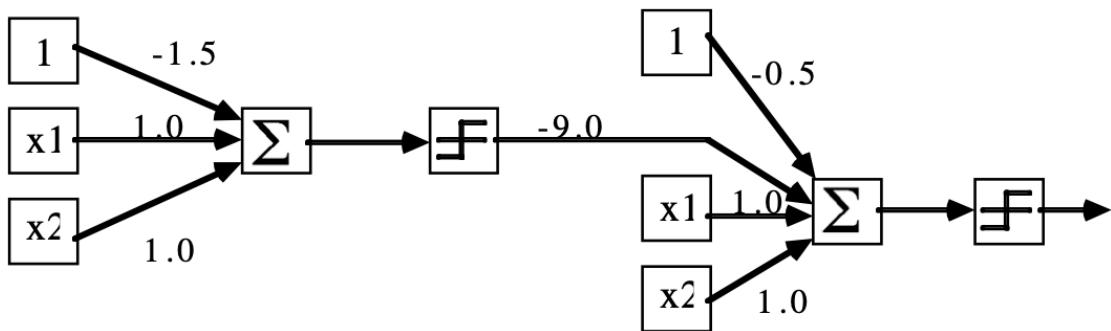


# COMP47750/COMP47990 Tutorial

## Neural Networks

1. (a) Even though the XOR Problem is linearly unseparable, the following arrangement of two Perceptrons is able to classify the XOR inputs correctly. Show that this is true. Assume that the transfer function for each neuron is a step function that outputs 1 for positive and 0 for negative input.



- (b) The -9.0 weight linking the output of the first neuron to the input of the second is much larger than is necessary. What is the minimum value that this can have and still produce the correct results?
2. Overfitting in neural networks can be managed by controlling the model complexity, by reducing the number of layers and by reducing the number of units in each layer.
  - Use the Diabetes data for this analysis.
  - Produce a graph of training and test set accuracy for different numbers of units in a neural network with a single hidden layer.
  - Set `alpha` to 0.15.
  - The code provided runs the evaluation from 2 to 20 units in steps of 2.
  - Extend the evaluation up to 40 units.
  - Extend again to 80 units.
3. The Neural Network implementation in `sklearn` provides the `alpha` parameter to control overfitting. The objective for this exercise is to examine the impact of `alpha` on train and test accuracy. Most of the code required for this is available in the NN tutorial notebook.
  - Run the code provided to identify a promising range for `alpha`.
  - Adjust the range of the search, the step size and the number of repetitions to home in on a good `alpha` value.

4. Use the grid search facility in `sklearn` to find good values for `alpha` and the hidden layer size for the Neural Net.
  - A grid-search example is available in notebook 13 Grid Search and in the NN Tutorial notebook.
  - You may need to run the grid-search a few times with different grids to home in on a good solution.
5. We have covered three methods for addressing overfitting in neural networks; name them and explain why they work.