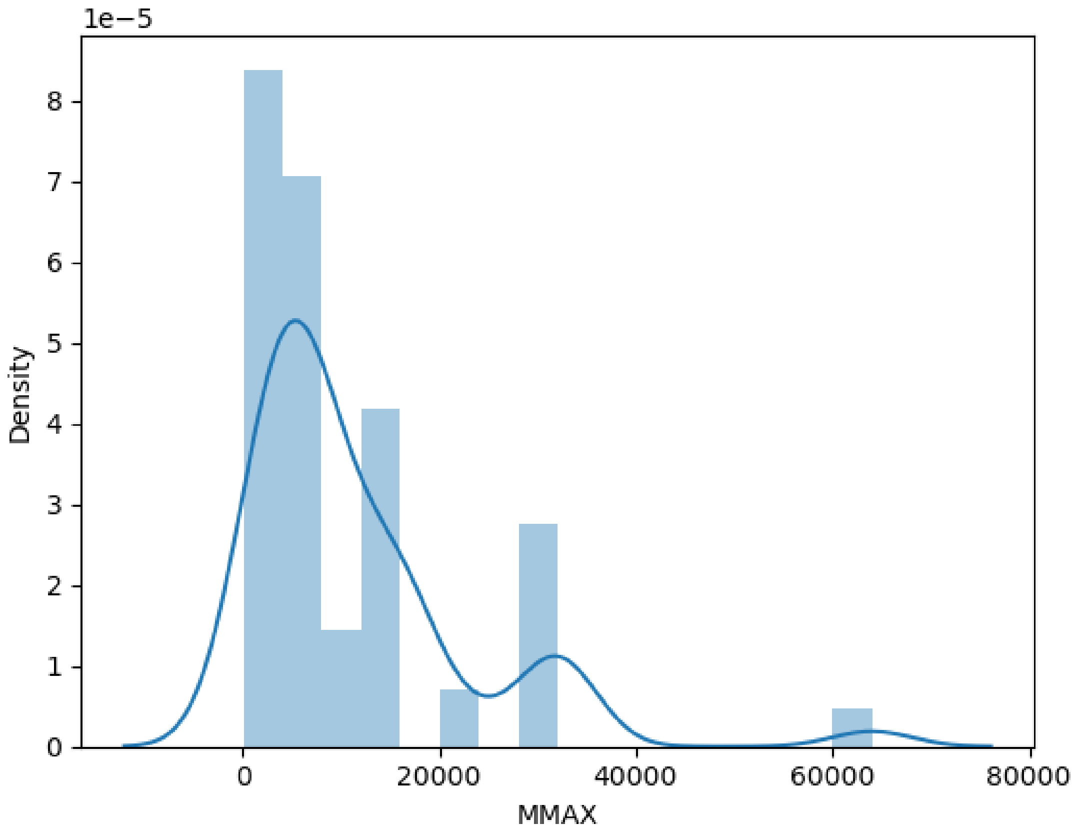
```
MYCT
0.39497709484613314
```



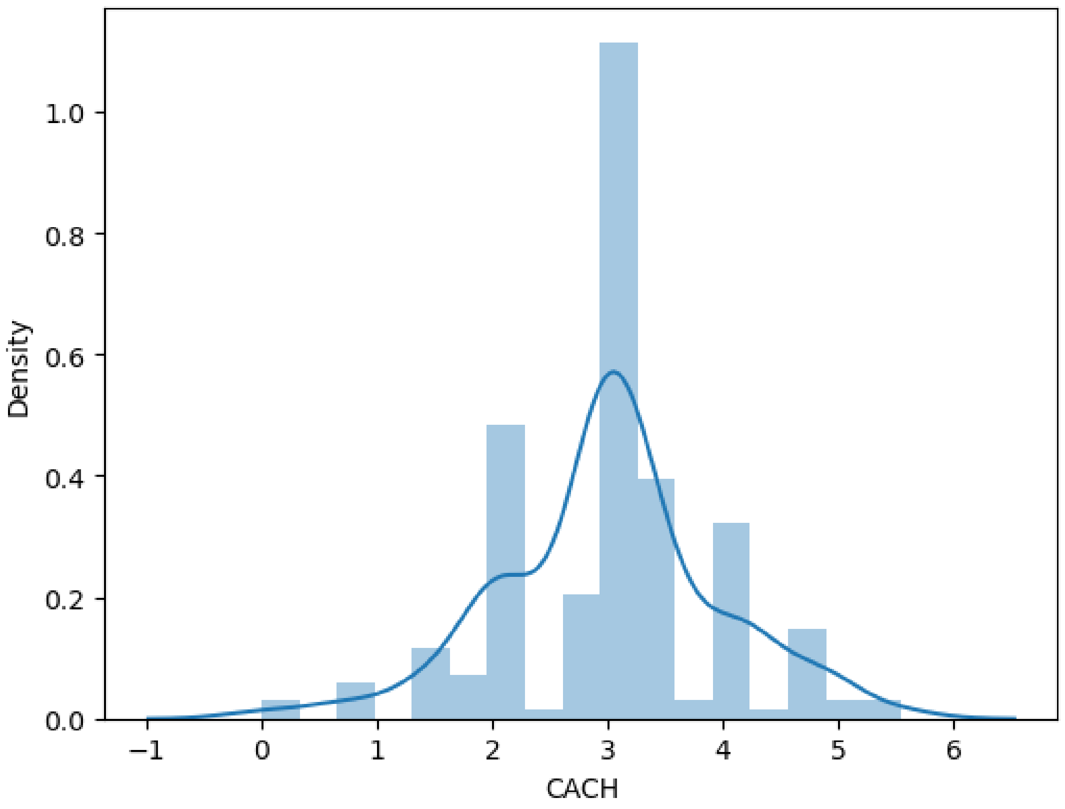
```
MMIN
3.4906489998203925
```



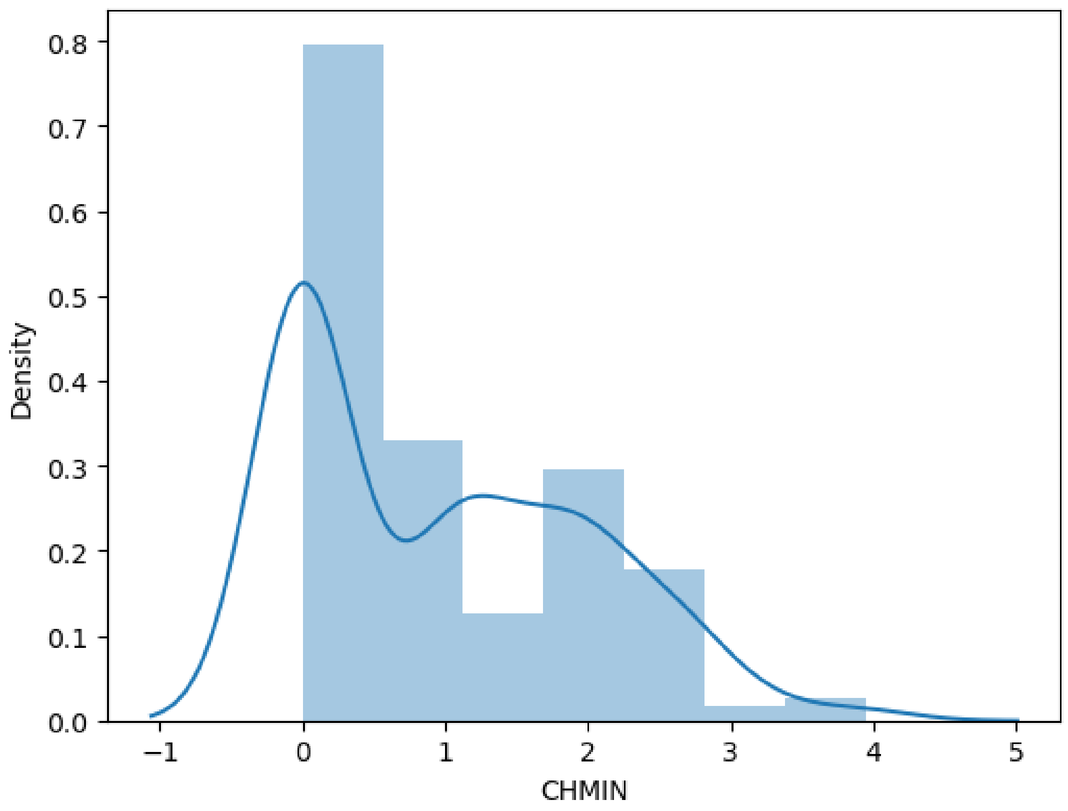
```
MMAX
2.1252682972972194
```



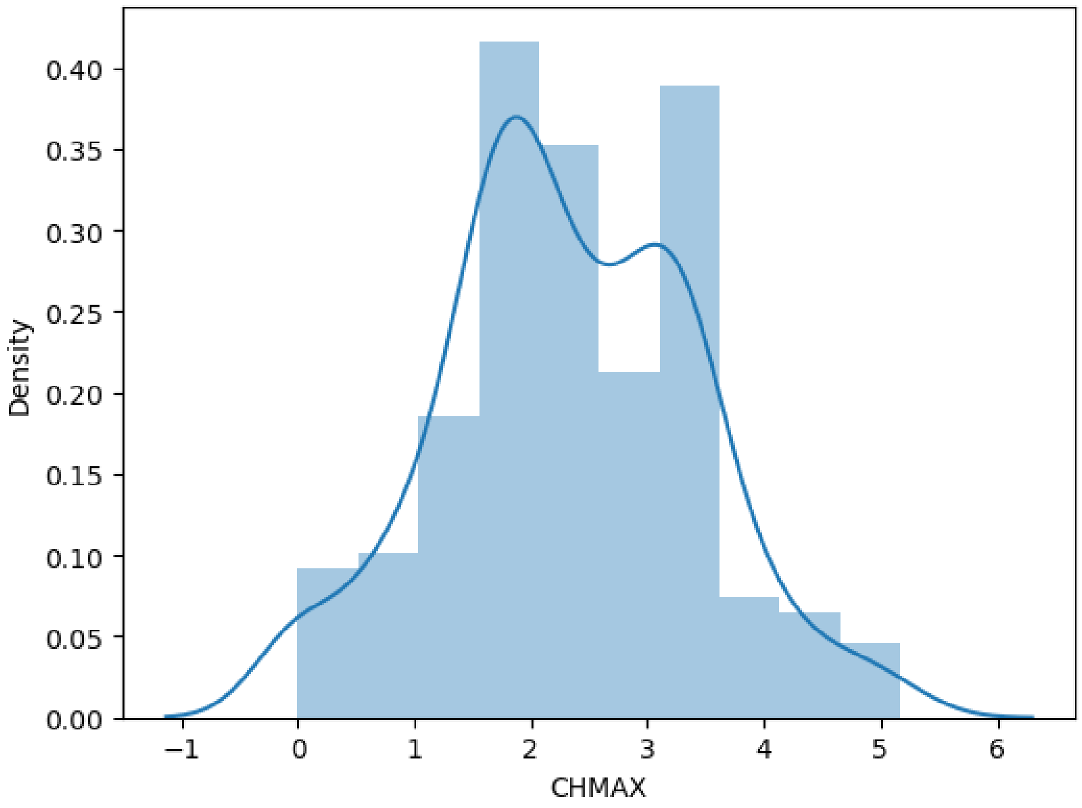
```
CACH
-0.14017851445843896
```



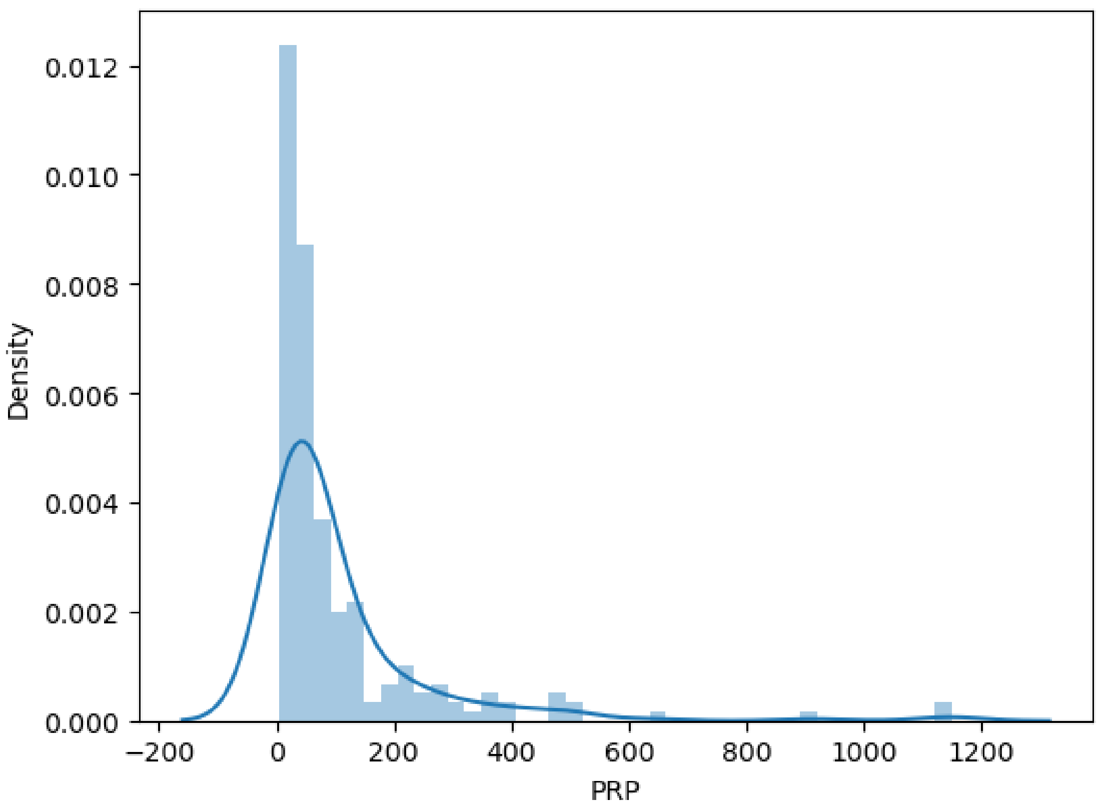
```
CHMIN
0.6142090540769856
```



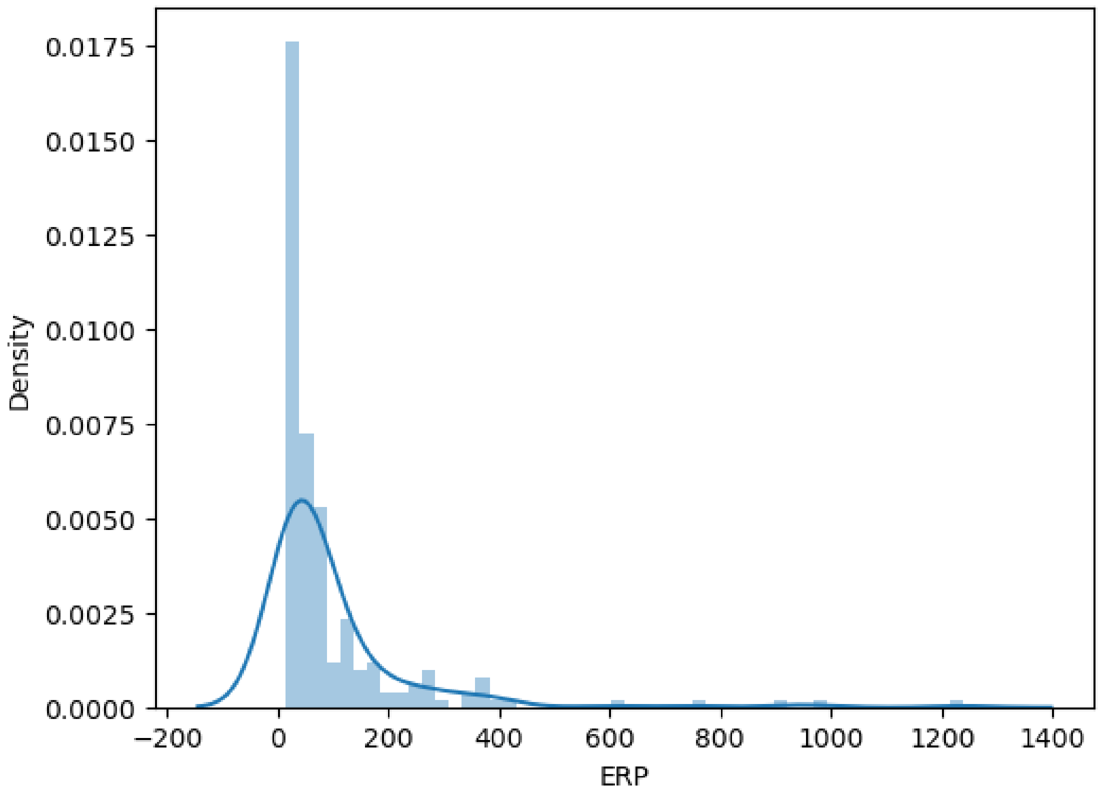
```
CHMAX
0.059470997616673085
```



```
PRP
3.864819547035671
```



```
ERP
4.273072105948175
```



[169]:
```
df.head()
```

[169]:
```
   Vendors    Model      MYCT  MMIN   MMAX      CACH     CHMIN     CHMAX  PRP  \
0  adviser    32/60  4.828314   256   6000  5.545177  2.772589  4.852030  198
1   amdahl   470v/7  3.367296  8000  32000  3.465736  2.079442  3.465736  269
2   amdahl  470v/7a  3.367296  8000  32000  3.465736  2.079442  3.465736  220
3   amdahl  470v/7b  3.367296  8000  32000  3.465736  2.079442  3.465736  172
4   amdahl  470v/7c  3.367296  8000  16000  3.465736  2.079442  2.772589  132

   ERP
0  199
1  253
2  253
3  253
4  132
```

[170]:
```
catcol=df.select_dtypes(['object']).columns
```

[171]:
```
df[catcol]
```

[171]:
```
     Vendors           Model
0    adviser           32/60
1     amdahl          470v/7
2     amdahl         470v/7a
3     amdahl         470v/7b
4     amdahl         470v/7c
..       …               …
204   sperry            80/8
205   sperry  90/80-model-3
206   sratus              32
207     wang          vs-100
208     wang           vs-90

[209 rows x 2 columns]
```

[172]:
```
x=df.iloc[:,:-1]
y=df.iloc[:,-1]
```

[173]:
```
from sklearn.preprocessing import OrdinalEncoder #encoding the categorial value
```

[174]:
```
oe=OrdinalEncoder()
```

[175]:
```
x[catcol]=oe.fit_transform(x[catcol])
```

[176]:
```
x
```

[176]:
```
     Vendors  Model      MYCT  MMIN   MMAX      CACH     CHMIN     CHMAX  PRP
0        0.0   29.0  4.828314   256   6000  5.545177  2.772589  4.852030  198
1        1.0   62.0  3.367296  8000  32000  3.465736  2.079442  3.465736  269
2        1.0   63.0  3.367296  8000  32000  3.465736  2.079442  3.465736  220
3        1.0   64.0  3.367296  8000  32000  3.465736  2.079442  3.465736  172
4        1.0   65.0  3.367296  8000  16000  3.465736  2.079442  2.772589  132
..       …      …        …   …     …        …         …       …   …
204     27.0  100.0  4.820282  1000   8000  3.012837  0.000000  2.079442   42
205     27.0  109.0  4.584967  1000   8000  3.465736  0.693147  2.079442   46
206     28.0   28.0  4.828314  2000   8000  3.012837  0.693147  2.639057   52
207     29.0  207.0  6.173786   512   8000  3.465736  0.971494  2.317956   67
208     29.0  208.0  6.173786  1000   4000  3.012837  0.971494  2.317956   45

[209 rows x 9 columns]
```

[177]:
```
y
```

[177]:
```
0      199
1      253
2      253
3      253
4      132
```

```
        …
204      37
205      50
206      41
207      47
208      25
Name: ERP, Length: 209, dtype: int64
```

2 training the model

```
[178]: from sklearn.model_selection import train_test_split
```

```
[179]: xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.3,random_state=1)
```

```
[180]: xtrain
```

```
[180]:      Vendors  Model      MYCT  MMIN   MMAX      CACH     CHMIN     CHMAX  PRP
56        10.0  169.0  5.393628  1000   8000  2.772589  0.000000  0.693147   71
179       25.0   70.0  5.075174  1000   8000  2.772589  0.000000  2.639057   60
55        10.0  168.0  4.700480  1000  12000  2.772589  0.000000  0.693147   60
84        15.0  154.0  5.799093  1000   4000  3.012837  1.098612  1.791759   22
53        10.0  166.0  5.298317  1000   8000  3.012837  0.000000  0.693147   36
..         …      …       …   …     …       …         …       …  …
203       27.0   99.0  5.192957   512   4000  3.012837  0.000000  1.098612   21
137       20.0  185.0  5.010635   512   4000  3.012837  2.079442  4.852030   30
72        16.0   21.0  5.164786   256   2000  3.012837  1.098612  3.178054   22
140       21.0  112.0  4.521789  2000   8000  3.465736  0.000000  1.791759   62
37         8.0  183.0  3.912023  1000   4000  2.079442  0.000000  1.609438   29

[146 rows x 9 columns]
```

```
[181]: ytrain
```

```
[181]: 56     42
179    43
55     56
84     25
53     36
       ..
203    24
137    33
72     20
140    53
37     29
Name: ERP, Length: 146, dtype: int64
```

```
[182]: from sklearn.linear_model import LinearRegression
```

[183]:
```
linreg=LinearRegression()
```

[184]:
```
linreg.fit(xtrain,ytrain)
```

[184]:
```
LinearRegression()
```

[185]:
```
ypred=linreg.predict(xtest)
```

[186]:
```
ypred
```

[186]:
```
array([ 71.09881595,  89.76422957,  25.41421396,  18.15197405,
       211.85664161, 187.33709124,  59.8855257 , 150.28876567,
       199.72471908, 150.22897457,  12.52301752, 139.67596735,
        40.37717789,   7.83430363,  89.25287228, 220.45400742,
        14.56873135,  13.07623384,  50.77784574, 140.56686816,
        36.86734133, 227.31498795,  60.77895385,  14.87916165,
        15.83328941,  41.02384623,  24.10778208, 113.41823494,
        20.79010846, 211.96629983,  14.62318372,  15.87276436,
         8.86369055,  56.86932004,  -2.47867215, 469.47775874,
       207.47294864,  32.4151343 ,  16.22207988, 372.94130696,
       372.12033212,  52.95061996,  36.60098724,  86.52828754,
       129.46335762, 288.8646765 ,  91.41897074,  22.13620622,
        30.99243953,  -4.46405754,  20.24559101,  11.12082273,
        11.81853063,  59.47151299, -12.79083495,  56.71994703,
         1.45008137,  94.76459068,  50.48813859,  53.43457939,
        -5.03319843, 343.15805823,  39.46865836])
```

3 evaluating the model

[187]:
```
from sklearn.metrics import r2_score
```

[216]:
```
r2=r2_score(ytest,ypred)
print(f'accuracy:{r2}')
```

```
accuracy:0.8022673023063933
```

[217]:
```
train=linreg.score(xtrain,ytrain)
test=linreg.score(xtest,ytest)
print(train)
print(test)
```

```
0.9704973330876837
0.8022673023063933
```

[190]:
```
from sklearn.linear_model import Ridge,Lasso
```

[215]:
```
l2=Ridge(alpha=55)
l2.fit(xtrain,ytrain)
```

```
train=l2.score(xtrain,ytrain)
test=l2.score(xtest,ytest)
print(train)
print(test)
```

```
0.9700338483945639
0.801244795002553
```

[211]:
```
l1=Lasso(alpha=1100)
l1.fit(xtrain,ytrain)
train=l1.score(xtrain,ytrain)
test=l1.score(xtest,ytest)
print(train)
print(test)
```

```
0.9609286292482392
0.8031233558099401
```