COMP305: Homework 7

1. Consider the following multilayer perceptron.
Weights of the first hidden layer:

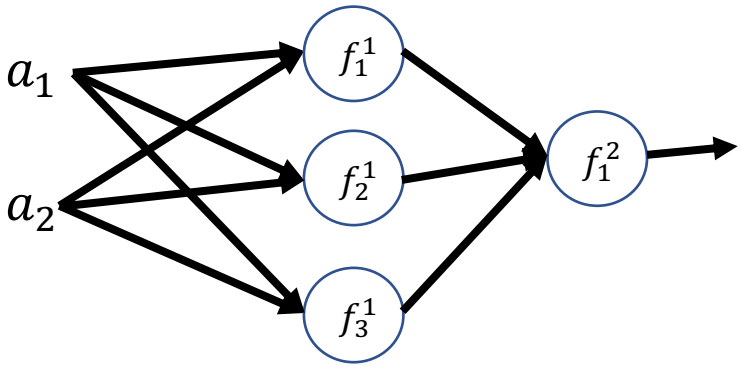
$$w_{11}^1 = 0.1, w_{12}^1 = 0.2,$$
$$w_{21}^1 = 0.6, w_{22}^1 = 0.2$$
$$w_{31}^1 = 0.5, w_{31}^1 = 0.3$$

Weights of the output layer:

$$w_{11}^2 = 0.7, w_{12}^2 = 0.8, w_{12}^2 = 0.9$$

The biases of the perceptron are all 0. That is,

$$b_1^1 = 0, b_2^1 = 0, b_3^1 = 0$$
$$b_1^2 = 0$$



Assume the input pattern at the current time step is $a_1 = 1$, $a_2 = -2$, and the label of this input pattern is 1. The the activation functions $f_1^1, f_2^1, f_3^1, f_1^2$ are all defined as:

$$f(x) = \frac{1}{1 + e^{-x}}$$

The learning rate $C = 0.1$.

Q2.1: Compute the output error E for the input pattern $a_1 = 1, a_2 = -2$.

Q2.2: Compute $\frac{\partial E}{\partial w_{21}^{1}}$ the partial derivative of E with respect to the weight w_{21}^{1} of the connection between the input a_1 and the second neuron in the first hidden layer.

Q2.3: Compute the updated value of the weight w_{21}^{1} at the next time step using stochastic gradient decent method.