**Perceptron Learning Lab** Name and period: **Shreyas Angara; Period 7**

**For boolean functions on n variables, a perceptron can learn:**

1. N=2:
   1. Learned: 14/16 = 87.5%
   2. 2 example functions and the learned weight vectors

function = [(array([0, 0, 1]), 0), (array([0, 1, 1]), 0), (array([1, 0, 1]), 0), (array([1, 1, 1]), 1)]

weight = [ 2 1 -2]

function = [(array([0, 0, 1]), 0), (array([0, 1, 1]), 0), (array([1, 0, 1]), 1), (array([1, 1, 1]), 0)]

weight = [ 1 -2 0]

1. N=3:
   1. Learned: 104/256 = 40.625%
   2. 2 example functions and the learned weight vectors

function = [(array([0, 0, 0, 1]), 1), (array([0, 0, 1, 1]), 0), (array([0, 1, 0, 1]), 0), (array([0, 1, 1, 1]), 1), (array([1, 0, 0, 1]), 1), (array([1, 0, 1, 1]), 1), (array([1, 1, 0, 1]), 1), (array([1, 1, 1, 1]), 0)]

weight = [-1 -2 -1 2]

function = [(array([0, 0, 0, 1]), 1), (array([0, 0, 1, 1]), 0), (array([0, 1, 0, 1]), 0), (array([0, 1, 1, 1]), 1), (array([1, 0, 0, 1]), 1), (array([1, 0, 1, 1]), 1), (array([1, 1, 0, 1]), 1), (array([1, 1, 1, 1]), 1)]

weight = [1 1 0 0]

1. N=4:
   1. Learned: 1882/65536= 2.872%
   2. 2 example functions and the learned weight vectors

function = [(array([0, 0, 0, 0, 1]), 0), (array([0, 0, 0, 1, 1]), 0), (array([0, 0, 1, 0, 1]), 0), (array([0, 0, 1, 1, 1]), 0), (array([0, 1, 0, 0, 1]), 0), (array([0, 1, 0, 1, 1]), 0), (array([0, 1, 1, 0, 1]), 0), (array([0, 1, 1, 1, 1]), 1), (array([1, 0, 0, 0, 1]), 0), (array([1, 0, 0, 1, 1]), 0), (array([1, 0, 1, 0, 1]), 1), (array([1, 0, 1, 1, 1]), 1), (array([1, 1, 0, 0, 1]), 1), (array([1, 1, 0, 1, 1]), 0), (array([1, 1, 1, 0, 1]), 1), (array([1, 1, 1, 1, 1]), 0)]

weight = [-1 -1 3 -2 -1]

function = [(array([0, 0, 0, 0, 1]), 0), (array([0, 0, 0, 1, 1]), 0), (array([0, 0, 1, 0, 1]), 0), (array([0, 0, 1, 1, 1]), 0), (array([0, 1, 0, 0, 1]), 0), (array([0, 1, 0, 1, 1]), 0), (array([0, 1, 1, 0, 1]), 0), (array([0, 1, 1, 1, 1]), 1), (array([1, 0, 0, 0, 1]), 0), (array([1, 0, 0, 1, 1]), 0), (array([1, 0, 1, 0, 1]), 1), (array([1, 0, 1, 1, 1]), 1), (array([1, 1, 0, 0, 1]), 1), (array([1, 1, 0, 1, 1]), 0), (array([1, 1, 1, 0, 1]), 1), (array([1, 1, 1, 1, 1]), 1)]

weight = [ 1 2 3 0 -3]

Create a training set and a testing set over 10 boolean inputs (x) where the function f(x) = majority. Use a training size of about 100 vectors. Plot the accuracy of a perceptron and of a decision tree, each on the testing set, for the target concept. The x-axis should be “training set size” and the y-axis “accuracy on test set”. Plot both functions on the same set of axes.

For the perceptron: use as many epochs as you deem necessary. For both: do NOT test on the training data!