COMP305: Homework 6

1. Q: Prove that if the data set $D = \{a = (a_1, \cdots, a_n)\}$ is absolutely linearly separable, then the set $D' = \{[1, a] | a \in D\}$ is also absolutely linearly separable.

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

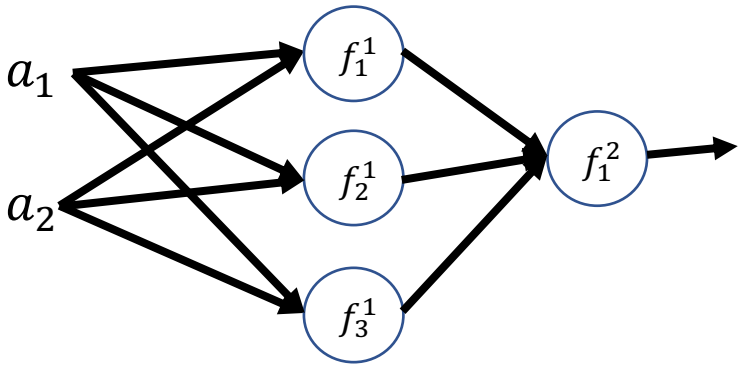
$$w_{11}^1 = 0.1, w_{12}^1 = 0.2,$$
$$w_{21}^1 = 0.6, w_{22}^1 = 0.2$$
$$w_{31}^1 = 0.5, w_{32}^1 = 0.3$$

Weights of the output layer:

$$w_{11}^2 = 0.7, w_{12}^2 = 0.8, w_{13}^2 = 0.9$$

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 inputs at the current time step are $a_1 = 1$, $a_2 = -2$.

Q2.1: If the activation functions f_1^1, f_2^1, f_3^1, f_1^2 are all defined as:

$$f(x) = \begin{cases} x, & x \geq 0, \\ 0, & x < 0. \end{cases}$$

Compute the output of this perceptron.

Q2.2: If the activation functions f_1^1, f_2^1, f_3^1, f_1^2 are all defined as:

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

Compute the output of this perceptron.