

$$110011 = (11)_{10}$$

1.

a) $a_1^{(1)} = 2$ to initialize $z_1^{(1)} = 0.880797$

b) $a_3^{(1)} = 8$ to initialize $z_3^{(1)} = 0.9996645$

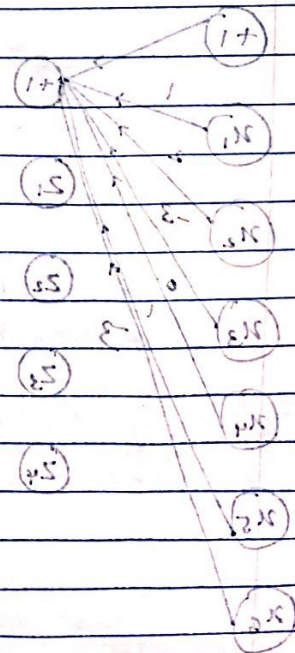
c) $b_2^{(1)} = 3.642966$

d) $\hat{y}_2^{(1)} = 0.26152113$

e) 0.63027784

f) 0.58249322

1	-5	5	1	= 8	5	1	0	-5	5	1	= 8
5	1	1	1		5	0	1	5	1	8	
1	1	1	5		1	5	5	5	5	5	
					5	5	1	5	0	1	



$$2. (a) E_{TOTAL} = \sum \frac{1}{2} (y - \hat{y})^2$$

$$\sum_{i=1}^n \frac{1}{2} (y_i - \hat{y}_i)^2 = 1$$

$$\frac{\partial E_{TOTAL}}{\partial w_1} = \frac{\partial E_{TOTAL}}{\partial y_{1,out}} \times \frac{\partial y_{1,out}}{\partial y_1} \times \frac{\partial y_1}{\partial w_1}$$

$$\Rightarrow \frac{\partial E_{TOTAL}}{\partial y_1}$$

$$y_{1,out} = z$$

$$y_1 =$$

$$\frac{\partial Loss}{\partial \beta_{2,1}} = \frac{\partial L}{\partial \hat{y}_2} \times \frac{\partial \hat{y}_2}{\partial b_2} \times \frac{\partial b_2}{\partial \beta_{2,1}}$$

$$\Rightarrow \frac{\partial}{\partial \hat{y}_2} [-y_1 \log \hat{y}_1 - y_2 \log \hat{y}_2 - y_3 \log \hat{y}_3] \times \frac{\partial}{\partial b_2} \left[\frac{\exp(b_2)}{(\exp(b_1) + \exp(b_2) + \exp(b_3))} \right]$$

$$+ \frac{\partial}{\partial \beta_{2,1}} \left[b_0 + \sum_{j=1}^4 \beta_{j,i} z_j \right]$$

$$= \frac{-y_2}{\hat{y}_2} \cdot \frac{\exp(b_2) (\exp(b_1) + \exp(b_2) + \exp(b_3)) - (\exp(b_2))^2}{(\exp(b_1) + \exp(b_2) + \exp(b_3))^2} \times z_1$$

$$\Rightarrow \frac{-y_2}{\hat{y}_2} \times \frac{\exp(b_2) (\exp(b_1) + \exp(b_3))}{(\exp(b_1) + \exp(b_2) + \exp(b_3))^2} \times z_1$$

$$= -0.3686 - 0.65045$$

$$\beta_{2,1} = \beta_{31} - \epsilon \frac{\partial L}{\partial \beta_{2,1}} = 1 - 1(-0.3686) = 1 + 0.65045$$

$$= 1.65045$$

$$(b) 1.7384 \Rightarrow 1 - \left(\frac{-y_2}{\hat{y}_2} \frac{\exp(b_2) (\exp(b_1) + \exp(b_3))}{(\exp(b_1) + \exp(b_2) + \exp(b_3))^2} \right)$$

2.

(c)

$$\frac{\partial L}{\partial \alpha_{3,4}} = \frac{\partial L}{\partial \hat{y}_1} \times \frac{\partial \hat{y}_1}{\partial b_1} \times \frac{\partial b_1}{\partial z_3} \times \frac{\partial z_3}{\partial a_3} \times \frac{\partial a_3}{\partial \alpha_{3,4}}$$

$$\frac{\partial L}{\partial \hat{y}_2} \times \frac{\partial \hat{y}_2}{\partial b_2} \times \frac{\partial b_2}{\partial z_3} \times \frac{\partial z_3}{\partial a_3} \times \frac{\partial a_3}{\partial \alpha_{3,4}}$$

$$+ \frac{\partial L}{\partial \hat{y}_3} \times \frac{\partial \hat{y}_3}{\partial b_3} \times \frac{\partial b_3}{\partial z_3} \times \frac{\partial z_3}{\partial a_3} \times \frac{\partial a_3}{\partial \alpha_{3,4}}$$

$$\alpha_{3,4} = \alpha_{3,4} - \eta \left[\frac{\partial L}{\partial \alpha_{3,4}} \right]$$

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$$(d) \alpha_{2,0} = \alpha_{2,0} - \eta \left[\frac{\partial L}{\partial \alpha_{2,0}} \right]$$