ECE/CS 559 - Fall 2021
Homework #1
Due: 09/14/2021, 11:00pm.

Erdem Koyuncu

- You are allowed to discuss the homework problems with your classmates, but you are supposed to do your assignment individually.
- Submit your solutions to Gradescope. Late submissions will be penalized.

1. **(50 pts)** Design a two-layer neural network with the **signum activation function** (i.e. $\text{sgn}(x) = 1$ if $x > 0$, $\text{sgn}(x) = -1$ if $x < 0$, and $\text{sgn}(0) = 0$) such that the network implements the logic gate $f(x_1, x_2, x_3) = \overline{x_1}x_2x_3 + x_1\overline{x_2}$. Assume that the input of -1 is used to represent a `FALSE`, and an input of 1 is used to represent a `TRUE`. Show your work and draw the final network. Note that in class, we have discussed examples where we have instead used the step activation function and a 0 for `FALSE`.
2. **(50 pts)** Consider the network in Fig. 1. In the $x - y$ plane, sketch the region where $z = 1$. Show your work. Make sure you correctly indicate which part of the boundaries belong to the region $z = 1$. Recall that $u(x) = 1$ if $x \geq 0$ and $u(x) = 0$ if $x < 0$.

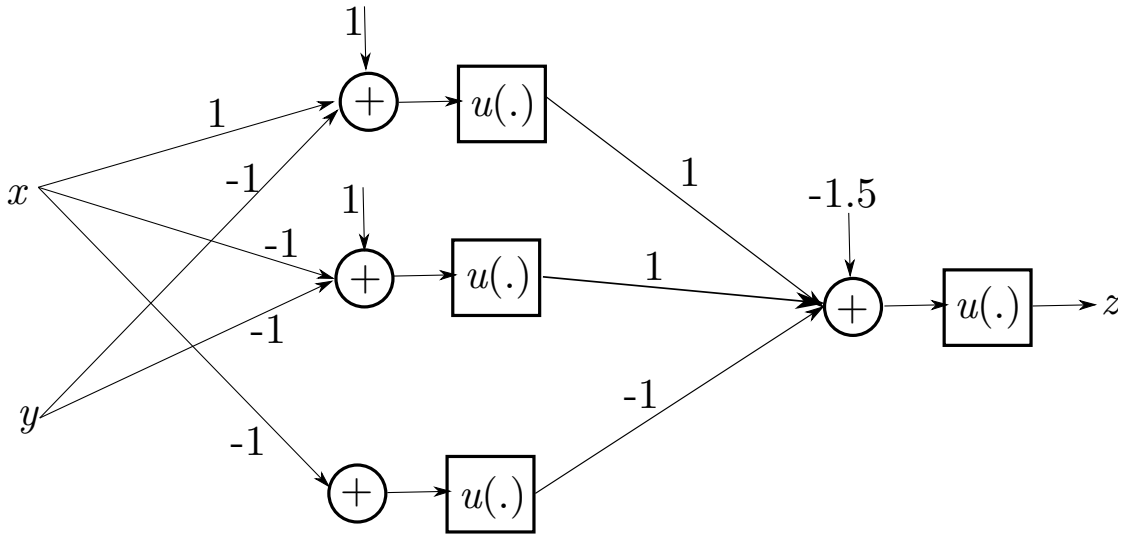

Figure 1: The neural network for Problem 2.