Consider that all neurons have the following transfer function:

\[
f(x) = \begin{cases} 
1 & \text{if } x > 0 \\
0 & \text{if } x \leq 0 
\end{cases}
\]

In order to solve logic functions, we will assume 0 means \textit{False} and 1 means \textit{True}.

1. Design a single-layer feedforward network with two inputs and one output that solves the \textit{and} logic gate. Your task is to specify the weights of the network: \(w_0\), \(w_1\), and \(w_2\). Remember that \(w_0\) is the threshold term. You can think of it as the weight from an additional input \(x_0\), which is always 1. Show the processing that the neuron does for each possible set of inputs (calculate the weighted sum of the inputs, and then the output after passing through the transfer function). The output of your neuron should be the same as the target output on the table (corresponding to the logic \textit{and} function).
2. Change the weights of your previous design \((w_0, w_1, w_2)\) so that the network solves the *or* logic gate. Specify the weights of the network. Show the processing that the neuron does for each possible set of inputs.

![Diagram of a neuron with inputs and weights](image)

<table>
<thead>
<tr>
<th></th>
<th>x1</th>
<th>x2</th>
<th>Sum</th>
<th>Neuron output</th>
<th>Target output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1</td>
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<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Design a feedforward network with two layers of neurons, two inputs and one output that solves the *xor* logic gate. As in questions 1 and 2: draw the network; specify the weights of the network; and show the processing that the neuron does for each possible set of inputs.

![Diagram of a feedforward network with two layers](image)

4. Design a feedforward network with three layers of neurons, two inputs and one output that solves the following function: Each of the inputs can be either -1, 0, or 1. The network should output 1 if both of the inputs are 0, and 0 otherwise. As in questions 1 and 2: draw the network; specify the weights of the network; and show the processing that the neuron does for each possible set of inputs.

![Diagram of a feedforward network with three layers](image)