Examples and Intuitions II

The Θ^{(1)} matrices for AND, NOR, and OR are:

```
\begin{align*}AND:\newline\Theta^{(1)}
&=\begin{bmatrix}-30 & 20 & 20\end{bmatrix}
\newline NOR:\newline\Theta^{(1)} &=
\begin{bmatrix}10 & -20 & -20\end{bmatrix} \newline
OR:\newline\Theta^{(1)} &= \begin{bmatrix}-10 & 20
& 20\end{bmatrix} \newline\end{align*}
```

We can combine these to get the XNOR logical operator (which gives 1 if x_1 and x_2 are both 0 or both 1).

```
\begin{align*}\begin{bmatrix}x_0 \newline x_1
\newline x_2\end{bmatrix}
\rightarrow\begin{bmatrix}a_1^{(2)} \newline
a_2^{(2)} \end{bmatrix}
\rightarrow\begin{bmatrix}a^{(3)}\end{bmatrix}
\rightarrow h_\Theta(x)\end{align*}
```

For the transition between the first and second layer, we'll use a Θ^{(1)} matrix that combines the values for AND and NOR:

```
\Theta^{(1)} =\begin{bmatrix}-30 & 20 & 20 \newline
10 & -20 & -20\end{bmatrix}
```

For the transition between the second and third layer, we'll use a Θ^{(2)} matrix that uses the value for OR:

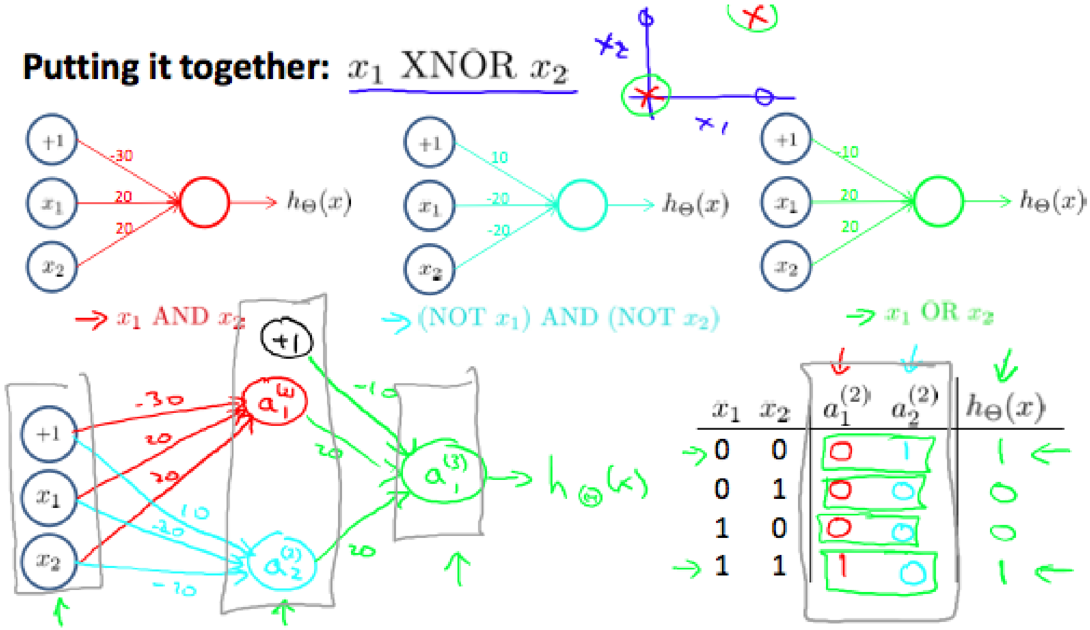
```
\Theta^{(2)} =\begin{bmatrix}-10 & 20 &
20\end{bmatrix}
```

Let's write out the values for all our nodes:

```
\begin{align*}& a^{(2)} = g(\Theta^{(1)} \cdot x)
\newline& a^{(3)} = g(\Theta^{(2)} \cdot a^{(2)})
\newline& h_\Theta(x) = a^{(3)}\end{align*}
```

And there we have the XNOR operator using a hidden layer with two nodes! The following summarizes the above algorithm:

Putting it together: $x_1 \text{ XNOR } x_2$



x_1	x_2	$a_1^{(2)}$	$a_2^{(2)}$	$h_\Theta(x)$
0	0	0	1	1
0	1	0	0	0
1	0	0	0	0
1	1	1	0	1