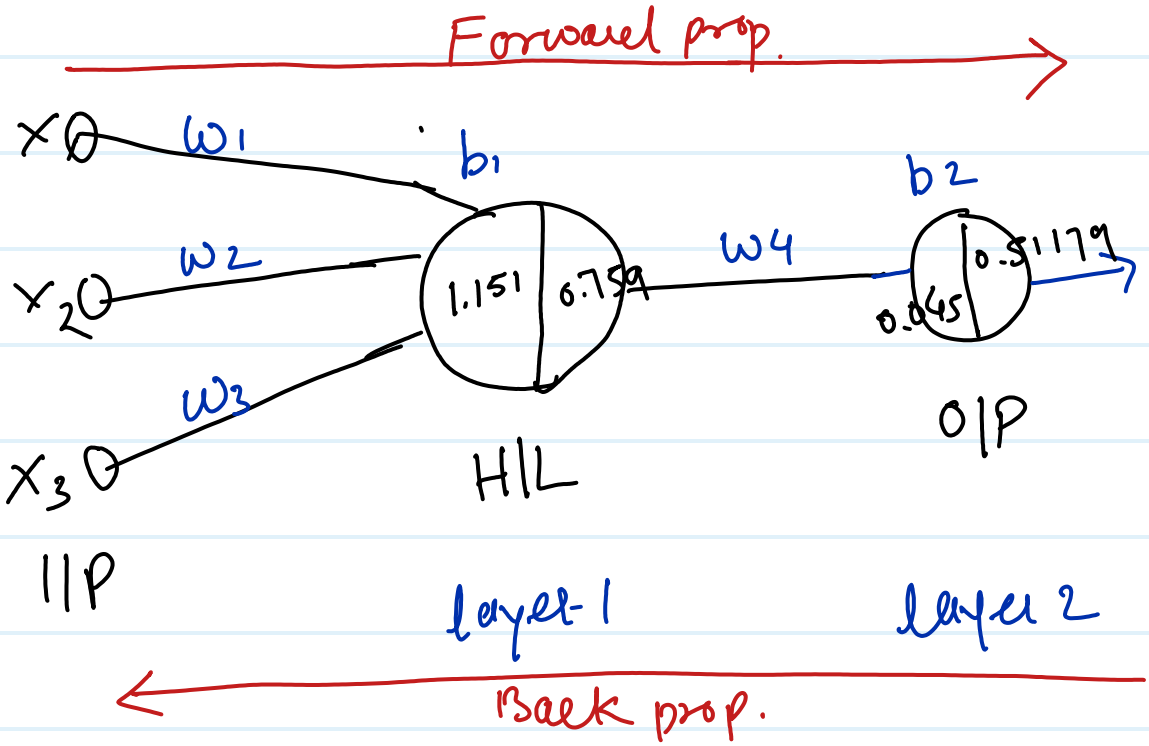
2 layer Neural Network



x_1	x_2	x_3	y
95	4	4	1
100	5	2	1
95	2	7	0

Assume weight $w_1 = 0.01$

$w_2 = 0.02$

$w_3 = 0.03$

Assume bias $b_1 = 0.01$

step-I $Z = x_1 w_1 + x_2 w_2 + b$

$[y = mx + c]$

$$Z = 95 \times 0.01 + 4 \times 0.02 + 4 \times 0.03 + 0.01$$

$$\boxed{Z = 1.151}$$

step-II

$$\text{Activation funct} = \frac{1}{1 + e^{-Z}}$$

$$= \frac{1}{1 + e^{-1.151}}$$

$$\boxed{= 0.759}$$

Till first layer

2nd layer

Assume $w_4 = 0.02$ $\quad b_2 = 0.03$

$$Z = 0.759 \times 0.02 + 0.03$$

$$\boxed{Z = 0.04518}$$

$$\sigma = \frac{1}{1+e^{-0.045}}$$

$$\boxed{\sigma = 0.51129}$$

$$\underline{\text{Loss}} = y - \hat{y}$$

$$= 1 - 0.51129$$

$$\boxed{= 0.49}$$

Back propogation –

$$w_{4new} = w_{4old} - \eta \frac{\partial Loss}{\partial w_{4old}}$$

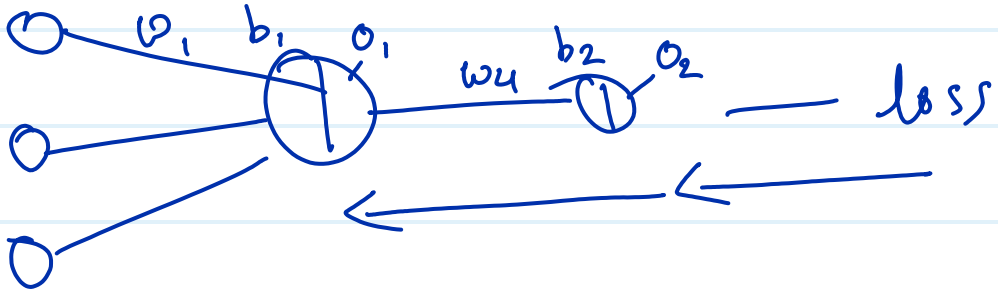
$$w_{4new} = 0.02 - \eta \frac{\partial 0.49}{\partial 0.02}$$

$$b_{2new} = b_{2old} - \eta \frac{\partial Loss}{\partial b_{2old}}$$

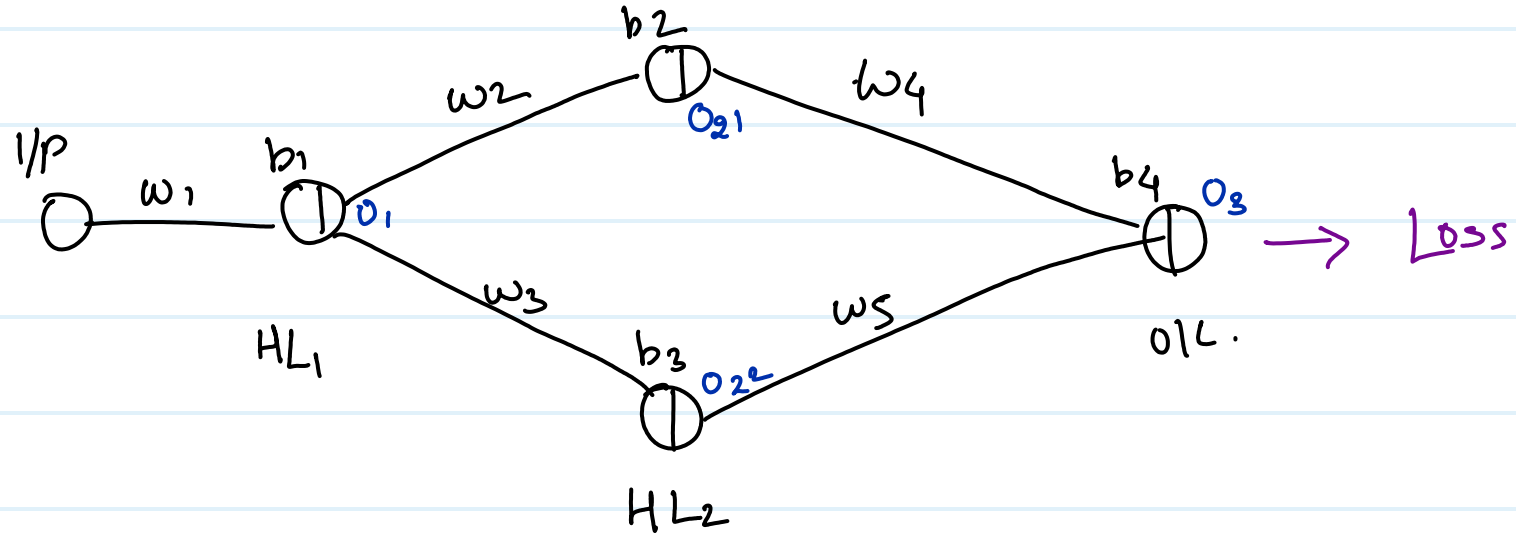
✡ chain Rule -

$$w_{1new} = w_{1old} - \eta \frac{\partial loss}{\partial w_{1old}}$$

$$\boxed{\frac{\partial loss}{\partial w_{1old}} = \frac{\partial L}{\partial O_2} \times \frac{\partial O_2}{\partial O_1} \times \frac{\partial O_1}{\partial w_{1old}}}$$



$$w_{3new} = w_{3old} - \eta \left[\frac{\partial L}{\partial O_2} \times \frac{\partial O_2}{\partial O_1} \times \frac{\partial O_1}{\partial w_{3old}} \right]$$



$$w_{2new} = w_{2old} - \eta \frac{\partial L}{\partial w_{2old}}$$

$$\frac{\partial L}{\partial w_{2old}} = \frac{\partial L}{\partial O_3} \times \frac{\partial O_3}{\partial O_{21}} \times \frac{\partial O_{21}}{\partial w_{2old}}$$

$$w_{1new} = w_{1old} - \eta \frac{\partial Loss}{\partial w_{1old}}$$

$$\frac{\partial Loss}{\partial w_{1old}} = \left[\frac{\partial L}{\partial O_3} \times \frac{\partial O_3}{\partial O_{21}} \times \frac{\partial O_{21}}{\partial O_1} \times \frac{\partial O_1}{\partial w_{1old}}\right] +$$

$$\left[\frac{\partial L}{\partial O_3} \times \frac{\partial O_3}{\partial O_{22}} \times \frac{\partial O_{22}}{\partial O_1} \times \frac{\partial O_1}{\partial w_{1old}}\right]$$