Homework-3

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AXV22006 2

Question 1

1. $e_1 < e_2$ is more likely as ~~the~~ in the case of e_2 only 16 examples are taken and in the case of e_1 20 examples are taken as for training data.

4. $e_1 > e_3$ is more likely as e_3 takes 1000 examples and e_1 only takes 20 examples hence error estimate is more in method 1 than in method 3.

6. $e_2 > e_3$ is more likely as method 2 e_2 takes only 16 examples & method 3 takes 1000 examples for training data.

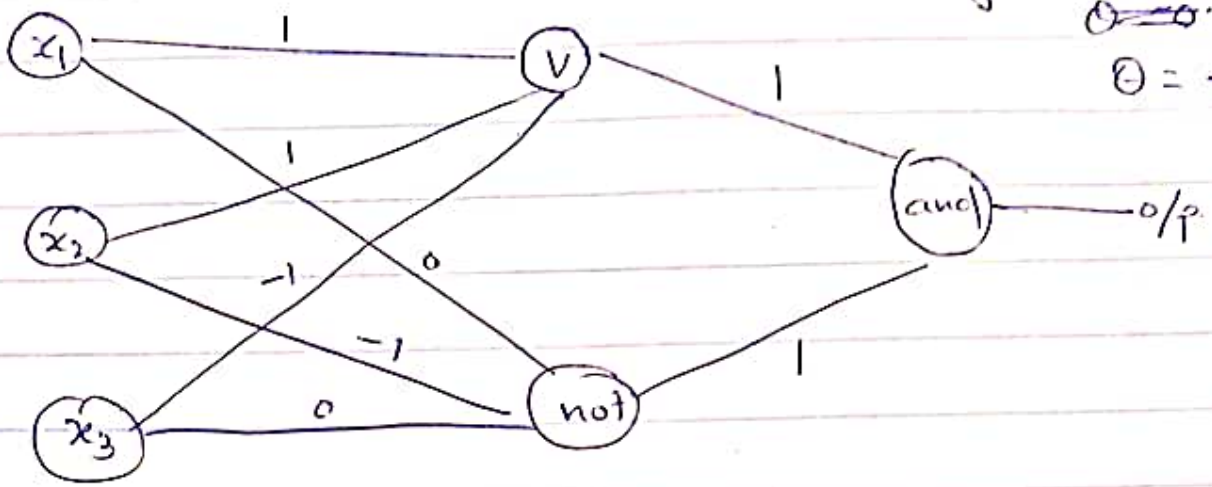
(2)

x_1	x_2	x_3	$\overline{x_3}$	z_1: $x_1 \vee x_2 \vee \overline{x_3}$	$\overline{x_2}$	$z_1 \wedge \overline{x_2}$
0	0	0	1	1	1	1
0	0	1	0	1	1	1
0	1	0	1	1	0	0
0	1	1	0	1	0	0
1	0	0	1	1	1	1
1	0	1	0	1	1	1
1	1	0	1	1	0	0
1	1	1	0	1	0	0

Question 2 :-

$$\begin{cases} 0 & \text{for } y \le 0 \\ 1 & \text{for } y \ge 0 \end{cases}$$

$\theta = -0.5$



Question ③

Given $o = g(h) = \frac{1}{1+|h|}$

Case(i) :- $h \leq 0$

$$o = g(h) = \frac{1}{1-h}$$

$$g'(h) = \frac{-1}{(1-h)^2}$$

$$g'(h) = -o^2$$

Case(ii) :- $h > 0$

$$o = g(h) = \frac{1}{1+h}$$

$$g'(h) = \frac{1}{(1+h)^2}$$

$$g'(h) = o^2$$

$$g'(h) = \begin{cases} -o^2 & \text{if } h \leq 0 \\ o^2 & \text{if } h > 0. \end{cases}$$

Delta update rule:

$$\Delta w_i = w_i + e\delta x_i$$

If $h \leq 0$ $\quad \Delta w_i = w_i + e(y-o) \times g'(h) x_i$

$$\Delta w_i = w_i - e o^2 (y-o) x_i$$

If $h > 0$ $\quad \Delta w_i = w_i + o^2 (y-o) x_i$

$$\delta = \begin{cases} -o^2(y-o) & \text{for } h \leq 0 \\ o^2(y-o) & \text{for } h > 0. \end{cases}$$

Question (4)

given $\beta = 1$

initial weights $W_1 = 0 \quad W_2 = 1$

for eg $x_1 = 2 \quad x_2 = 0$

$$Z = W_1 x_1 + W_2 x_2 = 0 \times 2 + 1 \times 0 = 0$$

$$\text{Sigmoid}(z) = \frac{1}{1 + e^{-z\beta}} = \frac{1}{2}$$

$$\text{error} = y - O$$

$$= 0 - \frac{1}{2}$$

$$\boxed{\text{error} = -0.5}$$

$$\boxed{\delta = 0.25 \times -0.5 = -0.125}$$

given $e = 0.1$

$$W_1' = W_1 + (0.1)(-0.125) \times 2$$

$$= W_1 - 0.025$$

$$= 0 - 0.025$$

$$\boxed{W_1' = 0.025}$$

$$\boxed{\text{Expression is } W_1' = W_1 + (0.1)(-0.125) \times 2}$$

$$W_2' = W_2 + (0.1)(-0.125)(0)$$

$$\boxed{\text{Expression } W_2' = W_2}$$

$$\boxed{W_2' = 1}$$