K02-T1-IF2220-13520020

April 16, 2022

[1]:
```python
#Tugas Besar Probabilitas dan Statistika IF2220
#Dibuat oleh:
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import pandas as pd
import numpy
import scipy
from scipy import stats
import matplotlib.pyplot as plt
import math

#file csv awal ditambahkan dengan:
#id,pH,Hardness,Solids,Chloramines,Sulfate,Conductivity,OrganicCarbon,
#Trihalomethanes,Turbidity,Potability
#pada baris pertama file agar data lebih mudah diakses

dataset = pd.read_csv("water_potability.csv")
print(dataset)
```
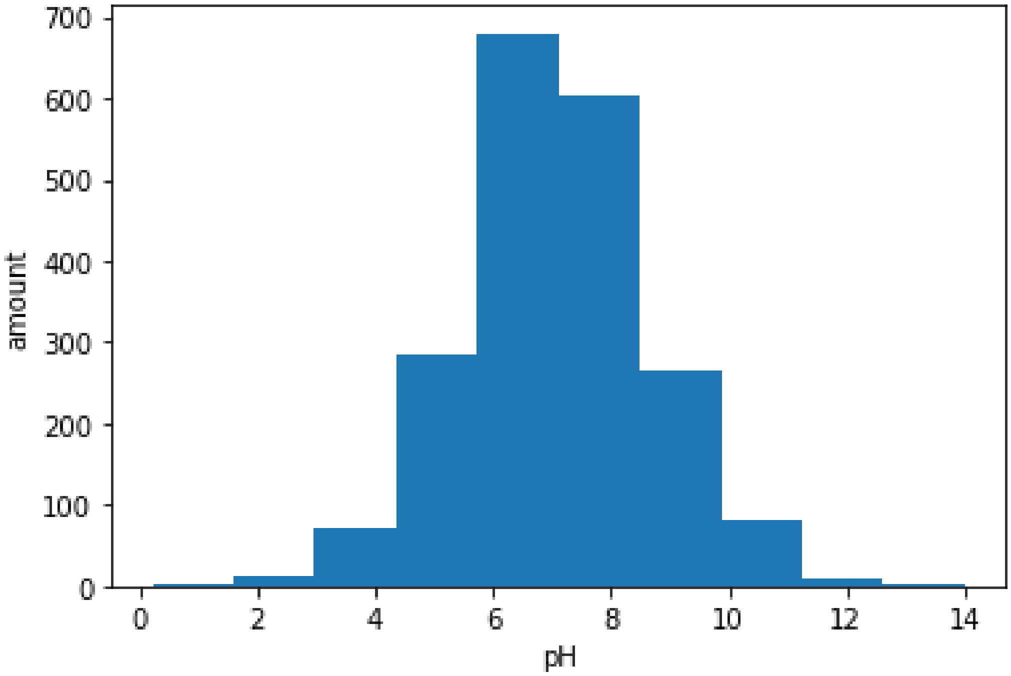

```
        id         pH    Hardness        Solids  Chloramines     Sulfate  \
0        1   8.316766  214.373394  22018.417441     8.059332  356.886136
1        2   9.092223  181.101509  17978.986339     6.546600  310.135738
2        3   5.584087  188.313324  28748.687739     7.544869  326.678363
3        4  10.223862  248.071735  28749.716544     7.513408  393.663396
4        5   8.635849  203.361523  13672.091764     4.563009  303.309771
...    ...        ...         ...           ...          ...         ...
2005  2006   8.197353  203.105091  27701.794055     6.472914  328.886838
2006  2007   8.989900  215.047358  15921.412018     6.297312  312.931022
2007  2008   6.702547  207.321086  17246.920347     7.708117  304.510230
2008  2009  11.491011   94.812545  37188.826022     9.263166  258.930600
2009  2010   6.069616  186.659040  26138.780191     7.747547  345.700257

      Conductivity  OrganicCarbon  Trihalomethanes  Turbidity  Potability
0       363.266516      18.436524       100.341674   4.628771           0
1       398.410813      11.558279        31.997993   4.075075           0
2       280.467916       8.399735        54.917862   2.559708           0
3       283.651634      13.789695        84.603556   2.672989           0
```

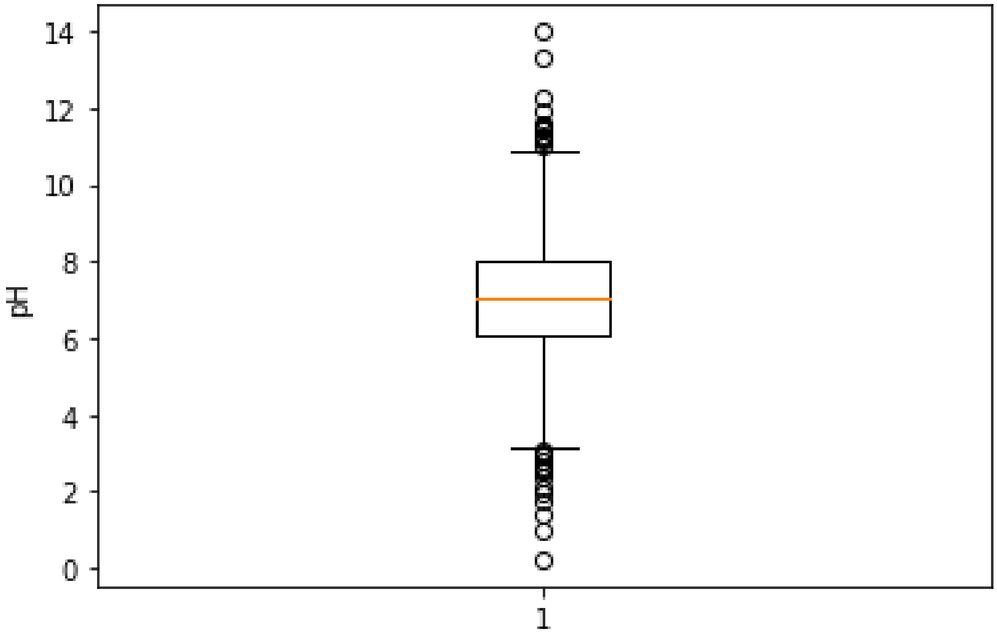
```
4       474.607645      12.363817        62.798309    4.401425             0
...            ...            ...              ...         ...           ...
2005    444.612724      14.250875        62.906205    3.361833             1
2006    390.410231       9.899115        55.069304    4.613843             1
2007    329.266002      16.217303        28.878601    3.442983             1
2008    439.893618      16.172755        41.558501    4.369264             1
2009    415.886955      12.067620        60.419921    3.669712             1

[2010 rows x 11 columns]
```

[2]:

```python
# Mengerjakan no 1, 2 dan 3 untuk kolom data pH

# Descriptive Statistics Data
pHMean = numpy.mean(dataset.pH)
pHMedian = numpy.median(dataset.pH)
pHModus = scipy.stats.mode(dataset.pH)
pHSTD = numpy.std(dataset.pH)
pHVariance = numpy.var(dataset.pH)
pHMin = numpy.min(dataset.pH)
pHMax = numpy.max(dataset.pH)
pHRange = pHMax-pHMin
pHQ1 = numpy.quantile(dataset.pH,0.25)
pHQ2 = numpy.quantile(dataset.pH,0.5)
pHQ3 = numpy.quantile(dataset.pH,0.75)
pHIQR = pHQ3 - pHQ1
pHSkew = scipy.stats.skew(dataset.pH)
pHKurtosis = scipy.stats.kurtosis(dataset.pH)

print("pH mean: " + str(pHMean))
print("pH median: " + str(pHMedian))
print("pH modus: " + str(pHModus[0][0]) + " ; Jumlah Kemunculan =␣
 ↪"+str(pHModus[1][0]))
print("pH standard deviation: " + str(pHSTD))
print("pH variance: " + str(pHVariance))
print("pH min: " + str(pHMin))
print("pH max: " + str(pHMax))
print("pH range: " + str(pHRange))
print("pH Q1: " + str(pHQ1))
print("pH Q2: " + str(pHQ2))
print("pH Q3: " + str(pHQ3))
print("pH IQR: " + str(pHIQR))
print("pH Skew: " + str(pHSkew))
print("pH Kurtosis: " + str(pHKurtosis))

temp, histogram_pH = plt.subplots(1,1)
histogram_pH.hist(dataset.pH)
histogram_pH.set_xlabel("pH")
histogram_pH.set_ylabel("amount")
plt.show();

temp, boxplot_pH = plt.subplots(1,1)
boxplot_pH.boxplot(dataset.pH)
boxplot_pH.set_ylabel("pH")
plt.show();

#harus melakukan pengecekan data skew dan kurtosis untuk melihat jika data␣
 ↪memiliki normal distribution
#nilai skew dan kurtosis harus mendekati 0
#(nilai kurtosis mengikuti definisi fisher sehingga hasil akhir kurtosis pada␣
 ↪hasil print kurtosis sudah dikurangi 3)
#(untuk menentukan normal distribution, skew memiliki range -0.1 < skew < 0.1␣
 ↪dan kurtosis memiliki range -0.1 < kurtosis < 0.1)

#data pH tidak memiliki distribusi normal karena memiliki nilai kurtosis yang␣
 ↪besar
#jika dilihat dari histogram, bagian tengah histogram jauh lebih tinggi daripada␣
 ↪bagian sekitar dan naik secara drastis sehingga tidak memiliki distribusi␣
 ↪normal
```

```
pH mean: 7.0871927687138205
pH median: 7.0294904554741855
pH modus: 0.2274990502021987 ; Jumlah Kemunculan = 1
pH standard deviation: 1.572411653857112
pH variance: 2.4724784091856584
pH min: 0.2274990502021987
pH max: 13.999999999999998
pH range: 13.7725009497978
pH Q1: 6.09078502142353
pH Q2: 7.0294904554741855
pH Q3: 8.053006240791538
pH IQR: 1.9622212193680078
pH Skew: 0.04849828675523678
pH Kurtosis: 0.6223621582163492
```


700
600
500
400
300
200
100
0
amount
0
2
4
6
8
10
12
14
pH

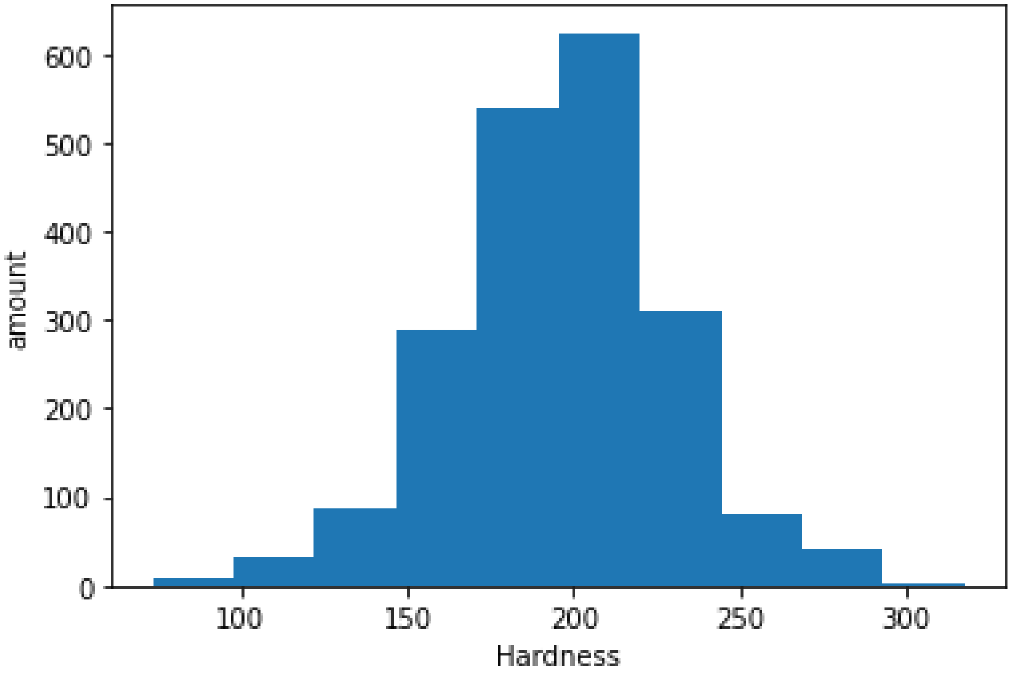

14
12
10
8
6
4
2
0
pH
1

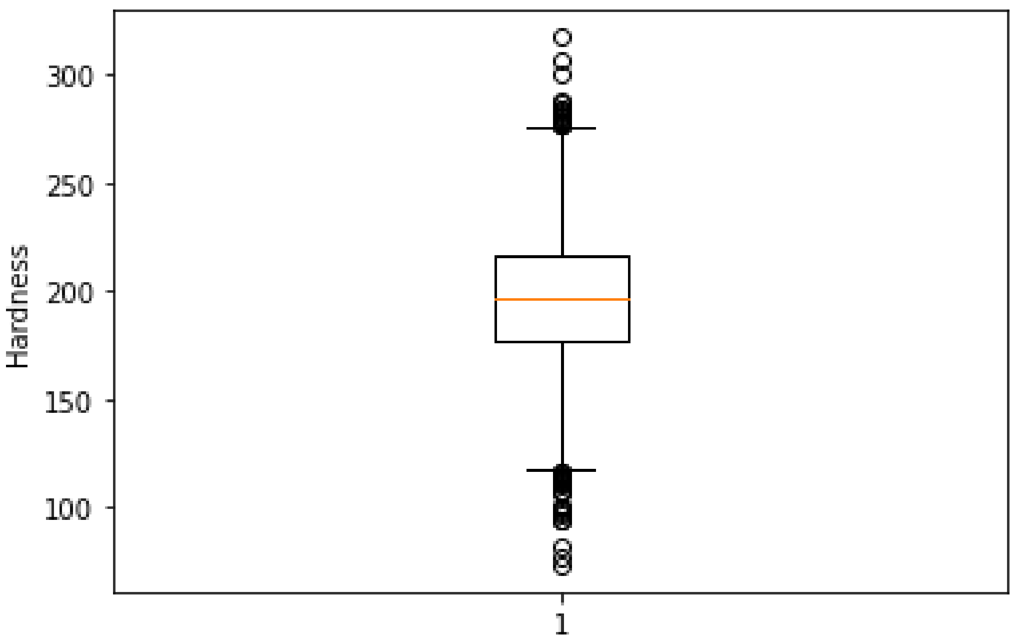
[3]:

```
#Mengerjakan no 1, 2, dan 3 untuk kolom data Hardness

# Descriptive Statistics Data
HardnessMean = numpy.mean(dataset.Hardness)
HardnessMedian = numpy.median(dataset.Hardness)
HardnessModus = scipy.stats.mode(dataset.Hardness)
HardnessSTD = numpy.std(dataset.Hardness)
HardnessVariance = numpy.var(dataset.Hardness)
HardnessMin = numpy.min(dataset.Hardness)
HardnessMax = numpy.max(dataset.Hardness)
HardnessRange = HardnessMax-HardnessMin
HardnessQ1 = numpy.quantile(dataset.Hardness,0.25)
HardnessQ2 = numpy.quantile(dataset.Hardness,0.5)
HardnessQ3 = numpy.quantile(dataset.Hardness,0.75)
HardnessIQR = HardnessQ3 - HardnessQ1
HardnessSkew = scipy.stats.skew(dataset.Hardness)
HardnessKurtosis = scipy.stats.kurtosis(dataset.Hardness)

print("Hardness mean: " + str(HardnessMean))
print("Hardness median: " + str(HardnessMedian))
print("Hardness modus: " + str(HardnessModus[0][0]) +" ; Jumlah kemunculan = " +␣
 ↪str(HardnessModus[1][0]))
print("Hardness standard deviation: " + str(HardnessSTD))
print("Hardness variance: " + str(HardnessVariance))
print("Hardness min: " + str(HardnessMin))
print("Hardness max: " + str(HardnessMax))
print("Hardness range: " + str(HardnessRange))
print("Hardness Q1: " + str(HardnessQ1))
print("Hardness Q2: " + str(HardnessQ2))
print("Hardness Q3: " + str(HardnessQ3))
print("Hardness IQR: " + str(HardnessIQR))
print("Hardness Skew: " + str(HardnessSkew))
print("Hardness Kurtosis: " + str(HardnessKurtosis))

temp, histogram_Hardness = plt.subplots(1,1)
histogram_Hardness.hist(dataset.Hardness)
histogram_Hardness.set_xlabel("Hardness")
histogram_Hardness.set_ylabel("amount")
plt.show();

temp, boxplot_Hardness = plt.subplots(1,1)
boxplot_Hardness.boxplot(dataset.Hardness)
boxplot_Hardness.set_ylabel("Hardness")
plt.show();

#nilai skewness mendekati 0 tetapi nilai kurtosis tidak mendekati 0 (definisi␣
 ↪fisher) dan berbentuk leptokurtic (kurtosis > 0)
```

```
#data Hardness tidak memiliki distribusi normal karena memiliki nilai kurtosis yang besar
#jika dilihat dari histogram, bagian tengah histogram jauh lebih tinggi daripada bagian sekitar dan naik secara drastis sehingga tidak memiliki distribusi normal
```

```
Hardness mean: 195.96920903783553
Hardness median: 197.20352491941043
Hardness modus: 73.4922336890611 ; Jumlah kemunculan = 1
Hardness standard deviation: 32.63504465869229
Hardness variance: 1065.0461398748398
Hardness min: 73.4922336890611
Hardness max: 317.33812405558257
Hardness range: 243.84589036652147
Hardness Q1: 176.74065667669896
Hardness Q2: 197.20352491941043
Hardness Q3: 216.4475886672716
Hardness IQR: 39.70693199057263
Hardness Skew: -0.08525735610579517
Hardness Kurtosis: 0.5211906487769773
```

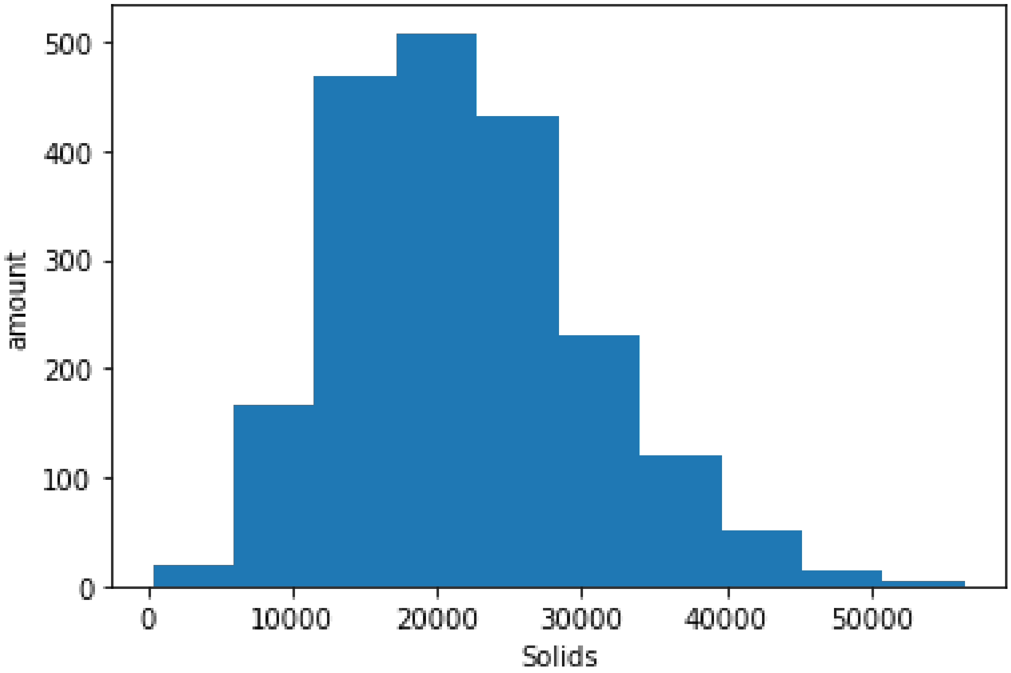




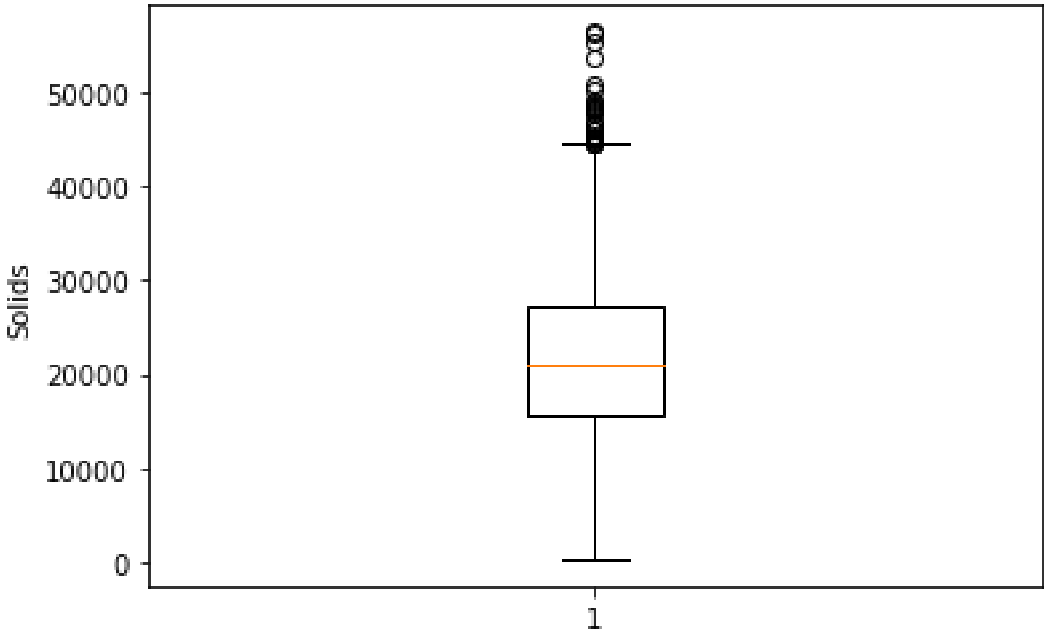
[4]:

```python
#Mengerjakan no 1, 2, dan 3 untuk kolom data Solids

SolidsMean = numpy.mean(dataset.Solids)
SolidsMedian = numpy.median(dataset.Solids)
SolidsModus = scipy.stats.mode(dataset.Solids)
SolidsSTD = numpy.std(dataset.Solids)
SolidsVariance = numpy.var(dataset.Solids)
SolidsMin = numpy.min(dataset.Solids)
SolidsMax = numpy.max(dataset.Solids)
SolidsRange = SolidsMax-SolidsMin
SolidsQ1 = numpy.quantile(dataset.Solids,0.25)
SolidsQ2 = numpy.quantile(dataset.Solids,0.5)
SolidsQ3 = numpy.quantile(dataset.Solids,0.75)
SolidsIQR = SolidsQ3 - SolidsQ1
SolidsSkew = scipy.stats.skew(dataset.Solids)
SolidsKurtosis = scipy.stats.kurtosis(dataset.Solids)

print("Solids mean: " + str(SolidsMean))
print("Solids median: " + str(SolidsMedian))
print("Solids modus: " + str(SolidsModus[0][0]) +" ; Jumlah kemunculan = " +␣
 ↪str(SolidsModus[1][0]))
print("Solids standard deviation: " + str(SolidsSTD))
print("Solids variance: " + str(SolidsVariance))
print("Solids min: " + str(SolidsMin))
print("Solids max: " + str(SolidsMax))
print("Solids range: " + str(SolidsRange))
print("Solids Q1: " + str(SolidsQ1))
print("Solids Q2: " + str(SolidsQ2))
print("Solids Q3: " + str(SolidsQ3))
print("Solids IQR: " + str(SolidsIQR))
print("Solids Skew: " + str(SolidsSkew))
print("Solids Kurtosis: " + str(SolidsKurtosis))

temp, histogram_Solids = plt.subplots(1,1)
histogram_Solids.hist(dataset.Solids)
histogram_Solids.set_xlabel("Solids")
histogram_Solids.set_ylabel("amount")
plt.show();

temp, boxplot_Solids = plt.subplots(1,1)
boxplot_Solids.boxplot(dataset.Solids)
boxplot_Solids.set_ylabel("Solids")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness tidak mendekati 0 (positive skew)
#nilai kurtosis tidak mendekati 0 (definisi fisher) dan berbentuk leptokurtic␣
 ↪(kurtosis > 0)
#data Solids tidak memiliki distribusi normal karena memiliki nilai skew yang␣
 ↪besar
#jika dilihat dari histogram, bagian paling tinggi histogram berada di bagian␣
 ↪kiri gambar dan tidak di tengah sehingga tidak memiliki distribusi normal
```

```
Solids mean: 21904.673439053087
Solids median: 20926.88215534375
Solids modus: 320.942611274359 ; Jumlah kemunculan = 1
Solids standard deviation: 8623.2520228849
Solids variance: 74360475.45018852
Solids min: 320.942611274359
Solids max: 56488.672412739186
Solids range: 56167.729801464826
Solids Q1: 15614.412961614333
Solids Q2: 20926.88215534375
Solids Q3: 27170.5346486036
Solids IQR: 11556.121686989267
Solids Skew: 0.5905702277342098
Solids Kurtosis: 0.333498156306705
```



500
400
300
200
100
0
amount
0
10000
20000
30000
40000
50000
Solids



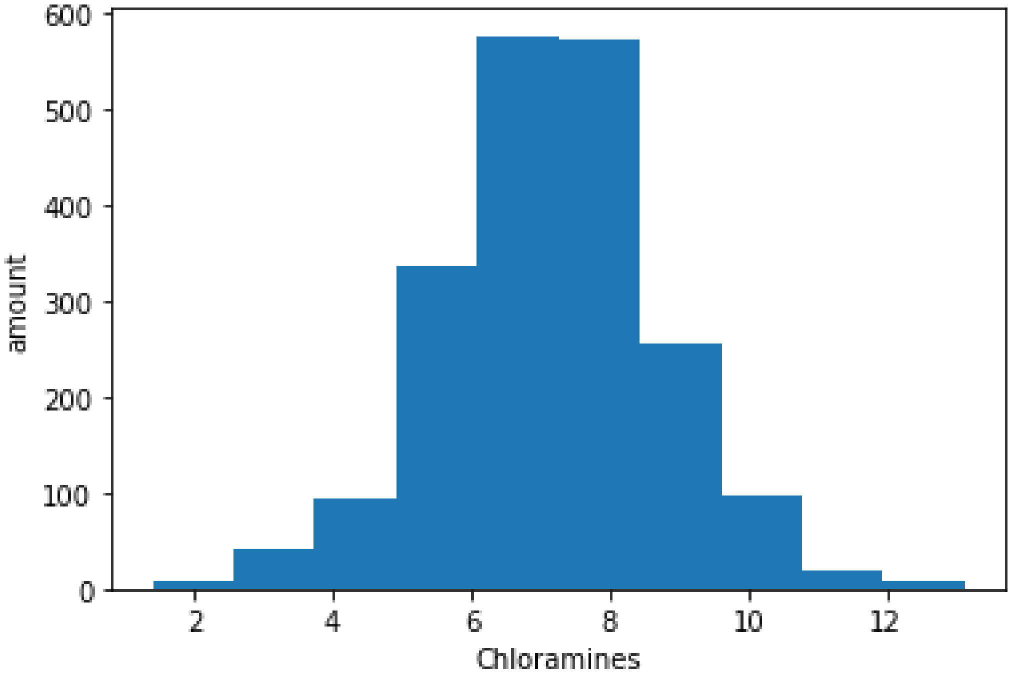
50000
40000
30000
20000
10000
0
Solids
1

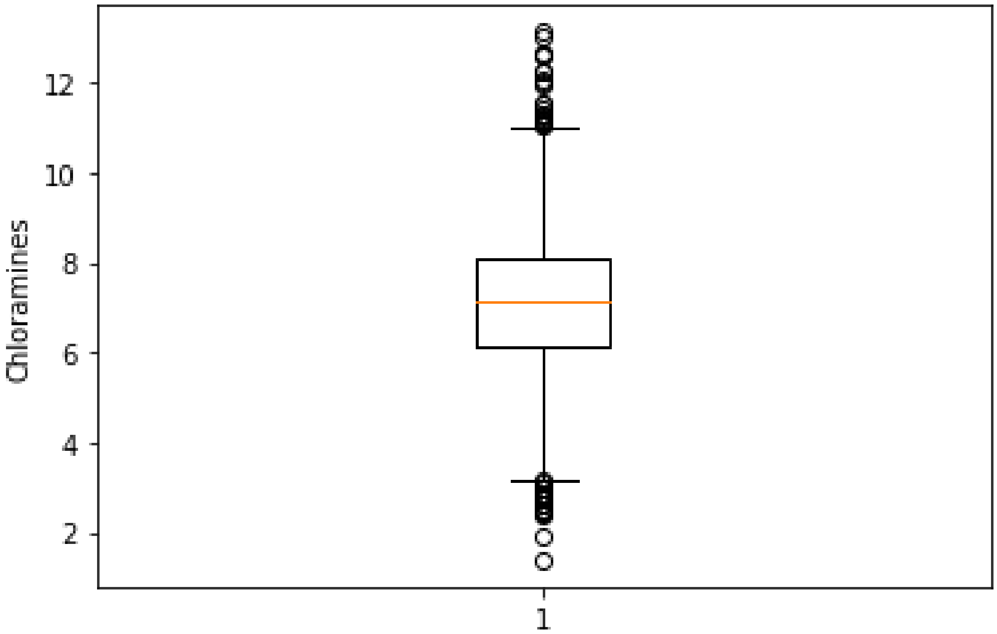
[5]:

```
#Mengerjakan no1, 2, dan 3 untuk kolom data Chloramines

ChloraminesMean = numpy.mean(dataset.Chloramines)
ChloraminesMedian = numpy.median(dataset.Chloramines)
ChloraminesModus = scipy.stats.mode(dataset.Chloramines)
ChloraminesSTD = numpy.std(dataset.Chloramines)
ChloraminesVariance = numpy.var(dataset.Chloramines)
ChloraminesMin = numpy.min(dataset.Chloramines)
ChloraminesMax = numpy.max(dataset.Chloramines)
ChloraminesRange = ChloraminesMax-ChloraminesMin
ChloraminesQ1 = numpy.quantile(dataset.Chloramines,0.25)
ChloraminesQ2 = numpy.quantile(dataset.Chloramines,0.5)
ChloraminesQ3 = numpy.quantile(dataset.Chloramines,0.75)
ChloraminesIQR = ChloraminesQ3 - ChloraminesQ1
ChloraminesSkew = scipy.stats.skew(dataset.Chloramines)
ChloraminesKurtosis = scipy.stats.kurtosis(dataset.Chloramines)

print("Chloramines mean: " + str(ChloraminesMean))
print("Chloramines median: " + str(ChloraminesMedian))
print("Chloramines modus: " + str(ChloraminesModus[0][0]) +" ; Jumlah kemunculan␣
 ↪= " + str(ChloraminesModus[1][0]))
print("Chloramines standard deviation: " + str(ChloraminesSTD))
print("Chloramines variance: " + str(ChloraminesVariance))
print("Chloramines min: " + str(ChloraminesMin))
print("Chloramines max: " + str(ChloraminesMax))
print("Chloramines range: " + str(ChloraminesRange))
print("Chloramines Q1: " + str(ChloraminesQ1))
print("Chloramines Q2: " + str(ChloraminesQ2))
print("Chloramines Q3: " + str(ChloraminesQ3))
print("Chloramines IQR: " + str(ChloraminesIQR))
print("Chloramines Skew: " + str(ChloraminesSkew))
print("Chloramines Kurtosis: " + str(ChloraminesKurtosis))

temp, histogram_Chloramines = plt.subplots(1,1)
histogram_Chloramines.hist(dataset.Chloramines)
histogram_Chloramines.set_xlabel("Chloramines")
histogram_Chloramines.set_ylabel("amount")
plt.show();

temp, boxplot_Chloramines = plt.subplots(1,1)
boxplot_Chloramines.boxplot(dataset.Chloramines)
boxplot_Chloramines.set_ylabel("Chloramines")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness mendekati 0
```

```
#nilai kurtosis tidak mendekati 0 (definisi fisher) dan berbentuk leptokurtic (kurtosis > 0)
#data Chloramines tidak memiliki distribusi normal karena memiliki nilai kurtosis yang besar
#jika dilihat dari histogram, bagian tengah histogram jauh lebih tinggi daripada bagian sekitar dan naik secara drastis sehingga tidak memiliki distribusi normal
```

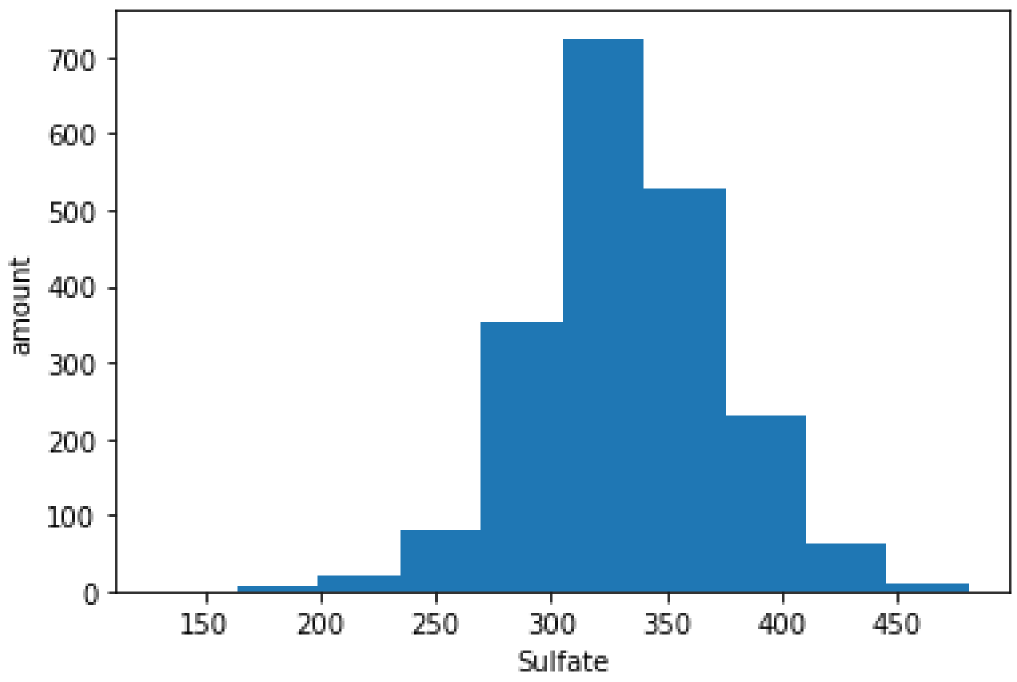
```
Chloramines mean: 7.134322344600092
Chloramines median: 7.142014304622665
Chloramines modus: 1.3908709048851806 ; Jumlah kemunculan = 1
Chloramines standard deviation: 1.5848197173405132
Chloramines variance: 2.511653536471264
Chloramines min: 1.3908709048851806
Chloramines max: 13.127000000000002
Chloramines range: 11.736129095114823
Chloramines Q1: 6.138326387572855
Chloramines Q2: 7.142014304622665
Chloramines Q3: 8.109933216133502
Chloramines IQR: 1.9716068285606472
Chloramines Skew: 0.012993791664418162
Chloramines Kurtosis: 0.5454318545555785
```

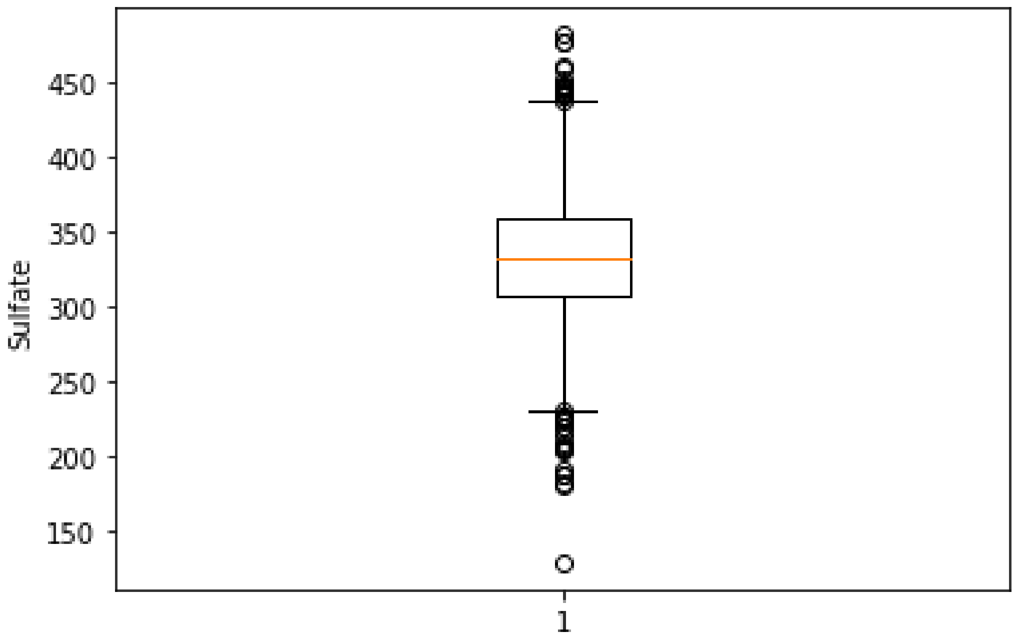




[6]:
```
#Mengerjakan no 2 dan 3 untuk kolom data Sulfate

SulfateMean = numpy.mean(dataset.Sulfate)
SulfateMedian = numpy.median(dataset.Sulfate)
SulfateModus = scipy.stats.mode(dataset.Sulfate)
SulfateSTD = numpy.std(dataset.Sulfate)
SulfateVariance = numpy.var(dataset.Sulfate)
SulfateMin = numpy.min(dataset.Sulfate)
SulfateMax = numpy.max(dataset.Sulfate)
SulfateRange = SulfateMax-SulfateMin
SulfateQ1 = numpy.quantile(dataset.Sulfate,0.25)
SulfateQ2 = numpy.quantile(dataset.Sulfate,0.5)
SulfateQ3 = numpy.quantile(dataset.Sulfate,0.75)
SulfateIQR = SulfateQ3 - SulfateQ1
SulfateSkew = scipy.stats.skew(dataset.Sulfate)
SulfateKurtosis = scipy.stats.kurtosis(dataset.Sulfate)

print("Sulfate mean: " + str(SulfateMean))
print("Sulfate median: " + str(SulfateMedian))
print("Sulfate modus: " + str(SulfateModus[0][0]) +" ; Jumlah kemunculan = " + str(SulfateModus[1][0]))
print("Sulfate standard deviation: " + str(SulfateSTD))
print("Sulfate variance: " + str(SulfateVariance))
print("Sulfate min: " + str(SulfateMin))
print("Sulfate max: " + str(SulfateMax))
print("Sulfate range: " + str(SulfateRange))
print("Sulfate Q1: " + str(SulfateQ1))
print("Sulfate Q2: " + str(SulfateQ2))
print("Sulfate Q3: " + str(SulfateQ3))
print("Sulfate IQR: " + str(SulfateIQR))
print("Sulfate Skew: " + str(SulfateSkew))
print("Sulfate Kurtosis: " + str(SulfateKurtosis))

temp, histogram_Sulfate = plt.subplots(1,1)
histogram_Sulfate.hist(dataset.Sulfate)
histogram_Sulfate.set_xlabel("Sulfate")
histogram_Sulfate.set_ylabel("amount")
plt.show();

temp, boxplot_Sulfate = plt.subplots(1,1)
boxplot_Sulfate.boxplot(dataset.Sulfate)
boxplot_Sulfate.set_ylabel("Sulfate")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness mendekati 0
#nilai kurtosis tidak mendekati 0 (definisi fisher) dan berbentuk leptokurtic␣
 ↪(kurtosis > 0)
#data Sulfate tidak memiliki distribusi normal karena memiliki nilai kurtosis␣
 ↪yang besar
#jika dilihat dari histogram, bagian tengah histogram jauh lebih tinggi daripada␣
 ↪bagian sekitar
#bentuk histogram juga tidak terlihat simetris
```

```
Sulfate mean: 333.21137641518925
Sulfate median: 332.2141128069568
Sulfate modus: 129.00000000000003 ; Jumlah kemunculan = 1
Sulfate standard deviation: 41.20085823007217
Sulfate variance: 1697.5107188945055
Sulfate min: 129.00000000000003
Sulfate max: 481.03064230599716
Sulfate range: 352.03064230599716
Sulfate Q1: 307.6269864860709
Sulfate Q2: 332.2141128069568
Sulfate Q3: 359.2681473914155
Sulfate IQR: 51.64116090534458
Sulfate Skew: -0.045693672132827333
Sulfate Kurtosis: 0.7819149219038852
```


700
600
500
400
300
200
100
0
amount
150
200
250
300
350
400
450
Sulfate

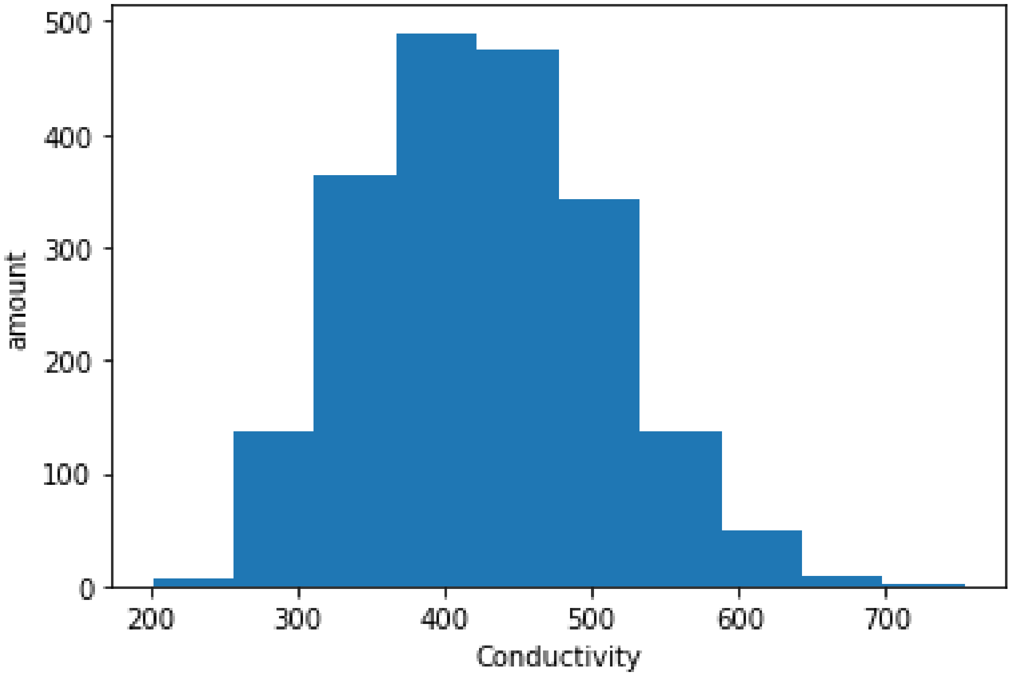

450
400
350
300
250
200
150
Sulfate
1

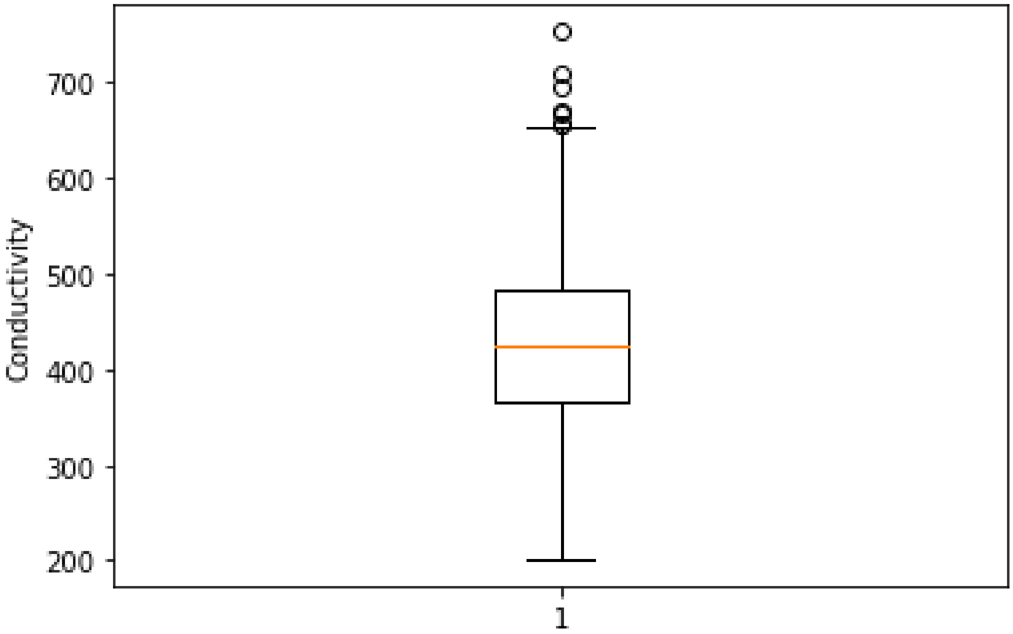
[7]:

```
#Mengerjakan no 2 dan 3 untuk kolom data Conductivity

ConductivityMean = numpy.mean(dataset.Conductivity)
ConductivityMedian = numpy.median(dataset.Conductivity)
ConductivityModus = scipy.stats.mode(dataset.Conductivity)
ConductivitySTD = numpy.std(dataset.Conductivity)
ConductivityVariance = numpy.var(dataset.Conductivity)
ConductivityMin = numpy.min(dataset.Conductivity)
ConductivityMax = numpy.max(dataset.Conductivity)
ConductivityRange = ConductivityMax-ConductivityMin
ConductivityQ1 = numpy.quantile(dataset.Conductivity,0.25)
ConductivityQ2 = numpy.quantile(dataset.Conductivity,0.5)
ConductivityQ3 = numpy.quantile(dataset.Conductivity,0.75)
ConductivityIQR = ConductivityQ3 - ConductivityQ1
ConductivitySkew = scipy.stats.skew(dataset.Conductivity)
ConductivityKurtosis = scipy.stats.kurtosis(dataset.Conductivity)

print("Conductivity mean: " + str(ConductivityMean))
print("Conductivity median: " + str(ConductivityMedian))
print("Conductivity modus: " + str(ConductivityModus[0][0]) +" ; Jumlah␣
 ↪kemunculan = " + str(ConductivityModus[1][0]))
print("Conductivity standard deviation: " + str(ConductivitySTD))
print("Conductivity variance: " + str(ConductivityVariance))
print("Conductivity min: " + str(ConductivityMin))
print("Conductivity max: " + str(ConductivityMax))
print("Conductivity range: " + str(ConductivityRange))
print("Conductivity Q1: " + str(ConductivityQ1))
print("Conductivity Q2: " + str(ConductivityQ2))
print("Conductivity Q3: " + str(ConductivityQ3))
print("Conductivity IQR: " + str(ConductivityIQR))
print("Conductivity Skew: " + str(ConductivitySkew))
print("Conductivity Kurtosis: " + str(ConductivityKurtosis))

temp, histogram_Conductivity = plt.subplots(1,1)
histogram_Conductivity.hist(dataset.Conductivity)
histogram_Conductivity.set_xlabel("Conductivity")
histogram_Conductivity.set_ylabel("amount")
plt.show();

temp, boxplot_Conductivity = plt.subplots(1,1)
boxplot_Conductivity.boxplot(dataset.Conductivity)
boxplot_Conductivity.set_ylabel("Conductivity")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness tidak mendekati 0 (positive skew)
```

```
#nilai kurtosis tidak mendekati 0 (definisi fisher) dan berbentuk platykrutic (kurtosis < 0)
#data Conductivity tidak memiliki distribusi normal karena memiliki nilai skew yang besar
#jika dilihat dari histogram, bagian paling tinggi histogram berada di bagian kiri gambar dan tidak di tengah sehingga tidak memiliki distribusi normal
```

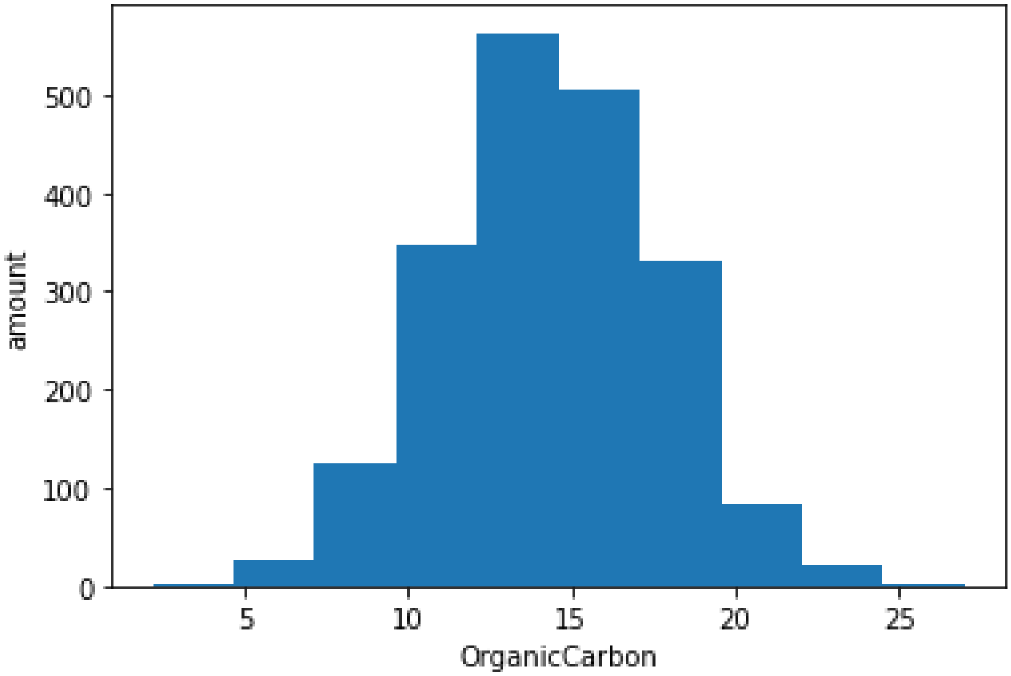
```
Conductivity mean: 426.4767083525792
Conductivity median: 423.43837202443706
Conductivity modus: 201.6197367551575 ; Jumlah kemunculan = 1
Conductivity standard deviation: 80.68179421728163
Conductivity variance: 6509.55191811978
Conductivity min: 201.6197367551575
Conductivity max: 753.3426195583046
Conductivity range: 551.7228828031471
Conductivity Q1: 366.6192192963244
Conductivity Q2: 423.43837202443706
Conductivity Q3: 482.2097724598859
Conductivity IQR: 115.59055316356154
Conductivity Skew: 0.26781228234697924
Conductivity Kurtosis: -0.2395999421551358
```

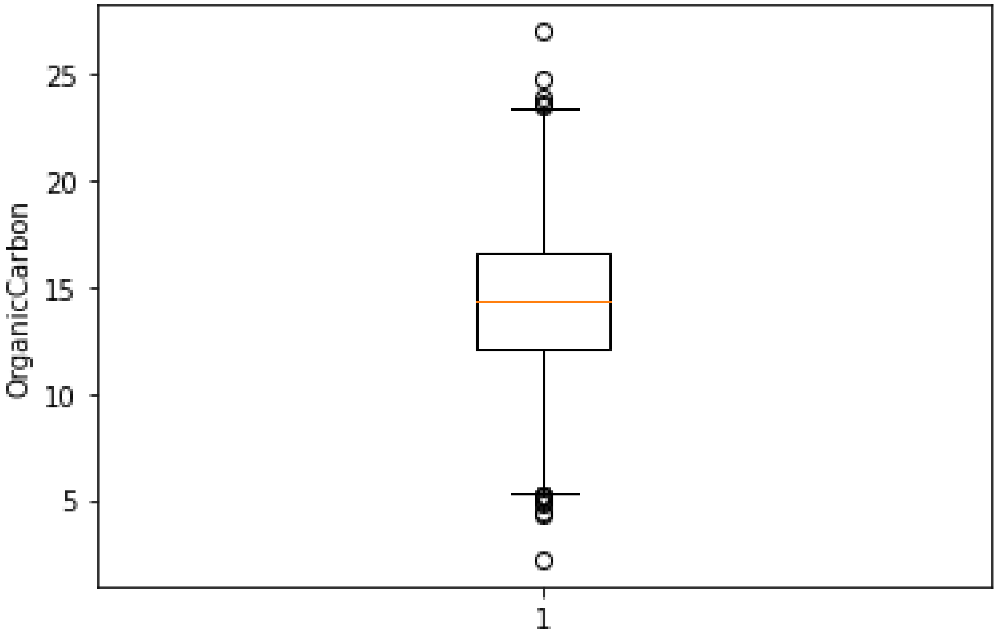




[8]:
```python
#Mengerjakan no 2 dan 3 untuk kolom data OrganicCarbon

OrganicCarbonMean = numpy.mean(dataset.OrganicCarbon)
OrganicCarbonMedian = numpy.median(dataset.OrganicCarbon)
OrganicCarbonModus = scipy.stats.mode(dataset.OrganicCarbon)
OrganicCarbonSTD = numpy.std(dataset.OrganicCarbon)
OrganicCarbonVariance = numpy.var(dataset.OrganicCarbon)
OrganicCarbonMin = numpy.min(dataset.OrganicCarbon)
OrganicCarbonMax = numpy.max(dataset.OrganicCarbon)
OrganicCarbonRange = OrganicCarbonMax-OrganicCarbonMin
OrganicCarbonQ1 = numpy.quantile(dataset.OrganicCarbon,0.25)
OrganicCarbonQ2 = numpy.quantile(dataset.OrganicCarbon,0.5)
OrganicCarbonQ3 = numpy.quantile(dataset.OrganicCarbon,0.75)
OrganicCarbonIQR = OrganicCarbonQ3 - OrganicCarbonQ1
OrganicCarbonSkew = scipy.stats.skew(dataset.OrganicCarbon)
OrganicCarbonKurtosis = scipy.stats.kurtosis(dataset.OrganicCarbon)

print("OrganicCarbon mean: " + str(OrganicCarbonMean))
print("OrganicCarbon median: " + str(OrganicCarbonMedian))
print("OrganicCarbon modus: " + str(OrganicCarbonModus[0][0]) +" ; Jumlah␣
 ↪kemunculan = " + str(OrganicCarbonModus[1][0]))
print("OrganicCarbon standard deviation: " + str(OrganicCarbonSTD))
print("OrganicCarbon variance: " + str(OrganicCarbonVariance))
print("OrganicCarbon min: " + str(OrganicCarbonMin))
print("OrganicCarbon max: " + str(OrganicCarbonMax))
print("OrganicCarbon range: " + str(OrganicCarbonRange))
print("OrganicCarbon Q1: " + str(OrganicCarbonQ1))
print("OrganicCarbon Q2: " + str(OrganicCarbonQ2))
print("OrganicCarbon Q3: " + str(OrganicCarbonQ3))
print("OrganicCarbon IQR: " + str(OrganicCarbonIQR))
print("OrganicCarbon Skew: " + str(OrganicCarbonSkew))
print("OrganicCarbon Kurtosis: " + str(OrganicCarbonKurtosis))

temp, histogram_OrganicCarbon = plt.subplots(1,1)
histogram_OrganicCarbon.hist(dataset.OrganicCarbon)
histogram_OrganicCarbon.set_xlabel("OrganicCarbon")
histogram_OrganicCarbon.set_ylabel("amount")
plt.show();

temp, boxplot_OrganicCarbon = plt.subplots(1,1)
boxplot_OrganicCarbon.boxplot(dataset.OrganicCarbon)
boxplot_OrganicCarbon.set_ylabel("OrganicCarbon")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness mendekati 0
#nilai kurtosis mendekati 0
#data OrganicCarbon memiliki distribusi normal karena nilai skew dan kurtosis␣
 ↪mendekati 0
#jika dilihat di histogram, bagian paling tinggi berada di tengah, tinggi bagian␣
 ↪tengah tidak terlalu drastis dibandingkan dengan data disampingnya
```

```
OrganicCarbon mean: 14.357939902048088
OrganicCarbon median: 14.323285610653329
OrganicCarbon modus: 2.1999999999999886 ; Jumlah kemunculan = 1
OrganicCarbon standard deviation: 3.3249425928037897
OrganicCarbon variance: 11.055243245440789
OrganicCarbon min: 2.1999999999999886
OrganicCarbon max: 27.00670661116601
OrganicCarbon range: 24.80670661116602
OrganicCarbon Q1: 12.122530374047729
OrganicCarbon Q2: 14.323285610653329
OrganicCarbon Q3: 16.683561746173808
OrganicCarbon IQR: 4.561031372126079
OrganicCarbon Skew: -0.020204663792376603
OrganicCarbon Kurtosis: 0.027957691493330827
```


500
400
300
200
100
0
amount
5
10
15
20
25
OrganicCarbon

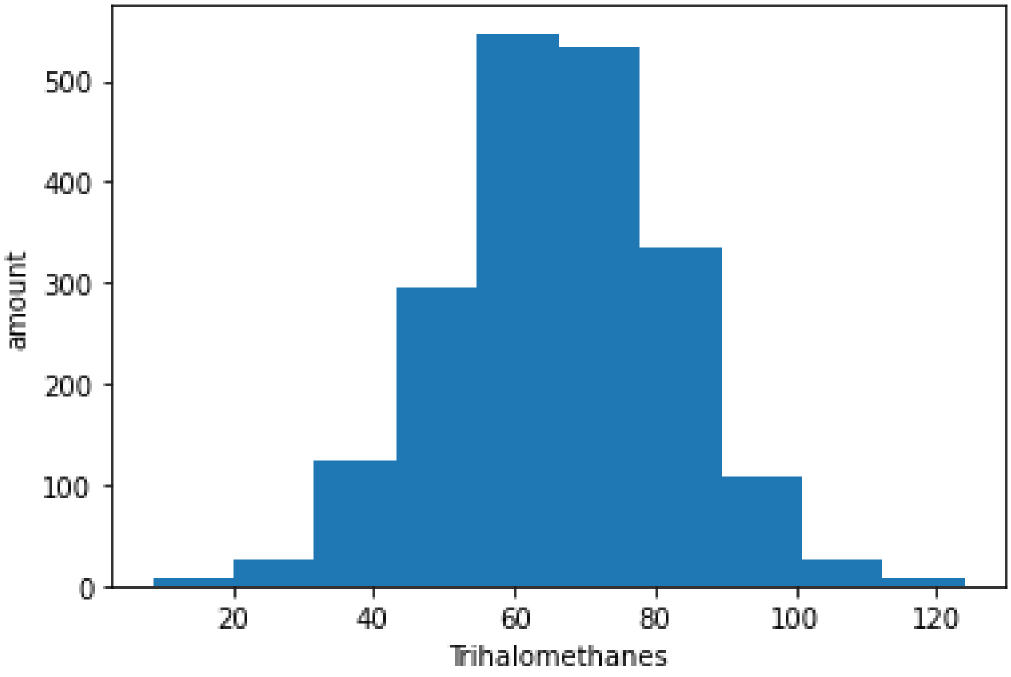

25
20
15
10
5
OrganicCarbon
1

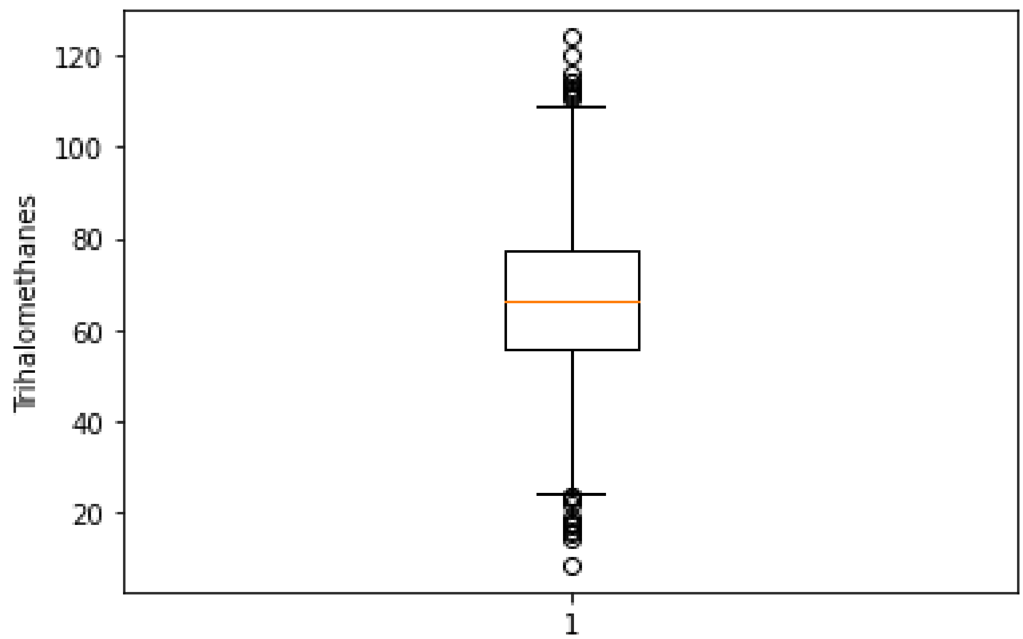
[9]:

```
#Mengerjakan no 2 dan 3 untuk kolom data Trihalomethanes

TrihalomethanesMean = numpy.mean(dataset.Trihalomethanes)
TrihalomethanesMedian = numpy.median(dataset.Trihalomethanes)
TrihalomethanesModus = scipy.stats.mode(dataset.Trihalomethanes)
TrihalomethanesSTD = numpy.std(dataset.Trihalomethanes)
TrihalomethanesVariance = numpy.var(dataset.Trihalomethanes)
TrihalomethanesMin = numpy.min(dataset.Trihalomethanes)
TrihalomethanesMax = numpy.max(dataset.Trihalomethanes)
TrihalomethanesRange = TrihalomethanesMax-TrihalomethanesMin
TrihalomethanesQ1 = numpy.quantile(dataset.Trihalomethanes,0.25)
TrihalomethanesQ2 = numpy.quantile(dataset.Trihalomethanes,0.5)
TrihalomethanesQ3 = numpy.quantile(dataset.Trihalomethanes,0.75)
TrihalomethanesIQR = TrihalomethanesQ3 - TrihalomethanesQ1
TrihalomethanesSkew = scipy.stats.skew(dataset.Trihalomethanes)
TrihalomethanesKurtosis = scipy.stats.kurtosis(dataset.Trihalomethanes)

print("Trihalomethanes mean: " + str(TrihalomethanesMean))
print("Trihalomethanes median: " + str(TrihalomethanesMedian))
print("Trihalomethanes modus: " + str(TrihalomethanesModus[0][0]) +" ; Jumlah␣
 ↪kemunculan = " + str(TrihalomethanesModus[1][0]))
print("Trihalomethanes standard deviation: " + str(TrihalomethanesSTD))
print("Trihalomethanes variance: " + str(TrihalomethanesVariance))
print("Trihalomethanes min: " + str(TrihalomethanesMin))
print("Trihalomethanes max: " + str(TrihalomethanesMax))
print("Trihalomethanes range: " + str(TrihalomethanesRange))
print("Trihalomethanes Q1: " + str(TrihalomethanesQ1))
print("Trihalomethanes Q2: " + str(TrihalomethanesQ2))
print("Trihalomethanes Q3: " + str(TrihalomethanesQ3))
print("Trihalomethanes IQR: " + str(TrihalomethanesIQR))
print("Trihalomethanes Skew: " + str(TrihalomethanesSkew))
print("Trihalomethanes Kurtosis: " + str(TrihalomethanesKurtosis))

temp, histogram_Trihalomethanes = plt.subplots(1,1)
histogram_Trihalomethanes.hist(dataset.Trihalomethanes)
histogram_Trihalomethanes.set_xlabel("Trihalomethanes")
histogram_Trihalomethanes.set_ylabel("amount")
plt.show();

temp, boxplot_Trihalomethanes = plt.subplots(1,1)
boxplot_Trihalomethanes.boxplot(dataset.Trihalomethanes)
boxplot_Trihalomethanes.set_ylabel("Trihalomethanes")
plt.show();

#Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
 ↪(definisi fisher)
#nilai skewness mendekati 0
```

```
#nilai kurtosis tidak mendekati 0 (definisi fisher) dan berbentuk leptokurtic (kurtosis > 0)
#data Trihalomethanes tidak berdistribusi normal karena kurtosis tidak mendekati 0.
#jika dilihat di histogram, bagian paling tinggi berada di tengah, tinggi bagian tengah relatif drastis dibandingkan dengan data disampingnya
#berdasarkan perhitungan kurtosis
```

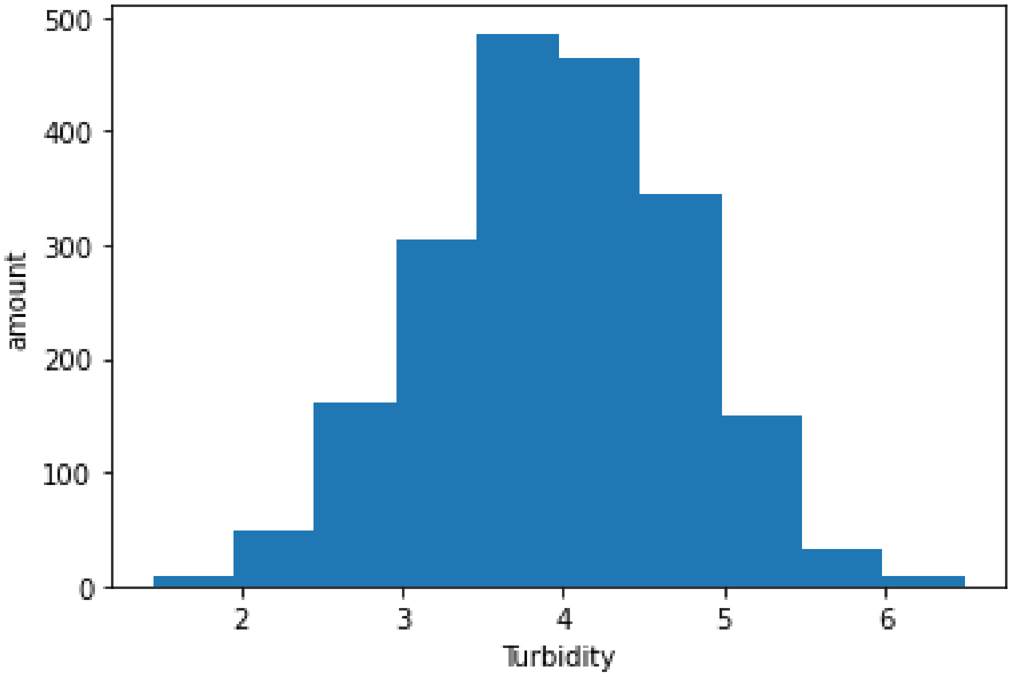
```
Trihalomethanes mean: 66.40071666307463
Trihalomethanes median: 66.48204080309809
Trihalomethanes modus: 8.577012932983806 ; Jumlah kemunculan = 1
Trihalomethanes standard deviation: 16.077108208788328
Trihalomethanes variance: 258.473408357089
Trihalomethanes min: 8.577012932983806
Trihalomethanes max: 124.0
Trihalomethanes range: 115.4229870670162
Trihalomethanes Q1: 55.94999302803187
Trihalomethanes Q2: 66.48204080309809
Trihalomethanes Q3: 77.29461280606742
Trihalomethanes IQR: 21.34461977803555
Trihalomethanes Skew: -0.05134433127761586
Trihalomethanes Kurtosis: 0.21947880896670524
```

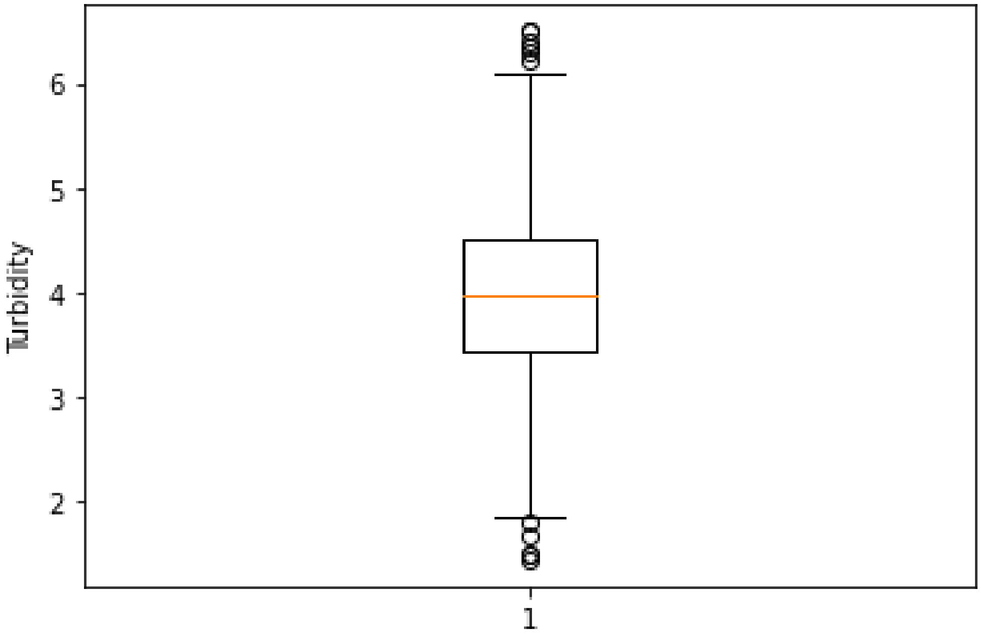




```
[10]: #Mengerjakan no 2 dan 3 untuk kolom data Turbidity

      TurbidityMean = numpy.mean(dataset.Turbidity)
      TurbidityMedian = numpy.median(dataset.Turbidity)
      TurbidityModus = scipy.stats.mode(dataset.Turbidity)
      TurbiditySTD = numpy.std(dataset.Turbidity)
      TurbidityVariance = numpy.var(dataset.Turbidity)
      TurbidityMin = numpy.min(dataset.Turbidity)
      TurbidityMax = numpy.max(dataset.Turbidity)
      TurbidityRange = TurbidityMax-TurbidityMin
      TurbidityQ1 = numpy.quantile(dataset.Turbidity,0.25)
      TurbidityQ2 = numpy.quantile(dataset.Turbidity,0.5)
      TurbidityQ3 = numpy.quantile(dataset.Turbidity,0.75)
      TurbidityIQR = TurbidityQ3 - TurbidityQ1
      TurbiditySkew = scipy.stats.skew(dataset.Turbidity)
      TurbidityKurtosis = scipy.stats.kurtosis(dataset.Turbidity)

      print("Turbidity mean: " + str(TurbidityMean))
      print("Turbidity median: " + str(TurbidityMedian))
      print("Turbidity modus: " + str(TurbidityModus[0][0]) +" ; Jumlah kemunculan = "␣
       ↪+ str(TurbidityModus[1][0]))
      print("Turbidity standard deviation: " + str(TurbiditySTD))
      print("Turbidity variance: " + str(TurbidityVariance))
      print("Turbidity min: " + str(TurbidityMin))
      print("Turbidity max: " + str(TurbidityMax))
      print("Turbidity range: " + str(TurbidityRange))
      print("Turbidity Q1: " + str(TurbidityQ1))
      print("Turbidity Q2: " + str(TurbidityQ2))
      print("Turbidity Q3: " + str(TurbidityQ3))
      print("Turbidity IQR: " + str(TurbidityIQR))
      print("Turbidity Skew: " + str(TurbiditySkew))
      print("Turbidity Kurtosis: " + str(TurbidityKurtosis))

      temp, histogram_Turbidity = plt.subplots(1,1)
      histogram_Turbidity.hist(dataset.Turbidity)
      histogram_Turbidity.set_xlabel("Turbidity")
      histogram_Turbidity.set_ylabel("amount")
      plt.show();

      temp, boxplot_Turbidity = plt.subplots(1,1)
      boxplot_Turbidity.boxplot(dataset.Turbidity)
      boxplot_Turbidity.set_ylabel("Turbidity")
      plt.show();

      #Syarat distribusi normal : skewness mendekati 0 dan kurtosis mendekati 0␣
       ↪(definisi fisher)
      #nilai skewness mendekati 0
      #nilai kurtosis mendekati 0
      #data Turbidity memiliki distribusi normal karena nilai skew dan kurtosis␣
       ↪mendekati 0
      #jika dilihat di histogram, bagian paling tinggi berada di tengah, tinggi bagian␣
       ↪tengah tidak terlalu drastis dibandingkan dengan data disampingnya
```

```
Turbidity mean: 3.969496912630371
Turbidity median: 3.967373963531836
Turbidity modus: 1.45 ; Jumlah kemunculan = 1
Turbidity standard deviation: 0.780276869529695
Turbidity variance: 0.6088319931230607
Turbidity min: 1.45
Turbidity max: 6.494748555990991
Turbidity range: 5.044748555990991
Turbidity Q1: 3.4428816235574393
Turbidity Q2: 3.967373963531836
Turbidity Q3: 4.514662720201883
Turbidity IQR: 1.071781096644444
Turbidity Skew: -0.03224189559762099
Turbidity Kurtosis: -0.052690516304206625
```

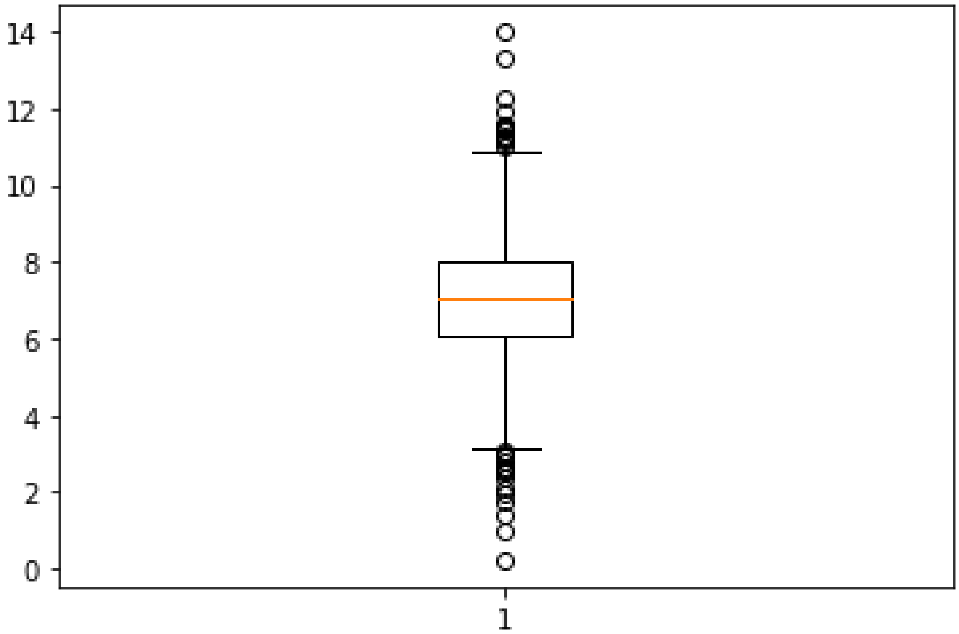

500
400
300
200
100
0
amount
2
3
4
5
6
Turbidity


6
5
4
3
2
Turbidity
1

[11]:

```
#Nomor 4a

H0_pH = 7
pH_result = pHMean
alpha = 0.05
totaldata = 2010
nilai_kritis_pH = scipy.stats.t.ppf(q=1-alpha, df=totaldata-1)
nilai_uji_pH = ((pH_result - H0_pH)/(pHSTD/math.sqrt(totaldata)))
nilai_p_pH = scipy.stats.t.sf(abs(nilai_uji_pH), df=totaldata-1)

print("mean: " + str(pH_result))
print("STD: " + str(pHSTD))
print("nilai kritis: " + str(nilai_kritis_pH))
print("hasil nilai uji: " + str(nilai_uji_pH))
print("hasil nilai p: " + str(nilai_p_pH))

if (nilai_uji_pH > nilai_kritis_pH or nilai_p_pH < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#jika H0 ditolak, maka rata-rata pH > 7

plt.boxplot(dataset.pH)
plt.show()
```

```
mean: 7.0871927687138205
STD: 1.572411653857112
nilai kritis: 1.6456124504017113
hasil nilai uji: 2.486063648110245
hasil nilai p: 0.006498604504908631
H0 ditolak
```

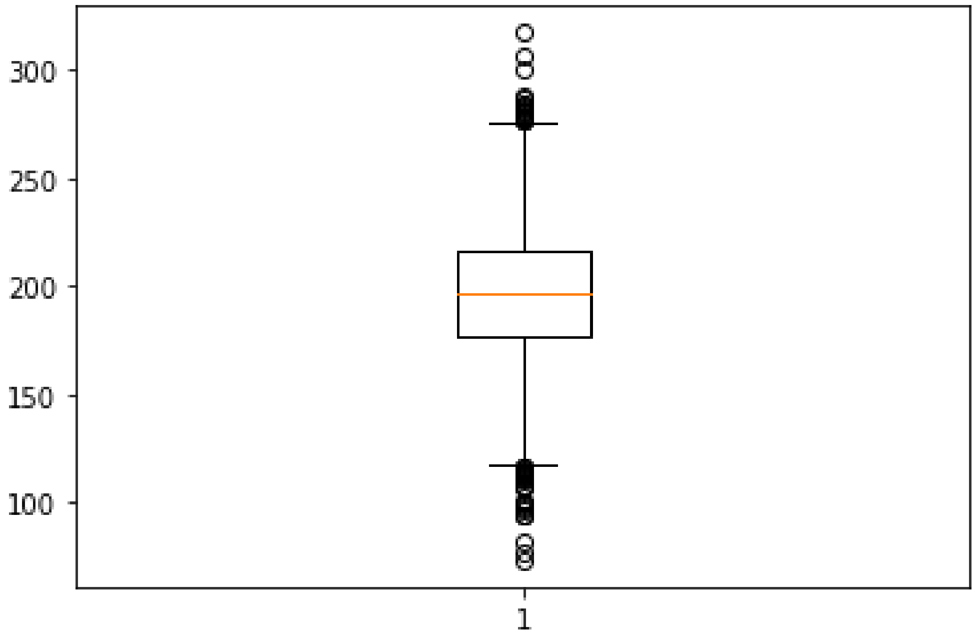


[12]:

```
#Nomor 4b

H0_Hardness = 205
Hardness_result = HardnessMean
alpha = 0.05
totaldata = 2010
nilai_kritis_Hardness = scipy.stats.t.ppf(q=1-(alpha/2), df=totaldata-1)
nilai_uji_Hardness = ((Hardness_result - H0_Hardness)/(HardnessSTD/math.
 ↪sqrt(totaldata)))
nilai_p_Hardness = (scipy.stats.t.sf(abs(nilai_uji_Hardness), df=totaldata-1)) *␣
 ↪2

print("mean: " + str(HardnessMean))
print("STD: " + str(HardnessSTD))
print("nilai kritis: " + str(nilai_kritis_Hardness))
print("hasil nilai uji: " + str(nilai_uji_Hardness))
print("hasil nilai p: " + str(nilai_p_Hardness))

if ((nilai_uji_Hardness > nilai_kritis_Hardness or nilai_uji_Hardness <␣
 ↪-1*nilai_kritis_Hardness) or nilai_p_Hardness < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 ditolak, maka rata-rata Hardness != 205
```

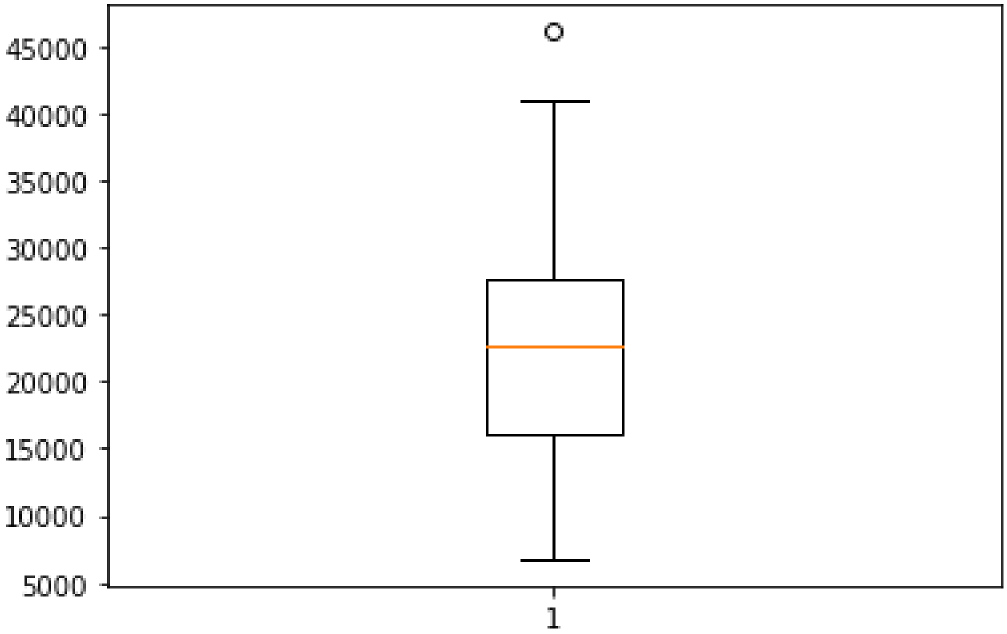
```
plt.boxplot(dataset.Hardness)
plt.show()
```

```
mean: 195.96920903783553
STD: 32.63504465869229
nilai kritis: 1.9611455060885261
hasil nilai uji: -12.406223679245638
hasil nilai p: 4.148029129970065e-34
H0 ditolak
```



[13]:
```
#Nomor 4c

SolidsMean100 = numpy.mean(dataset.Solids[0:100])
SolidsSTD100 = numpy.std(dataset.Solids[0:100])

H0_Solids = 21900
Solids_result = SolidsMean100
alpha = 0.05
totaldata = 100
nilai_kritis_Solids = scipy.stats.t.ppf(q=1-(alpha/2), df=totaldata-1)
nilai_uji_Solids = ((Solids_result - H0_Solids)/(SolidsSTD100/math.
 ↪sqrt(totaldata)))
nilai_p_Solids = (scipy.stats.t.sf(abs(nilai_uji_Solids), df=totaldata-1)) * 2

print("mean: " + str(SolidsMean100))
print("STD: " + str(SolidsSTD100))
print("nilai kritis: " + str(nilai_kritis_Solids))
print("hasil nilai uji: " + str(nilai_uji_Solids))
print("hasil nilai p: " + str(nilai_p_Solids))

if ((nilai_uji_Solids > nilai_kritis_Solids or nilai_uji_Solids < -1 *␣
 ↪nilai_kritis_Solids) or nilai_p_Solids < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#karena nilai uji tidak berada di daerah kritis dan nilai p > 0.05 maka tidak␣
 ↪cukup data untuk menolak H0 dan rata-rata 100 data Solids pertama sama dengan /
 ↪ mendekati 21900

plt.boxplot(dataset.Solids[0:100])
plt.show()
```

```
mean: 22347.334446383422
STD: 7896.1881689518505
nilai kritis: 1.9842169515086827
hasil nilai uji: 0.5665194861266858
hasil nilai p: 0.5723227935487426
H0 diterima
```



[14]:

```
#Nomor 4d

H0_Conductivity = 0.1
Conductivity_result = dataset.Conductivity[dataset.Conductivity > 450].count()/
 ↪totaldata
alpha = 0.05
totaldata = 2010
q0_Conductivity = 1-H0_Conductivity
nilai_kritis_Conductivity = scipy.stats.t.ppf(q=1-alpha, df=totaldata-1)
nilai_uji_Conductivity = (Conductivity_result - H0_Conductivity)/math.
 ↪sqrt(H0_Conductivity*q0_Conductivity/totaldata)
nilai_p_Conductivity = (scipy.stats.binom.pmf(dataset.Conductivity[dataset.
 ↪Conductivity > 450].count(), totaldata, H0_Conductivity))

print("ratio: " + str(Conductivity_result))
print("nilai kritis: " + str(nilai_kritis_Conductivity))
print("hasil nilai uji: " + str(nilai_uji_Conductivity))
print("hasil nilai p: " + str(nilai_p_Conductivity))

if ((nilai_uji_Conductivity > nilai_kritis_Conductivity or␣
 ↪nilai_uji_Conductivity < -1*nilai_kritis_Conductivity) or nilai_p_Conductivity␣
 ↪< alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 ditolak, maka proporsi Conductivity != 0.1
```

```
ratio: 7.45
nilai kritis: 1.6456124504017113
hasil nilai uji: 1098.4090768015349
hasil nilai p: 8.039654739499262e-230
H0 ditolak
```

[15]:

```
#Nomor 4e

H0_Trihalomethanes = 0.05
Trihalomethanes_result = dataset.Trihalomethanes[dataset.Trihalomethanes < 40].
 ↪count()/totaldata
alpha = 0.05
totaldata = 2010
q0_Trihalomethanes = 1 - H0_Trihalomethanes
nilai_kritis_Trihalomethanes = scipy.stats.t.ppf(q=1-alpha, df=totaldata-1)
nilai_uji_Trihalomethanes = (Trihalomethanes_result - H0_Trihalomethanes)/math.
 ↪sqrt(H0_Trihalomethanes*q0_Trihalomethanes/totaldata)
nilai_p_Trihalomethanes = (scipy.stats.binom.pmf(dataset.Trihalomethanes[dataset.
 ↪Trihalomethanes < 40].count(), totaldata, H0_Trihalomethanes))
```

```
print("ratio: " + str(Trihalomethanes_result))
print("nilai kritis: " + str(nilai_kritis_Trihalomethanes))
print("hasil nilai uji: " + str(nilai_uji_Trihalomethanes))
print("hasil nilai p: " + str(nilai_p_Trihalomethanes))

if ((nilai_uji_Trihalomethanes < nilai_kritis_Trihalomethanes) or␣
 ↪nilai_p_Trihalomethanes < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 ditolak, maka proporsi Trihalomethanes < 0.05
```

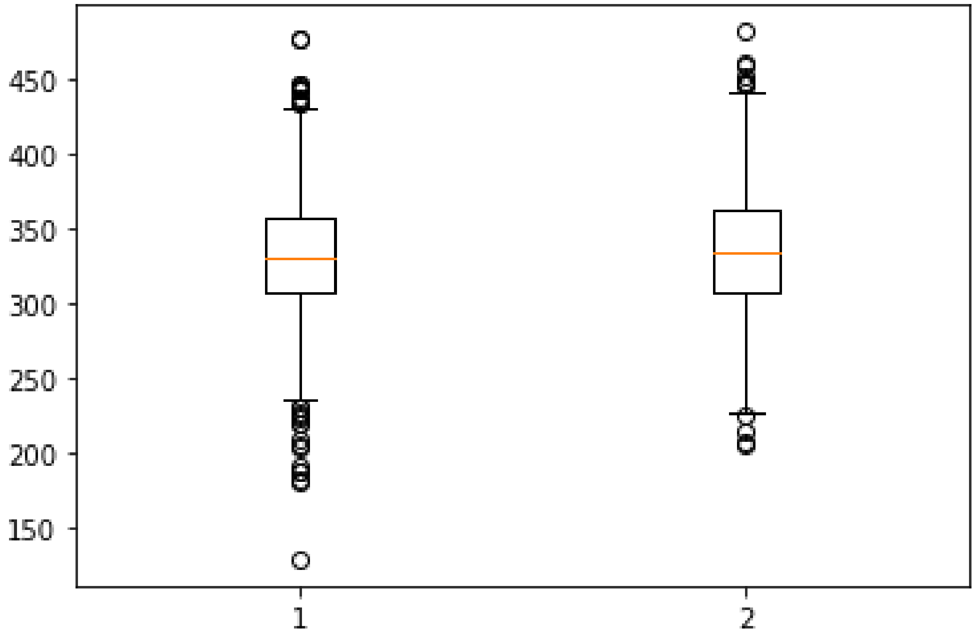
```
ratio: 0.0527363184079602
nilai kritis: 1.6456124504017113
hasil nilai uji: 0.5628826416670951
hasil nilai p: 0.03404367379225386
H0 ditolak
```

[16]:

```
#Nomor 5a

SulfateMean1 = numpy.mean(dataset.Sulfate[0:int(len(dataset.Sulfate)/2)])
SulfateMean2 = numpy.mean(dataset.Sulfate[int(len(dataset.Sulfate)/2):
 ↪len(dataset.Sulfate)])
SulfateSTD1 = numpy.std(dataset.Sulfate[0:int(len(dataset.Sulfate)/2)])
SulfateSTD2 = numpy.std(dataset.Sulfate[int(len(dataset.Sulfate)/2):len(dataset.
 ↪Sulfate)])
print("mean first half: " + str(SulfateMean1))
print("mean second half: " + str(SulfateMean2))
print("std first half: " + str(SulfateSTD1))
print("std second half: " + str(SulfateSTD2))

H0_Sulfate = 0
Sulfate_result = SulfateMean1-SulfateMean2
alpha = 0.05
totaldata = 2010
Sulfate_S12 = math.sqrt((((totaldata/2)-1) * (SulfateSTD1**2) + ((totaldata/
 ↪2)-1) * (SulfateSTD2**2)) / totaldata-2)
nilai_kritis_Sulfate = scipy.stats.t.ppf(q=1-(alpha/2), df=totaldata-2)
nilai_uji_Sulfate = (Sulfate_result-H0_Sulfate)/(Sulfate_S12*math.sqrt((1/
 ↪(totaldata/2)) + (1/(totaldata/2))))
nilai_p_Sulfate = scipy.stats.t.sf(abs(nilai_uji_Sulfate), df=totaldata-2) * 2

print("nilai kritis: " + str(nilai_kritis_Sulfate))
print("hasil nilai uji: " + str(nilai_uji_Sulfate))
print("hasil nilai p: " + str(nilai_p_Sulfate))
```

```
if ((nilai_uji_Sulfate > nilai_kritis_Sulfate or nilai_uji_Sulfate <␣
 ↪-1*nilai_kritis_Sulfate) and nilai_p_Sulfate < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 ditolak, maka SulfateMean1 != SulfateMean2

data = [(dataset.Sulfate[0:int(len(dataset.Sulfate)/2)]),(dataset.
 ↪Sulfate[int(len(dataset.Sulfate)/2):len(dataset.Sulfate)])]
plt.boxplot(data)
plt.show()
```

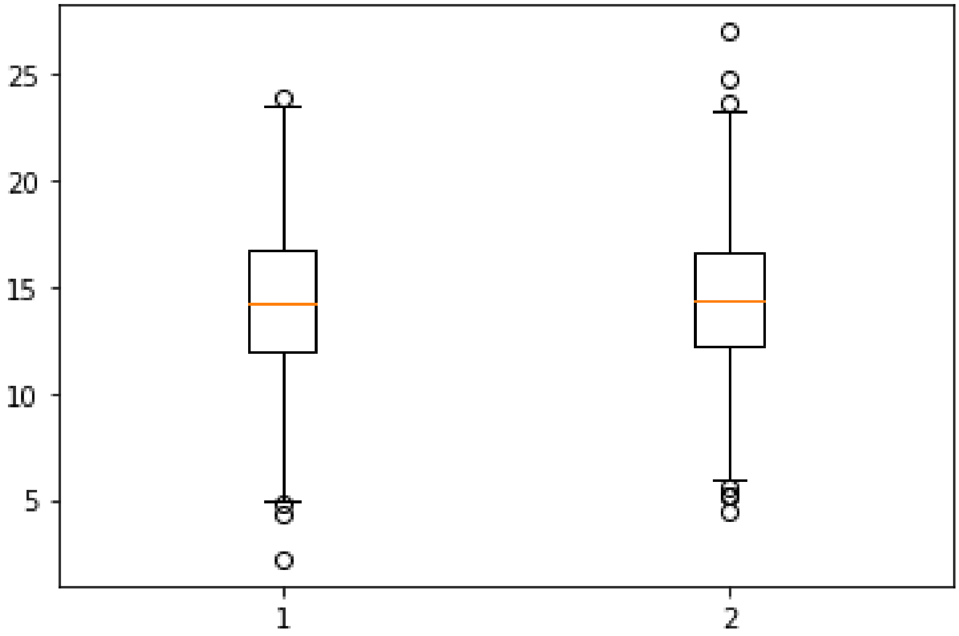
```
mean first half: 331.3053295054953
mean second half: 335.11742332488234
std first half: 41.31218591361096
std second half: 41.00071588624226
nilai kritis: 1.9611460948444246
hasil nilai uji: -2.0785647605086353
hasil nilai p: 0.037784080630858335
H0 ditolak
```



[17]:

```
#Nomor 5b

OrganicCarbonMean1 = numpy.mean(dataset.OrganicCarbon[0:int(len(dataset.
 ↪OrganicCarbon)/2)])
OrganicCarbonMean2 = numpy.mean(dataset.OrganicCarbon[int(len(dataset.
 ↪OrganicCarbon)/2):len(dataset.OrganicCarbon)])
OrganicCarbonSTD1 = numpy.std(dataset.OrganicCarbon[0:int(len(dataset.
 ↪OrganicCarbon)/2)])
OrganicCarbonSTD2 = numpy.std(dataset.OrganicCarbon[int(len(dataset.
 ↪OrganicCarbon)/2):len(dataset.OrganicCarbon)])
print("mean first half: " + str(OrganicCarbonMean1))
print("mean second half: " + str(OrganicCarbonMean2))
print("std first half: " + str(OrganicCarbonSTD1))
print("std second half: " + str(OrganicCarbonSTD2))

H0_OrganicCarbon = 0.15
OrganicCarbon_result = OrganicCarbonMean1-OrganicCarbonMean2
alpha = 0.05
totaldata = 2010
OrganicCarbon_S12 = math.sqrt((((totaldata/2)-1) * (OrganicCarbonSTD1**2) +␣
 ↪((totaldata/2)-1) * (OrganicCarbonSTD2**2)) / totaldata-2)
nilai_kritis_OrganicCarbon = scipy.stats.t.ppf(q=1-alpha, df=totaldata-2)
nilai_uji_OrganicCarbon = (OrganicCarbon_result-H0_OrganicCarbon)/
 ↪(OrganicCarbon_S12*math.sqrt((1/(totaldata/2)) + (1/(totaldata/2))))
nilai_p_OrganicCarbon = scipy.stats.t.sf(abs(nilai_uji_OrganicCarbon),␣
 ↪df=totaldata-2) * 2

print("nilai kritis: " + str(nilai_kritis_OrganicCarbon))
print("hasil nilai uji: " + str(nilai_uji_OrganicCarbon))
print("hasil nilai p: " + str(nilai_p_OrganicCarbon))

if ((nilai_uji_OrganicCarbon > nilai_kritis_OrganicCarbon or␣
 ↪nilai_uji_OrganicCarbon < -1 * nilai_kritis_OrganicCarbon) or␣
 ↪nilai_p_OrganicCarbon < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 ditolak, maka rata-rata bagian awal OrganicCarbon lebih besar sebesar 0.15␣
 ↪dibandingkan dengan rata-rata bagian akhir OrganicCarbon

data = [(dataset.OrganicCarbon[0:int(len(dataset.OrganicCarbon)/2)]), (dataset.
 ↪OrganicCarbon[int(len(dataset.OrganicCarbon)/2):len(dataset.OrganicCarbon)])]
plt.boxplot(data)
plt.show()
```

```
mean first half: 14.253972723723418
mean second half: 14.461907080372763
std first half: 3.3494944109867832
std second half: 3.2969311993598382
nilai kritis: 1.6456128284772815
hasil nilai uji: -2.669590985872718
hasil nilai p: 0.0076555615100778246
H0 ditolak
```

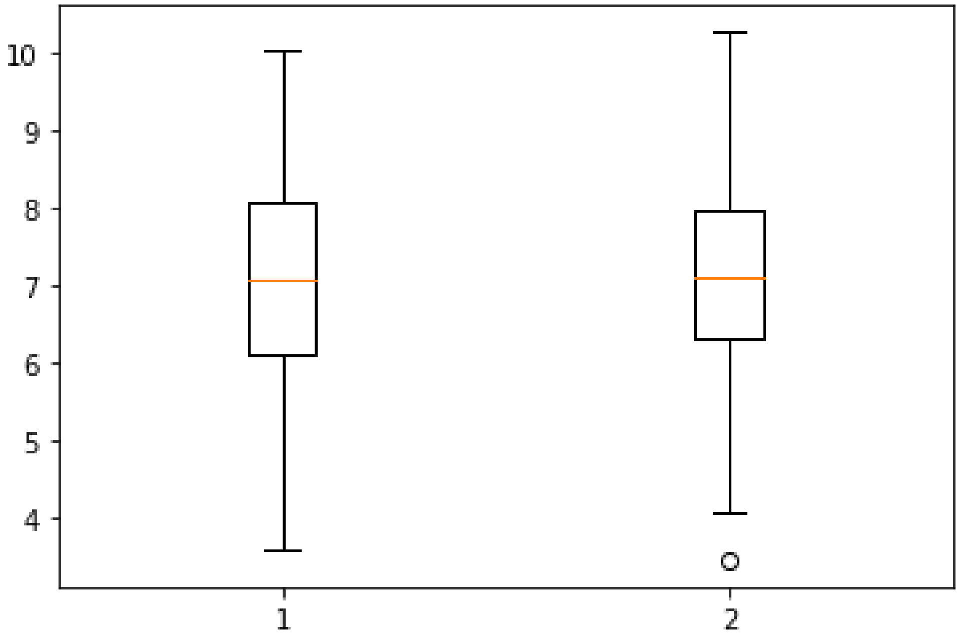


[18]:

```
#Nomor 5c

ChloraminesMean1 = numpy.mean(dataset.Chloramines[0:100])
ChloraminesMean2 = numpy.mean(dataset.Chloramines[int(len(dataset.
 ↪Chloramines)-100):len(dataset.Chloramines)])
ChloraminesSTD1 = numpy.std(dataset.Chloramines[0:100])
ChloraminesSTD2 = numpy.std(dataset.Chloramines[int(len(dataset.
 ↪Chloramines)-100):len(dataset.Chloramines)])
print("mean first half: " + str(ChloraminesMean1))
print("mean second half: " + str(ChloraminesMean2))
print("std first half: " + str(ChloraminesSTD1))
print("std second half: " + str(ChloraminesSTD2))

H0_Chloramines = 0
Chloramines_result = ChloraminesMean1-ChloraminesMean2
alpha = 0.05
totaldata = 200
```

```
Chloramines_S12 = math.sqrt((((totaldata/2)-1) * (ChloraminesSTD1**2) +␣
 ↪((totaldata/2)-1) * (ChloraminesSTD2**2)) / (totaldata-2))
nilai_kritis_Chloramines = scipy.stats.t.ppf(q=1-(alpha/2), df=totaldata-2)
nilai_uji_Chloramines = Chloramines_result/(Chloramines_S12*math.sqrt((1/
 ↪(totaldata/2)) + (1/(totaldata/2))))
nilai_p_Chloramines = scipy.stats.t.sf(abs(nilai_uji_Chloramines),␣
 ↪df=totaldata-2) * 2

print("nilai kritis: " + str(nilai_kritis_Chloramines))
print("hasil nilai uji: " + str(nilai_uji_Chloramines))
print("hasil nilai p: " + str(nilai_p_Chloramines))

if ((nilai_uji_Chloramines > nilai_kritis_Chloramines or nilai_uji_Chloramines <␣
 ↪-1 * nilai_kritis_Chloramines) or nilai_p_Chloramines < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 tidak memiliki cukup bukti untuk ditolak sehingga rata-rata 100 data awal␣
 ↪Chloramines sama dengan rata-rata 100 data akhir Chloramines

data = [(dataset.Chloramines[0:100]),(dataset.Chloramines[int(len(dataset.
 ↪Chloramines)-100):len(dataset.Chloramines)])]
plt.boxplot(data)
plt.show()
```

```
mean first half: 7.007771140423916
mean second half: 7.147197636249924
std first half: 1.4734692281775799
std second half: 1.300255877055854
nilai kritis: 1.9720174778338955
hasil nilai uji: -0.7094988920428581
hasil nilai p: 0.47884959419258677
H0 diterima
```



[19]:

```
#Nomor 5d

datasetTurbidity1 = dataset.Turbidity[0:int(len(dataset.Turbidity)/2)]
datasetTurbidity2 = dataset.Turbidity[int(len(dataset.Turbidity)/2):len(dataset.
 ↪Turbidity)]
TurbidityRatio1 = datasetTurbidity1[datasetTurbidity1 > 4].count() /␣
 ↪len(datasetTurbidity1)
TurbidityRatio2 = datasetTurbidity2[datasetTurbidity2 > 4].count() /␣
 ↪len(datasetTurbidity2)
print("Ratio 1: " + str(TurbidityRatio1))
print("Ratio 2: " + str(TurbidityRatio2))

H0_Turbidity = 0
Turbidity_result = TurbidityRatio1 - TurbidityRatio2
alpha = 0.05
totaldata = 2010
p_accent = (datasetTurbidity1[datasetTurbidity1 > 4].count() +␣
 ↪datasetTurbidity2[datasetTurbidity2 > 4].count())/ totaldata
q_accent = 1-p_accent
nilai_kritis_Turbidity = scipy.stats.t.ppf(q=1-alpha, df=totaldata)
nilai_uji_Turbidity = (Turbidity_result-H0_Turbidity)/(math.
 ↪sqrt(p_accent*q_accent*((1/(totaldata/2)) + (1/(totaldata/2)))))
nilai_p_Turbidity = scipy.stats.t.sf(abs(nilai_uji_Turbidity), df=totaldata)

print("nilai kritis: " + str(nilai_kritis_Turbidity))
print("hasil nilai uji: " + str(nilai_uji_Turbidity))
print("hasil nilai p: " + str(nilai_p_Turbidity))

if ((nilai_uji_Turbidity > nilai_kritis_Turbidity) or nilai_p_Turbidity < alpha):
    print("H0 ditolak")
else:
    print("H0 diterima")

#H0 tidak memiliki cukup bukti untuk ditolak sehingga ratio Turbidity awal sama␣
 ↪dengan ratio Turbidity akhir
```

```
Ratio 1: 0.4835820895522388
Ratio 2: 0.48656716417910445
nilai kritis: 1.6456120727025103
hasil nilai uji: -0.13388958661778735
hasil nilai p: 0.44675164429687164
H0 diterima
```

[20]:

```
#Nomor 5e

SulfateVariance1 = numpy.var(dataset.Sulfate[0:int(len(dataset.Sulfate)/2)])
SulfateVariance2 = numpy.var(dataset.Sulfate[int(len(dataset.Sulfate)/2):
 ↪len(dataset.Sulfate)])
print("Variance 1: " + str(SulfateVariance1))
print("Variance 2: " + str(SulfateVariance2))

H0_Sulfate = 0
Sulfate_result = SulfateVariance1-SulfateVariance2
alpha = 0.05
totaldata = 2010
batas1_Sulfate = scipy.stats.f.ppf(1-(alpha/2),(totaldata/2)-1,(totaldata/2)-1)
batas2_Sulfate = scipy.stats.f.ppf(alpha/2,(totaldata/2)-1,(totaldata/2)-1)
nilai_f_Sulfate = SulfateVariance1/SulfateVariance2

print("batas 1: " + str(batas1_Sulfate))
print("batas 2: " + str(batas2_Sulfate))
print("nilai f: " + str(nilai_f_Sulfate))


if(nilai_f_Sulfate < batas1_Sulfate or nilai_f_Sulfate > batas2_Sulfate):
    print("H0 ditolak")
else:
    print("H0 diterima")


#Nilai f berada di luar batas sehingga pengujian ditolak dan nilai variansi␣
 ↪bagian awal tidak sama dengan nilai variansi bagian akhir
```

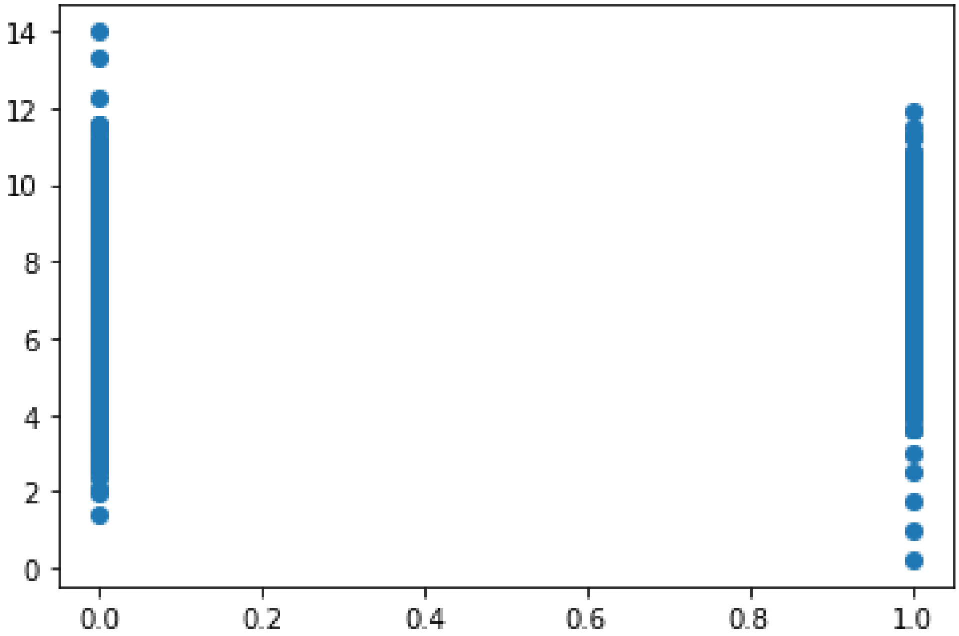
```
Variance 1: 1706.6967049607556
Variance 2: 1681.0587031843586
batas 1: 1.1317692392568777
batas 2: 0.883572344355818
nilai f: 1.0152511043950054
H0 ditolak
```

[21]:

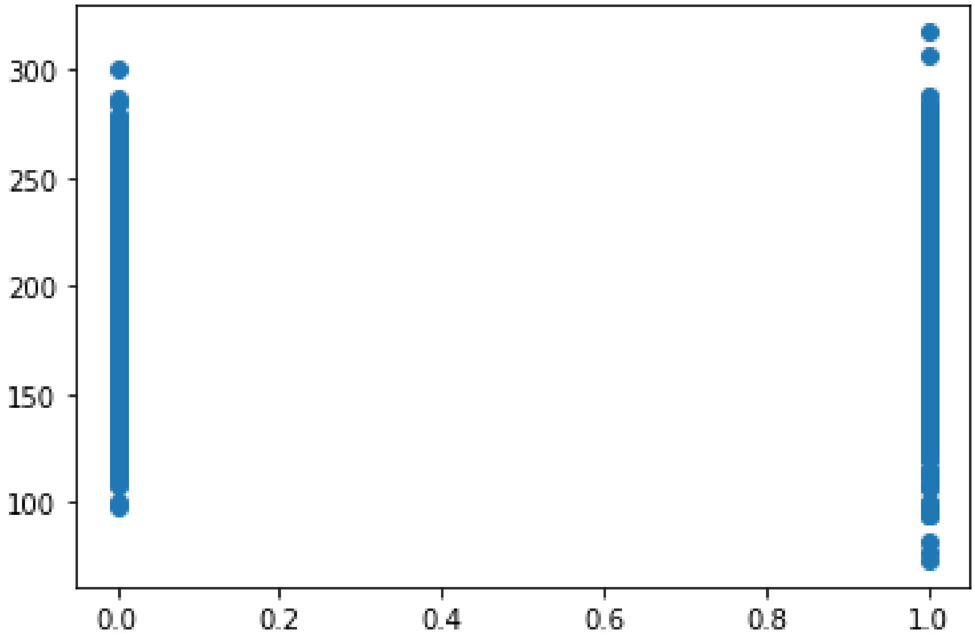
```
#Nomor 6
#Tes korelasi data Potability dengan kolom data lain
#Menggunakan metode Pearson

Potability_pH_corr = scipy.stats.pearsonr(dataset.Potability, dataset.pH)
print("koefisien korelasi: " +str(Potability_pH_corr[0]))
plt.scatter(dataset.Potability, dataset.pH)
plt.show()

Potability_Hardness_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪Hardness)
print("koefisien korelasi: " + str(Potability_Hardness_corr[0]))
plt.scatter(dataset.Potability, dataset.Hardness)
plt.show()

Potability_Solids_corr = scipy.stats.pearsonr(dataset.Potability, dataset.Solids)
print("koefisien korelasi: " + str(Potability_Solids_corr[0]))
plt.scatter(dataset.Potability, dataset.Solids)
plt.show()

Potability_Chloramines_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪Chloramines)
print("koefisien korelasi: " + str(Potability_Chloramines_corr[0]))
plt.scatter(dataset.Potability, dataset.Chloramines)
plt.show()

Potability_Sulfate_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪Sulfate)
print("koefisien korelasi: " + str(Potability_Sulfate_corr[0]))
plt.scatter(dataset.Potability, dataset.Sulfate)
plt.show()

Potability_Conductivity_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪Conductivity)
print("koefisien korelasi: " + str(Potability_Conductivity_corr[0]))
plt.scatter(dataset.Potability, dataset.Conductivity)
plt.show()

Potability_OrganicCarbon_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪OrganicCarbon)
```

```
print("koefisien korelasi: " + str(Potability_OrganicCarbon_corr[0]))
plt.scatter(dataset.Potability, dataset.OrganicCarbon)
plt.show()

Potability_Trihalomethanes_corr = scipy.stats.pearsonr(dataset.Potability,␣
 ↪dataset.Trihalomethanes)
print("koefisien korelasi: " + str(Potability_Trihalomethanes_corr[0]))
plt.scatter(dataset.Potability, dataset.Trihalomethanes)
plt.show()

Potability_Turbidity_corr = scipy.stats.pearsonr(dataset.Potability, dataset.
 ↪Turbidity)
print("koefisien korelasi: " + str(Potability_Turbidity_corr[0]))
plt.scatter(dataset.Potability, dataset.Turbidity)
plt.show()

#semua koefisien korelasi memiliki nilai mendekati 0 sehingga tidak ada korelasi␣
 ↪antara kolom target dan kolom non target
```

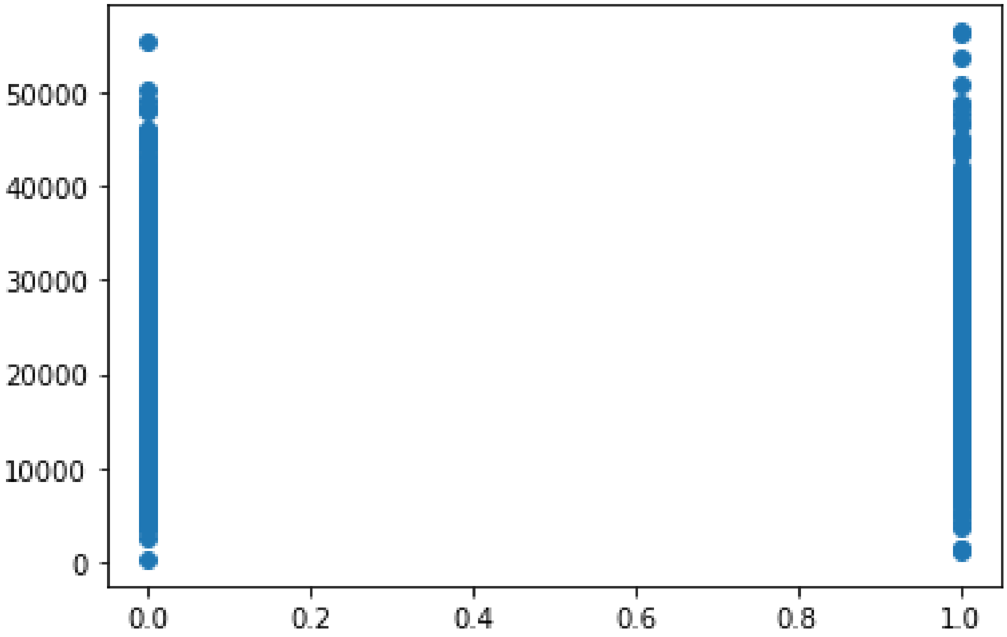
```
koefisien korelasi: 0.015475094408433468
```



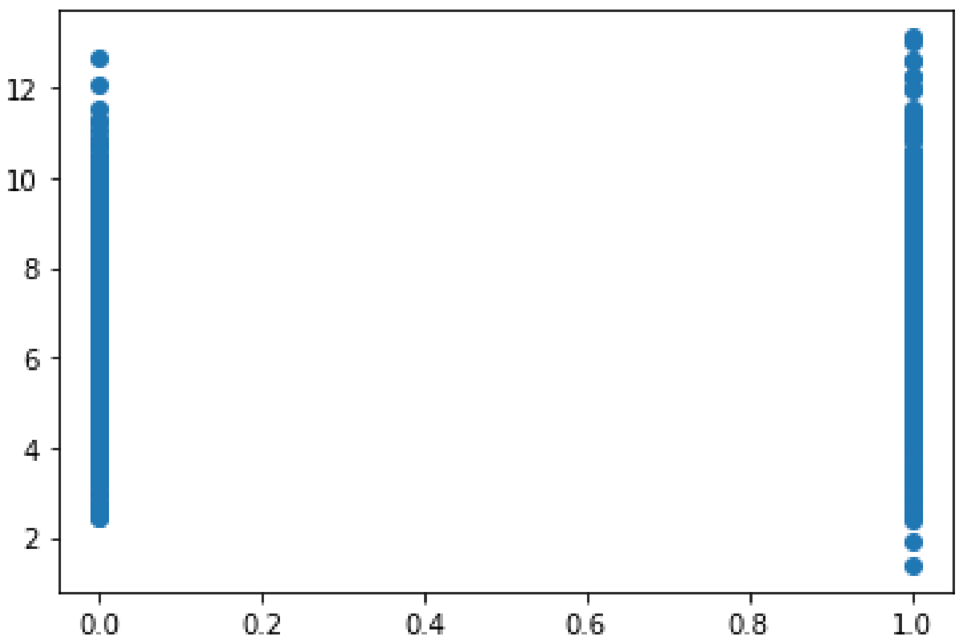
```
koefisien korelasi: -0.0014631528959479535
```



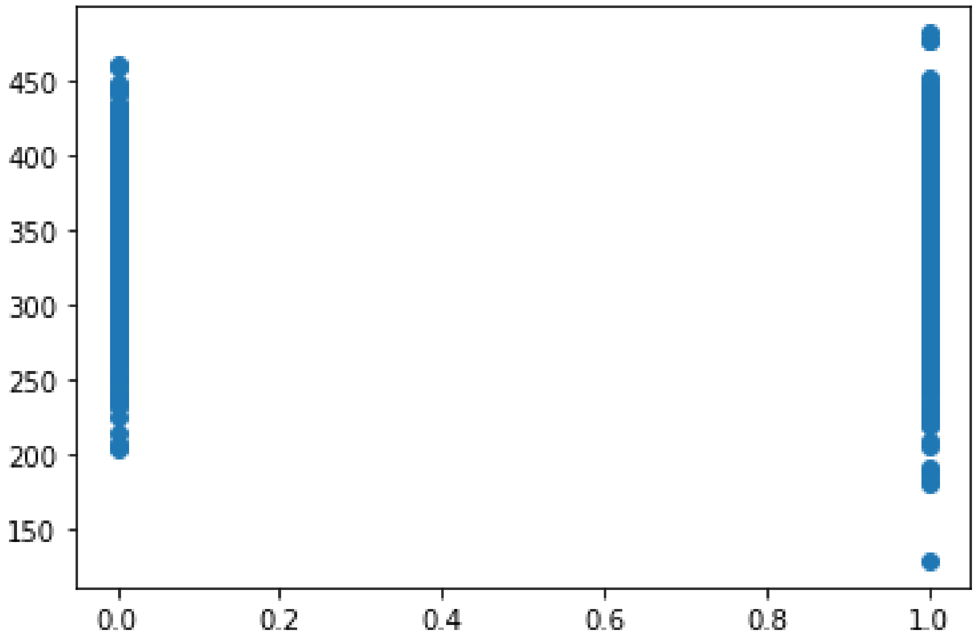
```
koefisien korelasi: 0.03897657818173471
```



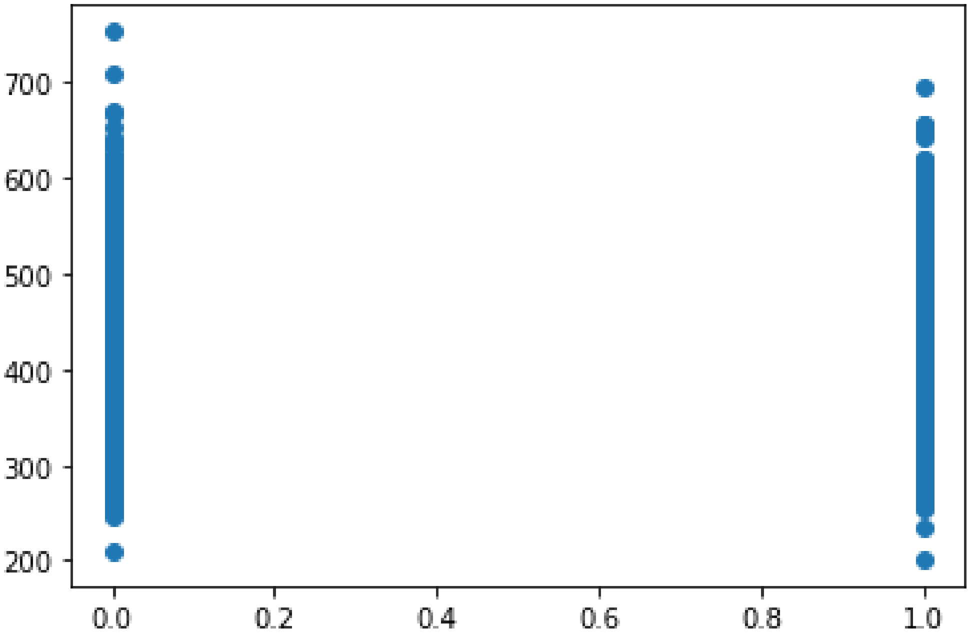
```
koefisien korelasi: 0.020778921840524097
```



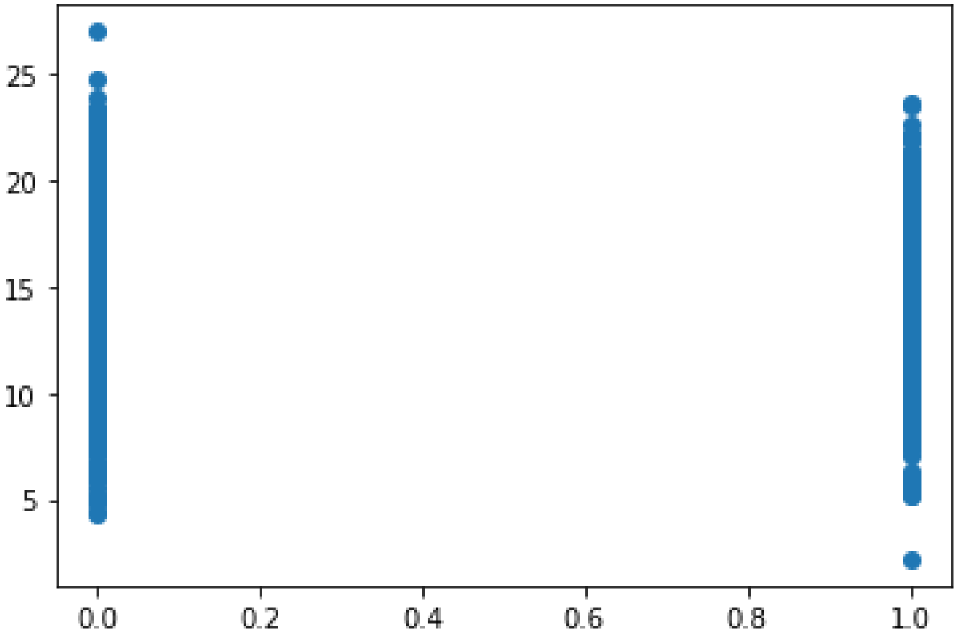
```
koefisien korelasi: -0.01570316441927383
```



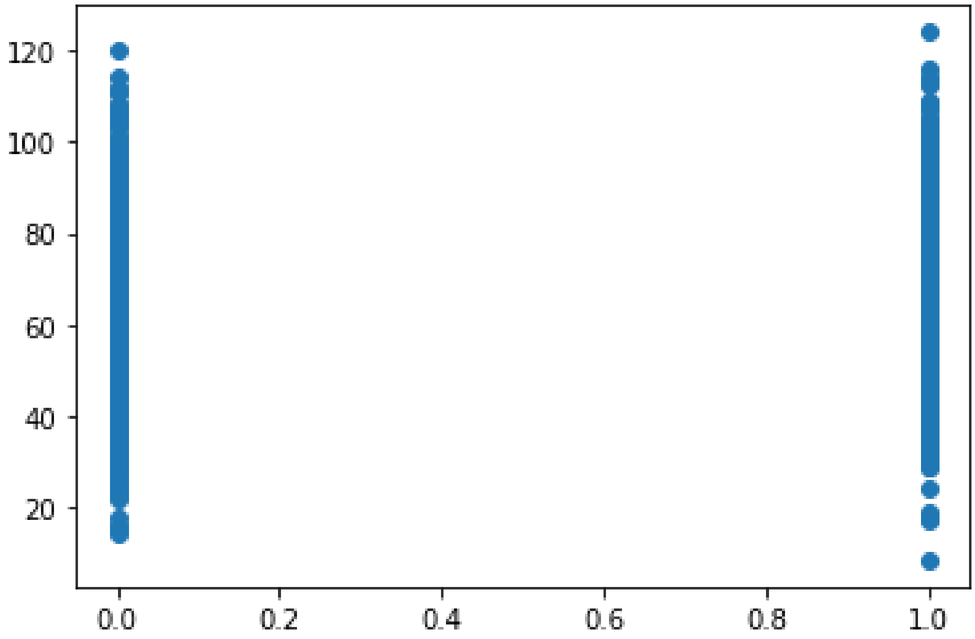
```
koefisien korelasi: -0.01625712011137707
```



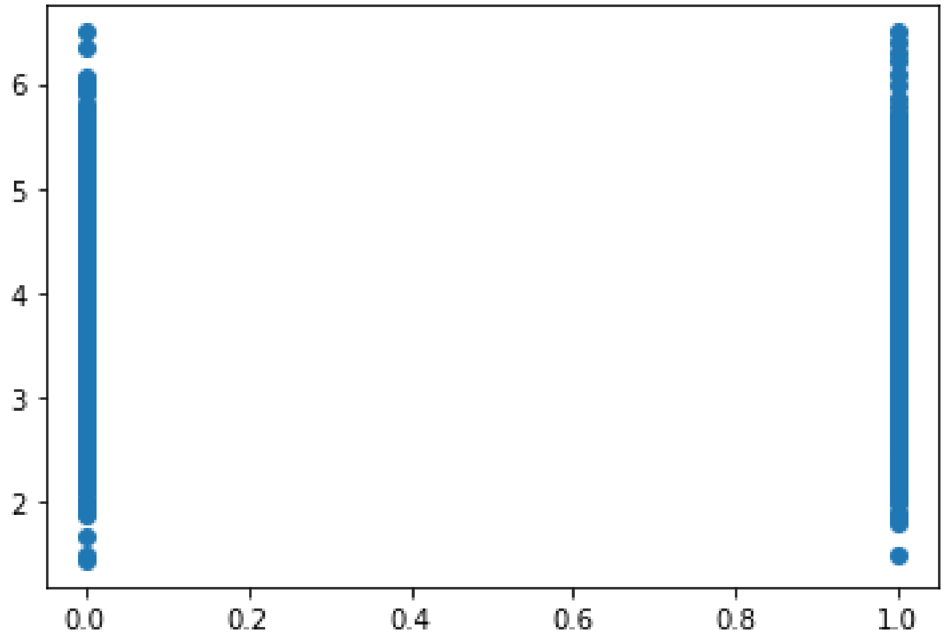
```
koefisien korelasi: -0.015488461910747285
```



```
koefisien korelasi: 0.009236711064713032
```



```
koefisien korelasi: 0.022331042640622682
```


6
5
4
3
2
0.0
0.2
0.4
0.6
0.8
1.0