

2.4

If the first Layer is  $\tilde{z}^{(1)} = W^{(1)}x + b^{(1)}$  for  $\tilde{z}^{(0)} = x$   
than the second layer is:

$$\begin{aligned}\tilde{z}^{(2)} &= W^{(2)}(W^{(1)}x + b^{(1)}) + b^{(2)} \\ &= \underbrace{W^{(2)}W^{(1)}}_{W^*}x + \underbrace{W^{(2)}b^{(1)} + b^{(2)}}_{b^* \text{ (some bias)}}\end{aligned}$$

which has the same form as the first layer

$$W^*x + b^*$$

If all functions in the network are linear, the whole network collapses into a single linear model and a linear model cannot separate the XOR-problem