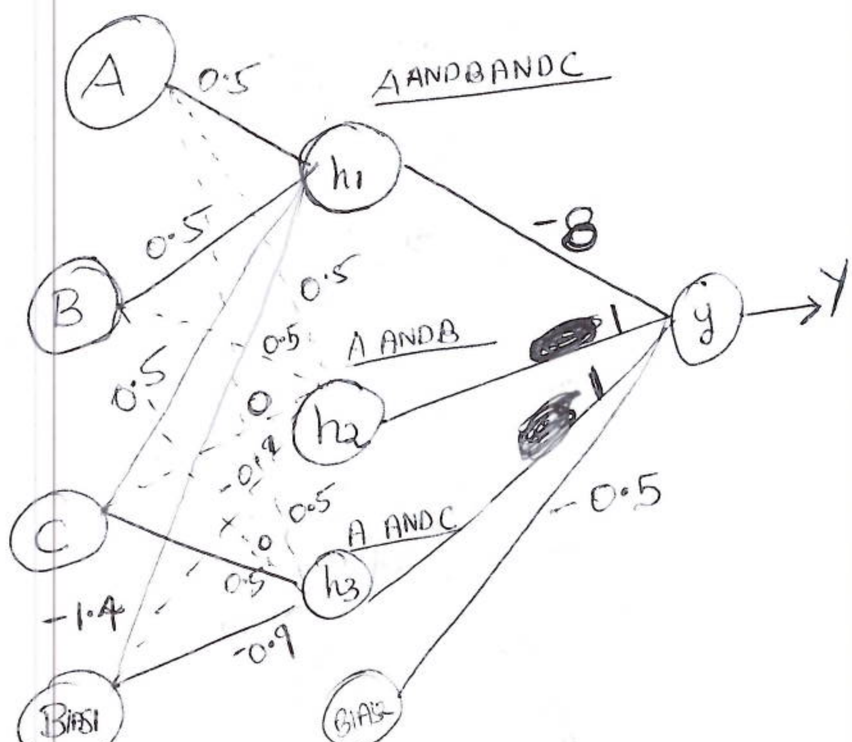
1) 1)

A	B	C	Y
1	1	1	0
1	1	0	1
1	0	1	1
1	0	0	0
0	1	1	0
0	1	0	0
0	0	1	0
0	0	0	0



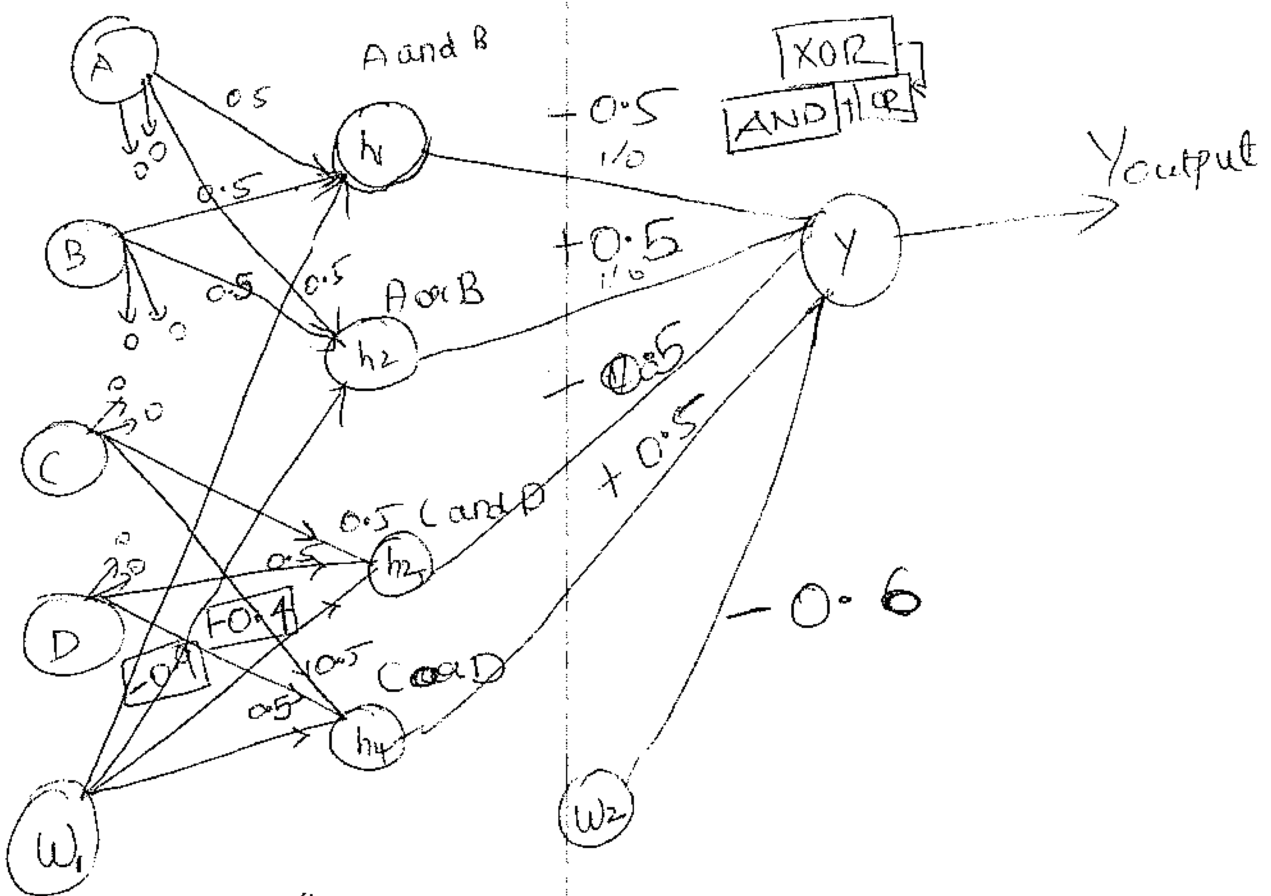
2)

A	B	C	D	Y
1	1	1	1	0
1	1	1	0	0
1	1	0	1	0
1	1	0	0	0
1	0	1	1	0
1	0	1	0	1
1	0	0	1	1
1	0	0	0	0
0	1	1	1	0
0	1	0	1	1
0	1	1	0	1
0	1	0	1	1
0	1	0	0	0
0	0	1	1	0
0	0	1	0	0

0 0 1 0 0 → 0 0 0 0 0

0 0 0 1 0

1)b) continued



$wh_1 = -0.9$

$wh_2 = -0.4$

$wh_3 = -0.9$

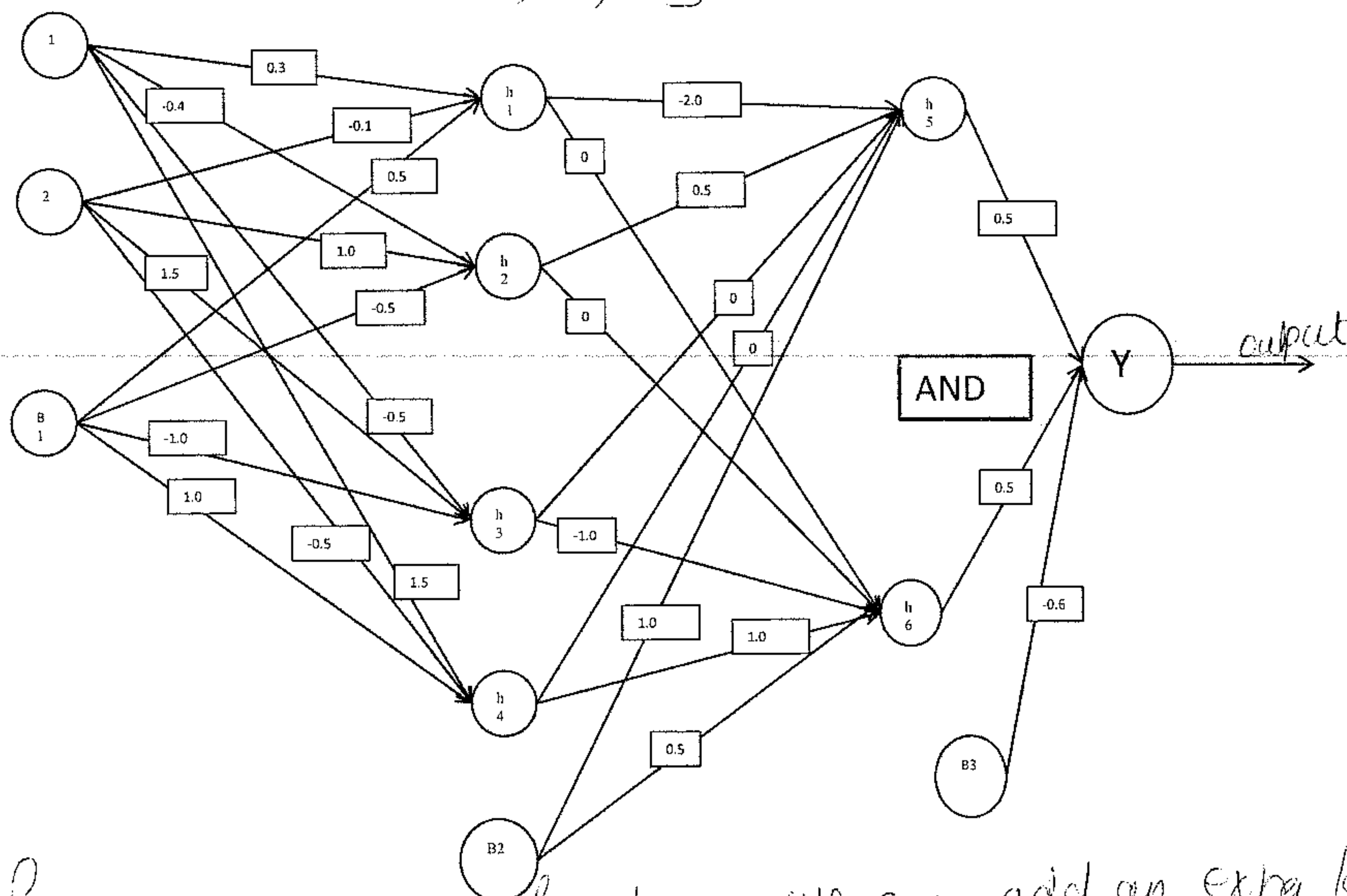
$wh_4 = -0.4$

2.Extra credit

2)
Extra Credit

h_1, h_2, h_3, h_4 } Activation function $f(x) = a \tanh(bx)$; $a = 1.716$, $b = 2/3$

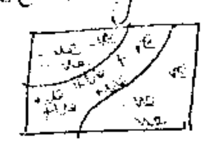
h_5, h_6, Y } linear threshold @ zero (step function)



Since we need 2 decision boundarys we can add an extra layer (hidden) and use the AND perceptron in the end. ∴

-ve	-ve	-ve
+ve	-ve	-ve
-ve	+ve	-ve
+ve	+ve	+ve

}



3)

a) <u>Proof</u>

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

$$f'(x) = \left(\frac{1}{1+e^{-x}}\right)^2 e^{-x}(-1)$$

$$= \left(\frac{1}{1+e^{-x}}\right)\left(\frac{1}{1+e^{-x}}\right)(-e^{-x})$$

$$= \left(\frac{1}{1+e^{-x}}\right) \times \left(\frac{-e^{-x}}{1+e^{-x}}\right)$$

$$\left(\frac{1}{1+e^{-x}}\right) \rightarrow f(x)$$

$$\left(\frac{-e^{-x}}{1+e^{-x}}\right) \rightarrow 1-f(x) = 1 - \frac{1}{1+e^{-x}}$$

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

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

$$\underline{f'(x) = f(x) \times [1-f(x)]}$$

(b) $x_1 = -0.5$ $x_2 = 1$

$f(x) = \dfrac{1}{1+e^{-x}}$ $h(x) = f'(x) = \dfrac{e^x}{(1+e^x)^2}$

$h_1 = -6$ $H_1 = f(h_1) = 0.0025$

$h_2 = 6.1$ $H_2 = f(h_2) = 0.9978$ $\eta = 0.1$

$y = 5H_1 + 5.2H_2 = 5.2007$

$Y = \text{Output} = f(y) = \underline{\underline{0.9945}}$

(C)

(a) $\Delta w_2 = \eta \times (t - Y) \times h(y) \times H2$

$= 0.1 \times (0.9 - 0.9945) \times h(5.2007) \times 0.9978$

$= \underline{-5.1418 \times 10^{-5}}$ $\boxed{\text{Ans}}$

(b) $\Delta w_1 = \eta \times (t - Y) \times h(y) \times H_1$

$= 0.1 \times (0.9 - 0.9945) \times h(5.2007) \times 0.0025$

$= \underline{-1.2742 \times 10^{-7}}$

(~~B~~)

Changed weights= $w_{\cancel{2}} = 5 + \Delta w_1 = 5.000\ldots$

$w_2 = 5.2 + \Delta w_2 = 5.1999\ldots$

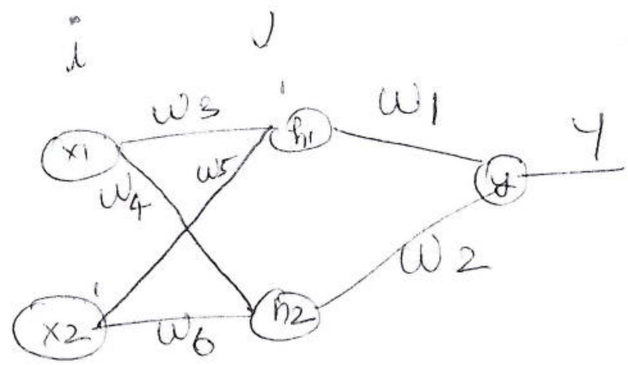
$\therefore \Delta w_3 = \eta \left[\sum_1 (t - Y) f'(y) \text{ changed weight } 1 \right] h(h_j)(x_1)$

$= 0.1 \times (0.9 - 0.9945) \times h(y) \times w_{1new} \times h(h_1) \times x_1$

$= \boxed{3.177 \times 10^{-7}}$

Extra Credit

For first Propogation



$\Delta w_1 = -1.2742 \times 10^{-7}$

$\Delta w_2 = $ 5.148 x 10^-5

$\Delta w_3 = 3.177 \times 10^{-7}$

$\Delta w_4 = \cancel{3.3048 \times 10^{-7}}$ 2.9917×10^{-7}

$\Delta w_5 = -6.3554 \times 10^{-7}$

$\Delta w_6 = -5.9834 \times 10^{-7}$

New weights

$w_1 \simeq 5$ $w_2 \sim 5.199$ $w_3 \simeq 4$ $w_4 \simeq -3$

$w_5 \simeq 4$ $w_6 \simeq 4.6$

Using MATLAB

↳ New Output

= 0.99452007

Old Output

= 0.99451766

} Error did not decrease significantly.