

# Problem 3

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08:52

③ a) 1)

$$\frac{1}{1 + \exp\left(-\left(W_3\left(\sigma\left(W_2\left(\sigma\left(W_1x + \beta_1\right) + \beta_2\right)\right) + \beta_3\right)\right)\right)}$$

$$x \in \mathbb{R}^{10 \times 1}$$

$$W_1 \in \mathbb{R}^{7 \times 10} \quad \beta_1 \in \mathbb{R}^{7 \times 1}$$

$$W_2 \in \mathbb{R}^{6 \times 7} \quad \beta_2 \in \mathbb{R}^{6 \times 1}$$

$$W_3 \in \mathbb{R}^{1 \times 6} \quad \beta_3 \in \mathbb{R}$$

$$\sigma = \max(x, 0) = \text{ReLU Function}$$

$\beta$  is bias and  $W$  are the weight matrices

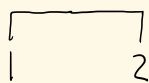
$$\text{Sigmoid Function} = \frac{1}{1 + e^{-x}}$$

2) The sigmoid Function in the output layer suggests this network should be used for binary classification. 0/1

$$3) (9+1) \cdot 7 + (7+1) \cdot 6 + (6+1) \cdot 1 = 125 \text{ parameters are estimated}$$

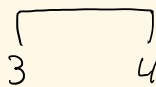
$$b) \begin{matrix} & 1 & 2 & 3 & 4 \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \end{matrix} & \begin{pmatrix} 0 & 3 & 5 & 7 \\ 3 & 0 & 6 & 4 \\ 5 & 6 & 0 & 5.5 \\ 7 & 4 & 5.5 & 0 \end{pmatrix} \end{matrix}$$

1) Fune 1 and 2 at height 3



$$\begin{matrix} 12 \\ \begin{pmatrix} 0 & 6 & 7 \\ 6 & 0 & 5.5 \\ 7 & 5.5 & 0 \end{pmatrix} \end{matrix}$$

2) Fune 3 and 4 at height 5.5



$$\begin{matrix} 12 & 34 \\ \begin{pmatrix} 0 & 7 \\ 7 & 0 \end{pmatrix} \end{matrix}$$

3) Fune 12 with 34 at height 7

Sketch:

