I am writing up a learning module for undergraduates on neural networks and want to include a worked example for one complete training sample; that is, a feed-forward to the output and error relative to the target, and then a backpropagation from that output back to the top, providing all of the adjust weights.

My neural network is [2,3,1] without a bias term: two inputs, one output, and three nodes in a hidden layer. The initial set of weights is w11 = 0.251, w12 = 0.103, w13 = -0.562, w21 = 0.565, w22 = -0.359, and w23 = -0.648, where the first index is the input and the second index is a hidden node. The weight from the first hidden node to the output is -0.199, the weight from the second hidden node to the output is 0.525, and the weight from the third hidden node to the output is 0.45. The first input is 0.600 and the second input is 0.400. Activation is always accomplished using a sigmoidal function. The expected output is 0.200.

Use a learning rate of 0.01. Before you begin, look over the details I have provided and let me know if the task isn’t clear or if there is some uncertainty about a value. The output will be step-by-step process. At each step state the purpose in plain terms, provide the equation(s) used to complete the calculation(s), and the result(s) of that calculation.

Organization is important as I will want to go through the output line-by-line to check my calculations against yours. I need the output in a form that is easily read by undergraduates; that is, equations should be easily legible to those who cannot read latex or mathjax code. I think a single pdf file is the best option, but you can present alternatives if you feel they are better. The file needs to be something that can be downloaded.