Compute performance metrics for the given Y and Y_score without sklearn

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

# 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

In [2]:

```
df_Positive = pd.read_csv('5_a.csv')
print("Actual : ", df_Positive.y.value_counts(), '\n')

df_Positive['pred'] = df_Positive.proba.apply(lambda x: 0 if x<0.5 else 1).astype('int')
print("Predicted : ", df_Positive['pred'].value_counts(), '\n')
```

```
Actual :  1.0    10000
0.0      100
Name: y, dtype: int64

Predicted :  1    10100
Name: pred, dtype: int64
```

In [3]:

```
def compute_tp_tn_fn_fp(y_act, y_pred):

    '''
    True positive - actual = 1, predicted = 1
    False positive - actual = 1, predicted = 0
    False negative - actual = 0, predicted = 1
    True negative - actual = 0, predicted = 0
    '''
    tp = sum((y_act == 1) & (y_pred == 1))
    tn = sum((y_act == 0) & (y_pred == 0))
    fn = sum((y_act == 1) & (y_pred == 0))
    fp = sum((y_act == 0) & (y_pred == 1))

    return tp, tn, fn, fp
    return tp, tn, fp, fn

def compute_accuracy(tp, tn, fn, fp):
    '''
    Accuracy = TP + TN / FP + FN + TP + TN
    '''
    return ((tp + tn) * 100)/ float( tp + tn + fn + fp)

def compute_precision(tp, fp):
    '''
    Precision = TP  / FP + TP
    '''
    if tp != 0:
        return (tp  * 100)/ float( tp + fp)
    else :
        return 0


def compute_recall(tp, fn):
    '''
    Recall = TP /FN + TP

    '''
    if tp != 0:
        return (tp  * 100)/ float( tp + fn)
    else :
        return 0


def false_pos_rate(fp, tn):
    '''
    FP = FP / FP + 1

    '''
    if fp != 0:
        return (fp  * 100)/ float( fp + tn)
    else :
        return 0


def compute_f1_score(y_true, y_pred):

    ''' calculates the F1 score '''

    tp, tn, fp, fn = compute_tp_tn_fn_fp(y_true, y_pred)
    precision = compute_precision(tp, fp)/100
    recall = compute_recall(tp, fn)/100

    f1_score = (2*precision*recall)/ (precision + recall)
    return f1_score

def AUC(tpr, fpr):

    '''
    Calculates AUC for various Thresholds

    '''

    return np.trapz(tpr, fpr)


tp, tn, fp, fn = compute_tp_tn_fn_fp(df_Positive.y, df_Positive.pred)

print('tp, tn, fp, fn : ', tp, tn, fp, fn)

print("Accuracy is : ", compute_accuracy(tp, tn, fp, fn))

print('Precision is :', compute_precision(tp, fp))

print('Recall is :', compute_recall(tp, fn))

print('F1 Score is : ', compute_f1_score(df_Positive.y, df_Positive.pred))
```

```
tp, tn, fp, fn :  10000 0 100 0
Accuracy is :  99.00990099009901
Precision is : 99.00990099009901
Recall is : 100.0
```

```
F1 Score is :  0.9950248756218906
```

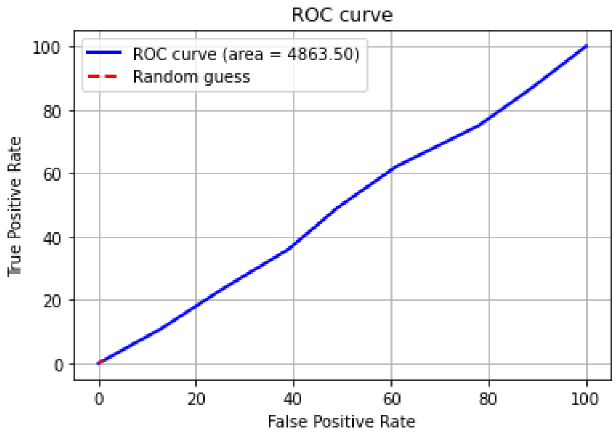
In [4]:

```
import matplotlib.pyplot as plt
from sklearn import metrics

TPR = []
FPR = []
threshold = []

for i in np.arange(0.1, 1.1, 0.05):

    df_Positive['thresh_' + str(i)] = df_Positive.proba.apply(lambda x: 0 if x<i else 
1).astype('int')

    tp, tn, fp, fn = compute_tp_tn_fn_fp(df_Positive.y, df_Positive['thresh_' + str(i)])

    tpr = int(compute_recall(tp, fn))
    fpr = int(false_pos_rate(fp, tn))

    TPR.append(tpr)
    FPR.append(fpr)
    threshold.append(i)

auc = AUC(np.array(sorted(TPR), ndmin=1), np.array(sorted(FPR), ndmin=1))

print("AUC IS : " , auc, '\n')
```

```
AUC IS :  4863.5
```

In [5]:

```
auc = AUC(np.array(sorted(TPR), ndmin=1), np.array(sorted(FPR), ndmin=1))

plt.plot(FPR, TPR, label='ROC curve (area = %.2f)'%auc, lw=2, color='b')
plt.plot([0, 1], [0, 1], linestyle='--', lw=2, color='r', label='Random guess')
plt.title('ROC curve')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.grid()
plt.legend()
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

In [6]:

```
df_Negative = pd.read_csv('5_b.csv')
print("Actual : ", df_Negative.y.value_counts(), '\n')

df_Negative['pred'] = df_Negative.proba.apply(lambda x: 0 if x<0.5 else 1)
print("Predicted : ", df_Negative['pred'].value_counts(), '\n')

tp, tn, fp, fn = compute_tp_tn_fn_fp(df_Negative.y, df_Negative.pred)

print('tp, tn, fp, fn : ', tp, tn, fp, fn)

print("Accuracy is : ", compute_accuracy(tp, tn, fp, fn))

print('Precision is :', compute_precision(tp, fp))

print('Recall is :', compute_recall(tp, fn))

print('F1 Score is : ', compute_f1_score(df_Negative.y, df_Negative.pred))
```

```
Actual :  0.0    10000
1.0      100
Name: y, dtype: int64

Predicted :  0    9806
1     294
Name: pred, dtype: int64

tp, tn, fp, fn :  55 9761 239 45
Accuracy is :  97.18811881188118
Precision is : 18.707482993197278
Recall is : 55.0
F1 Score is :  0.27918781725888325
```

In [7]:

```
import matplotlib.pyplot as plt
from sklearn import metrics

TPR = []
FPR = []
threshold = []

for i in np.arange(0.1, 1.1, 0.05):

    df_Negative['thresh_' + str(i)] = df_Negative.proba.apply(lambda x: 0 if x<i else
1).astype('int')

    tp, tn, fp, fn = compute_tp_tn_fn_fp(df_Negative.y, df_Negative['thresh_' + str(i)])

    tpr = int(compute_recall(tp, fn))
    fpr = int(false_pos_rate(fp, tn))

    TPR.append(tpr)
    FPR.append(fpr)
    threshold.append(i)

auc = AUC(np.array(sorted(TPR), ndmin=1), np.array(sorted(FPR), ndmin=1))

print("AUC IS : " , auc, '\n')
```

```
AUC IS :  9360.0
```

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
```

In [8]:

```
df = pd.read_csv('5_c.csv')

df.head()
```

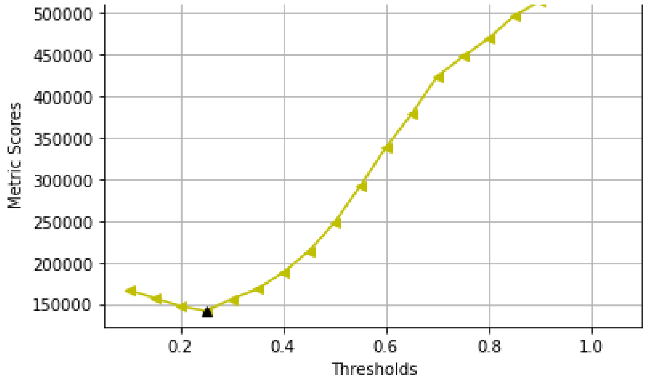
Out[8]:

	y	prob
0	0	0.458521
1	0	0.505037
2	0	0.418652
3	0	0.412057
4	0	0.375579

In [9]:

```
import matplotlib.pyplot as plt
from sklearn import metrics

print('Actual label is : ', df.y.value_counts())

scores=[]
threshold = []

for i in np.arange(0.1, 1.1, 0.05):

    df['thresh_' + str(i)] = df.prob.apply(lambda x: 0 if x<i else 1).astype('int')
    tp, tn, fp, fn = compute_tp_tn_fn_fp(df.y, df['thresh_' + str(i)])
    A = (500 * fn) + (100 * fp)

    threshold.append(i)
    scores.append(A)

min_score = min(scores)
optimal_threshold = threshold[scores.index(min_score)]
print("optimal threshold is : ", optimal_threshold)

plt.plot(threshold, scores, marker='<', color='y');

plt.plot(optimal_threshold, min_score, marker='^', color='k');
plt.xlabel("Thresholds")
plt.ylabel("Metric Scores")
plt.title("optimal threshold Curve")
plt.grid()
```

```
Actual label is :  0    1805
1    1047
Name: y, dtype: int64
optimal threshold is :  0.25000000000000006
```



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 [10]:

```
def MSE(Ytrue, Ypred):
    return np.square(np.subtract(Ypred,Ytrue)).mean()

def MAPE(ytrue, ypred):
    ytrue, ypred = np.array(ytrue), np.array(ypred)
    error = np.subtract(ytrue, ypred)
    return sum(error) / sum(ytrue) * 100

def R2(ytrue, ypred):
    act_mean = np.mean(ytrue)
    ss_tot = np.sum(np.subtract(ypred, ytrue)**2)
    ss_res = np.sum(np.subtract(ytrue, act_mean)**2)
    return 1-(ss_tot / ss_res)

df = pd.read_csv('5_d.csv')

print("MSE : ", MSE(df.pred, df.y), '\n')

print("R2 : ", R2(df.y, df.pred), '\n')

print("MAPE : ", MAPE(df.y, df.pred), '\n')
```

```
MSE :  177.16569974554707

R2 :  0.9563582786990937

MAPE :  0.11774195398124539
```