Practical No 02

Data Wrangling II

- Create an “Academic performance” dataset of students and perform the following operations using Python.
- Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.
- Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.
- Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.
- Reason and document your approach properly.

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

In [2]:

```
df = pd.read_excel('data_academic_performance.xlsx')
df
```

Out [2]:

	COD_S11	GENDER	EDU_FATHER	EDU_MOTHER	OCC_FATHER	OCC_MOTHER	STRATUM	SISBEN	PEOPL
0	SB11201210000129	F	Incomplete Professional Education	Complete technique or technology	Technical or professional level employee	Home	Stratum 4	It is not classified by the SISBEN	Three
1	SB11201210000137	F	Complete Secundary	Complete professional education	Entrepreneur	Independent professional	Stratum 5	It is not classified by the SISBEN	Three
2	SB11201210005154	M	Not sure	Not sure	Independent	Home	Stratum 2	Level 2	Five
3	SB11201210007504	F	Not sure	Not sure	Other occupation	Independent	Stratum 2	It is not classified by the SISBEN	Three
4	SB11201210007548	M	Complete professional education	Complete professional education	Executive	Home	Stratum 4	It is not classified by the SISBEN	One
...	...	...	...	...	...	...	...	...	...
12406	SB11201420568705	M	Ninguno	Complete Secundary	Other occupation	Auxiliary or Administrative	Stratum 2	It is not classified by the SISBEN	Six
12407	SB11201420573045	M	Complete professional education	Complete Secundary	Executive	Other occupation	Stratum 2	Level 2	Five
12408	SB11201420578809	M	Complete technique or technology	Complete technique or technology	Retired	Home	Stratum 2	Level 2	Five
12409	SB11201420578812	F	Complete professional education	Complete professional education	Independent professional	Small entrepreneur	Stratum 3	It is not classified by the SISBEN	Seven
12410	SB11201420583232	M	Complete Secundary	Complete primary	Independent	Home	Stratum 3	Level 1	Four

12411 rows × 45 columns

In [3]:

```
df.head() # It's showing top 5 result
```

Out [3]:

	COD_S11	GENDER	EDU_FATHER	EDU_MOTHER	OCC_FATHER	OCC_MOTHER	STRATUM	SISBEN	PEOPLE_HO
0	SB11201210000129	F	Incomplete Professional Education	Complete technique or technology	Technical or professional level employee	Home	Stratum 4	It is not classified by the SISBEN	Three
1	SB11201210000137	F	Complete Secundary	Complete professional education	Entrepreneur	Independent professional	Stratum 5	It is not classified by the SISBEN	Three
2	SB11201210005154	M	Not sure	Not sure	Independent	Home	Stratum 2	Level 2	Five
3	SB11201210007504	F	Not sure	Not sure	Other occupation	Independent	Stratum 2	It is not classified by the SISBEN	Three
4	SB11201210007548	M	Complete professional education	Complete professional education	Executive	Home	Stratum 4	It is not classified by the SISBEN	One

5 rows × 45 columns

In [4]:

```
df.tail() # It's showing bottom 5 result
```

Out [4]:

	COD_S11	GENDER	EDU_FATHER	EDU_MOTHER	OCC_FATHER	OCC_MOTHER	STRATUM	SISBEN	PEOPL
12406	SB11201420568705	M	Ninguno	Complete Secundary	Other occupation	Auxiliary or Administrative	Stratum 2	It is not classified by the SISBEN	Six
12407	SB11201420573045	M	Complete professional education	Complete Secundary	Executive	Other occupation	Stratum 2	Level 2	Five
12408	SB11201420578809	M	Complete technique or technology	Complete technique or technology	Retired	Home	Stratum 2	Level 2	Five
12409	SB11201420578812	F	Complete professional education	Complete professional education	Independent professional	Small entrepreneur	Stratum 3	It is not classified by the SISBEN	Seven
12410	SB11201420583232	M	Complete Secundary	Complete primary	Independent	Home	Stratum 3	Level 1	Four

5 rows × 45 columns

1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.

In [5]:

```
df.isnull().sum() # Caluclating the Null values
```

Out [5]:

```
COD_S11                  0
GENDER                   0
EDU_FATHER               0
EDU_MOTHER               0
OCC_FATHER               0
OCC_MOTHER               0
STRATUM                  0
SISBEN                   0
PEOPLE_HOUSE             0
Unnamed: 9           12411
INTERNET                 0
TV                       0
COMPUTER                 0
WASHING_MCH              0
MIC_OVEN                 0
CAR                      0
DVD                      0
FRESH                    0
PHONE                    0
MOBILE                   0
REVENUE                  0
JOB                      0
SCHOOL_NAME              0
SCHOOL_NAT               0
SCHOOL_TYPE              0
MAT_S11                  0
CR_S11                   0
CC_S11                   0
BIO_S11                  0
ENG_S11                  0
```

```
Cod_SPro             0
UNIVERSITY           0
ACADEMIC_PROGRAM     0
QR_PRO               0
CR_PRO               0
CC_PRO               0
ENG_PRO              0
WC_PRO               0
FEP_PRO              0
G_SC                 0
PERCENTILE           0
2ND_DECILE           0
QUARTILE             0
SEL                  0
SEL_IHE              0
dtype: int64
```

In [6]:

```
df.drop('Unnamed: 9',axis=1,inplace=True) # Droping Cabin Column becasue here lots of null values
```

In [7]:

```
df.dropna(inplace=True)
```

In [8]:

```
df.head()
```

Out [8]:

	COD_S11	GENDER	EDU_FATHER	EDU_MOTHER	OCC_FATHER	OCC_MOTHER	STRATUM	SISBEN	PEOPLE_HC
0	SB11201210000129	F	Incomplete Professional Education	Complete technique or technology	Technical or professional level employee	Home	Stratum 4	It is not classified by the SISBEN	Three
1	SB11201210000137	F	Complete Secundary	Complete professional education	Entrepreneur	Independent professional	Stratum 5	It is not classified by the SISBEN	Three
2	SB11201210005154	M	Not sure	Not sure	Independent	Home	Stratum 2	Level 2	Five
3	SB11201210007504	F	Not sure	Not sure	Other occupation	Independent	Stratum 2	It is not classified by the SISBEN	Three
4	SB11201210007548	M	Complete professional education	Complete professional education	Executive	Home	Stratum 4	It is not classified by the SISBEN	One

5 rows × 44 columns

In [9]:

```
df.isnull().sum() # Caluclating the Null values
```

Out [9]:

```
COD_S11             0
GENDER              0
EDU_FATHER          0
EDU_MOTHER          0
OCC_FATHER          0
OCC_MOTHER          0
STRATUM             0
SISBEN              0
PEOPLE_HOUSE        0
INTERNET            0
TV                  0
COMPUTER            0
WASHING_MCH         0
MIC_OVEN            0
CAR                 0
DVD                 0
FRESH               0
PHONE               0
MOBILE              0
REVENUE             0
JOB                 0
SCHOOL_NAME         0
SCHOOL_NAT          0
SCHOOL_TYPE         0
MAT_S11             0
CR_S11              0
CC_S11              0
BIO_S11             0
ENG_S11             0
Cod_SPro            0
UNIVERSITY          0
ACADEMIC_PROGRAM    0
QR_PRO              0
CR_PRO              0
CC_PRO              0
ENG_PRO             0
WC_PRO              0
FEP_PRO             0
G_SC                0
PERCENTILE          0
2ND_DECILE          0
QUARTILE            0
```

```
SEL                0
SEL_IHE            0
dtype: int64
```

In [10]:
```
df.describe() # Get some initial statistics.
```

Out [10]:

	MAT_S11	CR_S11	CC_S11	BIO_S11	ENG_S11	QR_PRO	CR_PRO	CC_PRO
count	12411.000000	12411.000000	12411.000000	12411.000000	12411.000000	12411.000000	12411.000000	12411.00000
mean	64.320764	60.778422	60.705181	63.950528	61.801064	77.417291	62.199339	59.18677
std	11.873650	10.025876	10.120524	11.156869	14.297777	22.673444	27.666558	28.99184
min	26.000000	24.000000	0.000000	11.000000	26.000000	1.000000	1.000000	1.00000
25%	56.000000	54.000000	54.000000	56.000000	50.000000	65.000000	42.000000	36.00000
50%	64.000000	61.000000	60.000000	64.000000	59.000000	85.000000	67.000000	65.00000
75%	72.000000	67.000000	67.000000	71.000000	72.000000	96.000000	86.000000	85.00000
max	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000	100.00000

In [11]:
```
df.info() # Getting some informatation about dataset
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 12411 entries, 0 to 12410
Data columns (total 44 columns):
 #   Column            Non-Null Count  Dtype 
---  ------            --------------  ----- 
 0   COD_S11           12411 non-null  object
 1   GENDER            12411 non-null  object
 2   EDU_FATHER        12411 non-null  object
 3   EDU_MOTHER        12411 non-null  object
 4   OCC_FATHER        12411 non-null  object
 5   OCC_MOTHER        12411 non-null  object
 6   STRATUM           12411 non-null  object
 7   SISBEN            12411 non-null  object
 8   PEOPLE_HOUSE      12411 non-null  object
 9   INTERNET          12411 non-null  object
 10  TV                12411 non-null  object
 11  COMPUTER          12411 non-null  object
 12  WASHING_MCH       12411 non-null  object
 13  MIC_OVEN          12411 non-null  object
 14  CAR               12411 non-null  object
 15  DVD               12411 non-null  object
 16  FRESH             12411 non-null  object
 17  PHONE             12411 non-null  object
 18  MOBILE            12411 non-null  object
 19  REVENUE           12411 non-null  object
 20  JOB               12411 non-null  object
 21  SCHOOL_NAME       12411 non-null  object
 22  SCHOOL_NAT        12411 non-null  object
 23  SCHOOL_TYPE       12411 non-null  object
 24  MAT_S11           12411 non-null  int64 
 25  CR_S11            12411 non-null  int64 
 26  CC_S11            12411 non-null  int64 
 27  BIO_S11           12411 non-null  int64 
 28  ENG_S11           12411 non-null  int64 
 29  Cod_SPro          12411 non-null  object
 30  UNIVERSITY        12411 non-null  object
 31  ACADEMIC_PROGRAM  12411 non-null  object
 32  QR_PRO            12411 non-null  int64 
 33  CR_PRO            12411 non-null  int64 
 34  CC_PRO            12411 non-null  int64 
 35  ENG_PRO           12411 non-null  int64 
 36  WC_PRO            12411 non-null  int64 
 37  FEP_PRO           12411 non-null  int64 
 38  G_SC              12411 non-null  int64 
 39  PERCENTILE        12411 non-null  int64 
 40  2ND_DECILE        12411 non-null  int64 
 41  QUARTILE          12411 non-null  int64 
 42  SEL               12411 non-null  int64 
 43  SEL_IHE           12411 non-null  int64 
dtypes: int64(17), object(27)
memory usage: 4.3+ MB
```

In [12]:
```
df.dtypes # Finding Data Types
```

Out [12]:
```
COD_S11             object
GENDER              object
EDU_FATHER          object
EDU_MOTHER          object
OCC_FATHER          object
OCC_MOTHER          object
STRATUM             object
SISBEN              object
PEOPLE_HOUSE        object
INTERNET            object
TV                  object
COMPUTER            object
WASHING_MCH         object
MIC_OVEN            object
CAR                 object
DVD                 object
FRESH               object
PHONE               object
MOBILE              object
```

```
REVENUE             object
JOB                 object
SCHOOL_NAME         object
SCHOOL_NAT          object
SCHOOL_TYPE         object
MAT_S11              int64
CR_S11               int64
CC_S11               int64
BIO_S11              int64
ENG_S11              int64
Cod_SPro            object
UNIVERSITY          object
ACADEMIC_PROGRAM    object
QR_PRO               int64
CR_PRO               int64
CC_PRO               int64
ENG_PRO              int64
WC_PRO               int64
FEP_PRO              int64
G_SC                 int64
PERCENTILE           int64
2ND_DECILE           int64
QUARTILE             int64
SEL                  int64
SEL_IHE              int64
dtype: object
```

In [14]:
```
df.shape # Finding Dimensions of the data frame.
```

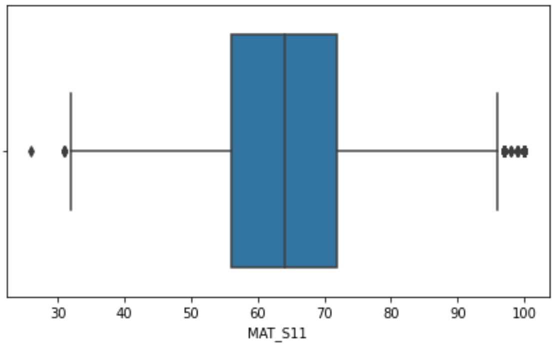
Out [14]:
```
(12411, 44)
```

Finding Outliers

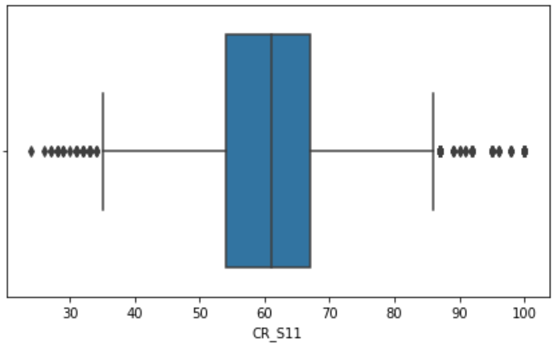
1. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.

In [15]:
```
def ploting(df,st):
    plt.figure(figsize=(16,4))
    plt.subplot(1,2,2)
    sns.boxplot(df[st])
    plt.show()
```

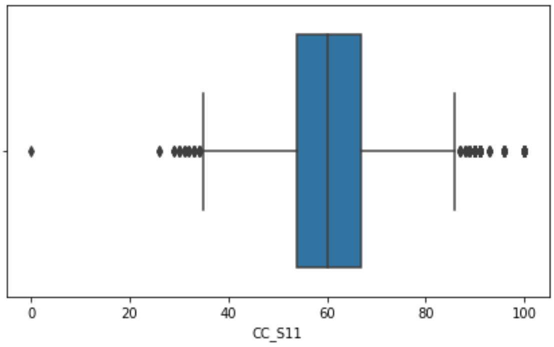
In [16]:
```
ploting(df,'MAT_S11')
```



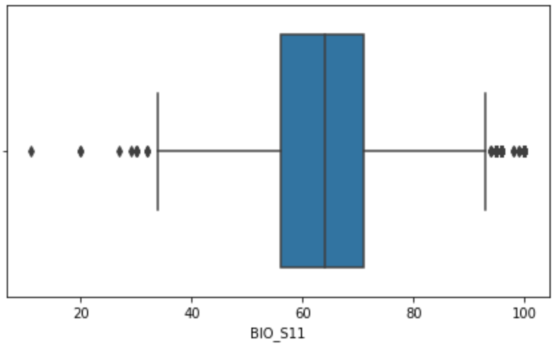
In [17]:
```
ploting(df,'CR_S11')
```



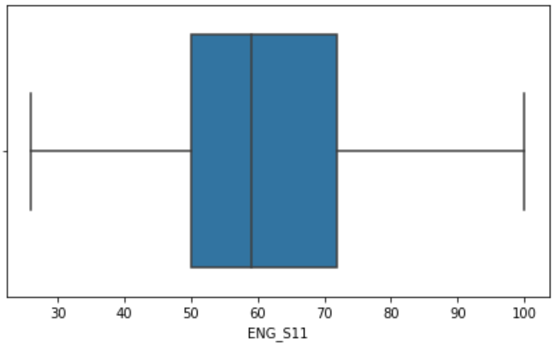
In [18]:
```
ploting(df,'CC_S11')
```



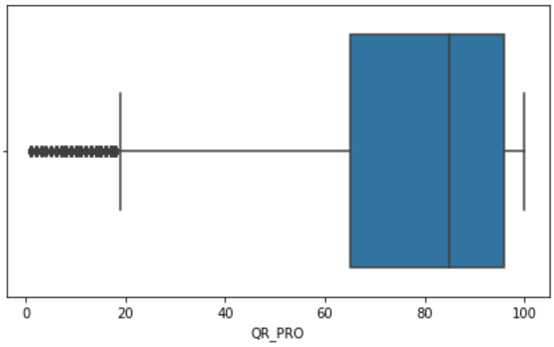
In [19]:
```
ploting(df,'BIO_S11')
```



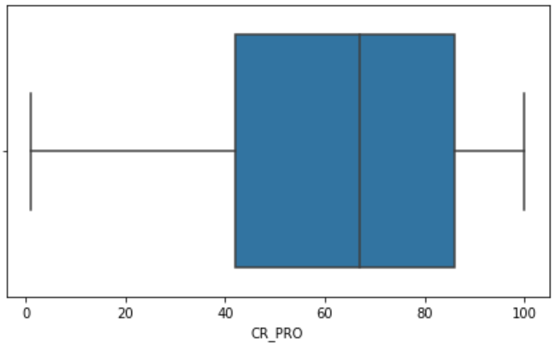
In [20]:
```
ploting(df,'ENG_S11')
```



In [21]:
```
ploting(df,'QR_PRO')
```

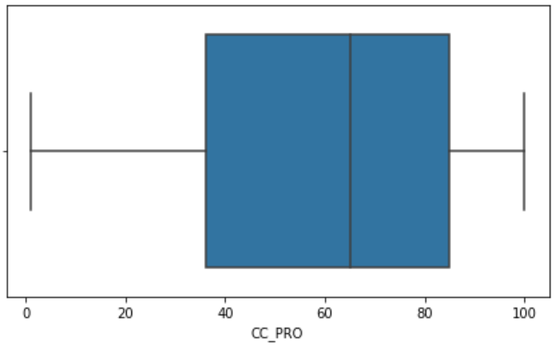


In [22]:
```
ploting(df,'CR_PRO')
```



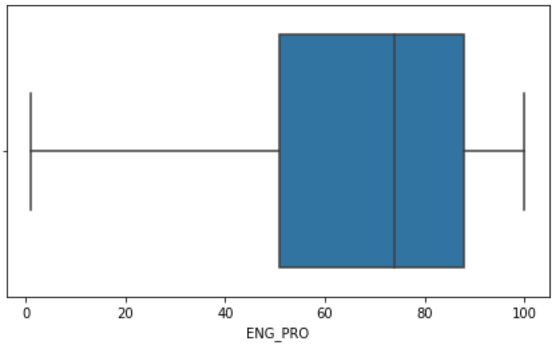
In [23]:

```
ploting(df,'CC_PRO')
```



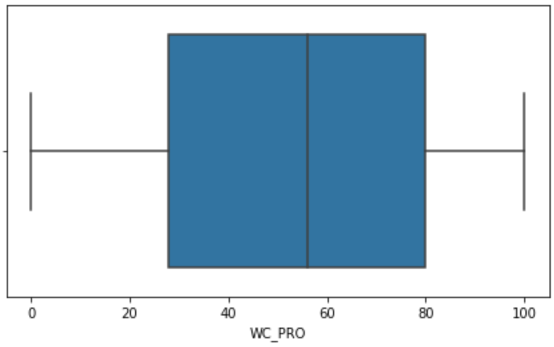
In [24]:

```
ploting(df,'ENG_PRO')
```



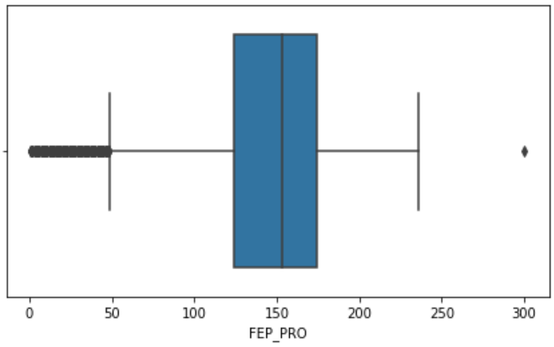
In [25]:

```
ploting(df,'WC_PRO')
```



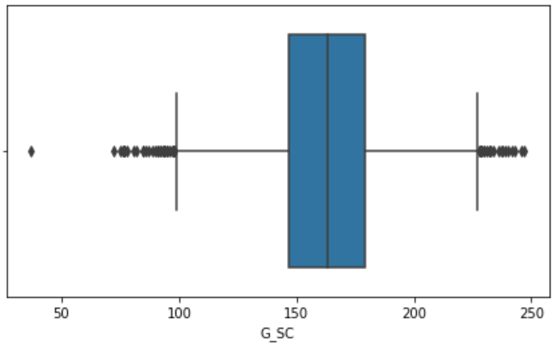
In [26]:

```
ploting(df,'FEP_PRO')
```



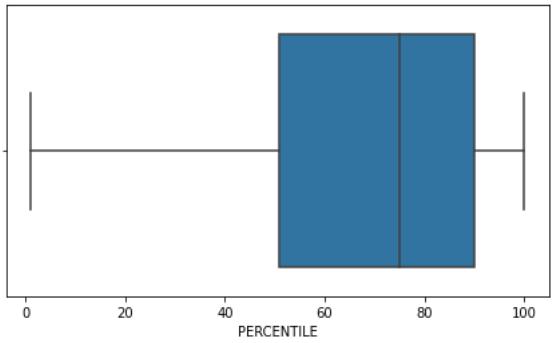
In [27]:

```
ploting(df,'G_SC')
```



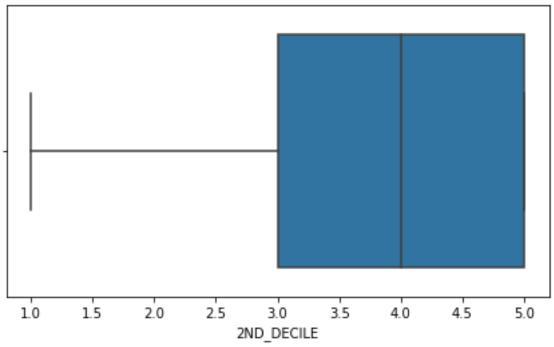
In [28]:

```
ploting(df,'PERCENTILE')
```



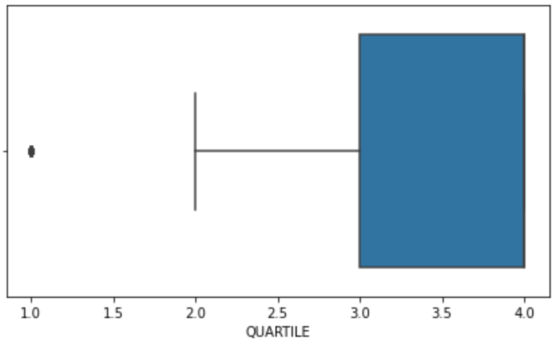
In [29]:

```
ploting(df,'2ND_DECILE')
```



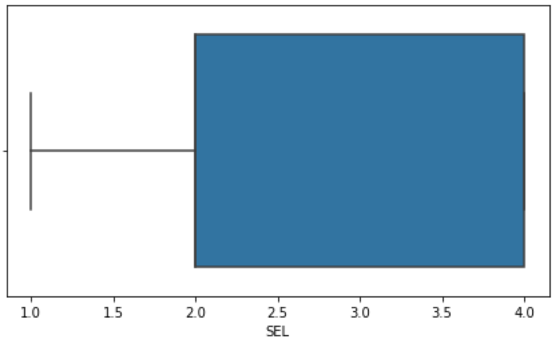
In [30]:

```
ploting(df,'QUARTILE')
```



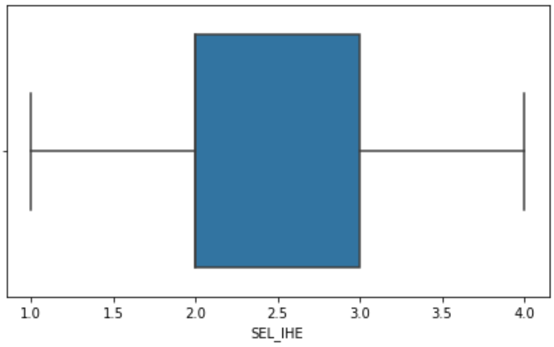
In [31]:

```
ploting(df,'SEL')
```



In [32]:

```
ploting(df,'SEL_IHE')
```



Detecting Outliers

In [33]:

```
# Detecting Outliers
import numpy as np
outliers = []
def detect_outliers_zscore(df):
    thres = 3
    mean = np.mean(df)
    std = np.std(df)
    # print(mean, std)
    for i in df:
        z_score = (i-mean)/std
        if (np.abs(z_score) > thres):
            outliers.append(i)
    return outliers
```

In [34]:

```
mat = detect_outliers_zscore(df['MAT_S11'])
print("Outliers from Z-scores method: ", mat)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [35]:

```
cr = detect_outliers_zscore(df['CR_S11'])
print("Outliers from Z-scores method: ", cr)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [36]:

```
cc = detect_outliers_zscore(df['CC_S11'])
print("Outliers from Z-scores method: ", cc)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [37]:

```
bio = detect_outliers_zscore(df['BIO_S11'])
print("Outliers from Z-scores method: ", bio)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [38]:

```
eng = detect_outliers_zscore(df['ENG_S11'])
print("Outliers from Z-scores method: ", eng)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [39]:

```
qr = detect_outliers_zscore(df['QR_PRO'])
print("Outliers from Z-scores method: ", qr)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [40]:

```
crpro = detect_outliers_zscore(df['CR_PRO'])
print("Outliers from Z-scores method: ", crpro)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [41]:

```
ccpro = detect_outliers_zscore(df['CC_PRO'])
print("Outliers from Z-scores method: ", ccpro)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [42]:

```
engpro = detect_outliers_zscore(df['ENG_PRO'])
print("Outliers from Z-scores method: ", engpro)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [43]:

```
wcpro = detect_outliers_zscore(df['WC_PRO'])
print("Outliers from Z-scores method: ", wcpro)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [44]:

```
feppro = detect_outliers_zscore(df['FEP_PRO'])
print("Outliers from Z-scores method: ", feppro)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [45]:

```
gsc = detect_outliers_zscore(df['G_SC'])
print("Outliers from Z-scores method: ", gsc)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [46]:

```
percentile = detect_outliers_zscore(df['PERCENTILE'])
print("Outliers from Z-scores method: ", percentile)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [47]:

```
decile = detect_outliers_zscore(df['2ND_DECILE'])
print("Outliers from Z-scores method: ", decile)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [48]:

```
quartile = detect_outliers_zscore(df['QUARTILE'])
print("Outliers from Z-scores method: ", quartile)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [49]:

```
sel = detect_outliers_zscore(df['SEL'])
print("Outliers from Z-scores method: ", sel)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

In [50]:

```
selihe = detect_outliers_zscore(df['SEL_IHE'])
print("Outliers from Z-scores method: ", selihe)
```

```
Outliers from Z-scores method:  [100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 10
```

Finding IQR

In [51]:

```
def finding_Iqr(df,st):
    #lets find the IQR (inter quantile range)
    Q1 = df[st].quantile(0.25)
    Q3 = df[st].quantile(0.75)
    IQR = Q3-Q1
    lower_boundry = Q1 -1.5*IQR
    upper_boundry = Q3 +1.5*IQR

    return lower_boundry , upper_boundry
```

In [52]:

```
lower_MAT_S11, upper_MAT_S11 = finding_Iqr(df,'MAT_S11')
print('upper limit is' , upper_MAT_S11)
print('lower limit is' , lower_MAT_S11)
```

```
upper limit is 96.0
lower limit is 32.0
```

In [53]:

```
lower_CR_S11, upper_CR_S11 = finding_Iqr(df,'CR_S11')
print('upper limit is' , upper_CR_S11)
print('lower limit is' , lower_CR_S11)
```

```
upper limit is 86.5
lower limit is 34.5
```

In [54]:

```
lower_CC_S11, upper_CC_S11 = finding_Iqr(df,'CC_S11')
print('upper limit is' , upper_CC_S11)
print('lower limit is' , lower_CC_S11)
```

```
upper limit is 86.5
lower limit is 34.5
```

In [55]:

```
lower_BIO_S11, upper_BIO_S11 = finding_Iqr(df,'BIO_S11')
print('upper limit is' , upper_BIO_S11)
print('lower limit is' , lower_BIO_S11)
```

```
upper limit is 93.5
lower limit is 33.5
```

In [56]:

```
lower_ENG_S11, upper_ENG_S11 = finding_Iqr(df,'ENG_S11')
print('upper limit is' , upper_ENG_S11)
print('lower limit is' , lower_ENG_S11)
```

```
upper limit is 105.0
lower limit is 17.0
```

In [57]:

```
lower_QR_PRO, upper_QR_PRO = finding_Iqr(df,'QR_PRO')
print('upper limit is' , upper_QR_PRO)
print('lower limit is' , lower_QR_PRO)
```

```
upper limit is 142.5
lower limit is 18.5
```

In [58]:

```
lower_CR_PRO, upper_CR_PRO = finding_Iqr(df,'CR_PRO')
print('upper limit is' , upper_CR_PRO)
print('lower limit is' , lower_CR_PRO)
```

```
upper limit is 152.0
lower limit is -24.0
```

In [59]:

```
lower_ENG_PRO, upper_ENG_PRO = finding_Iqr(df,'ENG_PRO')
print('upper limit is' , upper_CR_PRO)
print('lower limit is' , lower_CR_PRO)
```

```
upper limit is 152.0
lower limit is -24.0
```

In [60]:

```
lower_WC_PRO, upper_WC_PRO = finding_Iqr(df,'WC_PRO')
print('upper limit is' , upper_WC_PRO)
print('lower limit is' , lower_WC_PRO)
```

```
upper limit is 158.0
lower limit is -50.0
```

In [61]:

```
lower_FEP_PRO, upper_FEP_PRO = finding_Iqr(df,'FEP_PRO')
print('upper limit is' , upper_FEP_PRO)
print('lower limit is' , lower_FEP_PRO)
```

```
upper limit is 249.0
lower limit is 49.0
```

In [62]:

```
lower_G_SC, upper_G_SC = finding_Iqr(df,'G_SC')
print('upper limit is' , upper_G_SC)
print('lower limit is' , lower_G_SC)
```

```
upper limit is 227.0
lower limit is 99.0
```

In [63]:

```
lower_PERCENTILE, upper_PERCENTILE = finding_Iqr(df,'PERCENTILE')
print('upper limit is' , upper_PERCENTILE)
print('lower limit is' , lower_PERCENTILE)
```

```
upper limit is 148.5
lower limit is -7.5
```

In [64]:

```
lower_2ND_DECILE, upper_2ND_DECILE = finding_Iqr(df,'2ND_DECILE')
print('upper limit is' , upper_2ND_DECILE)
print('lower limit is' , lower_2ND_DECILE)
```

```
upper limit is 8.0
lower limit is 0.0
```

In [65]:

```
lower_QUARTILE, upper_QUARTILE = finding_Iqr(df,'QUARTILE')
print('upper limit is' , upper_QUARTILE)
print('lower limit is' , lower_QUARTILE)
```

```
upper limit is 5.5
lower limit is 1.5
```

In [66]:

```
lower_SEL, upper_SEL = finding_Iqr(df,'SEL')
print('upper limit is' , upper_SEL)
print('lower limit is' , lower_SEL)
```

```
upper limit is 7.0
lower limit is -1.0
```

In [67]:

```
lower_SEL_IHE, upper_SEL_IHE = finding_Iqr(df,'SEL_IHE')
print('upper limit is' , upper_SEL_IHE)
print('lower limit is' , lower_SEL_IHE)
```

```
upper limit is 4.5
lower limit is 0.5
```

Removing Outliers

In [68]:

```
#Removing Outliers
outliers_MAT_S11 = np.where(df['MAT_S11'] > upper_MAT_S11,True ,np.where(df['MAT_S11']< lower_MAT_
outliers_MAT_S11
```

Out [68]:

```
array([False, False, False, ..., False, False, False])
```

In [69]:

```
#Removing Outliers
outliers_CR_S11 = np.where(df['CR_S11'] > upper_CR_S11,True ,np.where(df['CR_S11']< lower_CR_S11,
outliers_CR_S11
```

Out [69]:

```
array([False, False, False, ..., False, False, False])
```

In [70]:
```
#Removing Outliers
outliers_CC_S11 = np.where(df['CC_S11'] > upper_CC_S11,True ,np.where(df['CC_S11']< lower_CC_S11,
outliers_CC_S11
```

Out [70]:
```
array([False, False, False, ..., False, False, False])
```

In [71]:
```
#Removing Outliers
outliers_BIO_S11 = np.where(df['BIO_S11'] > upper_BIO_S11,True ,np.where(df['BIO_S11']< lower_BIO_
outliers_BIO_S11
```

Out [71]:
```
array([False,  True, False, ..., False, False, False])
```

In [72]:
```
#Removing Outliers
outliers_QR_PRO = np.where(df['QR_PRO'] > upper_QR_PRO,True ,np.where(df['QR_PRO']< lower_QR_PRO,
outliers_QR_PRO
```

Out [72]:
```
array([False, False,  True, ..., False, False, False])
```

In [73]:
```
#Removing Outliers
outliers_FEP_PRO = np.where(df['FEP_PRO'] > upper_FEP_PRO,True ,np.where(df['FEP_PRO']< lower_FEP_
outliers_FEP_PRO
```

Out [73]:
```
array([False, False, False, ..., False, False, False])
```

In [74]:
```
#Removing Outliers
outliers_G_SC = np.where(df['G_SC'] > upper_G_SC,True ,np.where(df['G_SC']< lower_G_SC, True , Fal
outliers_G_SC
```

Out [74]:
```
array([False, False, False, ..., False, False, False])
```

In [75]:
```
#Removing Outliers
outliers_QUARTILE = np.where(df['QUARTILE'] > upper_QUARTILE,True ,np.where(df['QUARTILE']< lower_
outliers_QUARTILE
```

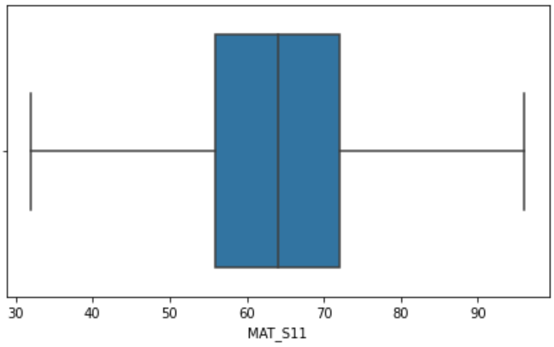
Out [75]:
```
array([False, False,  True, ..., False, False, False])
```

In [76]:
```
df['MAT_S11']= np.where(df['MAT_S11']> upper_MAT_S11 , upper_MAT_S11,np.where(df['MAT_S11'] < lowe
df['CR_S11']= np.where(df['CR_S11']> upper_CR_S11 , upper_CR_S11,np.where(df['CR_S11'] < lower_CR_
df['CC_S11']= np.where(df['CC_S11']> upper_CC_S11 , upper_CC_S11,np.where(df['CC_S11'] < lower_CC_
df['BIO_S11']= np.where(df['BIO_S11']> upper_BIO_S11 , upper_BIO_S11,np.where(df['BIO_S11'] < lowe
df['QR_PRO']= np.where(df['QR_PRO']> upper_QR_PRO , upper_QR_PRO,np.where(df['QR_PRO'] < lower_QR_
df['FEP_PRO']= np.where(df['FEP_PRO']> upper_FEP_PRO , upper_FEP_PRO,np.where(df['FEP_PRO'] < lowe
df['G_SC']= np.where(df['G_SC']> upper_G_SC , upper_G_SC,np.where(df['G_SC'] < lower_G_SC , lower_
df['QUARTILE']= np.where(df['QUARTILE']> upper_QUARTILE , upper_QUARTILE,np.where(df['QUARTILE'] <
```

After Removing Outliers

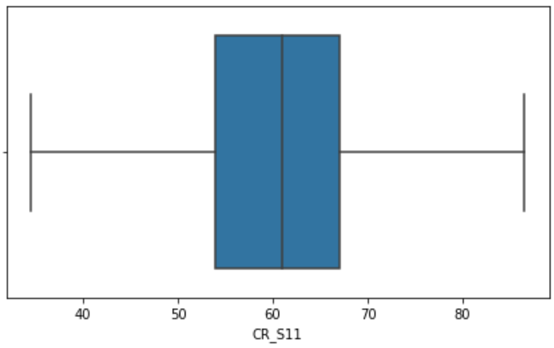
In [77]:
```
def boxplt(df,st):
    plt.figure(figsize=(16,4))
    plt.subplot(1,2,2)
    sns.boxplot(df[st])
    plt.show()
```

In [78]:
```
boxplt(df, 'MAT_S11')
```



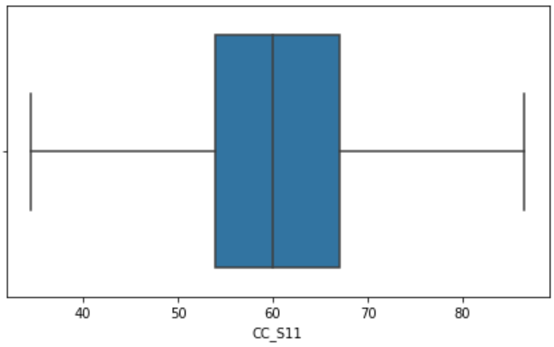
In [79]:

```
boxplt(df, 'CR_S11')
```



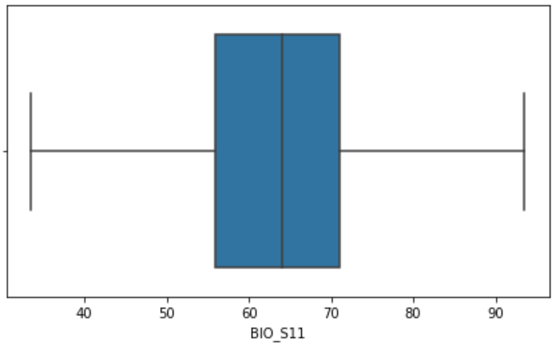
In [80]:

```
boxplt(df, 'CC_S11')
```



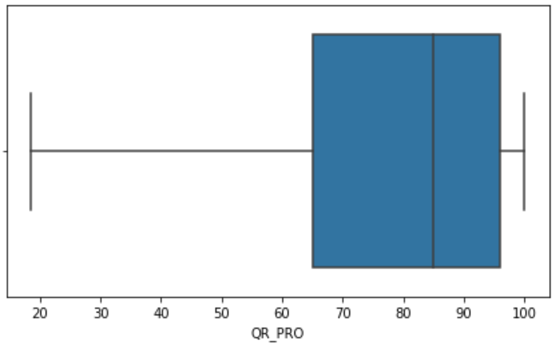
In [81]:

```
boxplt(df, 'BIO_S11')
```



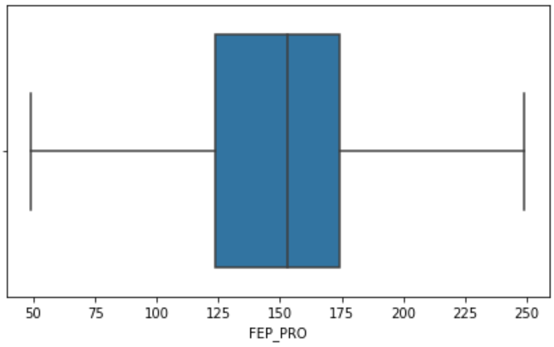
In [82]:

```
boxplt(df, 'QR_PRO')
```



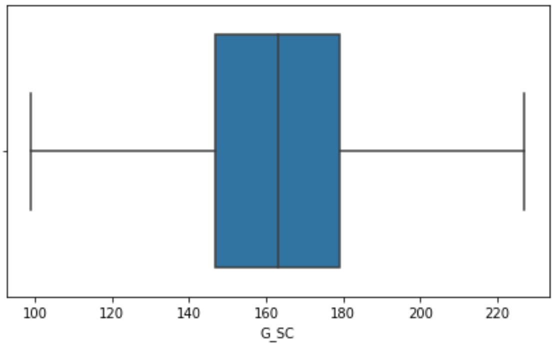
In [83]:

```
boxplt(df, 'FEP_PRO')
```



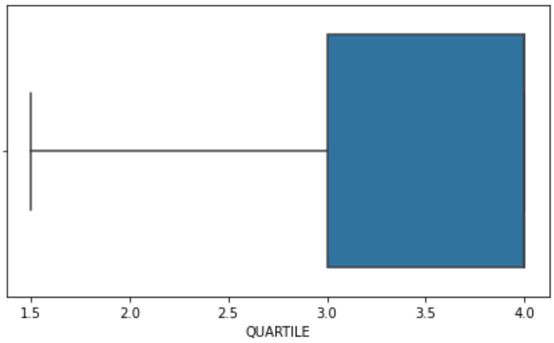
In [84]:

```
boxplt(df, 'G_SC')
```



In [85]:

```
boxplt(df, 'QUARTILE')
```



1. Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.

In [86]:

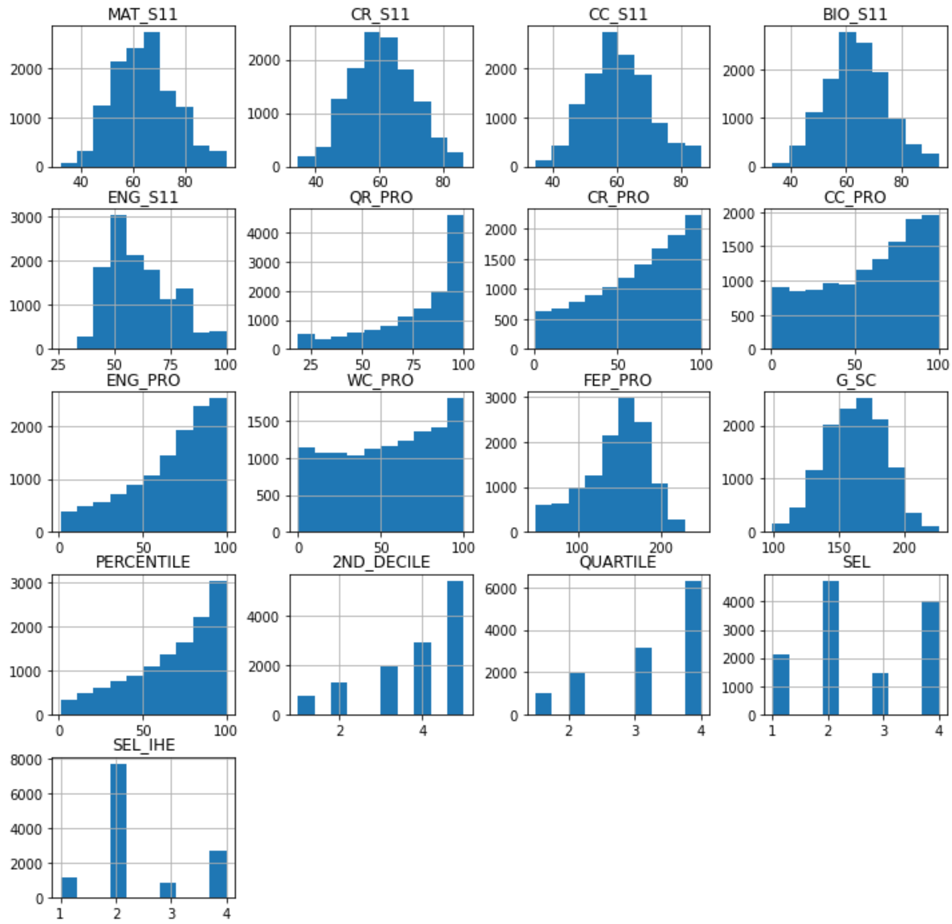
```
df.head()
```

Out [86]:

	COD_S11	GENDER	EDU_FATHER	EDU_MOTHER	OCC_FATHER	OCC_MOTHER	STRATUM	SISBEN	PEOPLE_HC
0	SB11201210000129	F	Incomplete Professional Education	Complete technique or technology	Technical or professional level employee	Home	Stratum 4	It is not classified by the SISBEN	Three
1	SB11201210000137	F	Complete Secundary	Complete professional education	Entrepreneur	Independent professional	Stratum 5	It is not classified by the SISBEN	Three
2	SB11201210005154	M	Not sure	Not sure	Independent	Home	Stratum 2	Level 2	Five
3	SB11201210007504	F	Not sure	Not sure	Other occupation	Independent	Stratum 2	It is not classified by the SISBEN	Three
4	SB11201210007548	M	Complete professional education	Complete professional education	Executive	Home	Stratum 4	It is not classified by the SISBEN	One

5 rows × 44 columns

In [87]:
```
df.hist(figsize=(12,12))
plt.show()
```



In [88]:
```
X = df.iloc[:,[24,25,26,27,28,32,33,34,35,36,37,38,39,40]]
```

In [89]:
```
X.head(5)
```

Out [89]:

	MAT_S11	CR_S11	CC_S11	BIO_S11	ENG_S11	QR_PRO	CR_PRO	CC_PRO	ENG_PRO	WC_PRO	FEP_PRO	G_SC	PERCI
0	71.0	81.0	61.0	86.0	82	71.0	93	71	93	79	181.0	180.0	91
1	83.0	75.0	66.0	93.5	88	97.0	38	86	98	78	201.0	182.0	92
2	52.0	49.0	38.0	46.0	42	18.5	1	18	43	22	113.0	113.0	7
3	56.0	55.0	51.0	64.0	73	65.0	35	76	80	48	137.0	157.0	67
4	80.0	65.0	76.0	85.0	92	94.0	94	98	100	71	189.0	198.0	98

In [90]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [91]:
```
scaler=MinMaxScaler(feature_range=(0, 1))
scaler.fit(X)
```

Out [91]:
```
MinMaxScaler()
```

In [92]:
```
scaled_data=scaler.transform(X)
```

In [93]:
```
scaled_data
```

Out [93]:
```
array([[0.609375  , 0.89423077, 0.50961538, ..., 0.6328125 , 0.90909091,
        1.        ],
       [0.796875  , 0.77884615, 0.60576923, ..., 0.6484375 , 0.91919192,
        1.        ],
       [0.3125    , 0.27884615, 0.06730769, ..., 0.109375  , 0.06060606,
        0.        ],
       ...,
       [0.53125   , 0.66346154, 0.77884615, ..., 0.6953125 , 0.94949495,
        1.        ],
       [0.328125  , 0.66346154, 0.56730769, ..., 0.3671875 , 0.49494949,
        0.5       ],
       [0.734375  , 0.58653846, 0.52884615, ..., 0.6171875 , 0.88888889,
        1.        ]])
```

---------------END---------------