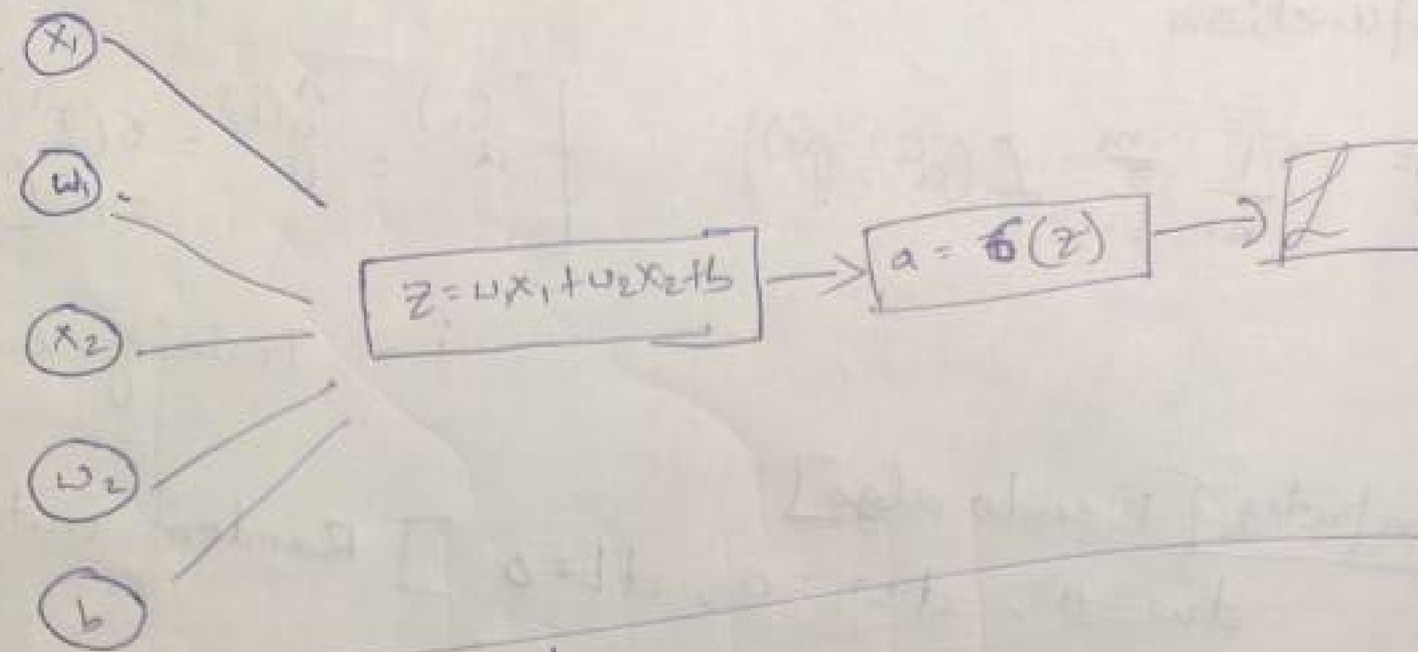
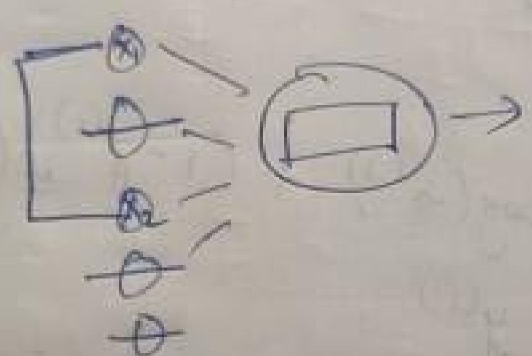
Lets see neural network

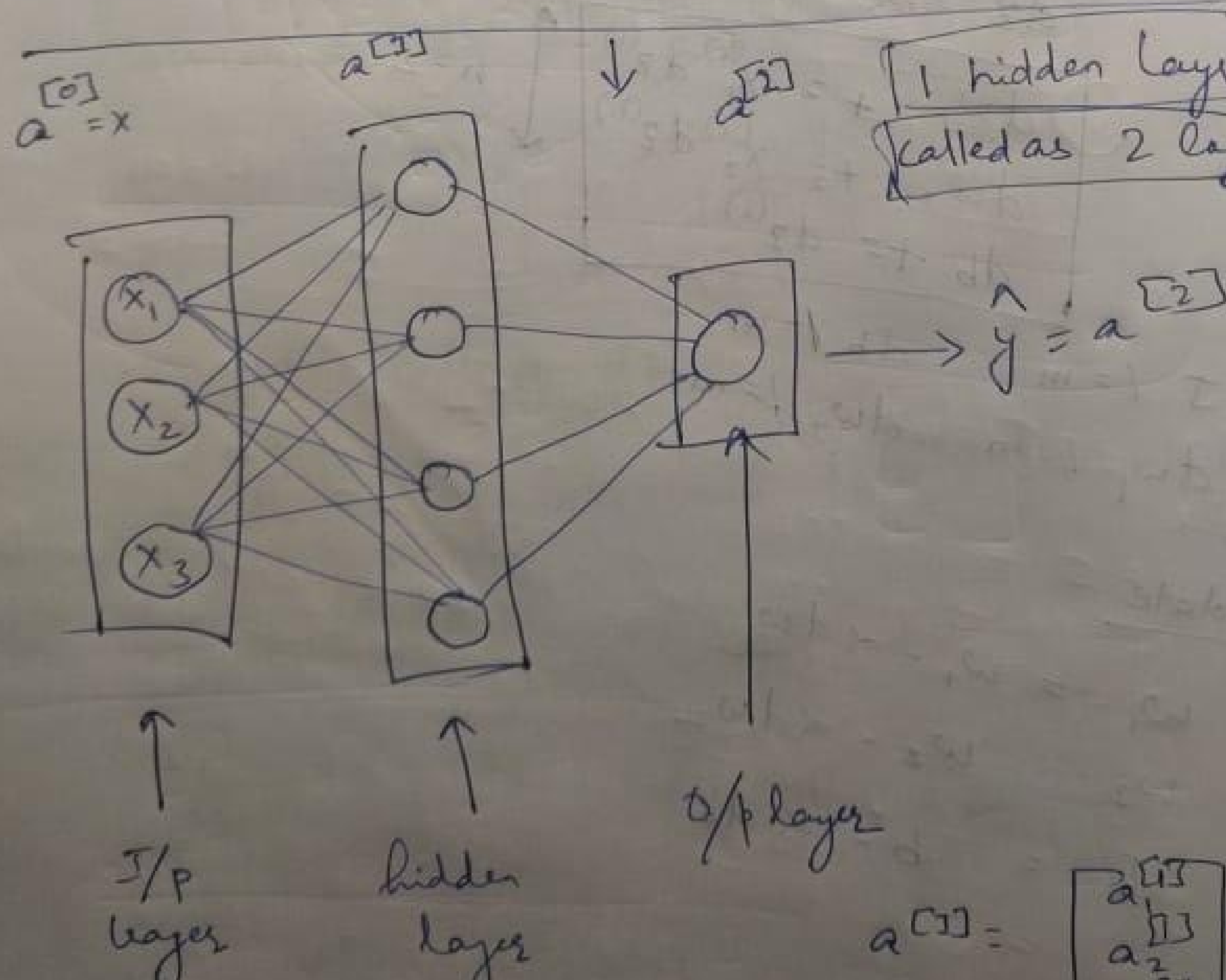




[zero hidden layer]

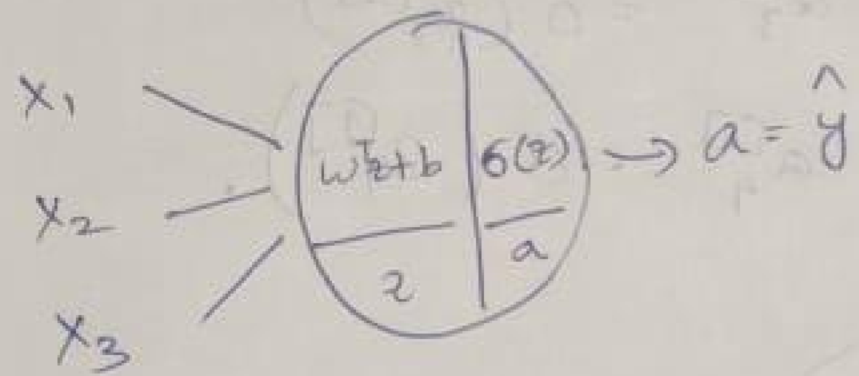
1 hidden layer

called as 2 layered

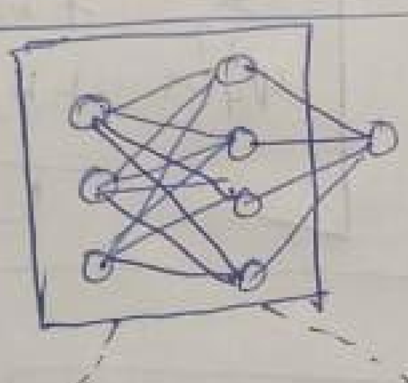


$$a^{[1]} = \begin{bmatrix} a_1^{[1]} \\ a_2^{[1]} \\ a_3^{[1]} \\ a_4^{[1]} \end{bmatrix}.$$

A logistic regression works like this



now how do we replicate the same to a 2 layered NN.
what happens in each node??



$a_i^{[l]}$ $[l] \rightarrow$ layer
$i \rightarrow$ node in layer.

$z \mid a$

x_1

$$z_1^{[1]} = w_1^{[1]T} x + b_1^{[1]}$$
$$a_1^{[1]} = \sigma(z_1^{[1]})$$

$z \mid a$

x_2

$$z_2^{[1]} = w_2^{1T} x + b_2^{[1]}$$
$$a_2^{[1]} = \sigma(z_2)$$

$z \mid a$

x_3

$$z_3^1 = w_3^{1T} x + b_3^1$$
$$a_3^1 = \sigma(z_3^1)$$

$z \mid a$

$$z_4^1 = w_4^{1T} x + b_4^1$$
$$a_4^1 = \sigma(z_4^1).$$

$$z_1^{[1]} = w_1^{[1]T} x + b_1^{[1]}, \quad a_1^{[1]} = \sigma(z_1^{[1]})$$

$$z_2^{[1]} = w_2^{[1]T} x + b_2^{[1]}, \quad a_2^{[1]} = \sigma(z_2^{[1]})$$

$$z_3^{[1]} = w_3^{[1]T} x + b_3^{[1]}, \quad a_3^{[1]} = \sigma(z_3^{[1]})$$

$$z_4^{[1]} = w_4^{[1]T} x + b_4^{[1]}, \quad a_4^{[1]} = \sigma(z_4^{[1]}).$$

$$\begin{array}{c} \text{node} \\ 4 \end{array} \left| \underbrace{\begin{bmatrix} \cdots\, w_1^{1T} \,\cdots \\ \cdots\, w_2^{1T} \,\cdots \\ \cdots\, w_3^{1T} \,\cdots \\ \cdots\, w_4^{1T} \,\cdots \end{bmatrix}}_{3\,(I/p)} \right. \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} b_1^{[1]} \\ b_2^{[1]} \\ b_3^{[1]} \\ b_4^{[1]} \end{bmatrix} = \begin{bmatrix} w_1^{1T} x + b_1^1 \\ w_2^{1T} x + b_1^1 \\ w_3^{1T} x + b_2^1 \\ w_4^{1T} x + b_3^1 \end{bmatrix} = \begin{bmatrix} z_1^{[1]} \\ z_2^{[1]} \\ z_3^{[1]} \\ z_4^{[1]} \end{bmatrix}$$

$$\boxed{[4\times3]\times[3\times1] + 4\times1 \rightarrow [4\times1]}$$

$$[4\times1]$$

$w^{[1]}$ $\quad b^{[1]}$ $\quad a^{[1]} \begin{bmatrix} a_1^1 \\ a_2^1 \\ a_3^1 \\ a_4^1 \end{bmatrix}$

So, this becomes

$$\boxed{\begin{aligned} z^{[1]} &= w^{[1]} x + b^{[1]} \\ a^{[1]} &= \sigma(z^{[1]}) \end{aligned}} \qquad \begin{aligned} 4\times1 &= [4\times3][3\times1] + [4\times1] \\ [4\times1] &= [4\times1] \end{aligned}$$

$$\boxed{\begin{aligned} z^{[2]} &= w^{[2]} a^{[1]} + b^{[2]} \\ a^{[2]} &= \sigma(z^{[2]}) \end{aligned}} \qquad \begin{aligned} 1\times1 &= [1\times4][4\times1] + [1\times1] \\ [1\times1] &= [1\times1] \end{aligned}$$