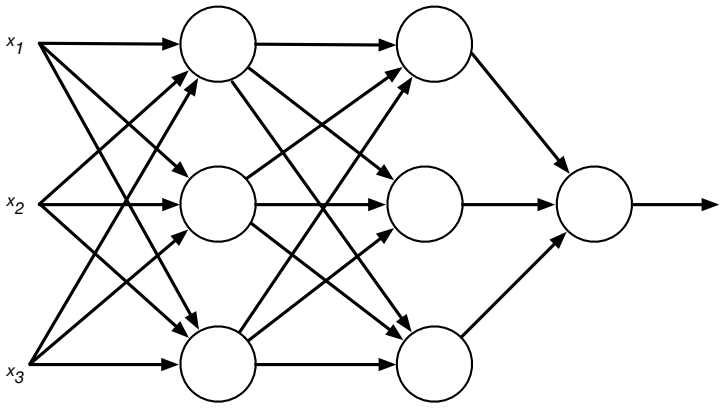
CS294-082: Experimental Design for Machine Learning on Multimedia Data
Fall 2020

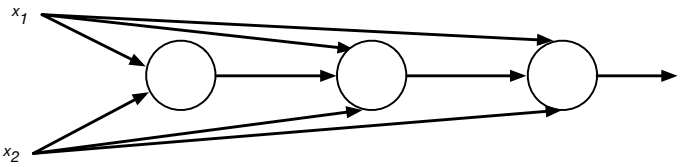
Homework 4

1) What is the maximum Memory Equivalent Capacity of the following neural networks. Assume binary classification, all weights are non-zero and all units have biases.

a)



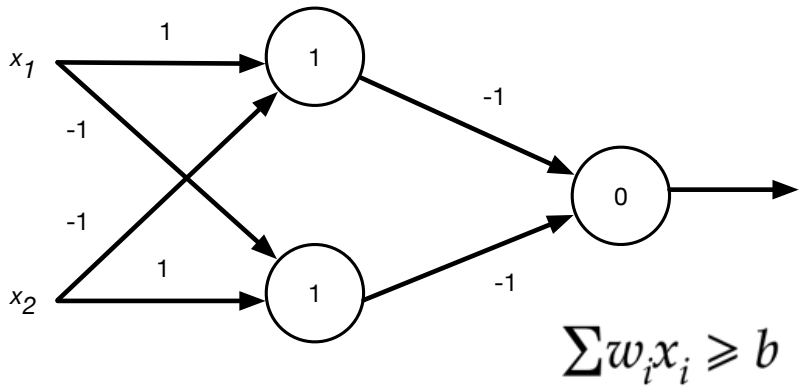
b)



c) What is the maximum amount of rows that each network in a) and b) can memorize?
d) Answer c) but for 4 classes instead of binary classification.

2) Draw two different neural network architectures that can guarantee to memorize the training data of a 12-instance binary classification problem of 4 dimensional inputs (assuming perfect training).

3) Convert the following neural network into
a) a decision tree, and
b) a finite state automaton.



This network will play an important role later.

4) 2,4,6,8,…
Train a neural network of your choice to (TensorFlow, Keras, PyTorch, SciKit Learn, Cafe, Weka, self-build, etc…) to distinguish odd from even numbers.

a) How many neurons are needed theoretically?
b) How many neurons did you end up using?
c) Discuss the limitations of your implementation.

5) First thoughts on Multimedia.
Do Exercise 40.8 in MacKay's book.