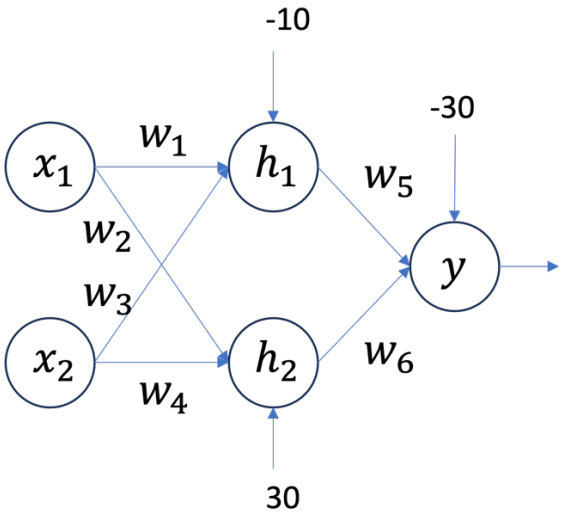
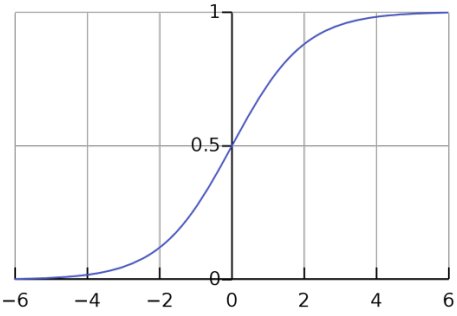
Quiz-4 (CLO3)
CS-470 Machine Learning
BEE-12

Name: Solution

1. Implement an XOR operation using a neural network with one hidden layer as given below. The inputs can be (0,0), (0,1), (1,0), (1,1) and output neuron should generate corresponding output which should be XOR of the input pair. Assume sigmoid activation function (also shown). Estimate the weights.
   Assume $\sigma(x) > 0.5 = 1, \sigma(x) < 0.5 = 0$. [8]
2. Can the XOR system be implemented without hidden layer i.e., two inputs (x_1, x_2) connected with output neuron y? [2]

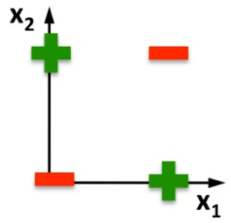


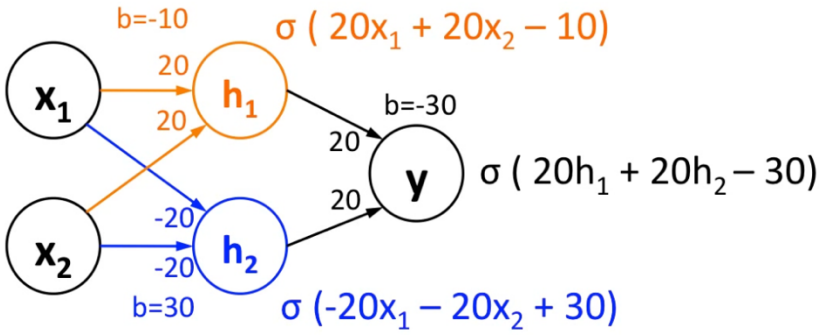


$$\sigma(x) = \frac{1}{(1+e^{-x})}$$

1.

Linear classifiers
cannot solve this





h_1	h_2	y
σ(20*0 + 20*0 – 10) ≈ 0	σ (-20*0 – 20*0 + 30) ≈ 1	σ (20*0 + 20*1 – 30) ≈ 0
σ(20*1 + 20*1 – 10) ≈ 1	σ (-20*1 – 20*1 + 30) ≈ 0	σ (20*1 + 20*0 – 30) ≈ 0
σ(20*0 + 20*1 – 10) ≈ 1	σ (-20*0 – 20*1 + 30) ≈ 1	σ (20*1 + 20*1 – 30) ≈ 1
σ(20*1 + 20*0 – 10) ≈ 1	σ (-20*1 – 20*0 + 30) ≈ 1	σ (20*1 + 20*1 – 30) ≈ 1

2. No, there won't be any combination to implement XOR without hidden layer as doing so will make neural network too linear to solve this classification problem.