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## 5. Introduction to Deep Neural Networks

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Exercises due Mar 29, 2023 08:59 -03 Completed

## Introduction and Motivation to Deep Neural Networks





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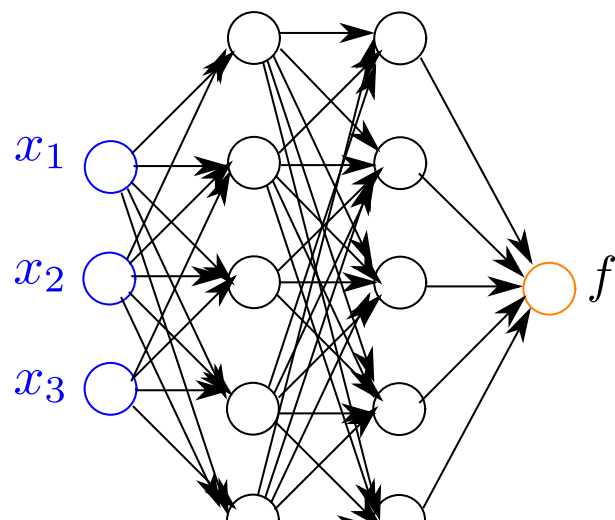
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A **deep (feedforward) neural network** refers to a neural network that contains not only input and output layers, but also hidden layers in between. For example, below is a deep feedforward neural network with 3 input layers, 2 hidden layers, and 1 output layer, with each hidden layer consisting of 5 units:



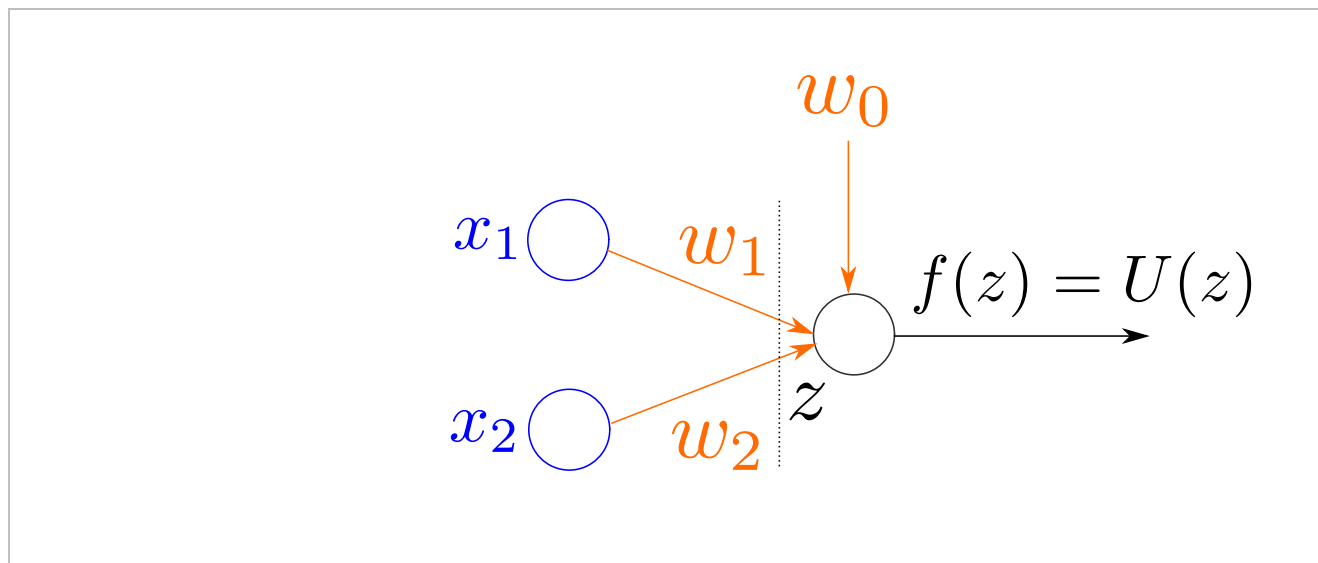
## Representation Power of Neural Networks: 1

3/3 points (graded)

In these two problems, we are going to explore how a neural network can represent any function. We will start in this problem by building the logic NAND function using a simple neural network.

The logic NAND function is defined as

where  $x_1$  and  $x_2$  are binary inputs (and  $\neg$  denotes NOT) and  $z$  denotes the output.



We will use the above simple neural network with  $U(z)$  chosen to be the unit step function:

and the activation function

Find  $w_0$ ,  $w_1$ , and  $w_2$  such that the output of the neural network gives the NAND function of  $x_1$  and  $x_2$ .

(Different correct answers will be accepted.)

0.21492221260413633



-0.09205675



-0.15797106

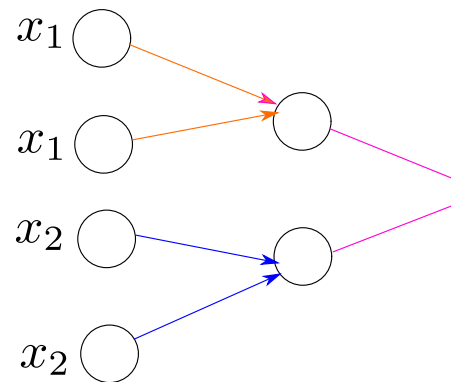
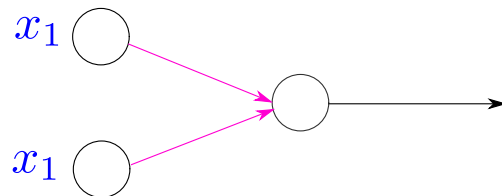


**Note:** Here, each pair of edges of the same color along with the nodes they are connected to represent a neural network unit that represents the NAND function. (They do not represent values of input or output.) In the example above,  $x_1$  and  $x_1$  are inputs to two NAND units, and are connected to output  $x_2$  by the blue and orange arrows.

(Check that these output the correct values.)

Which logic function does each of the following neural networks implement?

(Choose one for each column.)



function



function



function



function



function



function



function



function

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[why is a activation function used](#)

💬 [Again, this is a confusing excercise.](#)

[What are x1 and x2? Are those inputs or are they outputs of a NAND? According representation neural network](#)

💬 [hint](#)

[If anyone is still confused, the wikipedia page helped me a lot: \[https://en.wikipedia.org/wiki/NAND\\\_logic#XNOR\]\(https://en.wikipedia.org/wiki/NAND\_logic#XNOR\)](#)

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