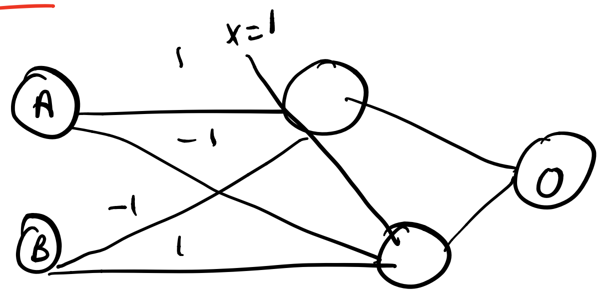
Kubra Iqbal - Homework 1

4.2

$A \text{ OR } B = (A \wedge \neg B) \vee (\neg A \wedge B)$

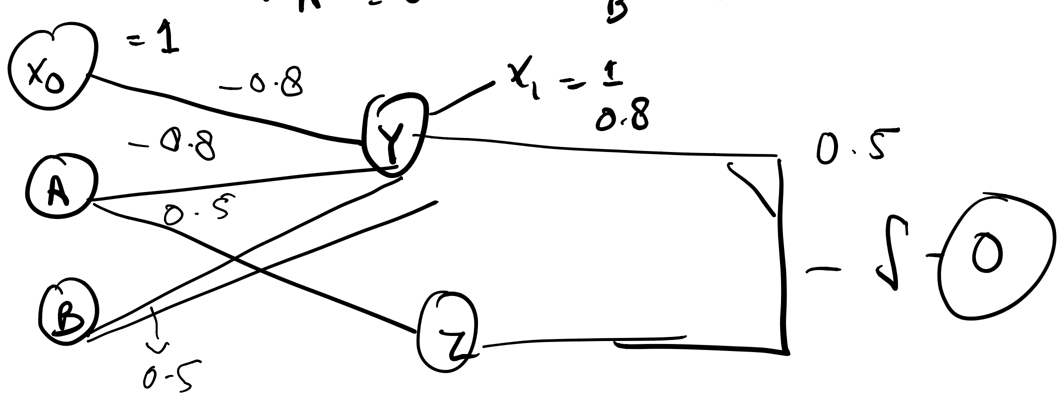


A	B
1	1
1	-1
-1	1
-1	-1

A	B	$\neg A$	$\neg B$	$A \wedge \neg B$	$\neg A \wedge B$	$(A \wedge \neg B) \vee (\neg A \wedge B)$
1	1	-1	-1	-1	-1	-1
1	-1	-1	1	1	-1	1
-1	1	1	-1	-1	1	1
-1	-1	1	1	-1	-1	-1

$A \wedge \neg B$

$W_x = -0.8 \quad W_A = 0.5 \quad W_B = -0.5$



A	B	$A \wedge \neg B$
1	1	-1
1	-1	1
-1	1	-1
-1	-1	-1

$\neg A \wedge B$

A	B	$\neg A \wedge B$
1	1	-1
1	-1	-1
-1	1	1
-1	-1	-1

$W_{x_0} = 0.8$

$W_A = 0.5$

$W_B = -0.5$

$\langle \langle -1, 1 \rangle, -1 \rangle$

$(1)(-0.8) + (1)(-0.5) + (1)(0.5)$

$= -0.8 \rightarrow -1$

$\langle \langle 1, -1 \rangle -1 \rangle$

$(1)(-0.8) + (1)(-0.5) + (-1)(0.5)$

$= -1.8 \rightarrow -1$

$(1)(-0.8) + (-1)(-0.5) + (1)(0.5) = 0.2$ — (1)

$(1)(-0.8) + (-1)(-0.5) + (-1)(0.5) = -0.8$ — (2)

$Y = A \wedge \neg B$	$Z = \neg A \wedge B$	$(A \wedge \neg B) \vee (\neg A \wedge B)$
-1	-1	-1

1	-1	1
-1	1	1
-1	-1	-1

$W_{x_1} = 0.8 \qquad W_y = 0.5 \qquad W_2 = 0.5$

$(1)(0.8) + (-1)(0.5) + (-1)(0.5)$

$= -0.2$

$(1)(0.8) + (1)(0.5) + (-1)(0.5)$

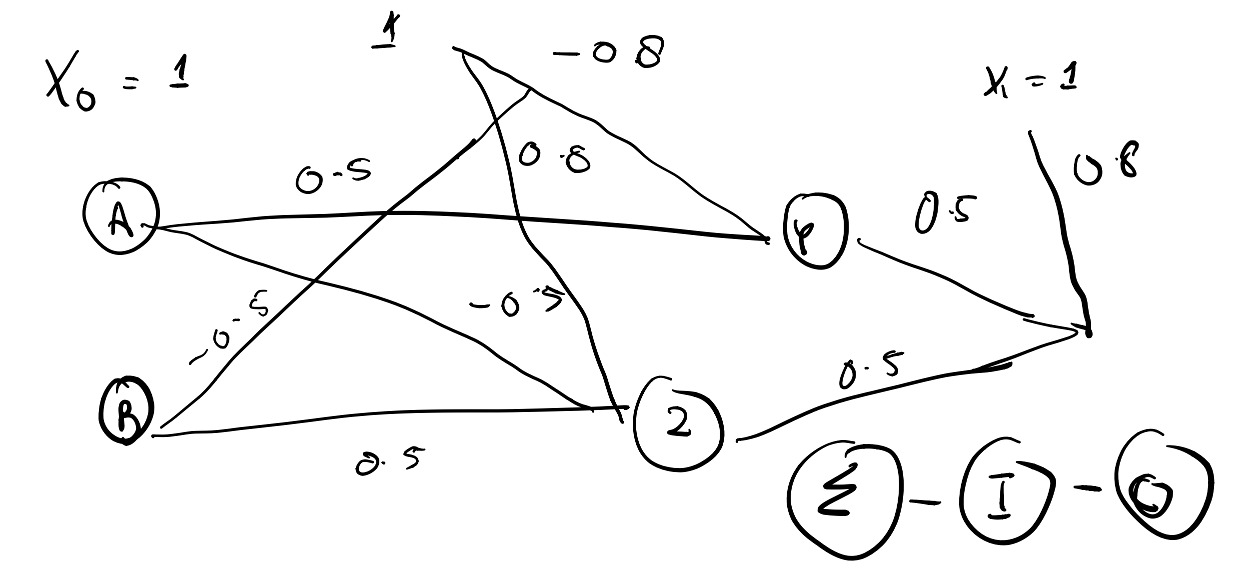
$= 0.8$

$\langle\langle -1, 1\rangle, 1\rangle$

$(1)(0.8) + (-1)(0.5) + (1)(0.5)$

$= 0.8$

$(-1)(0.8) + (-1)(0.5) + (-1)(0.5) = -1.8 - -1$



4.5 $O = w_0 + w_1 x_1 + w_1 x_1^2 + \dots + w_n x_n + w_n x_n^2$

$$\frac{\partial E}{\partial w_i} = \sum (out_x - O_x) \frac{\partial}{\partial w_i} (out_x - (w_0 + w_1 x_{1x} + w_1 x_{1n}^2 + \dots w_n x_{nx} + w_n x_{nx}^2))$$

$$= \sum (out_x - O_x)(-x_{ix} - x_{ix}^2)$$

The gradient descent training rule is —

$$\frac{\partial E}{\partial w_i} = \sum (out_x - O_x) \frac{\partial}{\partial w_i} (out_x - [w_0 + w_1 x_1 + w_1 x_{1x}^2 + \dots + w_n x_{nx} + w_n x_{nx}^2))$$

$$= \sum (out_x - O_x)(-x_{ix} - x_{1x}^2)$$

$$= \eta \sum_d (out_x - O_x)(x_{ix} + x_{1x}^2)$$

$$= w_i + \eta \sum_d (out_x - O_x)[x_{ix} + x^i x^2)$$

$$= \frac{1}{2} \sum 2 (out_x - O_x)^2 / 2 w_0 (out_x - w_0)$$

$$= \sum_2 (out_x - O_x)(w_0 (out_x - w_0)$$

$w_i = w_i + \Delta w_i$

(1) when $x_0 = 1$: $w_0 = w_0 + n \sum (out_x - O_x)$

(2) $w_i = w_i + n \sum (out_x + O_x)(X_{i\Delta} + x_{i\Delta})^2$