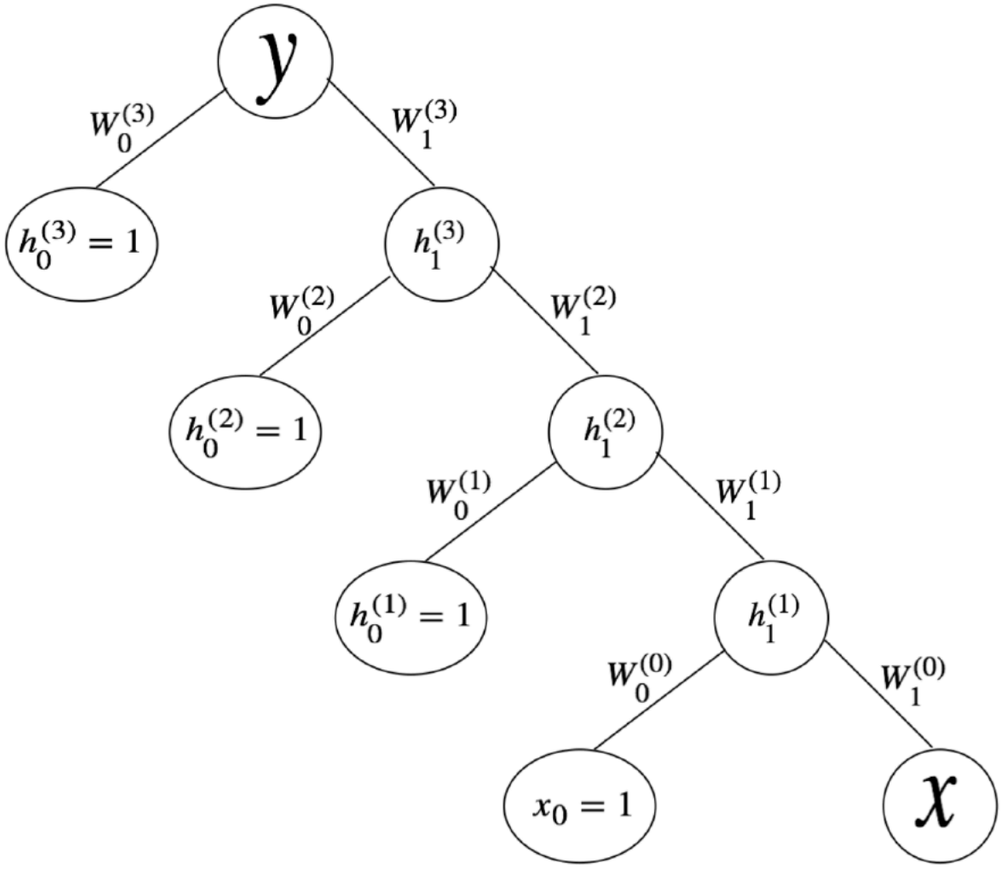
Question 2 (20 points): 12:25-12:45 (should submit by 12:50)

Consider the following neural network regressor with three hidden layers, where x is a one-dimensional input, y is a one-dimensional output, and $h_1^{(i)}$ is the hidden unit node in the i-th hidden layer. Note that this neural network also has a bias term x_0 in the input layer and $h_0^{(i)}$ in each i-th hidden layer. Suppose that all weights $W_0^{(i)}$ and $W_1^{(i)}$ have already been learned.

For the first hidden layer, the activation function is $f_1(a) = 1/(1 + 2\exp(-a))$. For the second hidden layer, the activation function is $f_2(a) = 2a + 1$. For the third hidden layer, the activation function is $f_3(a) = \max(0, 2a)$.



Is it possible to remove a hidden layer (or hidden layers) from this network such that the resulting one will represent the same output function with the original network? Here you are not allowed to change the activation functions and/or the number of hidden unit nodes in the remaining (non-removed) layers but you may change the values of the weights for the remaining connections.

If this is possible, indicate all hidden layers whose removal will not change the output function. In this case, draw the new network and write the new values of the weights that need to be changed.

If this is not possible, indicate its reason.