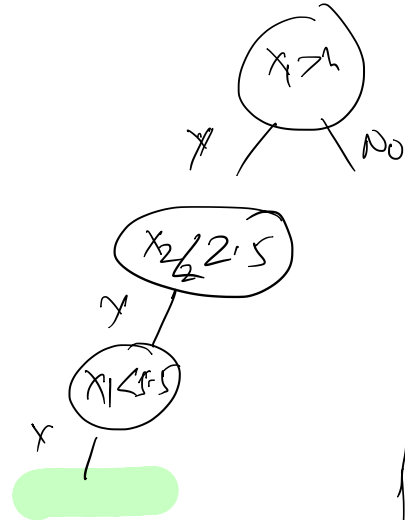
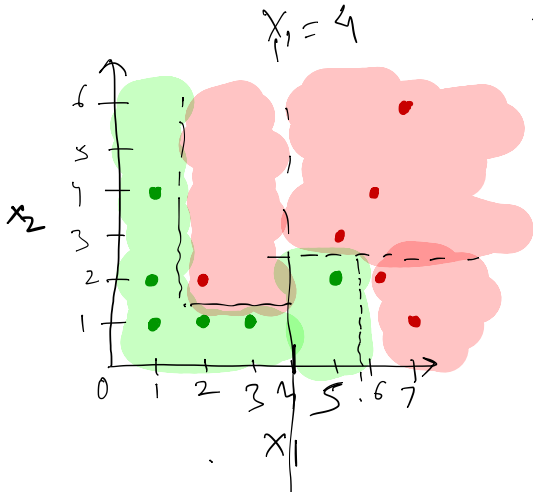
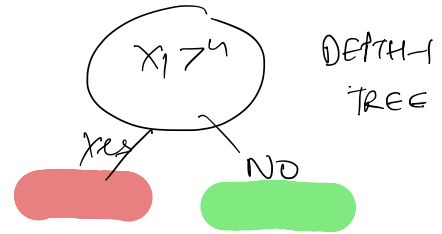
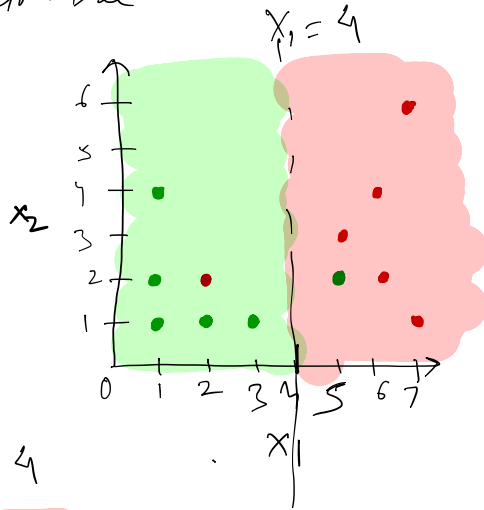


BIAS VARIANCE & CROSS-VALIDATION

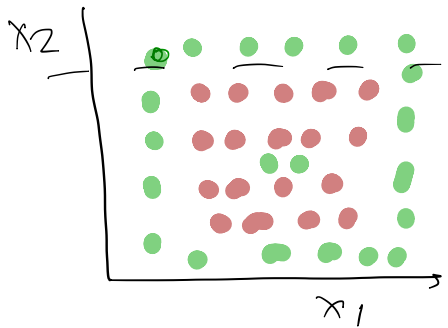
9 JAN 2019

Q. learn a decision tree



VERY DEEP TREE
BAD??
⇒ VERY COMPLEX
⇒ POOR AT GENERALISAT^N

BIAS & VARIANCE



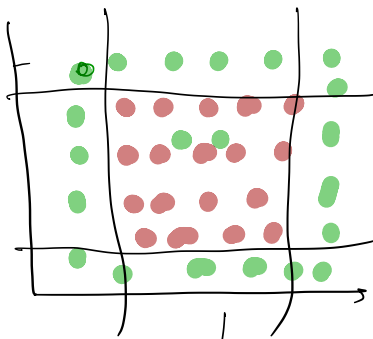
UNDERFITTING

(OR HIGH BIAS)

Only depth 1 decision tree

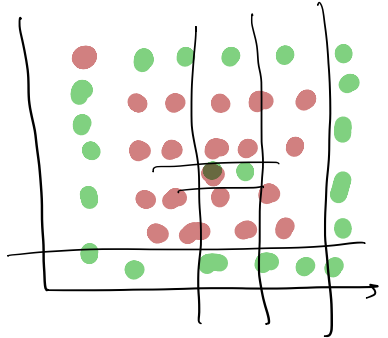


Very biased incorrect assumption



GOOD / PERFECT

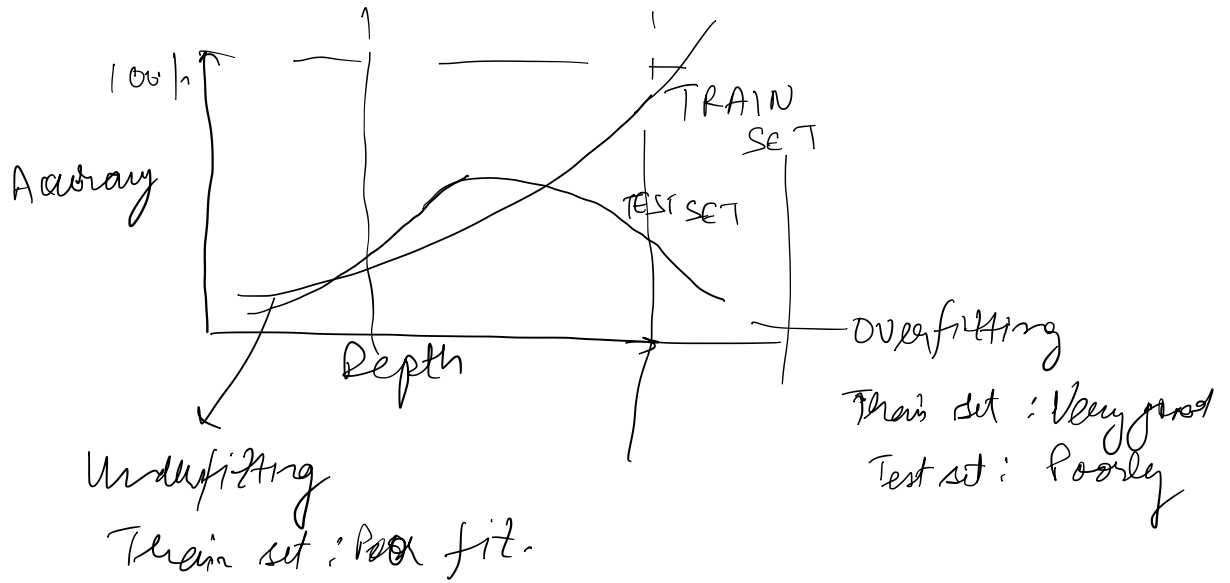
Even small changes in data lead to very different models



OVERFITTING (HIGH VARIANCE)

Tree T1 on S

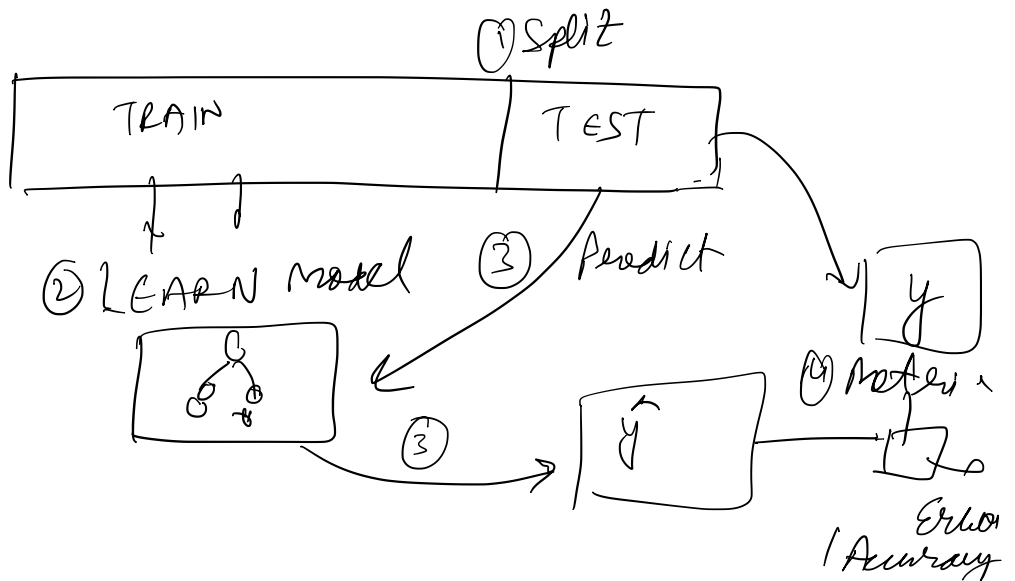
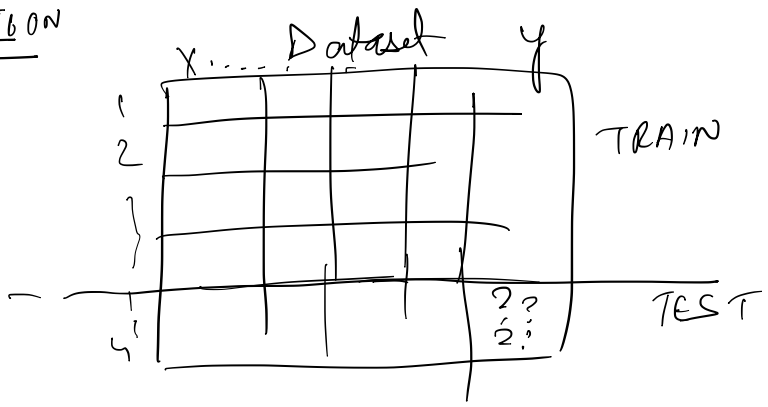


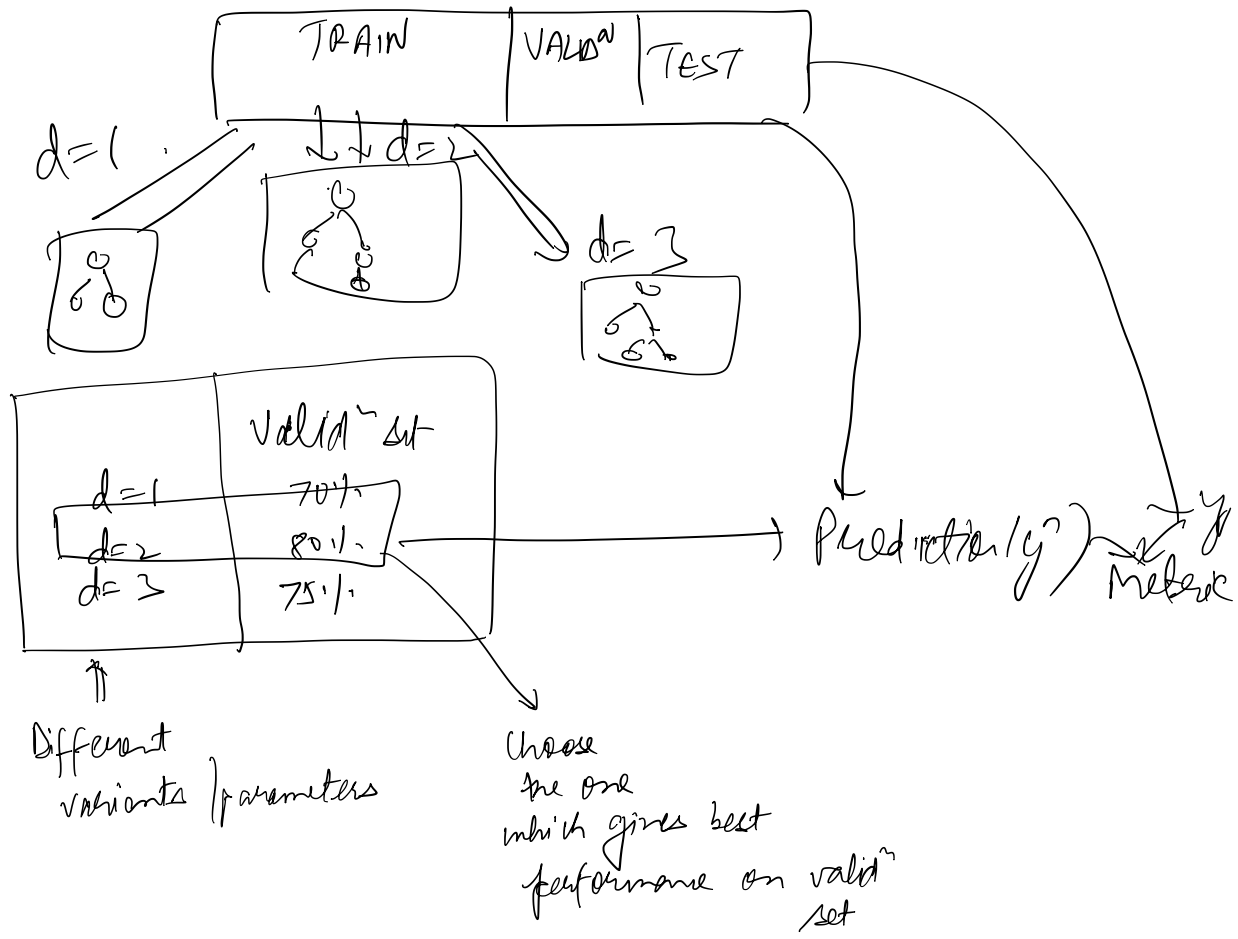


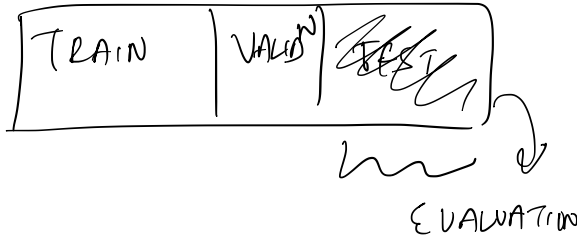
Questⁿ

How do you choose optimal depth?

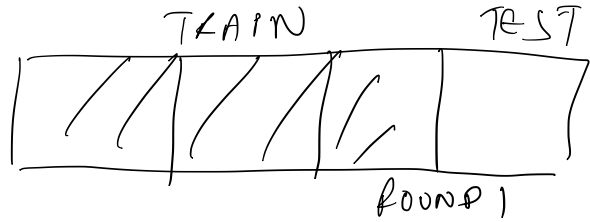
CROSS-VALIDATION



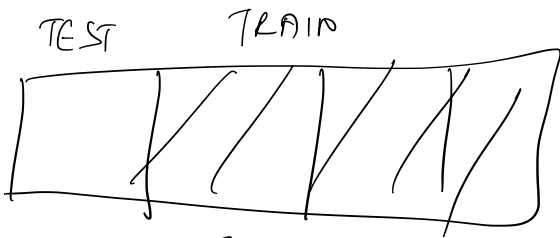




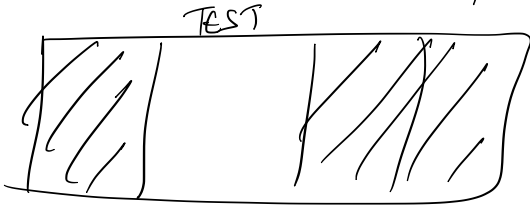
K-FOLD
CROSS
VALIDATION



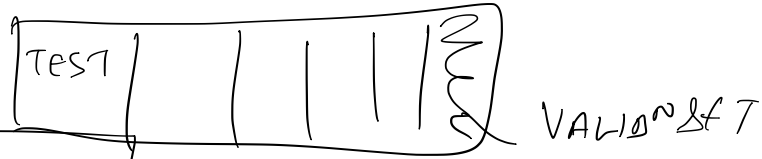
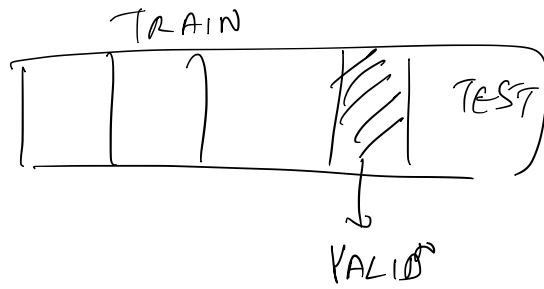
(K=4)



ROUND 2



ROUND 3

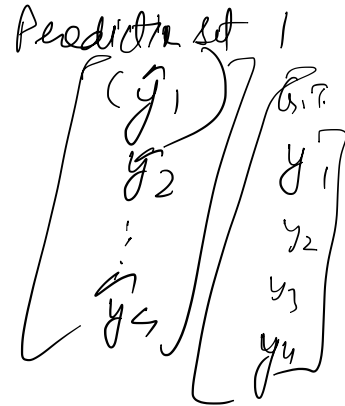


FOLD	ACURACY
1	80
2	90
3	70
4	60

Depth = 1
 Depth = 3
 Depth = 4
 Depth = 100

FOLD 1

FOLD



Overall Mean(Accuracy)

FOLD	PREDICTION	G.T.	ACCURACY
1	\hat{y}_1	y_1	90%
2	\hat{y}_2	y_2	80%
3	\hat{y}_3	y_3	70%
4	\hat{y}_4	y_4	60%

① Mean (90%, 80, 70, 60)

② Pred. $\begin{bmatrix} \hat{y}_1 \\ \hat{y}_2 \\ \hat{y}_3 \\ \hat{y}_4 \end{bmatrix}$ G.T. $\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_4 \end{bmatrix}$

$$\hat{y}_1 = \begin{bmatrix} 10 \\ 20 \end{bmatrix}$$

$$y_1 = \begin{bmatrix} 10 \\ 20 \end{bmatrix}$$

$$\hat{y}_2 = \begin{bmatrix} 30 \\ 40 \end{bmatrix}$$

...

$$\begin{bmatrix} \hat{y}_1 \\ 10 \\ 20 \\ 30 \\ 40 \\ \vdots \end{bmatrix}$$

$$y = \begin{bmatrix} 10 \\ 20 \\ \vdots \end{bmatrix}$$

METRIC