```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
sns.set_theme(color_codes=True)
```

```
df = pd.read_csv('dataR2.csv')
df
```

	Age	BMI	Glucose	Insulin	HOMA	Leptin	Adiponectin	Resistin	MCP.1	Classifica
0	48	23.500000	70	2.707	0.467409	8.8071	9.702400	7.99585	417.114	
1	83	20.690495	92	3.115	0.706897	8.8438	5.429285	4.06405	468.786	
2	82	23.124670	91	4.498	1.009651	17.9393	22.432040	9.27715	554.697	
3	68	21.367521	77	3.226	0.612725	9.8827	7.169560	12.76600	928.220	
4	86	21.111111	92	3.549	0.805386	6.6994	4.819240	10.57635	773.920	
...	...	...	...	...	...	...	...	...	...	
111	45	26.850000	92	3.330	0.755688	54.6800	12.100000	10.96000	268.230	
112	62	26.840000	100	4.530	1.117400	12.4500	21.420000	7.32000	330.160	
113	65	32.050000	97	5.730	1.370998	61.4800	22.540000	10.33000	314.050	
114	72	25.590000	82	2.820	0.570392	24.9600	33.750000	3.27000	392.460	
115	86	27.180000	138	19.910	6.777364	90.2800	14.110000	4.35000	90.090	

116 rows × 10 columns

Checking if there is null value

```
df.isnull().sum()
```

```
Age               0
BMI               0
Glucose           0
Insulin           0
HOMA              0
Leptin            0
Adiponectin       0
Resistin          0
MCP.1             0
Classification    0
dtype: int64
```

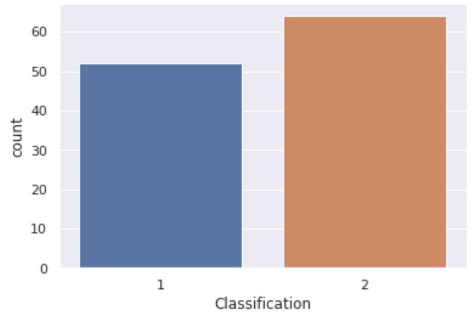
```
df_copy = df.copy(deep = True)
df_copy[['Age','BMI','Glucose','Insulin','HOMA','Leptin','Adiponectin','Resistin','MCP.1']] = df_copy[['Age','BMI','Glucose','Insulin','HOMA','Leptin','

# Showing the Count of NANs
print(df_copy.isnull().sum())
```

```
Age               0
BMI               0
Glucose           0
Insulin           0
HOMA              0
Leptin            0
Adiponectin       0
Resistin          0
MCP.1             0
Classification    0
dtype: int64
```

Checking if the class value is balanced or not

```
sns.countplot(df['Classification'])
print(df.Classification.value_counts())
```

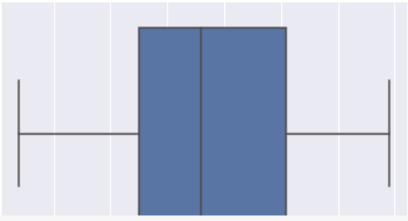
```
2    64
1    52
Name: Classification, dtype: int64
/usr/local/lib/python3.8/dist-packages/seaborn/_decorators.py:36: FutureWarning: Pass the followi
  warnings.warn(
```



Outlier Detection using Boxplot and Outlier Cleansing using Z-Score

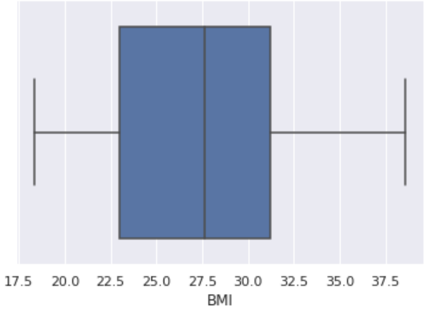
```
sns.boxplot(x=df["Age"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae25feb0>
```



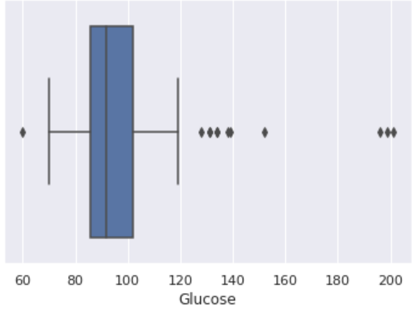
```
sns.boxplot(x=df["BMI"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae204880>
```



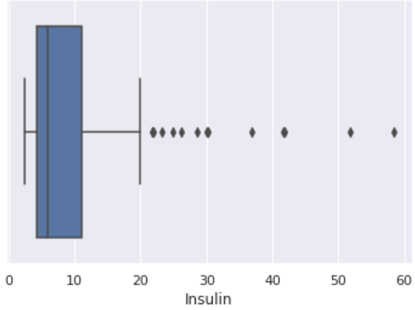
```
sns.boxplot(x=df["Glucose"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae19f610>
```



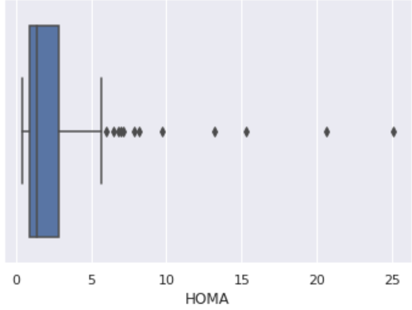
```
sns.boxplot(x=df["Insulin"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5af6aa370>
```



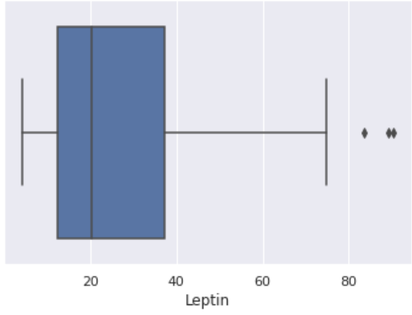
```
sns.boxplot(x=df["HOMA"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae0d2460>
```



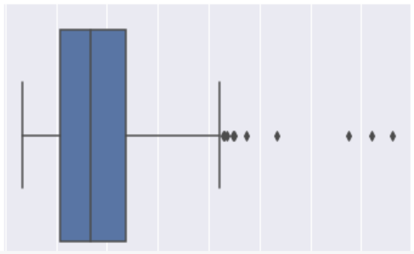
```
sns.boxplot(x=df["Leptin"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae09d4c0>
```



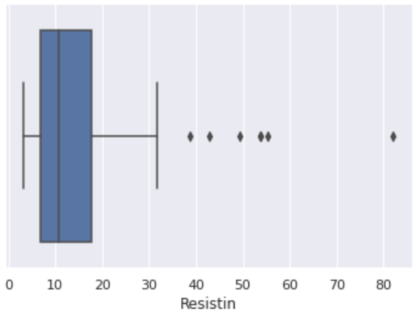
```
sns.boxplot(x=df["Adiponectin"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5ae0318e0>
```



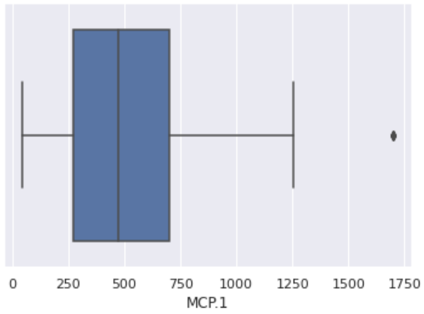
```
sns.boxplot(x=df["Resistin"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5adfdebe0>
```



```
sns.boxplot(x=df["MCP.1"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5adf35b20>
```

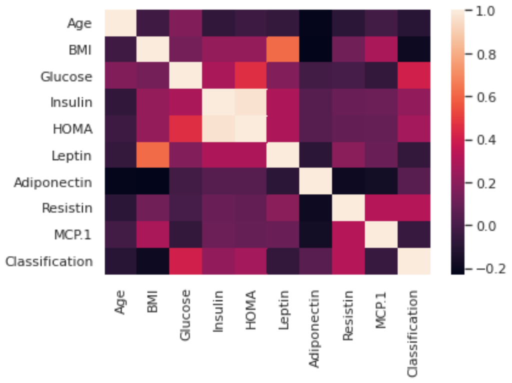


```
import scipy.stats as stats
z = np.abs(stats.zscore(df))
data_clean = df[(z<3).all(axis = 1)]
data_clean.shape
```

```
(102, 10)
```

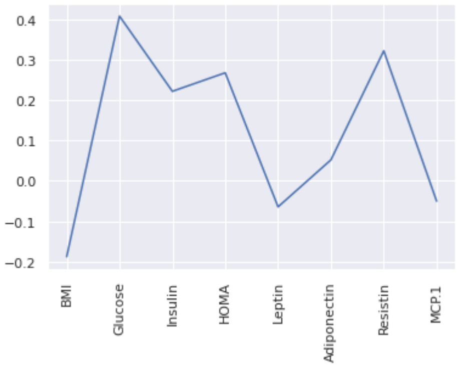
```
sns.heatmap(data_clean.corr())
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb5adefc430>
```



Correlation between Class and other attributes

```
corr = data_clean[data_clean.columns[1:]].corr()['Classification'][:-1]
plt.plot(corr)
plt.xticks(rotation=90)
plt.show()
```



Machine Learning

```
X = data_clean.drop('Classification', axis=1)
y = data_clean['Classification']
```

```
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.1,random_state=0)
```

Decision Tree

```
from sklearn.tree import DecisionTreeClassifier
dtree = DecisionTreeClassifier(random_state = 0)
dtree.fit(X_train, y_train)
```

```
DecisionTreeClassifier(random_state=0)
```

```
y_pred = dtree.predict(X_test)
print("Accuracy Score :", round(accuracy_score(y_test, y_pred)*100 ,2), "%")
```

```
Accuracy Score : 90.91 %
```

```
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score
print('F-1 Score : ',(f1_score(y_test, y_pred)))
print('Precision Score : ',(precision_score(y_test, y_pred)))
print('Recall Score : ',(recall_score(y_test, y_pred)))
```

```
F-1 Score :  0.8571428571428571
Precision Score :  0.75
Recall Score :  1.0
```

Random Forest

```
from sklearn.ensemble import RandomForestClassifier
rfc = RandomForestClassifier(random_state = 0)
rfc.fit(X_train, y_train)
```

```
RandomForestClassifier(random_state=0)
```

```
y_pred = rfc.predict(X_test)
print("Accuracy Score :", round(accuracy_score(y_test, y_pred)*100 ,2), "%")
```

```
Accuracy Score : 72.73 %
```

```
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score
print('F-1 Score : ',(f1_score(y_test, y_pred)))
print('Precision Score : ',(precision_score(y_test, y_pred)))
print('Recall Score : ',(recall_score(y_test, y_pred)))
```

```
F-1 Score :  0.5714285714285715
Precision Score :  0.5
Recall Score :  0.6666666666666666
```

Support Vector Machine

```
from sklearn import svm
sv = svm.SVC(random_state = 0)
sv.fit(X_train, y_train)
```

```
SVC(random_state=0)
```

```
y_pred = sv.predict(X_test)
print("Accuracy Score :", round(accuracy_score(y_test, y_pred)*100 ,2), "%")
```

```
Accuracy Score : 45.45 %
```

```
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score
print('F-1 Score : ',(f1_score(y_test, y_pred)))
print('Precision Score : ',(precision_score(y_test, y_pred)))
print('Recall Score : ',(recall_score(y_test, y_pred)))
```

```
F-1 Score :  0.25
Precision Score :  0.2
Recall Score :  0.3333333333333333
```

Logistic Regression

```
from sklearn.linear_model import LogisticRegression
lr = LogisticRegression(random_state = 0)
lr.fit(X_train, y_train)
```

```
/usr/local/lib/python3.8/dist-packages/sklearn/linear_model/_logistic.py:814: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
LogisticRegression(random_state=0)
```

```
y_pred = lr.predict(X_test)
print("Accuracy Score :", round(accuracy_score(y_test, y_pred)*100 ,2), "%")
```

```
Accuracy Score : 81.82 %
```

```
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score
print('F-1 Score : ',(f1_score(y_test, y_pred)))
print('Precision Score : ',(precision_score(y_test, y_pred)))
print('Recall Score : ',(recall_score(y_test, y_pred)))
```

```
F-1 Score :  0.7499999999999999
Precision Score :  0.6
Recall Score :  1.0
```