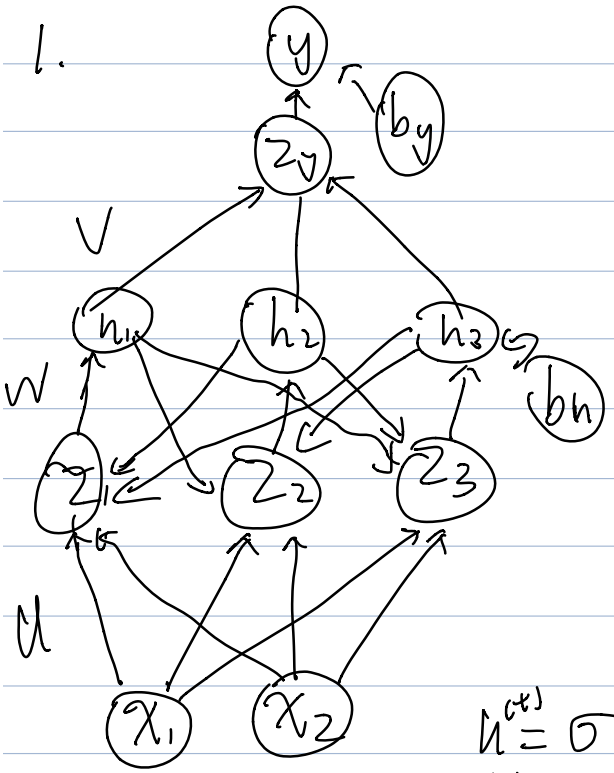
CSC321 Homework 5

1.



$b_y = -0.5$, $b_h = \begin{bmatrix} -0.5 \\ -1.5 \\ -2.5 \end{bmatrix}$

$U = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}$

$W = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

$V = [1, -2, 2]$

$h^{(t)} = \sigma(Ux^{(t)} + Wh^{(t-1)} + b_h)$

$y^{(t)} = Vh^{(t)}$

2. (a) $\overline{h^{(t)}} = \dfrac{\partial(i^{(t+1)} + f^{(t+1)} + o^{(t+1)} + g^{(t+1)})}{\partial h^{(t)}}$

$= \overline{i^{(t+1)}}(\sigma'(W_{ix}x^{(t+1)} + W_{ih}h^{(t)}))W_{ih}$
$+ \overline{f^{(t+1)}}(\sigma'(W_{fx}x^{(t+1)} + W_{fh}h^{(t)}))W_{fh}$
$+ \overline{o^{(t+1)}}(\sigma'(W_{ox}x^{(t+1)} + W_{oh}h^{(t)}))W_{oh}$
$+ \overline{g^{(t+1)}}(\sec^2(W_{gx}x^{(t+1)} + W_{gh}h^{(t)}))W_{gh}$

$\overline{c^{(t)}} = \dfrac{\partial(h^{(t)} + c^{(t+1)})}{\partial c^{(t)}}$

$= \overline{h^{(t)}}(o^{(t)}\sec^2(c^{(t)})) + \overline{c^{(t+1)}}f^{(t+1)}$

$$\overline{g^{(t)}} = \frac{\partial C^{(t)}}{\partial g^{(t)}} = \overline{C^{(t)}} \cdot i^{(t)}$$

$$\overline{o^{(t)}} = \frac{\partial h^{(t)}}{\partial o^{(t)}} = \overline{h^{(t)}} \cdot \tanh(C^{(t)})$$

$$\overline{f^{(t)}} = \frac{\partial C^{(t)}}{\partial f^{(t)}} = \overline{C^{(t)}} \cdot C^{(t-1)}$$

$$\overline{i^{(t)}} = \frac{\partial C^{(t)}}{\partial i^{(t)}} = \overline{C^{(t)}} \cdot g^{(t-1)}$$

(b) $$\overline{W_{ix}} = \sum_{t=1}^{T} \overline{i^{(t)}} \sigma'(W_{ix} x^{(t)} + W_{in} h^{(t-1)}) \cdot x^{(t)}$$