Compute performance metrics for the given Y and Y_score without sklearn

In [17]:

```
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

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

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/a/39678975/4084039 Note: it should be numpy.trapz(tpr_array, fpr_array) not numpy.trapz(fpr_array, tpr_array)

4. Compute Accuracy Score

A. 1. Confusion Matrix

In [18]:

```
#A.
#1. Confusion Matrix

data1 = pd.read_csv("5_a.csv")
data = pd.read_csv("5_a.csv")

#Classsifing the data
data.loc[data['proba'] < 0.5,'proba'] = 0
data.loc[data['proba'] >= 0.5,'proba'] = 1


y = list(data['y'])
proba = list(data['proba'])

#confusion Matrix as a funciton
def confusion_matrix(y,proba):
    true_neg, false_neg, false_pos, true_pos = 0,0,0,0

    for i in range(len(y)):
        if y[i] == 0 and proba[i] == 0:
            true_neg += 1

        elif y[i] == 0 and proba[i] == 1:
            false_pos += 1
        elif y[i] == 1 and proba[i] == 0:
            false_neg += 1
        elif y[i] == 1 and proba[i] == 1:
            true_pos += 1
```

```
    return (true_neg,false_neg,false_pos,true_pos)

true_neg,false_neg,false_pos,true_pos = confusion_matrix(y,proba)
print("TN"," ","FN"," ","FP"," ","TP")
print(true_neg,"  ",false_neg," ",false_pos," ",true_pos)
```

```
TN   FN   FP   TP
0    0   100   10000
```

A. 2. F1 score

In [19]:

```
#f1 score

precision = (true_pos/(true_pos+false_pos))

print("Precision: ",precision)

recall = (true_pos/(true_pos+false_neg))
print("Recall: ",recall)

f1_score = (2*precision*recall)/(precision+recall)
print("F1 Score: ",f1_score)
```

```
Precision:  0.9900990099009901
Recall:  1.0
F1 Score:  0.9950248756218906
```

A. 4. Accuracy Score

In [21]:

```
#Accuracy Score

accuracy_score = (true_pos+true_neg)/(true_pos+true_neg+false_pos+false_neg)
print("Accuracy Score: ",accuracy_score)
```

```
Accuracy Score:  0.9900990099009901
```

A. 3. AUC Score

In [22]:

```
#AUC score
from tqdm import tqdm

unique = data1.proba.unique()
unique = sorted(unique,reverse= True)

#Sorting the data
data1 = data1.sort_values(by='proba',ascending=False)

#Creating a copy of the data
temp = data1.copy()

#tpr and fpr array
true_positive_rates = []
false_positive_rates = []

#Calculatig tpr and fpr for each threshold value
for i in tqdm(unique):
    data1.loc[data1['proba'] >= i,'proba'] = 1
    data1.loc[data1['proba'] < i,'proba'] = 0

    y = list(data1['y'])
    proba = list(data1['proba'])
```

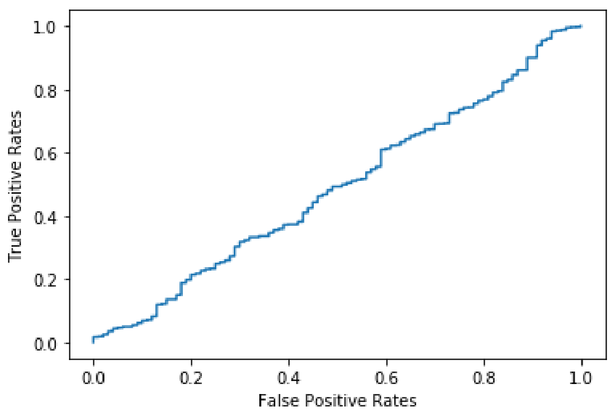
```python
    #getting values from confusion matrix
    true_neg,false_neg,false_pos,true_pos = confusion_matrix(y,proba)

    #calclating tpr and fpr for signle thershold value
    tpr = (true_pos/(true_pos+false_neg))
    fpr = (false_pos/(true_neg+false_pos))

    true_positive_rates.append(tpr)
    false_positive_rates.append(fpr)

    #restoring the original data
    data1 = temp.copy()

#Calculating the area under curve
auc_score = np.trapz(true_positive_rates,false_positive_rates)
print(auc_score)
```

```
100%|██████████| 10100/10100 [03:35<00:00, 63.20it/s]
```

```
0.48829900000000004
```

In [23]:

```python
import matplotlib.pyplot as plt
plt.plot(false_positive_rates, true_positive_rates)
plt.ylabel('True Positive Rates')
plt.xlabel('False Positive Rates')
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

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

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/a/39678975/4084039

4. Compute Accuracy Score

B. 1. Confusion Matrix

In [24]:

```
# write your code
#B.
#1. Confusion Matrix

data1 = pd.read_csv("5_b.csv")
data = pd.read_csv("5_b.csv")

#Classifing data
data.loc[data['proba'] < 0.5,'proba'] = 0
data.loc[data['proba'] >= 0.5,'proba'] = 1


y = list(data['y'])
proba = list(data['proba'])

#Confusion Matrix
def confusion_matrix(y,proba):
    true_neg, false_neg, false_pos, true_pos = 0,0,0,0

    for i in range(len(y)):
        if y[i] == 0 and proba[i] == 0:
            true_neg += 1

        elif y[i] == 0 and proba[i] == 1:
            false_pos += 1

        elif y[i] == 1 and proba[i] == 0:
            false_neg += 1

        elif y[i] == 1 and proba[i] == 1:
            true_pos += 1

    return (true_neg,false_neg,false_pos,true_pos)


true_neg,false_neg,false_pos,true_pos = confusion_matrix(y,proba)

print("TN","  ","FN"," ","FP"," ","TP")
print(true_neg,"",false_neg,"",false_pos," ",true_pos)
```

```
TN    FN   FP   TP
9761  45   239   55
```

B. 2. F1 score

In [25]:

```
#f1 score

precision = (true_pos/(true_pos+false_pos))
print("Precison: ",precision)

recall = (true_pos/(true_pos+false_neg))
print("Recall: ",recall)

f1_score = (2*precision*recall)/(precision+recall)
print("F1 Score: ",f1_score)
```

```
Precison:  0.1870748299319728
Recall:  0.55
F1 Score:  0.2791878172588833
```

B. 4. Accurcy Score

In [26]:

```
#Accuracy Score

accuracy_score = (true_pos+true_neg)/(true_pos+true_neg+false_pos+false_neg)
print("Accuracy Score: ",accuracy_score)
```

```
Accuracy Score:  0.9718811881188119
```

B. 3. AUC Score

In [27]:

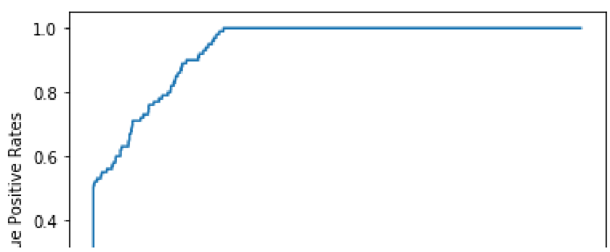
```
#lisitng unique values
unique = data1.proba.unique()
unique = sorted(unique,reverse= True)

#Sorting data
data1 = data1.sort_values(by='proba',ascending=False)

#Creating deep copy of data
temp = data1.copy()

#tpr and fpr arrays
true_positive_rates = []
false_positive_rates = []

for i in tqdm(unique):

    #Classifing based on threshold
    data1.loc[data1['proba'] >= i,'proba'] = 1
    data1.loc[data1['proba'] < i,'proba'] = 0

    y = list(data1['y'])
    proba = list(data1['proba'])

    #COnfusion matrix
    true_neg,false_neg,false_pos,true_pos = confusion_matrix(y,proba)

    tpr = (true_pos/(true_pos+false_neg))
    fpr = (false_pos/(true_neg+false_pos))

    true_positive_rates.append(tpr)
    false_positive_rates.append(fpr)

    data1 = temp.copy()

auc_score = np.trapz(true_positive_rates,false_positive_rates)
print(auc_score)
```

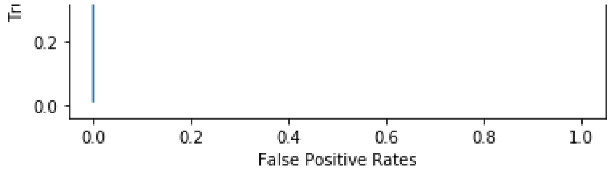
```
100%|██████████| 10100/10100 [02:28<00:00, 67.90it/s]
```

```
0.9377570000000001
```

In [28]:

```
import matplotlib.pyplot as plt
plt.plot(false_positive_rates, true_positive_rates)
plt.ylabel('True Positive Rates')
plt.xlabel('False Positive Rates')
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: $y^{pred}= \text{[0 if y_score < threshold else 1]}$

$ 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**

C.

In [12]:

```
import sys
INT_MAX = sys.maxsize

#holds the threshold of minimum metric value
minimum = INT_MAX

#holds the minimum metric value
threshold = -1

data2 = pd.read_csv("5_c.csv")

unique = data2.prob.unique()
unique = sorted(unique)

data2 = data2.sort_values(by='prob',ascending=False)
temp = data2.copy()

#Calculating false neg and false pos
for i in unique:
    data2.loc[data2['prob'] >= i,'prob'] = 1
    data2.loc[data2['prob'] < i,'prob'] = 0
    y = list(data2['y'])
    prob = list(data2['prob'])

    true_neg,false_neg,false_pos,true_pos = confusion_matrix(y,prob)

    A = 500*false_neg+100*false_pos

    if A < minimum:
        minimum = A
        threshold = i

    data2 = temp.copy()


print("Threshold Value:",threshold,"\n","Metric Value: ",minimum)
```

```
Threshold Value: 0.2300390278970873
 Metric Value:  141000
```

> **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

D. 1. Mean Squared Error

In [13]:

```
data3 = pd.read_csv('5_d.csv')

y = list(data3['y'])
pred = list(data3['pred'])

mean_square_error = np.square(np.subtract(y,pred)).mean()
print(mean_square_error)
```

```
177.16569974554707
```

D. 2. MAPE

In [14]:

```
error = np.absolute(np.subtract(y,pred))

MAPE = (sum(error)/sum(y))*100
print("MAPE", MAPE)
```

```
MAPE 12.91202994009687
```

D. 3. R Square

In [15]:

```
ss_total = np.sum(np.square(y-np.mean(y)))

ss_res = np.sum(np.square(np.subtract(y,pred)))

r_square = 1 - (ss_res/ss_total)
print("R Square:",r_square)
```

```
R Square: 0.9563582786990937
```