-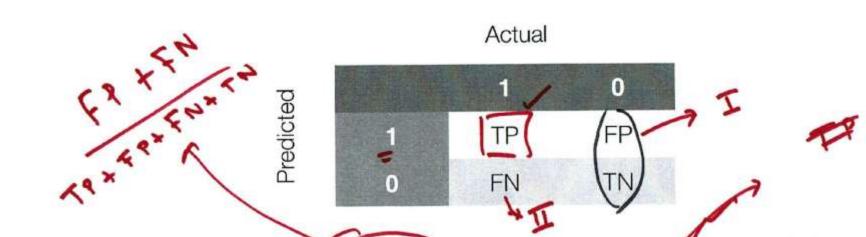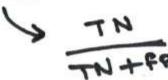 For classification problem with a class output, the confusion matrix gives the counts of correct and erroneous predictions:

Actual

Predicted

	1	0
1	TP	FP
0	FN	TN

Handwritten annotations:
$$\frac{FP + FN}{TP + FP + FN + TN}$$

I, II

- Classification Error Rate: sum of Type 1 (FP) and Type 2 (FN) Errors (in percentage). Accuracy is 1-(error rate).

- Sensitivity (also called Recall or True Positive Rate): proportion of Total Positives that were correctly identified

$$\rightarrow \frac{TP}{TP + FN}$$

- Specificity (also called True Negative Rate): proportion of Total Negatives that were correctly identified

$$\rightarrow \frac{TN}{TN + FP}$$

Truth

	P	N
P	**TP**	**FP** (Type 1)
N	**FN** (Type 2)	**TN**

Predicted

Accuracy = TP + TN / TP + TN + FP + FN

Truth

	P	N
P	0	0
N	10	$10^9 - 10$

Predicted

Out of 1 Billion People there are 10 terrorists

Accuracy = $10^9 - 10 / 10^9$

$\qquad\qquad = 1 - 10^{-8}$

$\qquad\qquad = 0.99999$

or 99.9999%

Recall (Sensitivity or TPR)

- Recall = TP / TP + FN
- Recall: Out of all terrorist what fraction did you identify

Precision:

- Precision = TP / TP + FP
- Out of all the predicted terrorists what fraction were really terrorists.

Label all as not a terrorist

	P	N
P	0	0
N	10	$10^9 - 10$

$$ACC = (10^9 - 10)/(10^9)$$

$$= 1 - 10^{-8}$$
$$= 0.999$$

Label all as terrorist

	P	N
P	10	$10^9 - 10$
N	0	0

	Acc	Recall	Precision
All as not terrorist	1	0	0
All as terrorist		1	low
Predicts the top terrible only		0	1

$$F_1 = (2 * P * R) / (P+R)$$

AUC ⊙ ∴/∵

$TPR \rightarrow \dfrac{TP}{TP+FN}$

$FPR \rightarrow \dfrac{FP}{FP+TN}$
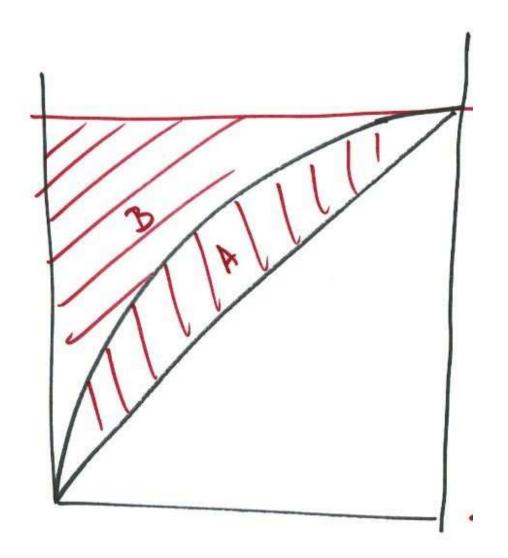
Model 3

Model 2

Model 1

? ——— 0.1

TPR ↑
FPR ↑

? ——— 0.9
?

1
0

TPR ↓
FPR ↓

Gini Coefficient = A / A + B

A = AUC - 0.5

A + B = 0.5

Gini Coefficient = AUC - 0.5 / 0.5

Gini Coefficient = 2 * AUC - 1