Q3

① Question 1 information helped with this question.

$$h_1 = \max\left[0, w_{11}x_1 + w_{21}x_2 + b_1\right]$$

$$h_2 = \max\left[0, w_{21}x_1 + w_{22}x_2 + b_2\right]$$

$$h_3 = \max\left[0, w_{13}x_1 + w_{23}x_2 + b_3\right]$$

$$h_4 = \max\left[0, w_{14}x_1 + w_{24}x_2 + b_4\right]$$

$$\therefore \hat{y} = \sigma\left[v_1h_1 + v_2h_2 + v_3h_3 + v_4h_4 + c\right]$$

where $\sigma(z)$

Loss Functn: $L(x, \theta) = -y \log \hat{y} - (1-y)\log(1-\hat{y})$

$$\frac{\sigma L}{\sigma v_i} = \frac{\sigma L}{\sigma \hat{y}} * \frac{\sigma \hat{y}}{\sigma z} * \frac{\sigma z}{\sigma v_i} = \left[\frac{-y}{\hat{y}} + \frac{1-y}{1-\hat{y}}\right]\hat{y}(1-\hat{y})h_i$$

$$\frac{\sigma L}{\sigma c} = \frac{\sigma L}{\sigma \hat{y}} * \frac{\sigma \hat{y}}{\sigma z} * \frac{\sigma z}{\sigma c} = \left[\frac{-y}{\hat{y}} + \frac{1-y}{1-\hat{y}}\right]\hat{y}(1-\hat{y})$$

$$\frac{\sigma L}{\sigma w_{ji}} = \frac{\sigma L}{\sigma \hat{y}} * \frac{\sigma \hat{y}}{\sigma z} * \frac{\sigma z}{\sigma h_j} * \frac{\sigma h_j}{\sigma w_{ji}} = \left[\frac{-y}{\hat{y}} + \frac{1-y}{1-\hat{y}}\right]\hat{y}(1-\hat{y})v_j x_i$$

$w_{j1}x_1 + w_{j2}x_2 + b_j > 0$ otherwise $\frac{\sigma L}{\sigma w_{ji}} = 0$