CSE 5526 - Autumn 2019

# Introduction to Neural Networks

## Homework #1

Due Tuesday, Sept. 3

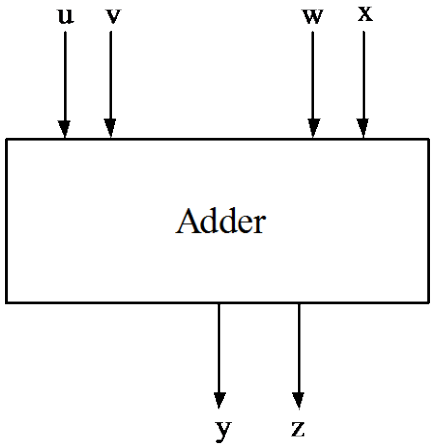
Grader: Hao Zhang
Office: 474 Dreese Lab
Office hours: 2:30-3:30 T & W
Email: zhang.6720@osu.edu

**Problem 1**. Give weights and bias for a McCulloch-Pitts (M-P) neuron with inputs $x$, $y$, and $z$, and whose output is $z$ if $x = -1$ and $y = 1$, and is -1 otherwise.

**Problem 2**. For this problem, change the definition of an M-P neuron so that both its inputs and output are binary. View $uv$, $wx$ as two-bit binary (0 or 1) numbers, and $yz$ as the 2 low-order bits of the numerical addition of $uv$ and $wx$.

(a) Give weights and biases for an M-P network which generates $z$.

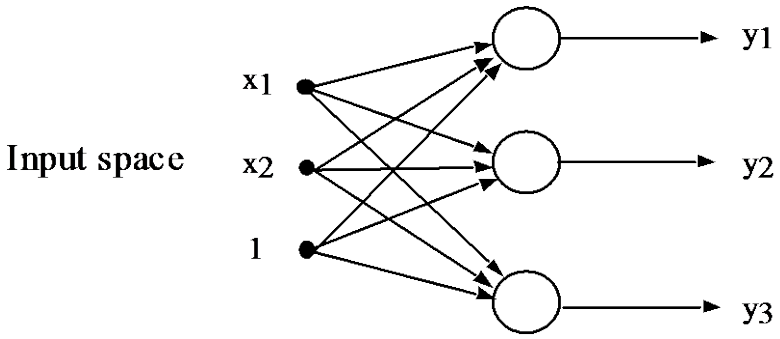
(b) Give weights and biases for an M-P network which generates $y$.




**Problem 3**. Give the following 3-class classification problem:

$C_1$: {(4, 1), (2, 3), (3, 5), (5, 4), (1, 6)}
$C_2$: {(0, 2), (-2, 2), (-3, 2), (-2, 4)}
$C_3$: {(1, -2), (3, -2)}

and the following single layer perceptron:




(a) Can the net learn to separate the samples, given that you want: if $\mathbf{x} \in C_i$ then $y_i = 1$ and $y_j = -1$ for $j \neq i$. No need to solve for the weights, but justify your answer.

(b) Add the sample (-1, 6) to $C_1$. Repeat part (a).