Compute performance metrics for the given Y and Y_score without sklearn

In [132]:
```
import numpy as np
import pandas as pd
# other than these two you should not import any other packages
```

A. Compute performance metrics for the given data **5_a.csv**
Note 1: in this data you can see number of positive points >> number of negatives points
Note 2: use pandas or numpy to read the data from **5_a.csv**
Note 3: you need to derive the class labels from given score

$$y^{pred} = [0 \text{ if y\_score} < 0.5 \text{ else } 1]$$

1. Compute Confusion Matrix

2. Compute F1 Score

3. Compute AUC Score, you need to compute different thresholds and for each threshold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_array) https://stackoverflow.com/q/53603376/4084039 (https://stackoverflow.com/q/53603376/4084039), https://stackoverflow.com/a/39678975/4084039 (https://stackoverflow.com/a/39678975/4084039) Note: it should be numpy.trapz(tpr_array, fpr_array) not numpy.trapz(fpr_array, tpr_array)

4. Compute Accuracy Score

In [133]:
```
#This function calculates the TN,FN,TP,FP
def confusion(a,b,DATA):
    x1=DATA[(DATA['y-pred']==b) & (DATA['y']==a)]['y'].count()
    return x1
```

In [135]:
```
#This function calculates the F1 Sscore
def F1(Pr,Re):
    F=2*((Pr*Re)/(Pr+Re))
    return F
```

In [136]:

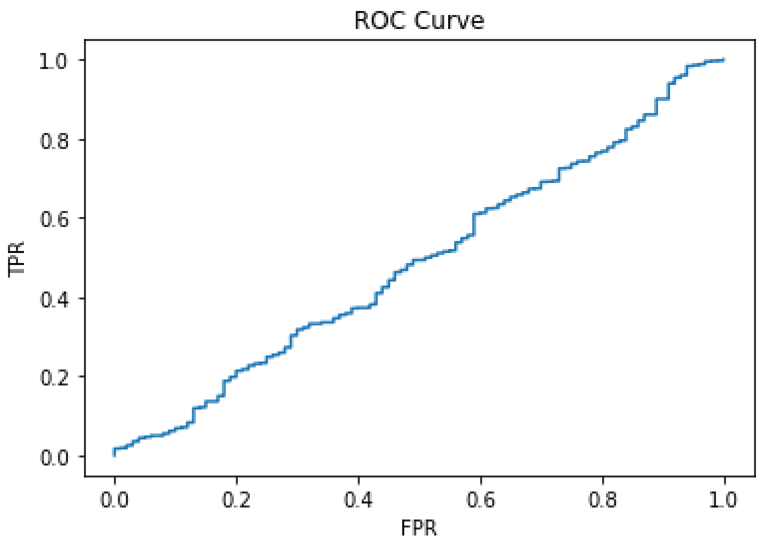
```
# This section computes the Confusion Matrix by calling the function confusion
dt=pd.read_csv("5_a.csv")

a = np.array(dt['proba'].values.tolist()) # converting the column proba to a numpy array for generating the binar
j = np.where(a >= 0.5, 1, 0).tolist() # predicted value >=0.5 1 else 0


df=pd.DataFrame(j,columns=['y-pred'])


data=pd.concat([dt,df],axis=1)


l1=[]
l2=[]
TN=confusion(0,0,data)
l1.append(TN)
FN=confusion(1,0,data)
l1.append(FN)
FP=confusion(0,1,data)
l2.append(FP)
TP=confusion(1,1,data)
l2.append(TP)

n=np.matrix([l1,l2])
print("Confusion Matrix \n",n)
print("="*50)

#******************************************************************************************
#This section computes the F1 score by calling the function F1

P=data[data['y']==1]['y'].count()
N=data[data['y']==0]['y'].count()
Recall=TP/P

Precision=TP/(TP+FP)

F1Score=F1(Precision,Recall)
print("F1Score  \n",F1Score)
print("="*50)

#******************************************************************************************
```

```python
#This section computes the accuracy

Accuracy=(TP+TN)/(TP+FP+TN+FN)
print("Accuracy \n",Accuracy)
print("="*50)

#*******************************************************************************************
#This section computes the Area Under The Curve for ROC

r=np.unique(data['proba'].values)
data=data.sort_values('proba',ascending=False)

q=-np.sort(-r,axis=0) #Sorting thresholds in descending order

TPR=[]
FPR=[]
for e in q:

    z1=(data['proba']>=e) & (data['y']==1) #Generating True Positives
    tp=z1[z1==True].count()

    z2=(data['proba']>=e) & (data['y']==0) #Generating False Positives
    fp=z2[z2==True].count()




    TPR.append(tp/P)
    FPR.append(fp/N)
auc=np.trapz(TPR,FPR)

print("AUC \n",auc)
```

```
Confusion Matrix
 [[    0     0]
 [  100 10000]]
==================================================
F1Score
 0.9950248756218906
==================================================
Accuracy
```

```
 0.9900990099009901
==================================================
AUC
 0.48829900000000004
```

In [127]:
```
#ROC for 5_a.csv
import matplotlib.pyplot as plt


plt.plot(FPR,TPR)
plt.xlabel("FPR")
plt.ylabel("TPR")
plt.title('ROC Curve')
plt.show()
```



B. Compute performance metrics for the given data **5_b.csv**
Note 1: in this data you can see number of positive points << number of negatives points
Note 2: use pandas or numpy to read the data from **5_b.csv**
Note 3: you need to derive the class labels from given score

$$y^{pred} = [0 \text{ if y\_score} < 0.5 \text{ else } 1]$$

1. Compute Confusion Matrix

2. Compute F1 Score

3. Compute AUC Score, you need to compute different thresholds and for each threshold compute tpr,fpr and then use numpy.trapz(tpr_array, fpr_array) https://stackoverflow.com/q/53603376/4084039 (https://stackoverflow.com/q/53603376/4084039), https://stackoverflow.com/a/39678975/4084039 (https://stackoverflow.com/a/39678975/4084039)

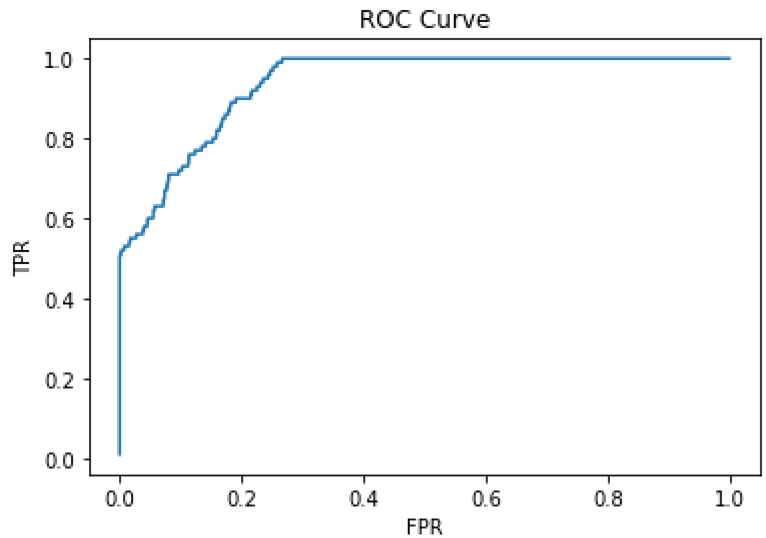
4. Compute Accuracy Score

In [137]:
```
# This section computes the Confusion Matrix by calling the function confusion
dt=pd.read_csv("5_b.csv")

a = np.array(dt['proba'].values.tolist()) # converting the column proba to a numpy array for generating the binar
j = np.where(a >= 0.5, 1, 0).tolist()     # predicted value >=0.5 1 else 0


df=pd.DataFrame(j,columns=['y-pred'])


data=pd.concat([dt,df],axis=1)


l1=[]
l2=[]
TN=confusion(0,0,data)
l1.append(TN)
FN=confusion(1,0,data)
l1.append(FN)
FP=confusion(0,1,data)
l2.append(FP)
TP=confusion(1,1,data)
l2.append(TP)

n=np.matrix([l1,l2])
print("Confusion Matrix \n",n)
print("="*50)

#***************************************************************************************
#This section computes the F1 score by calling the function F1

P=data[data['y']==1]['y'].count()
N=data[data['y']==0]['y'].count()
Recall=TP/P

Precision=TP/(TP+FP)

F1Score=F1(Precision,Recall)
print("F1Score  \n",F1Score)
print("="*50)

#***************************************************************************************
```

```
#This section computes the accuracy

Accuracy=(TP+TN)/(TP+FP+TN+FN)
print("Accuracy \n",Accuracy)
print("="*50)

#*****************************************************************************************
#This section computes the Area Under The Curve for ROC
r=np.unique(data['proba'].values)
data=data.sort_values('proba',ascending=False)

q=-np.sort(-r,axis=0) #Sorting thresholds in descending order

TPR=[]
FPR=[]
for e in q:

    z1=(data['proba']>=e) & (data['y']==1) #Generating True Positives
    tp=z1[z1==True].count()

    z2=(data['proba']>=e) & (data['y']==0) #Generating False Positives
    fp=z2[z2==True].count()




    TPR.append(tp/P)
    FPR.append(fp/N)
auc=np.trapz(TPR,FPR)
print("AUC \n",auc)
```

```
Confusion Matrix
 [[9761   45]
 [ 239   55]]
==================================================
F1Score
 0.2791878172588833
==================================================
Accuracy
 0.9718811881188119
==================================================
AUC
 0.9377570000000001
```

In [129]:
```
#ROC for 5_b.csv
import matplotlib.pyplot as plt


plt.plot(FPR,TPR)
plt.xlabel("FPR")
plt.ylabel("TPR")
plt.title('ROC Curve')
plt.show()
```



C. Compute the best threshold (similarly to ROC curve computation) of probability which gives lowest values of metric **A** for the given data **5_c.csv**

you will be predicting label of a data points like this: $y^{pred} = [0 \text{ if y\_score} < \text{threshold else } 1]$

$A = 500 \times \text{number of false negative} + 100 \times \text{numebr of false positive}$

> **Note 1:** in this data you can see number of negative points > number of positive points
> **Note 2:** use pandas or numpy to read the data from **5_c.csv**

In [130]:
```
#This section computes the best threshold for metrics A

dt=pd.read_csv("5_c.csv")
n=np.unique(dt['prob'].values)

q=-np.sort(-n,axis=0) #Sorting thresholds in descending order
dt=dt.sort_values('prob',ascending=False)
dict={}

for e in q: #iterating thresholds
    fn=0
    fp=0
    z1=(dt['prob']<e) & (dt['y']==1) #calculating False Negatives
    fn=z1[z1==True].count()

    z2=(dt['prob']>=e) & (dt['y']==0) #calculating False Positives
    fp=z2[z2==True].count()

    A=(500*fn)+(100*fp)
    dict[e]=A

k=min(dict, key=dict.get)
print("Best Threshold \n",k)
print("="*50)
```

```
Best Threshold 
 0.2300390278970873
==================================================
```

D. Compute performance metrics(for regression) for the given data **5_d.csv**
Note 2: use pandas or numpy to read the data from **5_d.csv**
Note 1: **5_d.csv** will having two columns Y and predicted_Y both are real valued features

1. Compute Mean Square Error
2. Compute MAPE: https://www.youtube.com/watch?v=ly6ztgIkUxk
3. Compute R^2 error: https://en.wikipedia.org/wiki/Coefficient_of_determination#Definitions

In [131]:
```
#This section computes the Mean Square Error

dataf=pd.read_csv("5_d.csv")

dataf['y-yPred']=dataf['y']-dataf['pred'] #calculating actual - predicted

dataf['y-yPredSquared']=dataf['y-yPred']*dataf['y-yPred'] #calculating (actual-predicted)^2

S=dataf['y-yPredSquared'].sum() #SSResidual
n=dataf['y'].count()
MSE=S/n
print("Mean Square Error \n",MSE)
print("="*50)

#*****************************************************************************************
#This section computes the Mean Absolute Percentage Error

a=dataf['y'].sum()
dataf['y-yPred']=dataf['y-yPred'].abs()

ei=dataf['y-yPred'].sum()
MAPE=ei/a
print("Mean Absolute Percentage Error \n",MAPE)
print("="*50)

#*****************************************************************************************
#This section computes the R^2 error

ymean=(dataf['y'].sum())/dataf['y'].count()

dataf['y']=(dataf['y']-ymean)*(dataf['y']-ymean)

SSTotal=dataf['y'].sum()

RSquare=1-(S/SSTotal)
print(" R^2 Error \n",RSquare)
```

```
Mean Square Error
 177.16569974554707
==================================================
Mean Absolute Percentage Error
 0.1291202994009687
```

```
==================================================
R^2 Error
0.9563582786990937
```