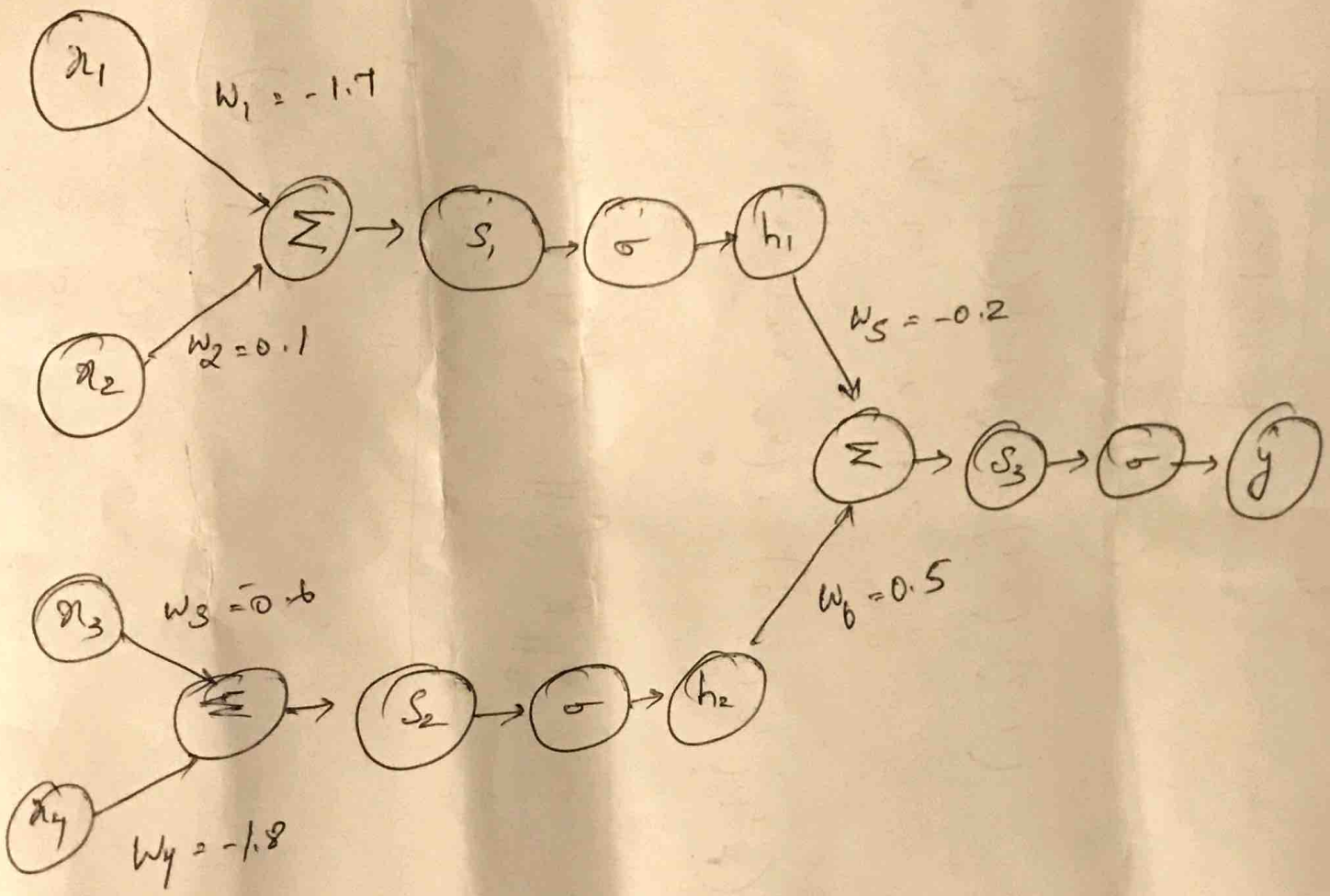
x_1
$W_1 = -1.7$
Σ
S_1
σ
h_1
x_2
$W_2 = 0.1$
$W_5 = -0.2$
Σ
S_3
σ
y
x_3
$W_3 = 0.6$
$W_6 = 0.5$
Σ
S_2
σ
h_2
x_4
$W_4 = -1.8$

input variable = x_1, x_2, x_3, x_4

Intermediate variable = h_1, h_2

O/P variable = $\hat{y}$

$S_1, S_2 \rightarrow$ Sum functions

$\sigma \rightarrow$ logistic function

$$\sigma(z) = \frac{1}{1+e^{-z}}$$

$$h_1 = \frac{1}{1+e^{-w_1 x_1 - w_2 x_2}}$$

L2 loss $L(y, \hat{y}) = \|\hat{y} - y\|^2$

$y = 0.5$

$(x_1, x_2, x_3, x_4) = (0.7, 1.2, 1.1, 2)$

$$S_1 = x_1 w_1 + x_2 w_2$$

$$S_1 = (0.7)(-1.7) + (1.2)(0.1)$$

$$S_1 = (-1.19) + (0.12)$$

$$\boxed{S_1 = -1.07}$$

$S_2 = x_3 w_3 + x_4 w_4$

$= (1.1)(-0.6) + (2)(-1.8)$

$= \boxed{-4.26}$

$S_3 = h_1 w_5 + h_2 w_6$

$= (0.255(-0.2)) + (0.013)(0.5))$

$= -(0.051) + (0.0065)$

$\boxed{S_3 = -0.0445}$

$\hat{y} = \dfrac{1}{1 + e^{-h_1 w_5 - h_2 w_6}}$

$= \dfrac{1}{1 + e^{-(0.255)(-0.2) - (0.013)(0.5)}}$

$= \dfrac{1}{1 + e^{0.051 - 0.0065}} = \dfrac{1}{1 + e^{0.0445}}$

$= \dfrac{1}{1 + 1.0450}$

$\hat{y} = 0.4889$

Given]

$h_1 = \dfrac{1}{1 + e^{-w_1 x_1 - w_2 x_2}}$

$h_1 = \dfrac{1}{1 + e^{-(-1.19) - (0.12)}}$

$\boxed{h_1 = 0.255}$

$h_2 = \dfrac{1}{1 + e^{-w_3 x_3 - w_4 x_4}}$

$h_2 = \dfrac{1}{1 + e^{-(-0.66) - (-3.6)}}$

$\boxed{h_2 = 0.013}$

Now, the gradient of L_2 Loss function

$$\frac{\partial \|\hat{y} - y\|^2}{\partial y} \text{ is } 2\|\hat{y} - y\| = \frac{\partial E}{\partial y}$$

Backward propagation

$$\frac{\partial E}{\partial w_1} = \frac{\partial E}{\partial \hat{y}} \times \frac{\partial \hat{y}}{\partial s_3} \times \frac{\partial s_3}{\partial h_1} \times \frac{\partial h_1}{\partial s_1} \times \frac{\partial s_1}{\partial w_1}$$

$$\frac{\partial E}{\partial w_1} = 2\|\hat{y} - y\| \times \sigma'(s_3) \times w_5 \times \sigma'(s_1) \times (x_1)$$

As $\left[\frac{\partial s_3}{\partial h_1} = w_5 \;\middle|\; \frac{\partial s_1}{\partial w_1} = x_1\right]$ ↑ Substituting the values in the

$$\frac{\partial E}{\partial w_1} = \left[2 \| 0.4899 - 0.5 \|)\right] \times \left[\sigma(s_3)(1 - \sigma(s_3))\right] \times \left[(-0.2)\right] \times \sigma(s_1)(1 - \sigma(s_1)) \times (0.7)$$

$$\sigma(s_3) = \frac{1}{1 + e^{-(-0.04405)}} = 0.4884$$

$$\sigma(s_1) = \frac{1}{1 + e^{-(-1.07)}} = 0.2554$$

$$\frac{\partial E}{\partial w_1} = \left[2 \| 0.4899 - 0.5 \|)\right] \times \left[(0.4884) / (1 - 0.4884)\right] \times 0.2 \times \left[(0.2554) / (1 - 0.2554)\right] \times 0.7$$

(3)

$$= [2(0.107)] \times [(0.4884)(1-0.484)] \times (0.2) \times ((0.2584)(1-0.2584)] \times (0.7)$$

$$= 0.214 \times 0.2520 \times 0.2 \times 0.1901 \times 0.7$$

$$= 0.0014$$