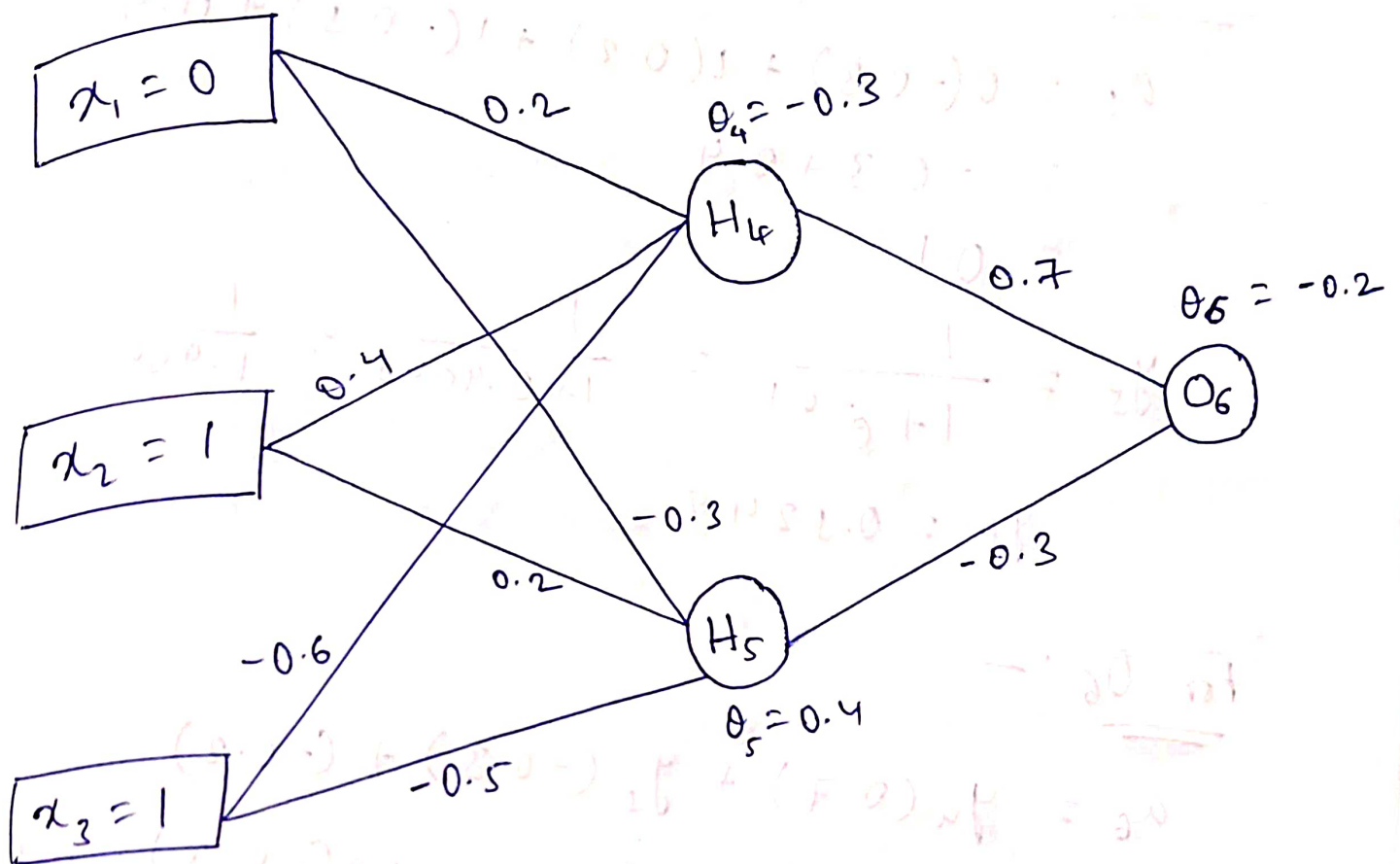


Om Shree  
2006077

$$\rightarrow m = \frac{7}{10} = 0.7$$



- Actual output ( $y$ ) = 1
- Learning rate = 0.9

First forward pass :  $\rightarrow$

For  $H_4$  :-

$$\begin{aligned} a_4 &= 0(0.2) + 1(0.4) + 1(-0.6) + (-0.3) \\ &= -0.2 - 0.3 \\ &= -0.5 \end{aligned}$$

$$y_4 = \frac{1}{1 + e^{-a_4}} = \frac{1}{1 + e^{0.5}} = \frac{1}{1 + 1.6487}$$

~~0.6487~~

$$y_4 = \frac{1}{2.6487} = 0.3775$$

For  $H_5$  :-

$$\begin{aligned} a_5 &= 0(-0.3) + 1(0.2) + 1(-0.5) + 0.4 \\ &= -0.3 + 0.4 \\ &= 0.1 \end{aligned}$$

$$y_5 = \frac{1}{1 + e^{-0.1}} = \frac{1}{1 + 0.9048} = \frac{1}{1.9048}$$

$$y_5 = 0.5249$$

For  $O_6$  :-

$$\begin{aligned} a_6 &= y_4(0.7) + y_5(-0.3) + (-0.2) \\ &= (0.3775)(0.7) + 0.5249(-0.3) - 0.2 \\ &= 0.2642 + (-0.1574) - 0.2 \\ &= -0.0932 \end{aligned}$$

$$y_6 = \frac{1}{1 + e^{-a_6}} = \frac{1}{1 + 1.0976} = \frac{1}{2.0976}$$

$$y_6 = 0.4767$$

$$y_b = O_b = 0.4767$$

$$\begin{aligned}\text{Error} &= 1 - 0.4767 \\ &= 0.5233 \quad [\text{for one forward pass}]\end{aligned}$$

• For first iteration of backpropagation

$$\begin{aligned}\delta_6 &= \text{output layer} = y_6(1-y_6)(1-0.4767) \\ &= 0.4767(0.5233)(0.5233) \\ &= 0.1305\end{aligned}$$

$$\begin{aligned}\delta_5 &= y_5(1-y_5)(w_{56} \cdot \delta_6) \\ &= (0.5244)(0.4751)(-0.3)(0.1305) \\ &= -0.00976\end{aligned}$$

$$\begin{aligned}\delta_4 &= y_4(1-y_4)(w_{46} \cdot \delta_6) \\ &= (0.3775)(0.6225)(0.7)(0.1305) \\ &= 0.02146\end{aligned}$$

$$\begin{aligned}\Delta w_{46} &= \eta \delta_4 O_6 = (0.9)(0.02146)(0.4767) \\ &= 0.009206\end{aligned}$$

$$\begin{aligned}w_{46}' &= w_{46} + \Delta w_{46} \\ &= 0.7 + 0.009206 \\ &= 0.709206\end{aligned}$$

$$\begin{aligned}\Delta w_{56} &= \eta \delta_5 O_6 = (0.9)(0.4767)(-0.00976) \\ &= -0.004187\end{aligned}$$

$$\begin{aligned}w_{56}' &= w_{56} + \Delta w_{56} \\ &= -0.3 - 0.004187 \\ &= -0.304187\end{aligned}$$

$$\Delta w_{14} = \eta \delta_4 x_1 = (0.9)(0) = 0$$

$$w_{14}' = w_{14} + \Delta w_{14} = 0 + 0.2$$

$$w_{14}' = 0.2$$

$$\Delta w_{15} = \eta \delta_5 x_1 = (0.9)(0) = 0$$

$$\Delta w_{15}' = 0 + (-0.3) = -0.3$$

$$\Delta w_{24} = \eta \delta_4 x_2 = (0.9)(0.02146)(1) = 0.0193$$

$$w_{24}' = w_{24} + \Delta w_{24} = 0.4 + 0.0193 = 0.4193$$

$$\Delta w_{25} = \eta \delta_5 x_2 = (0.9)(1)(-0.00876) = -0.00878$$

$$w_{25}' = w_{25} + \Delta w_{25} = -0.00878 + 0.2 = 0.19122$$

$$\Delta w_{34} = \eta \delta_4 x_3 = (0.9)(0.02146)(1) = 0.019314$$

$$w_{34}' = w_{34} + \Delta w_{34} = 0.019314 + (-0.4) = -0.3806$$



$$\Delta w_{35} = \eta \delta_5 \lambda_3 = (0.9)(-0.00976)(1) \\ = -0.00878$$

$$w_{35}' = w_{35} + \Delta w_{35} \\ = -0.5 + (-0.00878) \\ = -0.50878$$

$$\bullet \theta_6' = \theta_6 + \Delta \theta_6$$

$$\Delta \theta_6 = \delta_6 \theta_6 = (0.1305)(-0.2) \\ = -0.0261$$

$$\Rightarrow \theta_6' = -0.2 - 0.0261 \\ = -0.2261$$

$$\bullet \theta_5' = \theta_5 + \Delta \theta_5$$

$$\Delta \theta_5 = \delta_5 \theta_5 = (-0.00976)(0.4) \\ = -0.003904$$

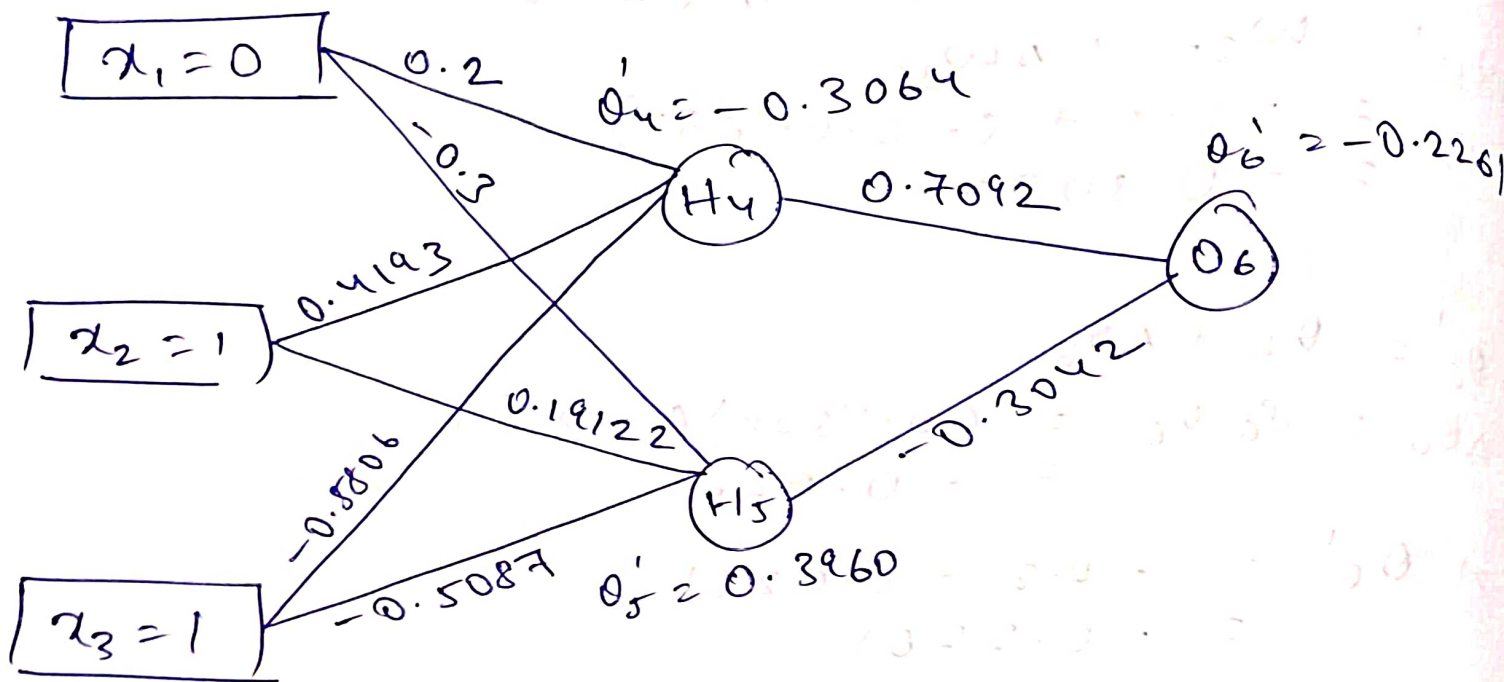
$$\Rightarrow \theta_5' = 0.4 - 0.003904 \\ = 0.396096$$

$$\bullet \theta_4' = \theta_4 + \Delta \theta_4$$

$$\Delta \theta_4 = \delta_4 \theta_4 = (-0.3)(0.02146) \\ = -0.006438$$

$$\Rightarrow \theta_4' = -0.3 - 0.006438 \\ = -0.306438$$

updated forward pass  $\rightarrow$



For  $H_4$ :-

$$\begin{aligned}
 a_4 &= 0(0.2) + 1(0.4193) + 1(-0.5806) - 0.3064 \\
 &= 0.4193 - 0.5806 - 0.3064 \\
 &= -0.4677
 \end{aligned}$$

$$y_4 = \frac{1}{1 + e^{0.4677}} = \frac{1}{2.5963} = 0.3851$$

For  $H_5$ :-

$$\begin{aligned}
 a_5 &= 0(-0.3) + 1(0.19122) + 1(-0.5087) + 0.3960 \\
 &= 0.1912 - 0.5087 + 0.3960 \\
 &= 0.0785
 \end{aligned}$$

$$y_5 = \frac{1}{1 + e^{-0.0785}} = \frac{1}{1.9245} = 0.5196$$

for  $O_6$  :-

$$\begin{aligned}a_6 &= y_4 \cdot w_{46} + y_5 \cdot w_{56} + \theta_6' \\&= (0.3851)(0.7092) + (0.5796)(-0.3042) \\&\quad - 0.2261 \\&= 0.27311 + (-0.15806) - 0.2261 \\&= -0.11106\end{aligned}$$

$$\begin{aligned}2) \quad O_6 &= \frac{1}{1 + e^{0.111}} = \frac{1}{1 + 1.11739} = \frac{1}{2.11739} \\&= 0.47227\end{aligned}$$

$$\begin{aligned}3) \quad \text{Error} &= 1 - 0.47227 \\&= 0.52773\end{aligned}$$

[After one back propagation]

\* These weights are not appropriate for this system.