Zadanie 1

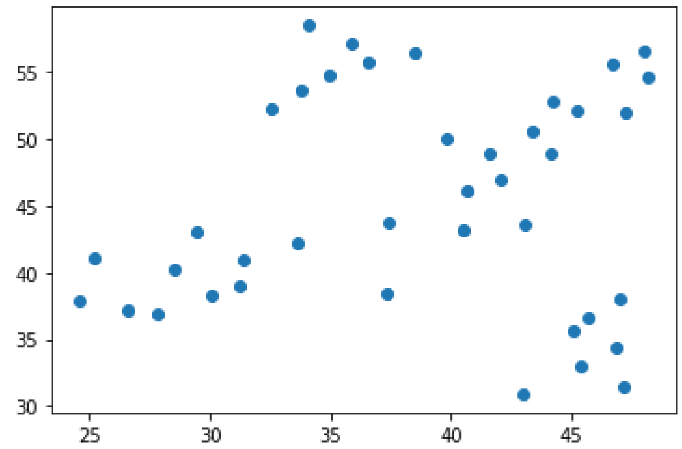
```
import pandas as pd
import numpy as np
```

```
dataEx1 = pd.read_csv('k_means_data.csv')
dataEx1
```

	X	Y
0	25.23	41.09
1	45.10	35.69
2	26.59	37.21
3	27.80	36.93
4	28.56	40.21
5	29.49	43.05
6	30.04	38.33
7	31.25	39.03
8	31.35	40.98
9	42.95	30.91
10	37.30	38.42
11	37.39	43.69
12	32.53	52.18
13	33.60	42.20
14	24.60	37.88
15	33.76	53.60
16	34.97	54.72
17	35.84	57.04
18	47.16	31.52
19	36.58	55.76
20	46.82	34.33
21	46.98	38.03
22	45.34	33.02

```
import matplotlib.pyplot as plt

plt.scatter(dataEx1.iloc[:,0],dataEx1.iloc[:,1])
plt.show()
```



```
from sklearn.cluster import AgglomerativeClustering
      30  44.28  52.81

k = 3
model = AgglomerativeClustering(linkage='single',n_clusters=k,affinity='euclidean', distance_threshold=None)
model.fit(dataEx1)

     AgglomerativeClustering(linkage='single', n_clusters=3)


model.labels_

     array([0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 2, 2, 2, 1, 2, 1, 1,
            1, 1, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])


from sklearn.cluster import KMeans


k = 3
model = KMeans(n_clusters=3).fit(dataEx1)
model.labels_
```

```
array([2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 0, 2, 2, 0, 0, 0, 1, 0, 1, 1,
       1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0], dtype=int32)
```

```
K=model.cluster_centers_
K
```

```
array([[40.91210526, 52.77789474],
       [44.84      , 36.31444444],
       [30.26666667, 39.91833333]])
```

Zadanie 2

```
data = pd.read_csv('k_means_data.csv')
print(data)
data = np.array(data)
```

```
        X      Y
0   25.23  41.09
1   45.10  35.69
2   26.59  37.21
3   27.80  36.93
4   28.56  40.21
5   29.49  43.05
6   30.04  38.33
7   31.25  39.03
8   31.35  40.98
9   42.95  30.91
10  37.30  38.42
11  37.39  43.69
12  32.53  52.18
13  33.60  42.20
14  24.60  37.88
15  33.76  53.60
16  34.97  54.72
17  35.84  57.04
18  47.16  31.52
19  36.58  55.76
```

```
20  46.82  34.33
21  46.98  38.03
22  45.34  33.02
23  45.70  36.63
24  48.12  54.53
25  47.25  51.99
26  38.48  56.41
27  34.10  58.45
28  39.81  49.98
29  40.47  43.18
30  40.66  46.02
31  41.59  48.86
32  42.05  46.89
33  43.04  43.52
34  43.34  50.49
35  44.17  48.94
36  44.23  52.81
37  45.19  52.05
38  46.68  55.59
39  47.98  56.47
```

```
Label = np.zeros((len(data),1),dtype=np.float64)
Label
```

```
array([[0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.]])
```

```
NewData = np.concatenate([data,Label],axis=1)
NewData
```

```
array([[25.23, 41.09,  0.  ],
       [45.1 , 35.69,  0.  ],
       [26.59, 37.21,  0.  ],
       [27.8 , 36.93,  0.  ],
       [28.56, 40.21,  0.  ],
       [29.49, 43.05,  0.  ],
       [30.04, 38.33,  0.  ],
       [31.25, 39.03,  0.  ],
       [31.35, 40.98,  0.  ],
       [42.95, 30.91,  0.  ],
       [37.3 , 38.42,  0.  ],
       [37.39, 43.69,  0.  ],
       [32.53, 52.18,  0.  ],
       [33.6 , 42.2 ,  0.  ],
       [24.6 , 37.88,  0.  ],
       [33.76, 53.6 ,  0.  ],
       [34.97, 54.72,  0.  ],
       [35.84, 57.04,  0.  ],
       [47.16, 31.52,  0.  ],
       [36.58, 55.76,  0.  ],
       [46.82, 34.33,  0.  ],
       [46.98, 38.03,  0.  ],
       [45.34, 33.02,  0.  ],
       [45.7 , 36.63,  0.  ],
       [48.12, 54.53,  0.  ],
       [47.25, 51.99,  0.  ],
       [38.48, 56.41,  0.  ],
       [34.1 , 58.45,  0.  ],
       [39.81, 49.98,  0.  ],
       [40.47, 43.18,  0.  ],
       [40.66, 46.02,  0.  ],
       [41.59, 48.86,  0.  ],
       [42.05, 46.89,  0.  ],
       [43.04, 43.52,  0.  ],
       [43.34, 50.49,  0.  ],
       [44.17, 48.94,  0.  ],
       [44.23, 52.81,  0.  ],
       [45.19, 52.05,  0.  ],
       [46.68, 55.59,  0.  ],
       [47.98, 56.47,  0.  ]])
```

```
NewData[:,2]
```

```
array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
       0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
       0., 0., 0., 0., 0., 0.])
```

```
minX = int(np.min(data[:,0]))
maxX = int(np.max(data[:,0]))
minY = int(np.min(data[:,1]))
maxY = int(np.max(data[:,1]))
print(minX," ",maxX," ",minY," ",maxY)
```

```
24   48   30   58
```

```
import random
CentersX = []
CentersY = []
```

```
for _ in range(0,3):
  CentersX.append(random.randrange(minX,maxX))
  CentersY.append(random.randrange(minY,maxY))

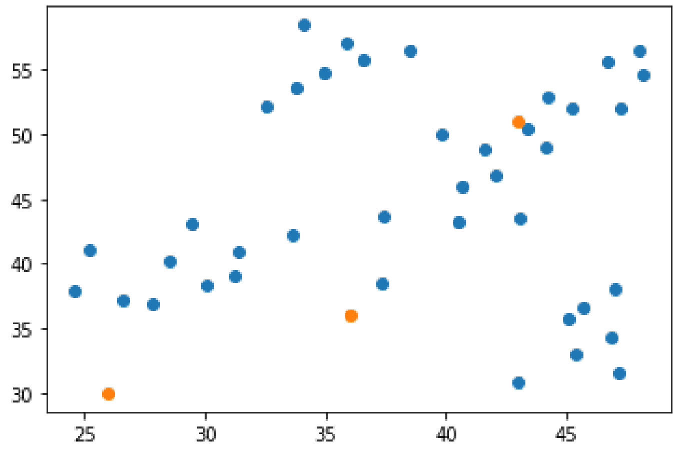
CentersX = np.array(CentersX).reshape(3,1)
CentersY = np.array(CentersY).reshape(3,1)

Centers = np.concatenate([CentersX,CentersY],axis=1).astype(np.float64)

Centers
```

```
array([[36., 36.],
       [43., 51.],
       [26., 30.]])
```

```
import matplotlib.pyplot as plt
plt.scatter(data[:,0],data[:,1])
plt.scatter(Centers[:,0],Centers[:,1])
plt.show()
```



```
import math
```

```
for point in NewData:
  print(point[0],point[1])
  i = -1
```

```
j= -1
print("    ")
for cent in Centers:
  print("Cent",cent[0],cent[1])
  i= i+1
  euclidesian=math.sqrt(((cent[1]-point[1])*(cent[1]-point[1]))+((cent[0]-point[0])*(cent[0]-point[0])))
  if(i==0):
    min=euclidesian
    j=i
  if(min>euclidesian):
    min=euclidesian
    j=i

  print(euclidesian)
  print("Max"," i ", min,i,j)
  point[2]=j
```

```
Cent 26.0 30.0
26.842423512045258
Max  i  0.6129437168288784 2 1
44.17 48.94

Cent 36.0 36.0
15.303349306606053
Max  i  15.303349306606053 0 0
Cent 43.0 51.0
2.3690715480964295
Max  i  2.3690715480964295 1 1
Cent 26.0 30.0
26.24638070287025
Max  i  2.3690715480964295 2 1
44.23 52.81

Cent 36.0 36.0
18.716543484308207
Max  i  18.716543484308207 0 0
Cent 43.0 51.0
2.1883783950679097
Max  i  2.1883783950679097 1 1
Cent 26.0 30.0
29.199811643228113
Max  i  2.1883783950679097 2 1
45.19 52.05
```

```
Cent 36.0 36.0
18.494826303590955
Max  i  18.494826303590955 0 0
Cent 43.0 51.0
2.428703357761088
Max  i  2.428703357761088 1 1
Cent 26.0 30.0
29.231123823760175
Max  i  2.428703357761088 2 1
46.68 55.59

Cent 36.0 36.0

22.312115542906284
Max  i  22.312115542906284 0 0
Cent 43.0 51.0
5.883068927014202
Max  i  5.883068927014202 1 1
Cent 26.0 30.0
32.90152732017163
Max  i  5.883068927014202 2 1
47.98 56.47

Cent 36.0 36.0
23.717953115730705
Max  i  23.717953115730705 0 0
Cent 43.0 51.0
7.397384672977332
Max  i  7.397384672977332 1 1
Cent 26.0 30.0
34.406123001582145
Max  i  7.397384672977332 2 1
```

```
NewData
```

```
array([[25.23, 41.09,  2.  ],
       [45.1 , 35.69,  0.  ],
       [26.59, 37.21,  2.  ],
       [27.8 , 36.93,  2.  ],
       [28.56, 40.21,  0.  ],
       [29.49, 43.05,  0.  ],
       [30.04, 38.33,  0.  ],
       [31.25, 39.03,  0.  ],
       [31.35, 40.98,  0.  ],
       [42.95, 30.91,  0.  ],
       [37.3 , 38.42,  0.  ],
       [37.39, 43.69,  0.  ],
       [32.53, 52.18,  1.  ],
       [33.6 , 42.2 ,  0.  ],
       [24.6 , 37.88,  2.  ],
       [33.76, 53.6 ,  1.  ],
       [34.97, 54.72,  1.  ],
       [35.84, 57.04,  1.  ],
       [47.16, 31.52,  0.  ],
       [36.58, 55.76,  1.  ],
       [46.82, 34.33,  0.  ],
       [46.98, 38.03,  0.  ],
       [45.34, 33.02,  0.  ],
       [45.7 , 36.63,  0.  ],
       [48.12, 54.53,  1.  ],
       [47.25, 51.99,  1.  ],
       [38.48, 56.41,  1.  ],
       [34.1 , 58.45,  1.  ],
       [39.81, 49.98,  1.  ],
       [40.47, 43.18,  1.  ],
       [40.66, 46.02,  1.  ],
       [41.59, 48.86,  1.  ],
       [42.05, 46.89,  1.  ],
       [43.04, 43.52,  1.  ],
       [43.34, 50.49,  1.  ],
       [44.17, 48.94,  1.  ],
       [44.23, 52.81,  1.  ],
       [45.19, 52.05,  1.  ],
       [46.68, 55.59,  1.  ],
       [47.98, 56.47,  1.  ]])
```

```
NewData[:,2]
```

```
array([2., 0., 2., 2., 0., 0., 0., 0., 0., 0., 0., 0., 1., 0., 2., 1., 1.,
       1., 0., 1., 0., 0., 0., 0., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1.,
       1., 1., 1., 1., 1., 1.])
```

```
OldCenters = Centers
while True:
  x0=0
  y0=0
```

```
i0=0
x1=0
y1=0
i1=0
x2=0
y2=0
i2=0

Cluster1X=[]
Cluster1Y=[]
Cluster2X=[]
Cluster2Y=[]
Cluster3X=[]
Cluster3Y=[]
for point in NewData:
  print(point[0],point[1],point[2])
  if(point[2]==0):
    x0=x0+point[0]
    Cluster1X.append(point[0])
    y0=y0+point[1]
    Cluster1Y.append(point[1])
    i0=i0+1
  if(point[2]==1):
    x1=x1+point[0]
    Cluster2X.append(point[0])
    y1=y1+point[1]
    Cluster2Y.append(point[1])
    i1=i1+1
  if(point[2]==2):
    x2=x2+point[0]
    Cluster3X.append(point[0])
    y2=y2+point[1]
    Cluster3Y.append(point[1])
    i2=i2+1

NewCentersX=[]
NewCentersY=[]

#NewCentersX.append(x0/i0)
#NewCentersY.append(y0/i0)
#NewCentersX.append(x1/i1)
```

```
#NewCentersX.append(x1/i1)
#NewCentersY.append(y1/i1)
#NewCentersX.append(x2/i2)
#NewCentersY.append(y2/i2)
NewCentersX.append(np.mean(Cluster1X))
NewCentersX.append(np.mean(Cluster2X))
NewCentersX.append(np.mean(Cluster3X))
NewCentersY.append(np.mean(Cluster1Y))
NewCentersY.append(np.mean(Cluster2Y))
NewCentersY.append(np.mean(Cluster3Y))
NewCentersX = np.array(NewCentersX).reshape(3,1)
NewCentersY = np.array(NewCentersY).reshape(3,1)

print(np.mean(Cluster1X))
print(np.mean(Cluster1Y))
print(np.mean(Cluster2X))
print(np.mean(Cluster2Y))
print(np.mean(Cluster3X))
print(np.mean(Cluster3Y))

NewCenters = np.concatenate([NewCentersX,NewCentersY],axis=1).astype(np.float64)

print(x0,y0,i0)
print(x1,y1,i1)
print(x2,y2,i2)
plt.scatter(NewData[:,0],NewData[:,1])
plt.scatter(NewCenters[:,0],NewCenters[:,1])
plt.show()

print(OldCenters)
print(NewCenters)
print("Space")

if np.array_equal(OldCenters,NewCenters)==True:
  break
OldCenters = NewCenters
#NewCenters

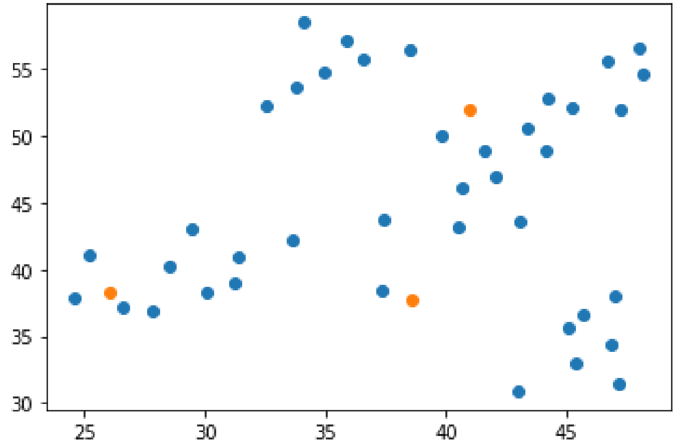

for point in NewData:
  #print(point[0],point[1])
```

```
    i = -1
    j= -1
    #print("    ")
    for cent in NewCenters:
      print("Cent",cent[0],cent[1])
      i= i+1
      #euclidesian=math.sqrt(((cent[1]-point[1])*(cent[1]-point[1]))+((cent[0]-point[0])*(cent[0]-point[0])))
      euclidesian=math.sqrt(((cent[0]-point[0])*(cent[0]-point[0]))+((cent[1]-point[1])*(cent[1]-point[1])))
      if(i==0):
        min=euclidesian
        j=i
      if(min>euclidesian):
        min=euclidesian
        j=i

      #print(euclidesian)
      #print("Max"," i ", min,i,j)
      point[2]=j
```

```
25.23 41.09 2.0
45.1 35.69 0.0
26.59 37.21 2.0
27.8 36.93 2.0
28.56 40.21 0.0
29.49 43.05 0.0
30.04 38.33 0.0
31.25 39.03 0.0
31.35 40.98 0.0
42.95 30.91 0.0
37.3 38.42 0.0
37.39 43.69 0.0
32.53 52.18 1.0
33.6 42.2 0.0
24.6 37.88 2.0
33.76 53.6 1.0
34.97 54.72 1.0
35.84 57.04 1.0
47.16 31.52 0.0
36.58 55.76 1.0
46.82 34.33 0.0
46.98 38.03 0.0
45.34 33.02 0.0
45.7 36.63 0.0
48.12 54.53 1.0
47.25 51.99 1.0
38.48 56.41 1.0
34.1 58.45 1.0
39.81 49.98 1.0
40.47 43.18 1.0
40.66 46.02 1.0
41.59 48.86 1.0
42.05 46.89 1.0
43.04 43.52 1.0
43.34 50.49 1.0
44.17 48.94 1.0
44.23 52.81 1.0
45.19 52.05 1.0
46.68 55.59 1.0
47.98 56.47 1.0
38.602
37.736
40.99238095238094
51.87999999999999
```

```
26.055
38.2775
579.0300000000001 566.04 15
860.84 1089.4799999999998 21
104.22 153.11 4
```



```
[[36. 36.]
 [43. 51.]
 [26. 30.]]
[[38.602      37.736     ]
 [40.99238095 51.88      ]
 [26.055      38.2775    ]]
Space
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
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Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
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Cent 40.99238095238094 51.87999999999999
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Cent 40.99238095238094 51.87999999999999
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Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
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Cent 38.602 37.736
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Cent 38.602 37.736
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Cent 40.99238095238094 51.87999999999999
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Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
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Cent 40.99238095238094 51.87999999999999
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Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
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Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
Cent 38.602 37.736
Cent 40.99238095238094 51.87999999999999
Cent 26.055 38.2775
25.23 41.09 2.0
45.1 35.69 0.0
26.59 37.21 2.0
27.8 36.93 2.0
28.56 40.21 2.0
29.49 43.05 2.0
30.04 38.33 2.0
31.25 39.03 2.0
31.35 40.98 2.0
42.95 30.91 0.0
37.3 38.42 0.0
37.39 43.69 0.0
32.53 52.18 1.0
33.6 42.2 0.0
24.6 37.88 2.0
33.76 53.6 1.0
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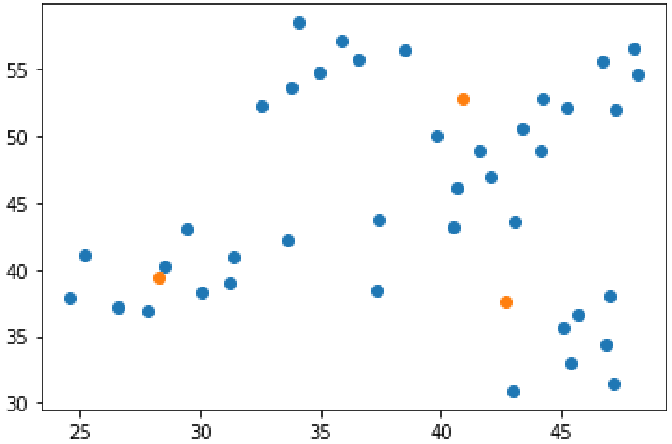

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