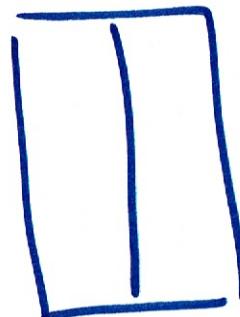
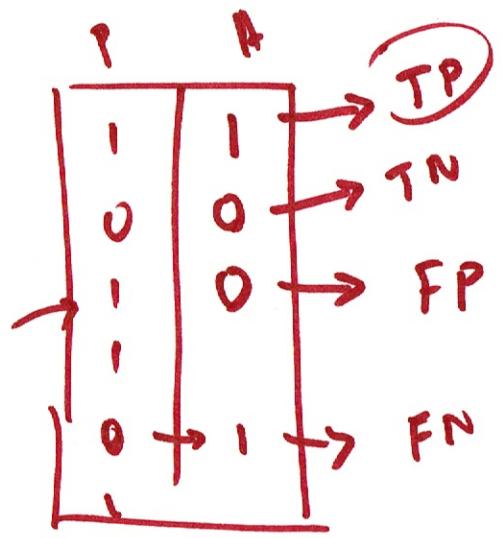


Performance Measures

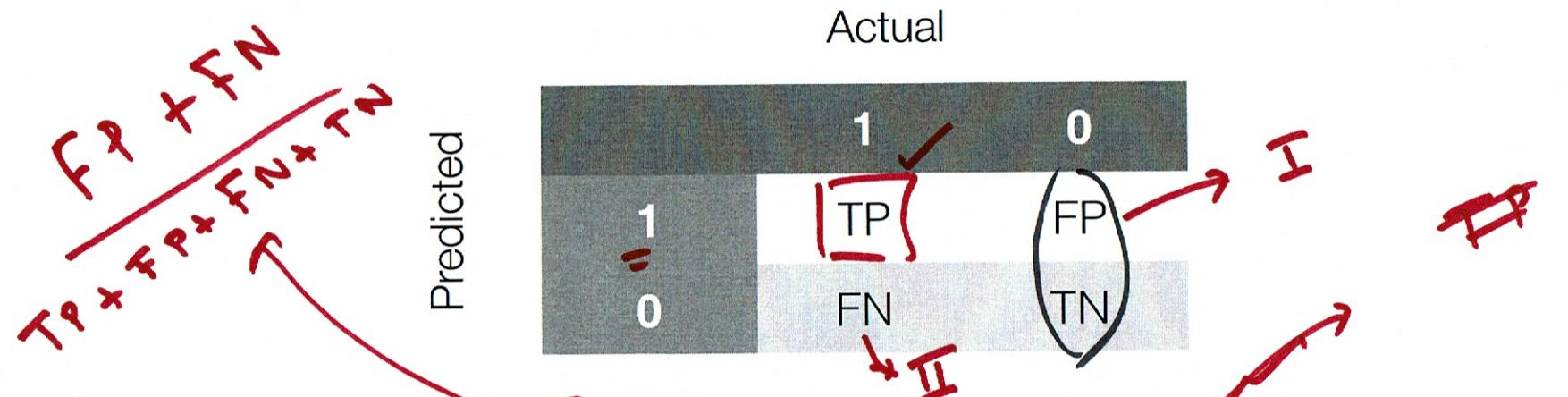
- Confusion Matrix ↵
- ROC Curves, Gini Coefficient ↵
- Gain and Lift Chart ↵
- Kolmogorov-Smirnov (K-S) chart ↵
- Concordance-Discordance ratio ↵
- Root Mean Square Error, Mean Absolute Error ↵





Confusion Matrix

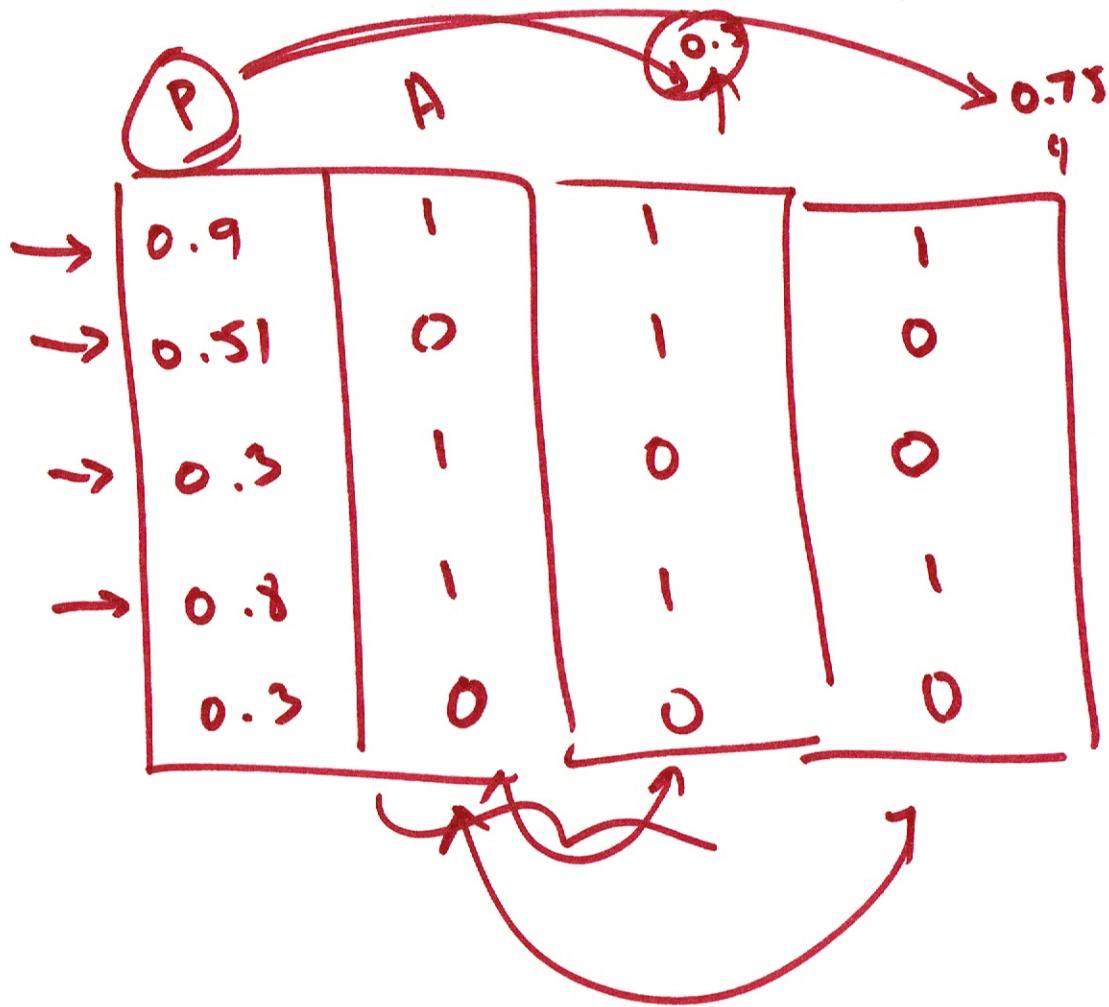
- For classification problem with a class output, the confusion matrix gives the counts of correct and erroneous predictions:

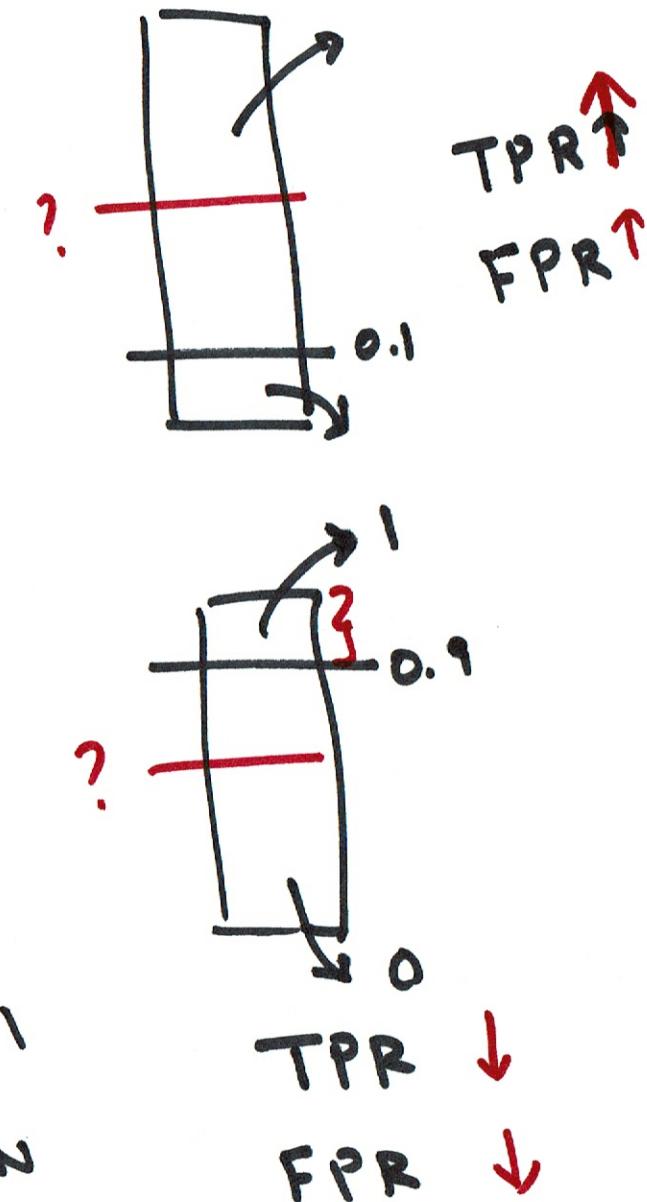
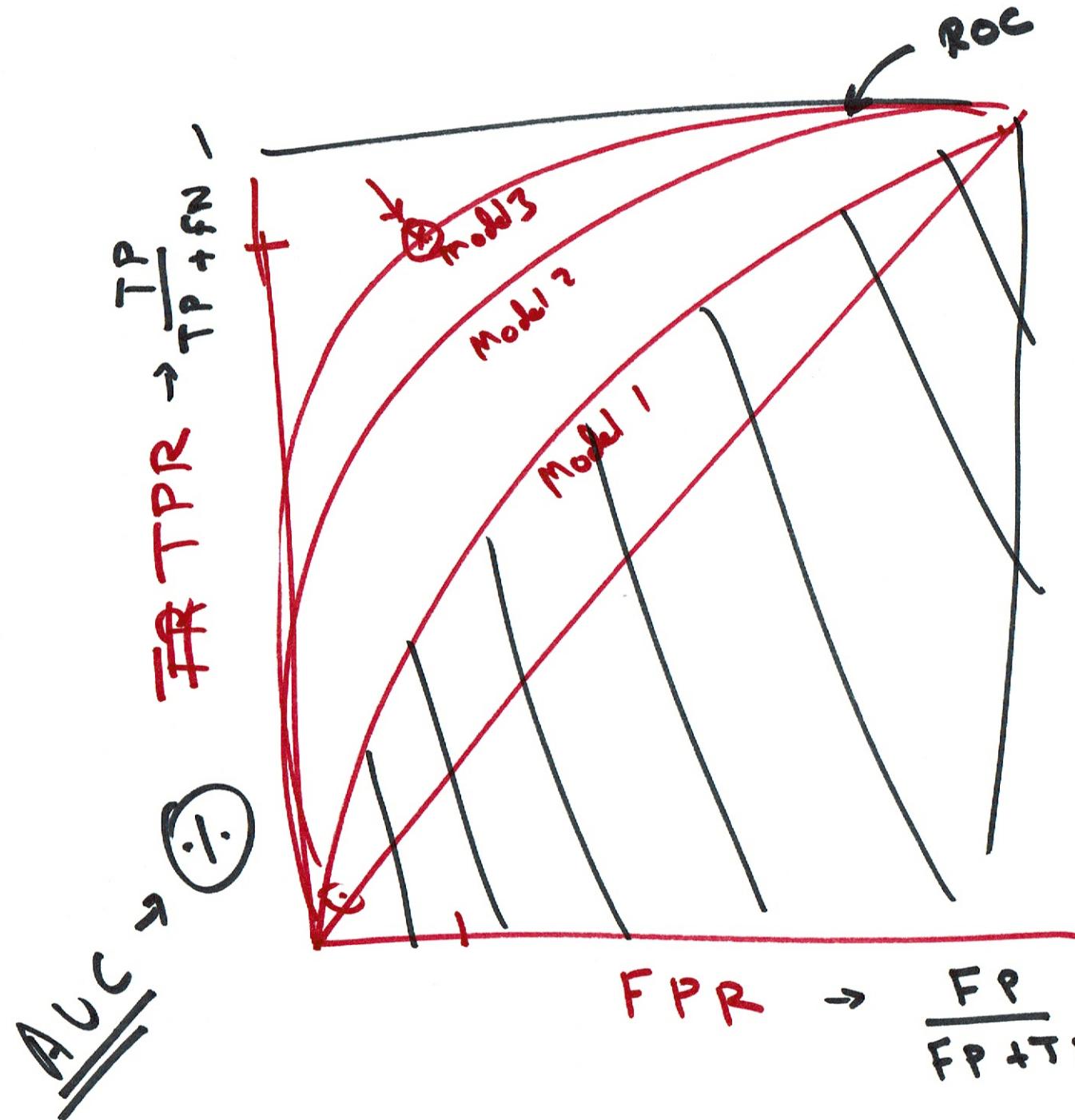


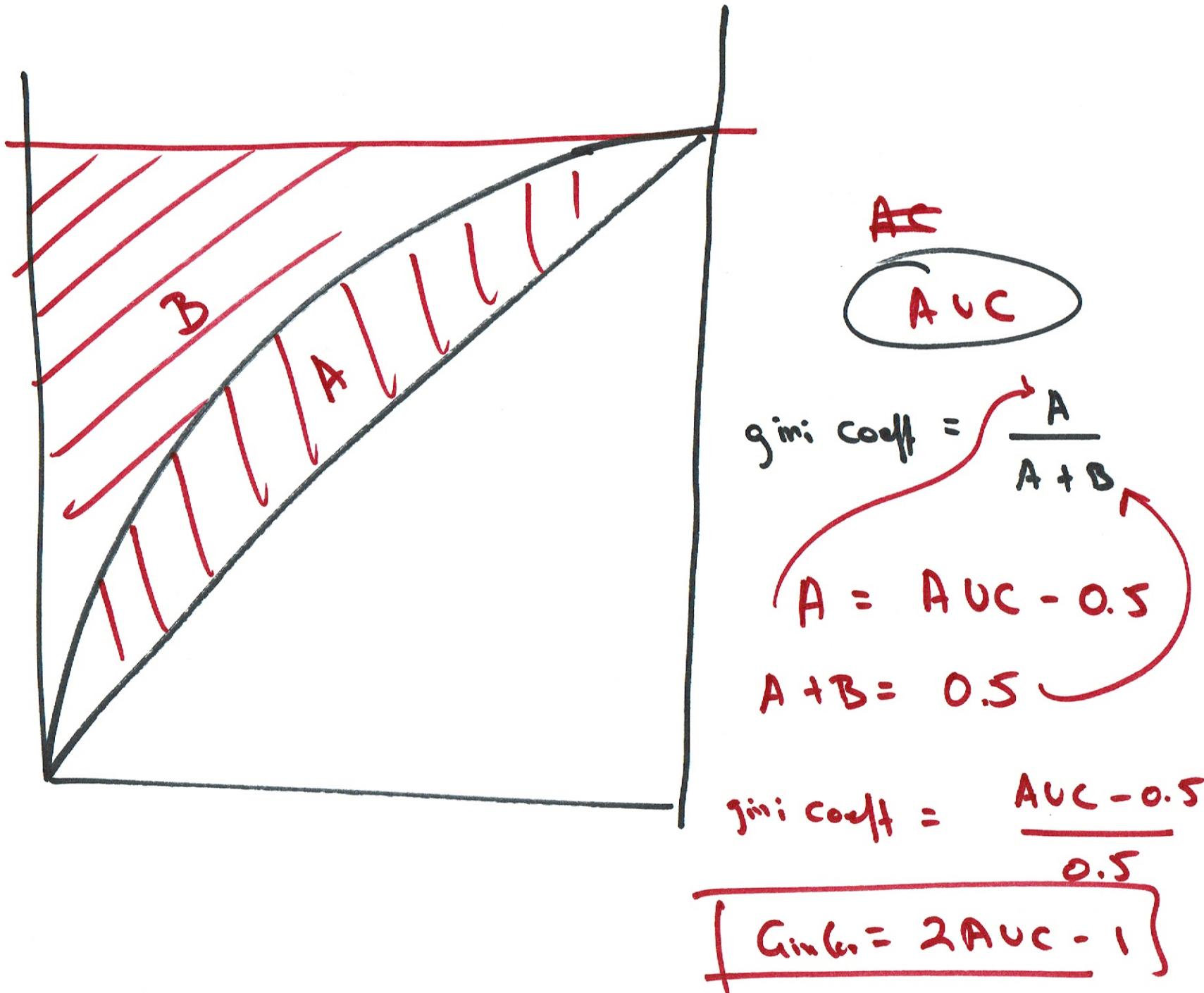
- Classification Error Rate: sum of Type 1 (FP) and Type 2 (FN) Errors (in percentage). Accuracy is $1 - (\text{error rate})$
- Sensitivity (also called Recall or True Positive Rate): proportion of Total Positives that were correctly identified
- Specificity (also called True Negative Rate): proportion of Total Negatives that were correctly identified

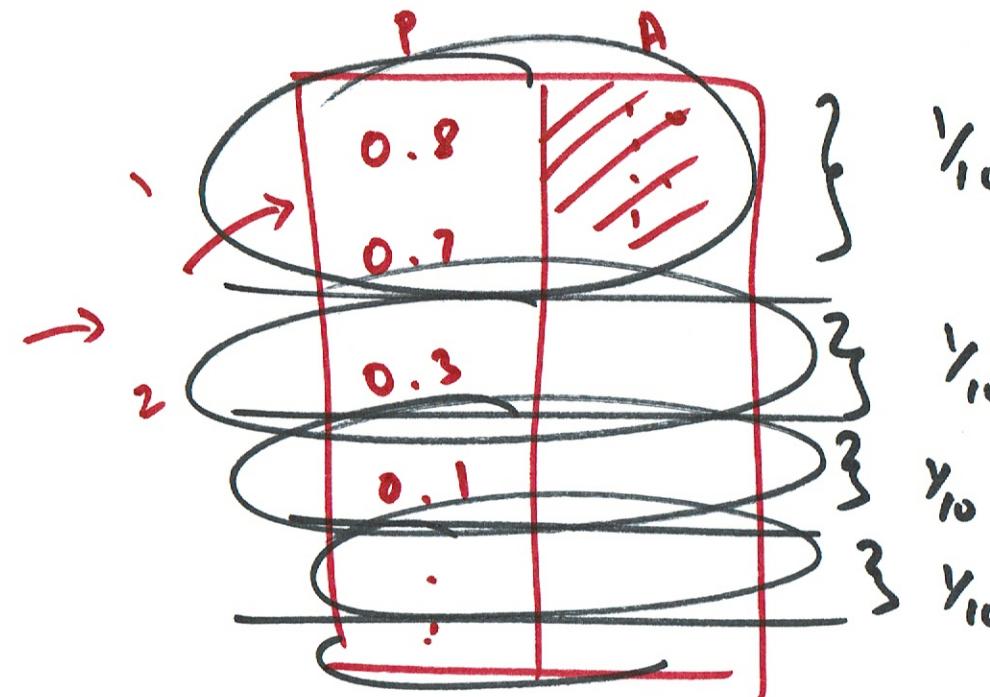
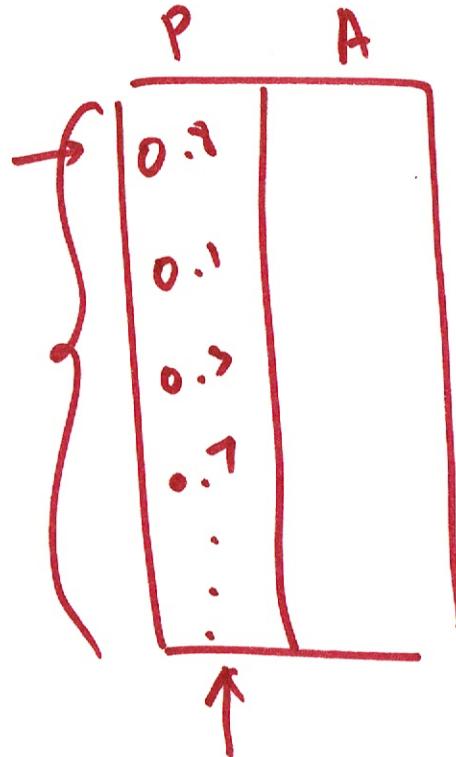
$$\frac{TP}{TP + FN}$$

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





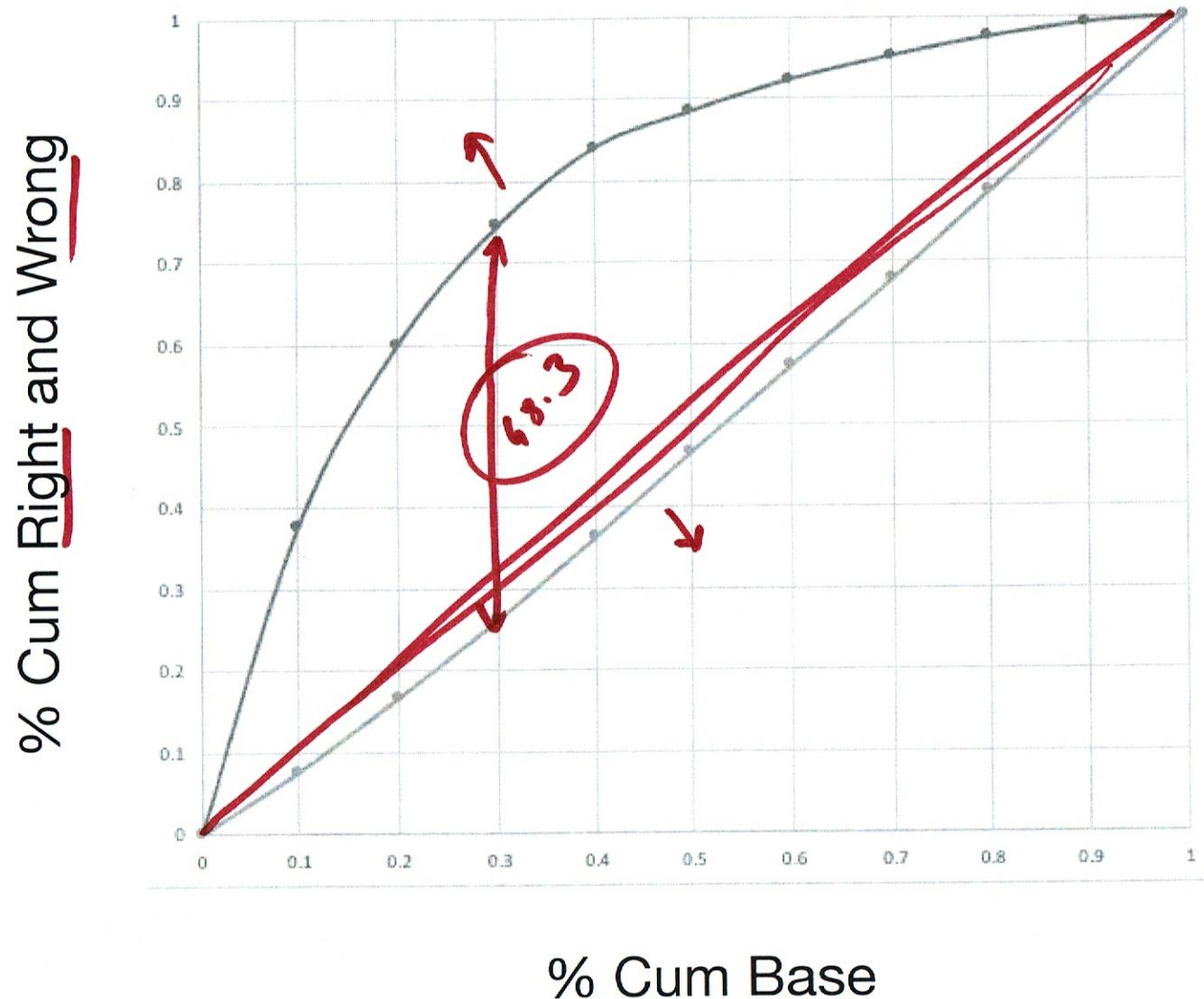




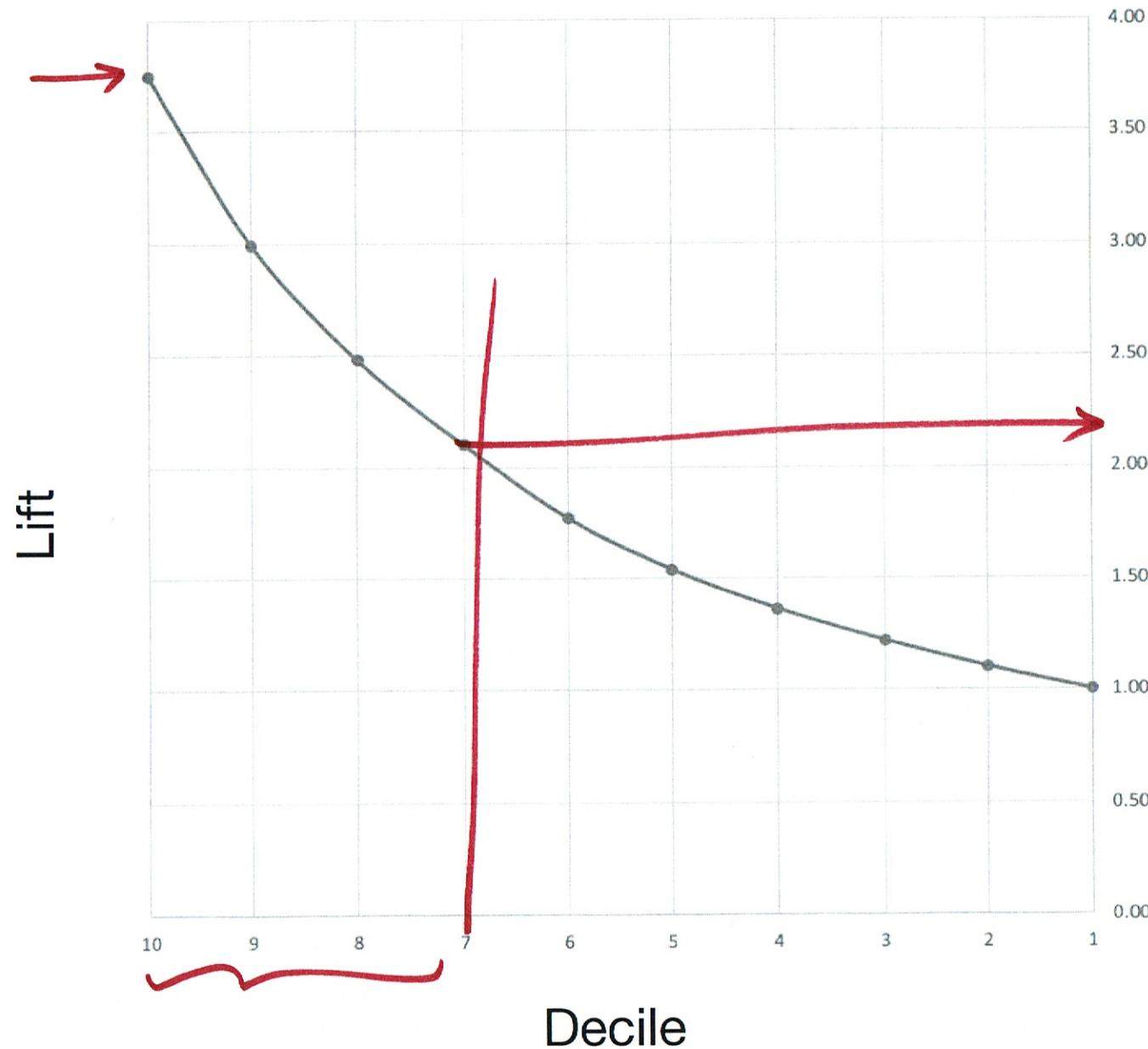
Rank Ordered Table Example

Decile	Base Cnt	#Right	# Wrong	%Right	Cum. Resp.	Cum. Non-	%Cum . Base	%Cum . Resp.	%Cum . Non-	KS	Lift
A	B	C	D=B-C	E=C/B	F = CumSum(C)	G=CumSum(D)	H = CumSum(B)/Total	I = F/Total	J=G/Total	I-J	I/H
10	1000	295	705	29.50%	295	705	10%	37.48%	7.65%	29.83%	3.75
9	1000	176	824	17.60%	471	1529	20%	59.85%	16.60%	43.25%	2.99
8	1000	115	885	11.50%	586	2414	30%	74.46%	26.20%	48.26%	2.48
7	1000	75	925	7.50%	661	3339	40%	83.99%	36.24%	47.75%	2.10
6	1000	35	965	3.50%	696	4304	50%	88.44%	46.72%	41.72%	1.77
5	1000	30	970	3.00%	726	5274	60%	92.25%	57.25%	35.00%	1.54
4	1000	23	977	2.30%	749	6251	70%	95.17%	67.85%	27.32%	1.36
3	1000	18	982	1.80%	767	7233	80%	97.46%	78.51%	18.95%	1.22
2	1000	13	987	1.30%	780	8220	90%	99.11%	89.22%	9.89%	1.10
1	1000	7	993	0.70%	787	9213	100%	100.00%	100.00%	0.00%	1.00
Total	10000	787	9213	7.87%	787	9213					

K-S Chart



Lift Chart



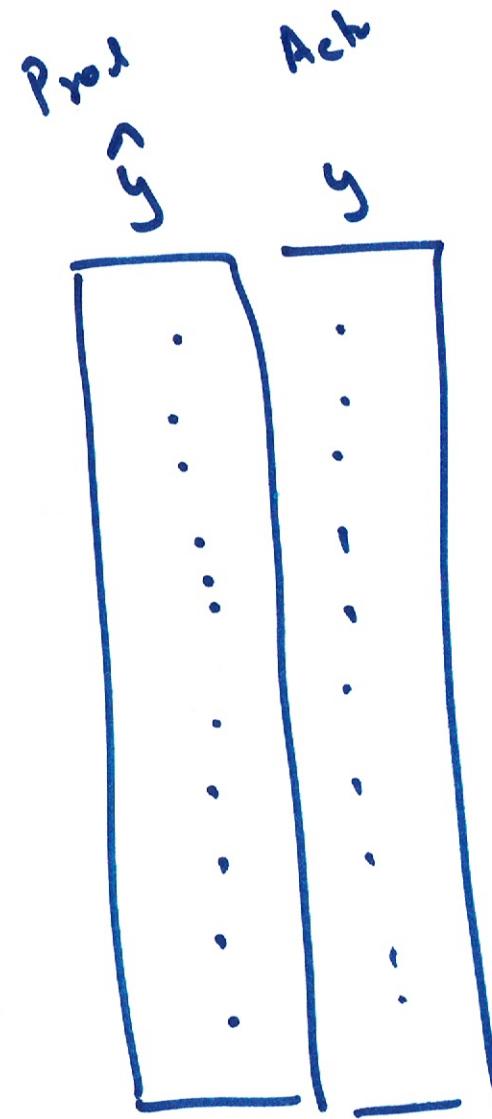
Example

Name	Right?	Prob
A	0	0.056
B	0	0.134
C	0	0.156
D	1	0.512
E	0	0.235
F	0	0.25
G	1	0.25
H	1	0.2
I	0	0.135
J	0	0.089

A P

- D, A $\rightarrow 0.512, 0.056 \rightarrow \checkmark C$
- D, B $\rightarrow 0.512, 0.0134 \rightarrow \checkmark C$
- D, C
- D, E
- D, F
- D, I
- D, J
- G, A
- G, F $\rightarrow 0.25, 0.25 \rightarrow O T$
- H, E $\rightarrow 0.2, 0.235 \rightarrow X D$

$$\text{Concordance Ratio} = \frac{18}{21}$$



$$\frac{1}{n} \sum |y_i - \hat{y}_i|$$

MAE

RMSE

$$\sqrt{\frac{1}{n} \sum (y_i - \hat{y}_i)^2}$$