Logistic Regression

April 25, 2019

In [2]:
```
import pandas as pd
```

In [3]:
```
import matplotlib.pyplot as plt
import numpy as np
from scipy.optimize import minimize
```

In [4]:
```
data=pd.read_csv('ex2data1.txt',names=['exam1_score','exam2_score','status'])
```

In [5]:
```
data.head(5)
```

Out[5]:

	exam1_score	exam2_score	status
0	34.623660	78.024693	0
1	30.286711	43.894998	0
2	35.847409	72.902198	0
3	60.182599	86.308552	1
4	79.032736	75.344376	1

In [6]:
```
np.shape(data)
```

Out[6]:
```
(100, 3)
```

In [7]:
```
X=data.iloc[:,0:2]
```

In [8]:
```
y=data.iloc[:,2]
```

In [9]:
```
def plotData(X,y):
    #pos=X[np.where(y==1)]
    pos=data.loc[data['status']==1]
    neg=data.loc[data['status']==0]
   # print(pos.tail(3))
    plt.plot(pos['exam1_score'],pos['exam2_score'],'b+')
    plt.plot(neg['exam1_score'],neg['exam2_score'],'ro')
    plt.xlabel('exam1_score')
    plt.ylabel('exam2_score')
    plt.legend(['Admitted','Not Admitted'])
```

In [10]:
```
m=len(y)
print(np.shape(X))
x=np.ones([m,1])
np.shape(x)
X=np.hstack((x,X));
print(np.shape(y))
```

```
(100, 2)
(100,)
```

In [11]:
```
theta=np.zeros(3)
np.shape(theta)
```

Out[11]:
```
(3,)
```

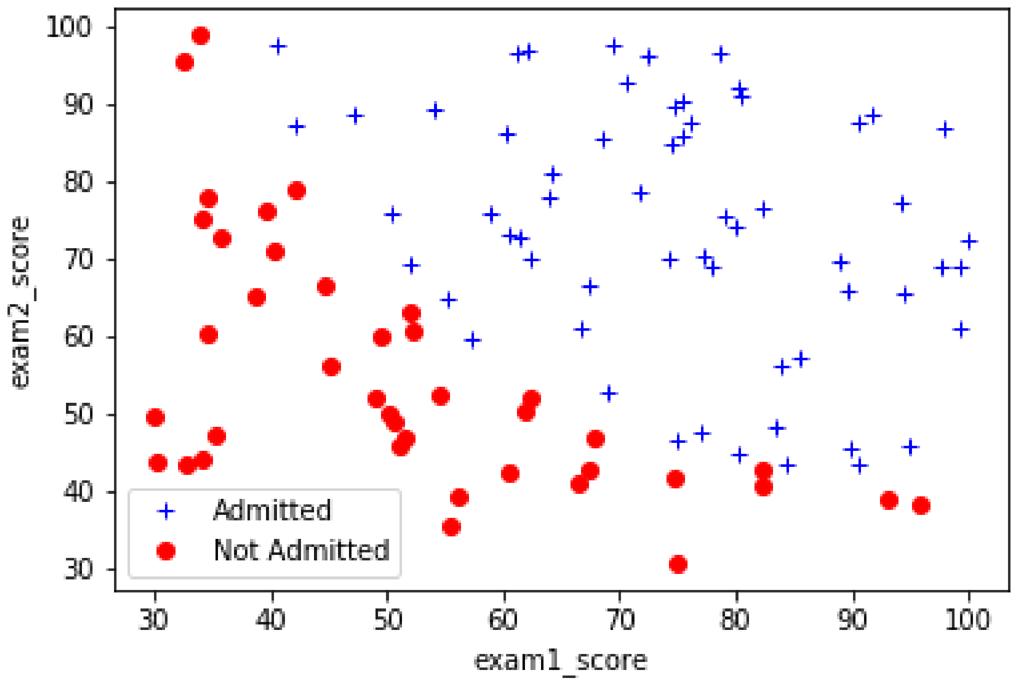
In [12]:
```
def sigmoid(X,theta):
    z=np.matmul(X,theta);
    g=1/(1+np.exp(-z));
    return g
```

In [13]:
```
def costFunction(theta,X,y):
    h=sigmoid(X,theta)
    J=0
    J=-(1/m)*((y*np.log(h))+(1-y)*np.log(1-h)).sum();
    #J = -1*(1/m)*(np.log(h).T.dot(y)+np.log(1-h).T.dot(1-y))
    grad =(1/m)*(X.T.dot(h-y))
    #grad =(1/m)*X.T.dot(h-y)
    #J=np.array(J)
    #J=J.reshape([1,1])
    return J,grad
```

In [14]:
```
np.shape(sigmoid(X,theta))
```

Out[14]:
```
(100,)
```

In [15]:
```
plotData(X,y)
plt.show()
```




```
In [16]: (J,grad)=costFunction(theta,X,y)

In [17]: grad

Out[17]: array([ -0.1        , -12.00921659, -11.26284221])

In [18]: theta

Out[18]: array([ 0.,  0.,  0.])

In [19]: np.shape(y)

Out[19]: (100,)

In [20]: res = minimize(costFunction,
                        theta,
                        method='Newton-CG',
                        args=(X,y),
                        jac=True,
                        options={'maxiter':400,
                                 'disp':True})

Optimization terminated successfully.
         Current function value: 0.203498
         Iterations: 29
         Function evaluations: 72
```

```
Gradient evaluations: 282
Hessian evaluations: 0
```

```
In [21]: #options={'maxiter':400}
```

```
In [22]: #result=minimize(costFunction,theta,args=(X,y),method='TNC',jac=True,options=options)
```

```
In [23]: theta=res.x
```

```
In [24]: cost=res.fun
```

```
In [25]: theta
```

```
Out[25]: array([-25.16234743,   0.20623982,   0.2014798 ])
```

```
In [26]: cost
```

```
Out[26]: 0.203497701742292
```

```
In [27]: def predict(X,y,theta):
             z=sigmoid(X,theta)>=0.5
             p=np.mean(z==y)*100
             return p
```

```
In [28]: p=predict(X,y,theta)
```

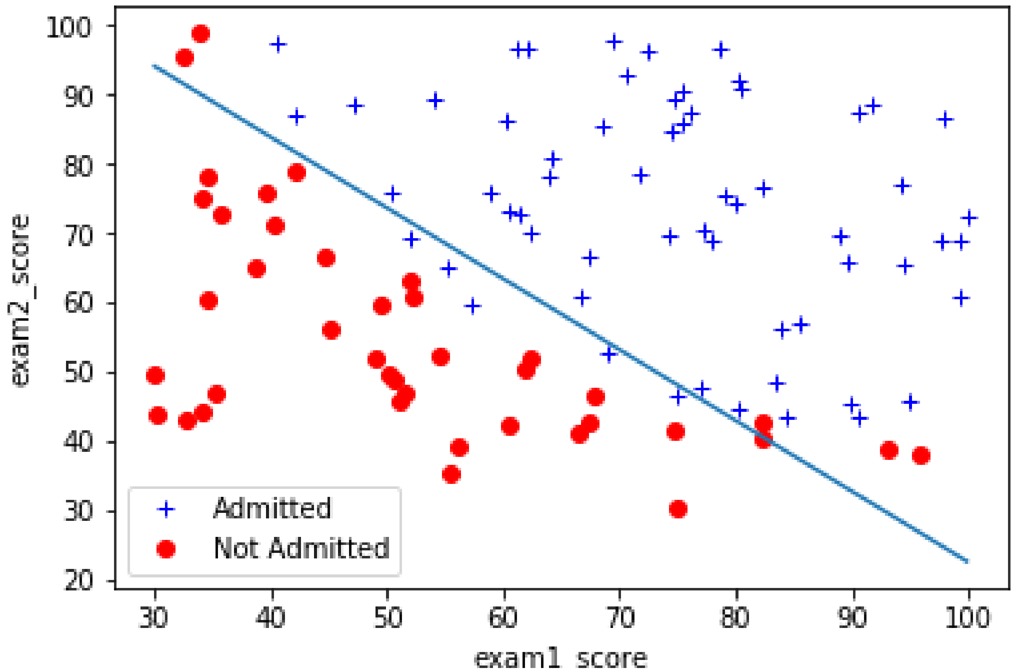
```
In [29]: p
```

```
Out[29]: 89.0
```

```
In [38]: def decisionBoundary(X,theta):
             plot_x=[min(X[:,1]),max(X[:,1])]

             plot_y=-(1/theta[2])*(np.multiply(theta[1],plot_x)+theta[0])
             plotData(X[:,2:3],y)
             plt.plot(plot_x,plot_y)
             plt.show()
```

```
In [39]: decisionBoundary(X,theta)
```




```
In [222]: c=[1,79.0327360507101,75.3443764369103]
          print(round(sigmoid(c,theta)))
          d=[1,67.94685547711617,46.67857410673128]
          print(round(sigmoid(d,theta)))
```

```
1.0
0.0
```

```
In [ ]:
```