In [1]:
```
# Import all the package you need to use:
```

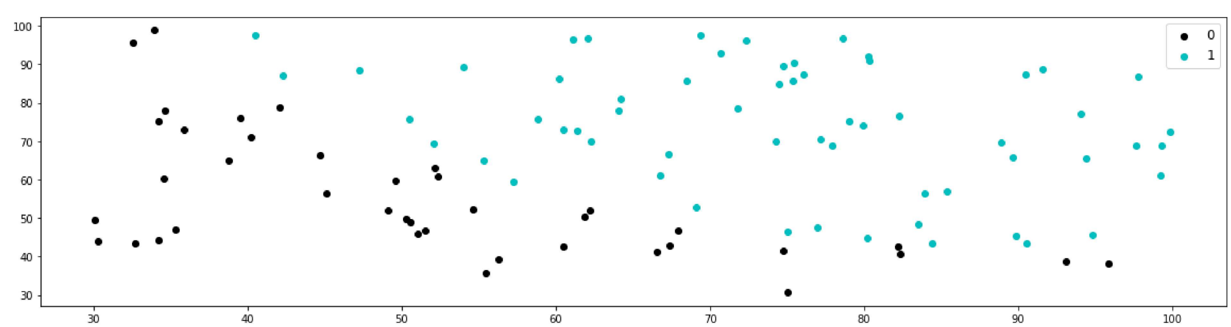
In [2]:
```
import csv
import numpy as np
import matplotlib.pyplot as plt
import scipy.optimize as opt
```

In [3]:
```
# Load the data:
```

In [4]:
```
with open('P2data1.txt') as csv_file:
    dataset = list(csv.reader(csv_file, delimiter=','))
    data=np.array([np.array(xi) for xi in dataset])
    data=np.transpose(data)
    X1=data[0]
    X2=data[1]
    X=np.column_stack((X1,X2)).astype(np.float)
    Y=data[2].astype(np.float)
    n=len(X)
```

In [5]:
```
# Plot the data:
```

In [6]:
```
plt.figure(figsize=(20,5))
#plt.plot(X,Y)
plt.scatter(X[Y==0][:,0], X[Y==0][:,1],color='k')
plt.scatter(X[Y==1][:,0], X[Y==1][:,1],color='c')
plt.legend(['0','1'], fontsize='12')
plt.show()
```



In [7]:
```
# Define the sigmoid function:
```

In [8]:
```
def sigmoid(z):
    return 1/(1+np.exp(-z))
```

In [9]:
```
# Define the compute cost function:
```

In [10]:
```
def compute_cost(theta, X, Y):
    theta = np.matrix(theta)
    X = np.matrix(X)
    Y=Y.reshape(-1,1)
    Y = np.matrix(Y)
    J =((np.multiply(-Y, np.log(sigmoid(X * theta.T))))-(np.multiply((1 - Y), np
    return J
```

In [11]:
```
# Define the compute gradient function:
```

In [12]:
```
def gradient(theta, X, Y):
    theta = np.matrix(theta)

    X = np.matrix(X)
    Y=Y.reshape(-1,1)
    Y = np.matrix(Y)

    k=theta.shape[1]
    g = np.zeros(k)
    #print(theta, X)
    p = sigmoid(X*theta.T) -Y

    for i in range(k):
        g[i] = np.multiply(p, X[:,i]).mean()


    return g
```

In [13]:
```
# Compute cost and gradient (The initial cost should be 0.69314718):
```

In [14]:
```
ones=(np.ones(n)).reshape(-1,1)
X=np.hstack((ones,X))
theta=np.zeros(3)
g=gradient(theta, X, Y)
#X.shape, Y.shape, theta.shape
cost=compute_cost(theta, X, Y)
print("The initial cost is:", cost)
print("The gradient is:", g)
```

```
The initial cost is: 0.6931471805599453
The gradient is: [ -0.1        -12.00921659 -11.26284221]
```

In [15]:
```
# Optimize the cost to find the minimum cost by using fmin_tnc:
# The optimal cost should be 0.20349

weights = opt.fmin_tnc(func=compute_cost, x0=theta, fprime=gradient, args=(X, Y)
w=weights[0]
print('The optimal weights are:',w)
print('The optimal cost is:',compute_cost(w, X, Y))
```

```
The optimal weights are: [-25.16131876   0.20623159   0.20147149]
The optimal cost is: 0.20349770158947397
```

In [ ]:

In [16]:
```
# Define a predict function to calculate the result:
```

In [17]:
```
def predict(w, X):
    X=np.matrix(X)
    h=sigmoid(X*w.T)
    h1=h.round()
    A=(h, )
    return h1
```

In [18]:
```
# Find the accuracy of the logistic regression:
```

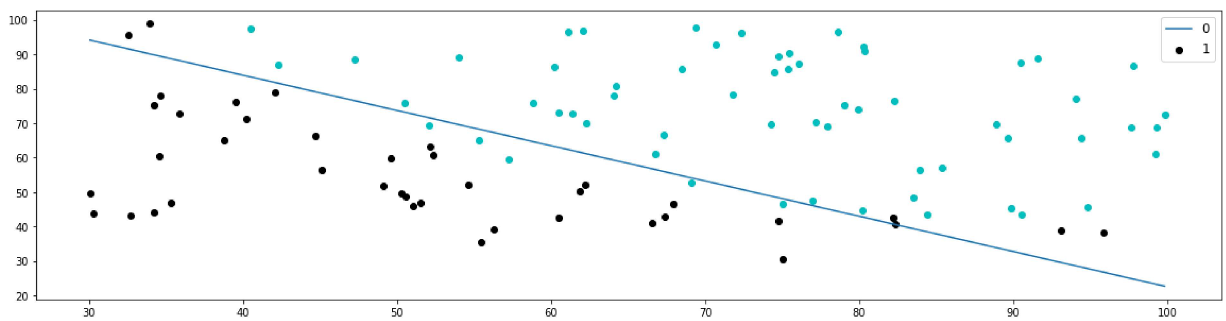
In [19]:
```
accuracy=predict(X,w)
p=(accuracy == Y).mean()
print('The accuracy from  calculation of logistic regression is:',p*100)
```

```
The accuracy from  calculation of logistic regression is: 0.89
```

In [20]:
```
# Plot the data and boundary:
```

In [21]:
```
import scipy
with open('P2data1.txt') as csv_file:
    dataset = list(csv.reader(csv_file, delimiter=','))
    data=np.array([np.array(xi) for xi in dataset])
    data=np.transpose(data)
    X1=data[0]
    X2=data[1]
    X=np.column_stack((X1,X2)).astype(np.float)
    Y=data[2].astype(np.float)
plt.figure(figsize=(20,5))

plt.scatter(X[Y==0][:,0], X[Y==0][:,1],color='k')
plt.scatter(X[Y==1][:,0], X[Y==1][:,1],color='c')
xPlot = scipy.linspace(min(X[:, 0]), max(X[:, 0]), 100)
plt.plot(xPlot, -w[0] / w[2] - w[1] / w[2] * xPlot)
plt.legend(['0','1'], fontsize='12')
plt.show()
```



In [ ]: