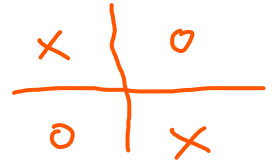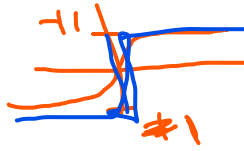# Spring 2021 318 711 Homework 3

Use programming tool if needed.

Problem 1

Suppose a data set contains four points in the plane, $[+1, +1], [-1, -1], [+1, -1], [-1, +1]$, and the first two belongs to one class and the last two belong to another class. Let $\varphi(t) = tanh(\beta t)$ (hyper-tangent function) where $\beta > 0$ is a constant. Manually construct a neural network that can separate the two classes. Use $\varphi(t)$ as the non-linearity in the neural network. Show the number of layers and the weight matrices.

Problem 2

Use a neural network to redo Problem 6 of Homework 2. Compare your results with those from logistic regression, what are your conclusions?

Problem 3

Use a neural network to redo Problem 7 of Homework 2. Compare your results with those from logistic regression, what are your conclusions?

Problem 4

In this problem, we have provided a training and testing data set for a classification problem. Train a neural network on the training data and test it on the testing data. For testing data, ground truth labels are not provided and you can submit your classification labels for evaluation by the TA. Record the neural network you used, e.g., the number of hidden layers, activation functions, and optimization algorithm (providing only the name, e.g., momentum).

Problem 5 (Optional)

In this problem, we train a CNN neural network to classify images. Like Problem 4, we will provide you with training and testing data sets. For testing data, ground truth labels are not provided and you can submit your classification labels for evaluation by the TA. Record the neural network you used, e.g., the number of hidden layers, activation functions, and optimization algorithm (providing only the name, e.g., momentum).