ISE754_hw2

May 27, 2019

In [1]:
```
import numpy as np
import pandas as pd
P=np.array([[1,1],[6,1],[6,5]])
```

In [2]:
```
#Euclidean-distance function handle
def d2h(x,P):
 d=np.sqrt(np.sum((x-P)**2, axis=1))
 return d
```

In [3]:
```
x=np.array([3,1])
d2h(x,P)
```

Out[3]:
```
array([2., 3., 5.])
```

In [4]:
```
# Minisum Distance Location
def TDh(x):
    return np.sum(d2h(x,P))
TDh(x)
```

Out[4]:
```
10.0
```

In [5]:
```
x0 = np.mean(P,axis=0)
x0
```

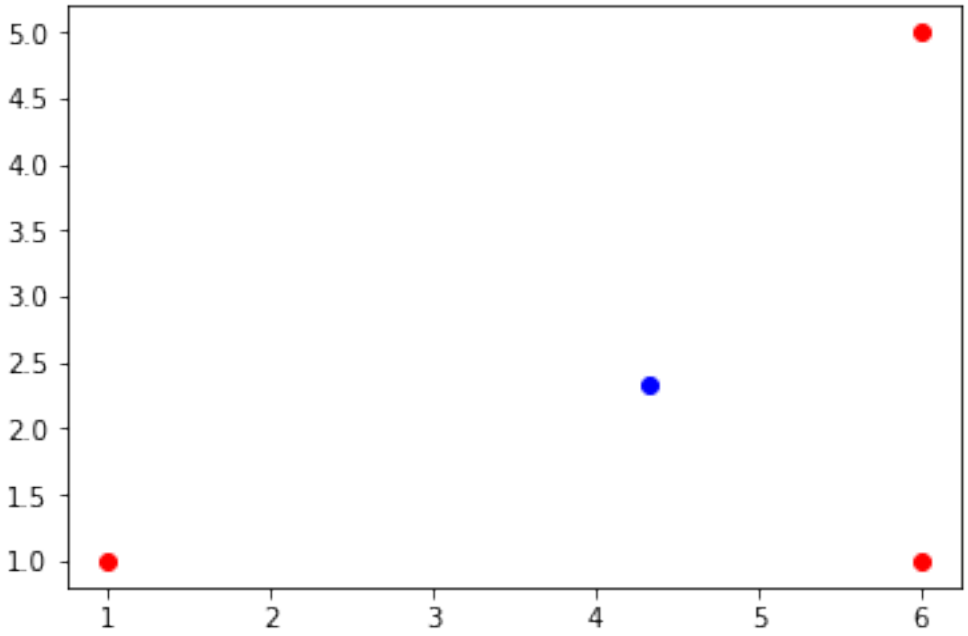
Out[5]:
```
array([4.33333333, 2.33333333])
```

In [6]:
```
from scipy.optimize import fmin
min=fmin(TDh,x0)
```

```
Optimization terminated successfully.
         Current function value: 8.697184
         Iterations: 30
         Function evaluations: 57
```

In [7]:
```
import matplotlib.pyplot as plt
```

In [8]:
```
plt.plot(P[:,0],P[:,1],'ro')
plt.plot(x0[0],x0[1],'bo')
plt.show()
```




```
In [9]: # 2-D Minisum Weighted-Distance Location
        P=np.random.randint(40,size=(10,2))
        w=np.random.randint(10,size=10)
        P,w

Out[9]: (array([[17, 10],
                [38, 10],
                [25, 32],
                [ 0, 10],
                [18, 15],
                [39,  9],
                [25, 20],
                [39, 28],
                [23, 13],
                [10, 34]]), array([0, 0, 2, 7, 3, 8, 4, 3, 1, 0]))

In [10]: def TCh(x):
             return sum(np.multiply(w,d2h(x,P)))

In [11]: fmin(TCh,x0)

Optimization terminated successfully.
         Current function value: 432.281143
         Iterations: 57
         Function evaluations: 112
```

```
Out[11]: array([24.61999024, 17.16384179])

In [12]: # 1-D Location with Procurement and Distribution Costs
         fout = [10,20,30]
         rout=1
         wout=np.dot(fout,rout)
         wout

Out[12]: array([10, 20, 30])

In [13]: BOM= [2,.5]
         fin=np.dot(BOM,sum(fout))
         fin

Out[13]: array([120.,  30.])

In [14]: rin=.33
         win=np.dot(fin,rin)
         win

Out[14]: array([39.6,  9.9])

In [15]: P=np.array([50,270,150,190,420]).reshape(5,1)
         P

Out[15]: array([[ 50],
                [270],
                [150],
                [190],
                [420]])

In [16]: w=np.concatenate((win,wout),axis=None)
         def TCh(x):
             return sum(np.multiply(w,d2h(x,P)))
         fmin(TCh,np.mean(P,axis=0))

Optimization terminated successfully.
         Current function value: 13636.000039
         Iterations: 26
         Function evaluations: 52


Out[16]: array([189.99999619])

In [17]: # Weight gaining or weight losing
         sum(win),sum(wout)

Out[17]: (49.5, 60)

In [18]: sum(fin),sum(fout)
```

```
Out[18]: (150.0, 60)
```

```
In [19]: # 2-D Maximin
         P=[[1,1],[7,1],[4,5]]
         def TCh(x):
             return -np.min(d2h(x,P))
         fmin(TCh,np.mean(P,axis=0))
```

```
Optimization terminated successfully.
         Current function value: -3.124984
         Iterations: 36
         Function evaluations: 70
```

```
Out[19]: array([4.00000788, 1.87501556])
```

```
In [20]: X,Y=np.meshgrid(np.arange(-4,12,.2),np.arange(-4,10,.2),sparse=False)
         Z=np.zeros(np.shape(X))
```

```
In [21]: for i in range(0,np.shape(X)[0]):
                 for j in range(0,np.shape(X)[1]):
                     Z[i][j]=TCh(np.array([X[i][j],Y[i][j]]))

         from mpl_toolkits.mplot3d import Axes3D
         fig=plt.figure()
         ax = fig.add_subplot(111, projection='3d')
         ax.plot_surface(X, Y, Z)
         ax.view_init(elev=60., azim=50)
         plt.show()
```