Problem 1

steps in solving single layer perceptron

$\alpha = 0.4$ → Given.

y → actual o/p

yout → predicted o/p

given table

x_1	x_2	bias	y	yout	error	w_1 0.2	w_2 0.3	w_0 −0.5
0	0	1	0	0	0	0.2	0.3	−0.5
0	1	1	1	0	1	0.2	0.7	−0.1
1	0	1	1	1	0	0.2	0.7	−0.1
1	1	1	1	1	0	0.2	0.7	−0.1

S_1: Understand the problem

S_2: Initialize the Nlw parameter (Neural Network)

→ i) epochs (iii) learning rate η

ii) bias i/p iv) I/p weights / bias weights

↓

also called as threshhold.

S_3: Start the training process.

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For each iteration (epochs) perform the following,

i) Compute the summation.

$f(x) = x_1 * w_1 + x_2 * w_2 + bias * w_0$

ii) Apply activation function → unit step sigmoid fn.

$$y_{out} = \begin{cases} 1 & f(x) > 0 \\ 0 & f(x) \leq 0 \end{cases}$$

iii) Update the input & bias weights

$error = y - y_{out}$

$w_1 = w_1 + (l) * error * x_1$

$w_2 = w_2 + (l) * error * x_2$

$w_0 = w_0 + (l) * error * bias.$

1) $f(x) = (0 * 0.2) + (0 \times 0.3) + (1 \times -0.5) =$

$f(x) = -0.5 = -0.5$

$y_{out} = 0$

error $\Rightarrow y - y_{out} \Rightarrow 0 - 0 = 0.$ → no updation for weights required.

2) $f(x) = (0 \times 0.2) + (1 \times 0.3) + (1 \times (-0.5))$

$= 0.3 - 0.5 = -0.2$

$y_{out} = 0.$

error $= y - y_{out} = 1 - 0 = 1.$ → so update weights

$w_1 = 0.2 + 0.4 * 1 * 0$

$= 0.2$ //

$w_2 = 0.3 + 0.4 * 1 * 1 = 0.7$

$w_0 = -0.5 + 0.4 * 1 * 1 = -0.1$

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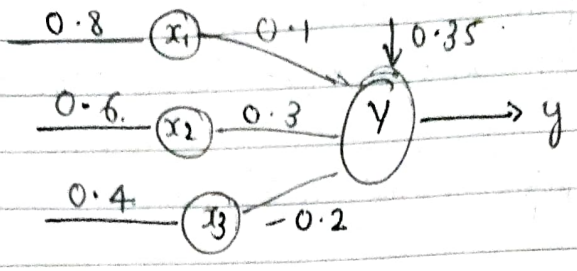
Ex for Sigmoid.

Problem 2



$y = x_1 w_1 + x_2 * w_2 + x_3 w_3 + b \cdot w_b$.

$= (0.8 \times 0.1) + (0.6 \times 0.3) + (0.4 \times -0.2) + 0.35$

$= 0.18 + 0.35$

$= 0.53$

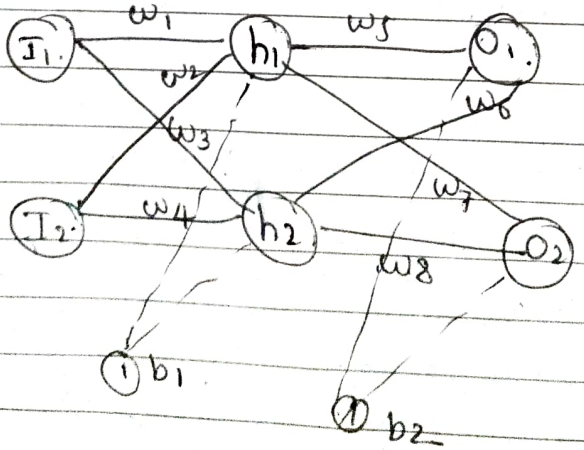
Applying sigmoid function

$$f(x) = \frac{1}{1+e^{-x}} = \frac{1}{1+e^{-0.53}}$$

$= 0.63$

$\approx 1.$

Backpropogation derivation & working with ex



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$b_2 w = 0.6$

$b_1 w = 0.35$ (weight for bias)

$w_1 = 0.15$
$w_2 = 0.20$
$w_3 = 0.25$
$w_4 = 0.30$
$w_5 = 0.40$
$w_6 = 0.45$
$w_7 = 0.50$
$w_8 = 0.55$ (~~weight of bias~~)

$x_1 = 0.05$
$x_2 = 0.10$

$h_1 = x_1 * w_1 + x_2 * w_2 + b_1 * w$
$= (0.05 \times 0.15) + (0.10 \times 0.20) + (0.35 \times 1)$
$= 0.3775$

$\text{Out } h_1 = \frac{1}{1+e^{-h_1}} = \frac{1}{1+e^{-0.3775}} = 0.59326$

$h_2 = x_1 * w_3 + x_2 * w_4 + b_1 * w$
$= (0.05 \times 0.25) + (0.10 \times 0.30) + (1 \times 0.35)$
$= 0.3925$

$\text{Out } h_2 = \frac{1}{1+e^{-h_2}} = \frac{1}{1+e^{-0.39}} = 0.5968$

$o_1 = \text{Out } h_1 * w_5 + \text{out } h_2 * w_6 + b_2 \times w$
$= (0.59 \times 0.40) + (0.59 * 0.45) + (1 \times 0.6)$
$o_1 = 1.10$

$\text{Out } o_1 = \frac{1}{1+e^{-1.10}} = 0.75$

$o_2 = (\text{out } h_1 * w_7) + \text{Out } h_2 * (w_8 + b_2 * w)$
$= 0.7729$