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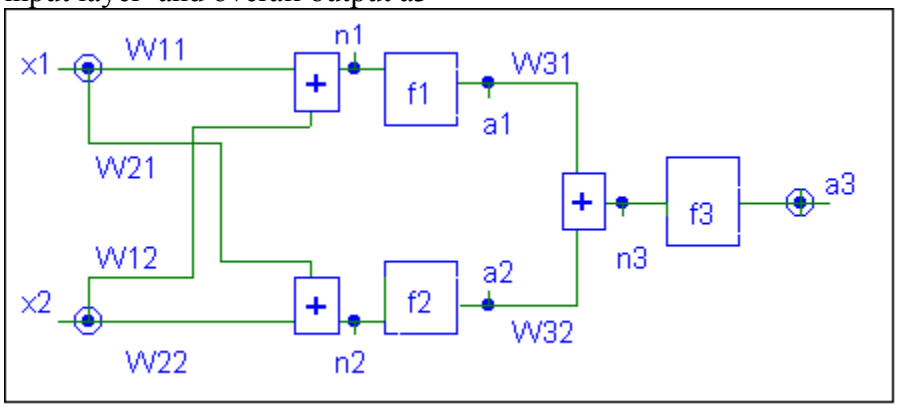
ENEE 434 Final Exam- Take Home Portion

Open book open notes; this portion is due at the beginning of the final period with penalties of a point per 5 minute late period.

1tkhm (100 points, 50 minutes)

A neural network has the structure shown, that is, it has two inputs, x1 and x2, with four weights to two input layer neurons of activation functions, f1 & f2, and one output layer neuron with a purelin activation function, f3, with two weights to it from the input layer and overall output a3



a) Give the expression for the output a3 as a function of the inputs, weights, and activation functions of the network.

b) What restriction does the absence of biases place upon the class of functions a3=y(x1,x2) which can be realized with no error?

c) Assume that over the two dimensional square [0,1]x[0,1] it is desired that this network approximate

$$y = \frac{1}{3}(x1)^3 + (x1)(x2)$$

c1) Calculate the output error, y-a3, for all weights being 1 and at $x=[1, ½]^T$ with f1(z)=f2(z)=tanh(z) [recall that f3 is purelin].

c2) Give the sensitivity matrices of interest for backpropagation with the same conditions as in c1).

c3) Under the same conditions as c1) give the weight updates ΔWij for the next update step.

c4) What is the error y-a3 after the update of c3)?