Exercise 1 – Neural Networks

The activation is



The output is

1. The output is

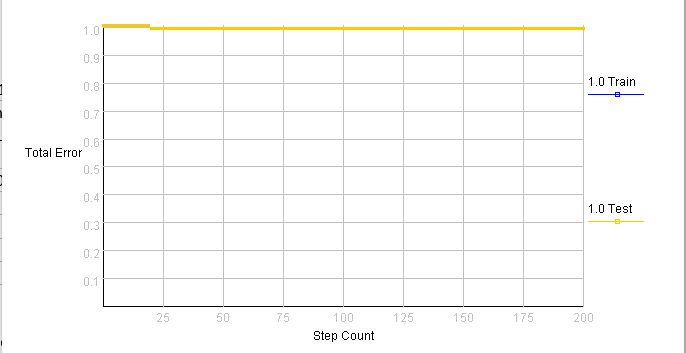
* Pattern p2:
* Pattern p3:
* Pattern p4:

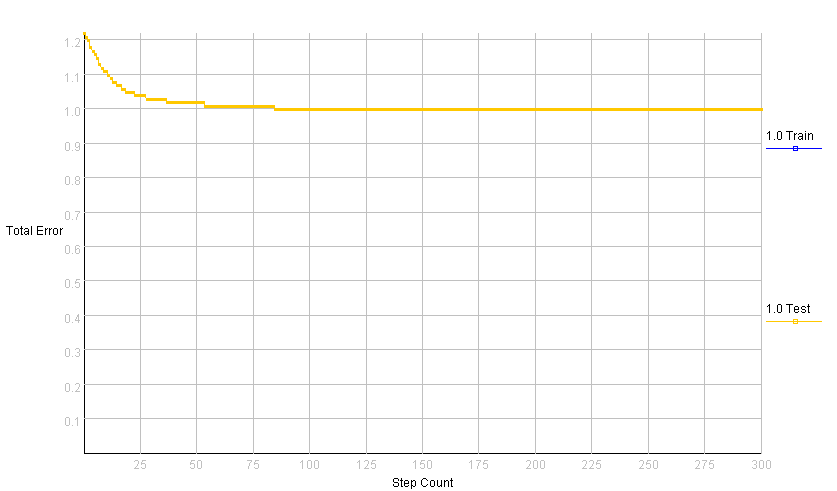
1. The learning does not change the weight vector for pattern p4 because the target output of the pattern is and the output , therefore the update equation would become:

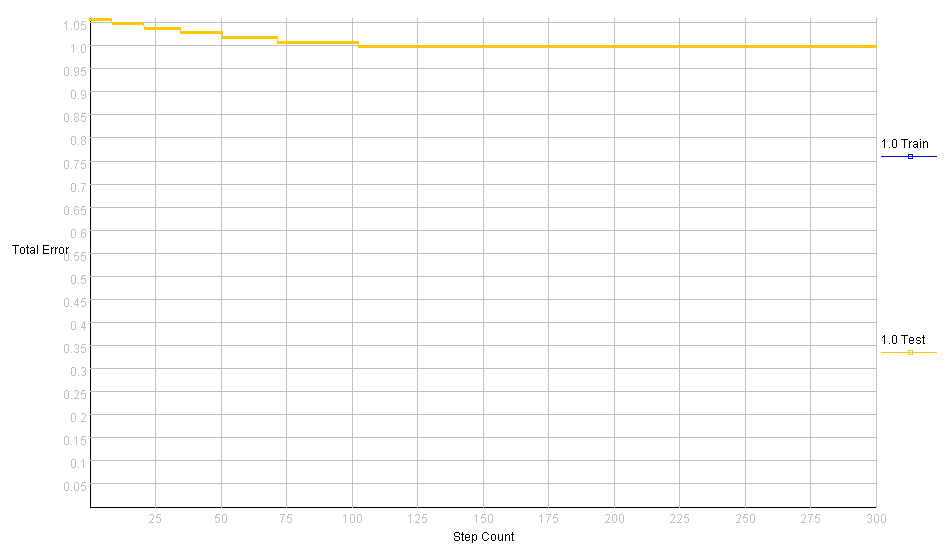
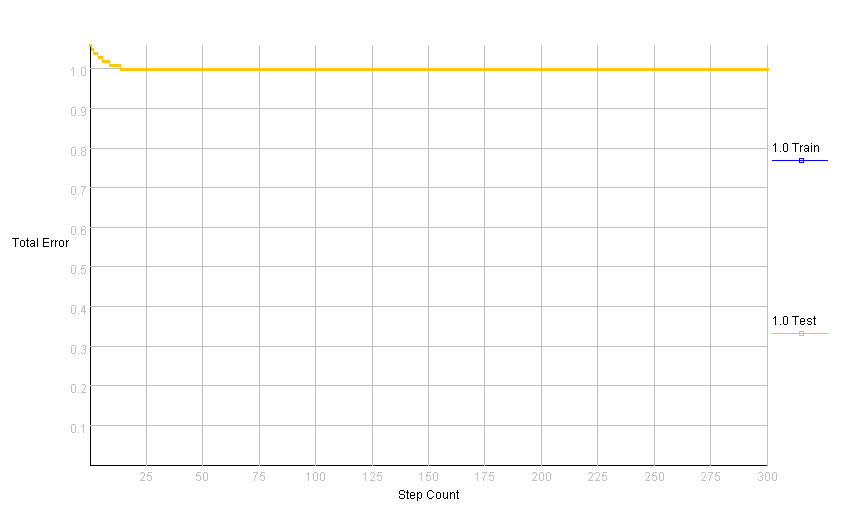
As a result, the weight vector for pattern p4 is the same as the wieght vector for pattern p3.

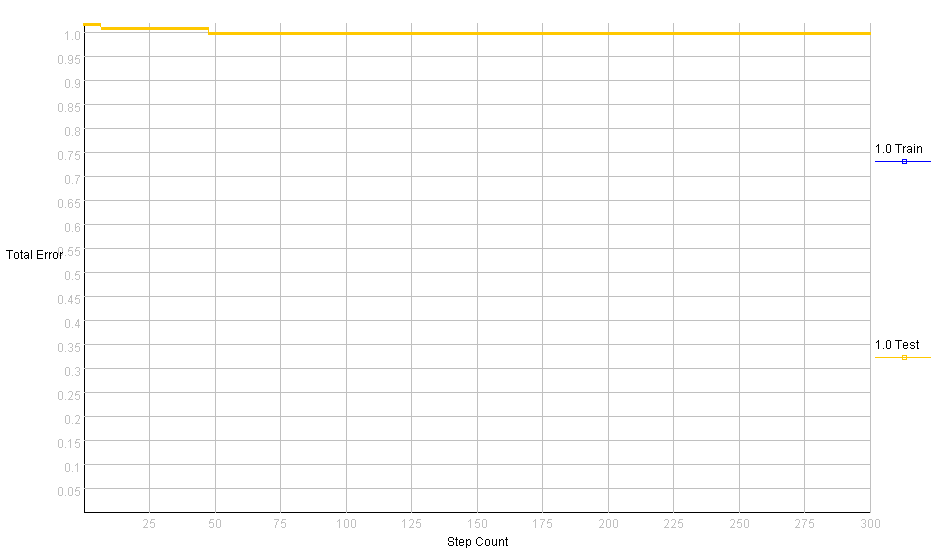
1. Yes.
2. Initial Test Error: 1.0211

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test no | Initial | Initial | Final | Final | Correct test ex (50) | Correct test ex (100) | Correct test ex (150) | Correct test ex (200) | Correct test ex (250) | Correct test ex (300) |
| 1 | 0.5 | 0.21 | 0.09 | 0.06 | 50% | 50% | 50% | 50% | - | - |
| 2 | 0.95 | -0.61 | 0.01 | -0.03 | 50% | 50% | 50% | 50% | 50% | 50% |
| 3 | 0.29 | -0.01 | 0.0 | -0.01 | 50% | 50% | 50% | 50% | 50% | 50% |
| 4 | -0.86 | 0.71 | -0.02 | 0.03 | 75% | 75% | 50% | 50% | 50% | 50% |
| 5 | 0.38 | 0.37 | 0.04 | 0.04 | 25% | 25% | 25% | 25% | 25% | 25% |

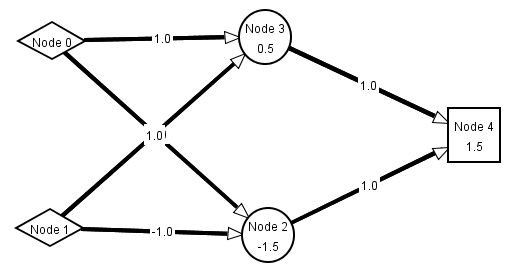




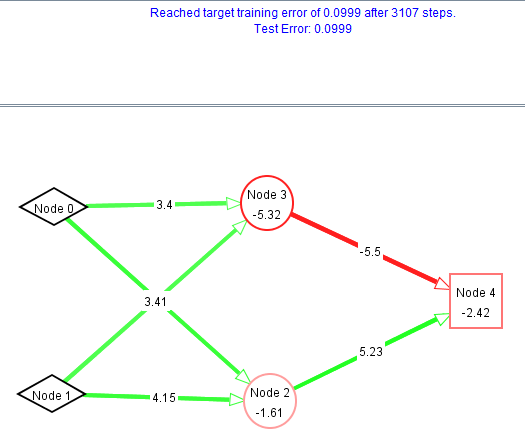




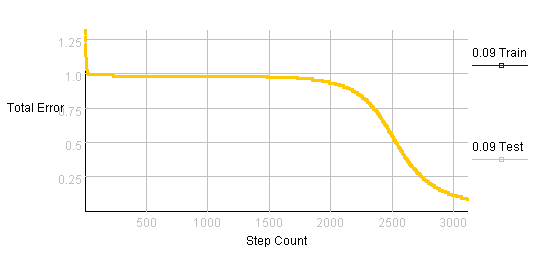
1. The single neuron doesn’t converge to classify all test patterns correctly
2. XOR is not a linearly separable problem.
3. The network won’t solve XOR.
4. The network that solves XOR:



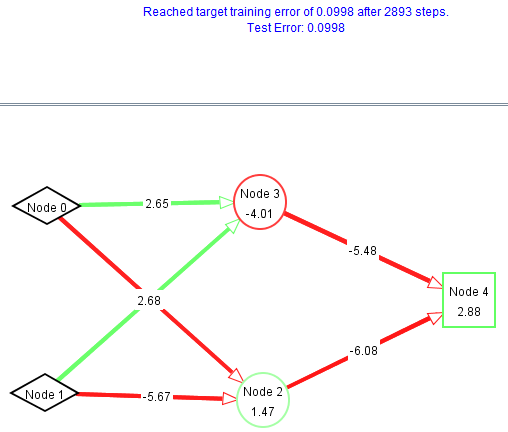
Trial 1 (weights and steps):



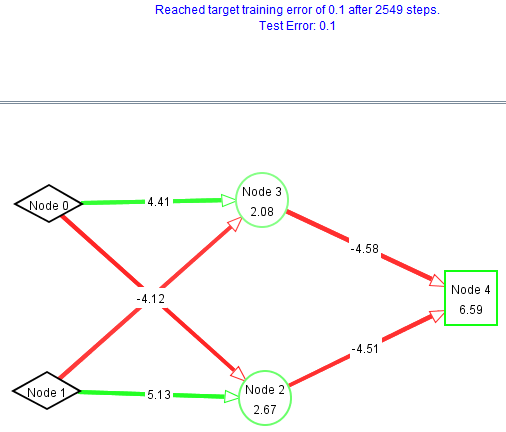
Trial 1 (error graph):



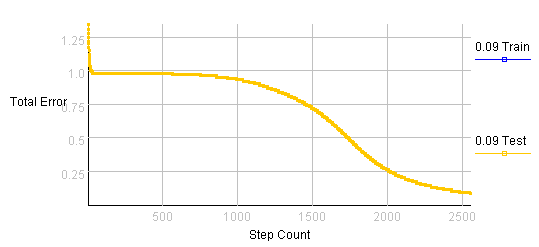
Trial 2 (weights and steps):



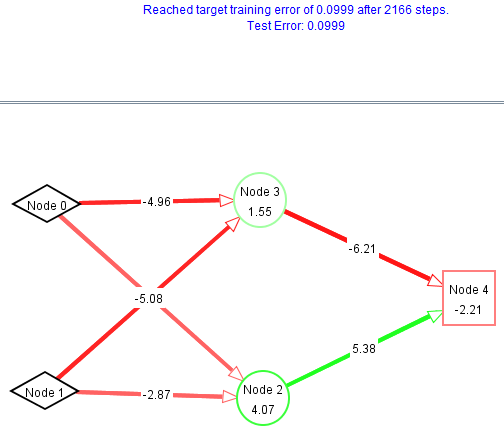
Trial 3 (weights and steps):



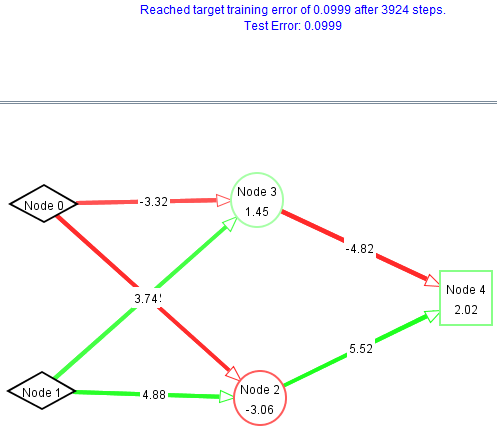
Trial 3 (error graph):



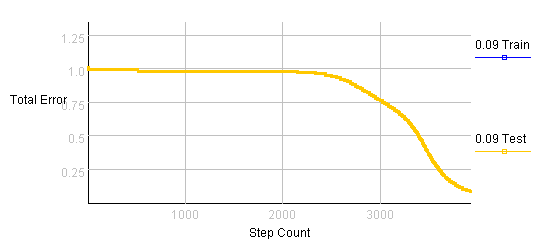
Trial 4 (weights and steps):



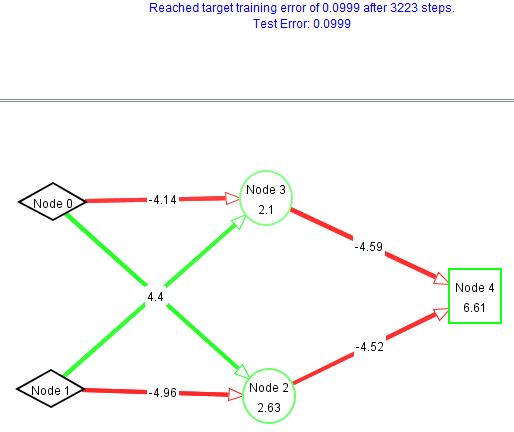
Trial 5 (weights and steps):



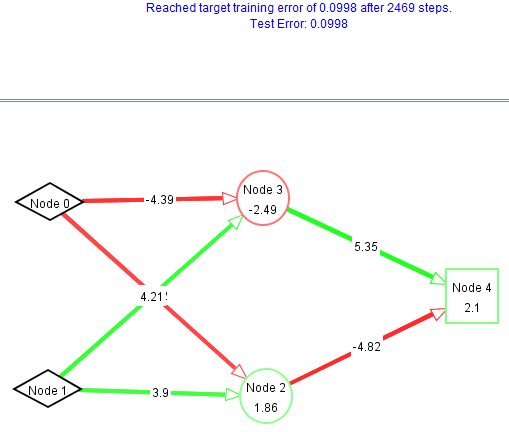
Trial 5 (error graph):



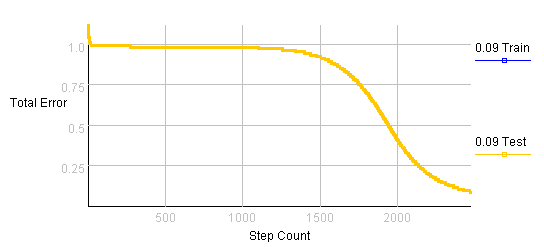
Trial 6 (weights and steps):



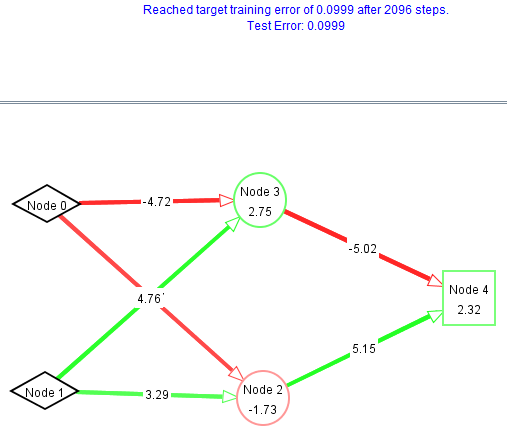
Trial 7 (weights and steps):



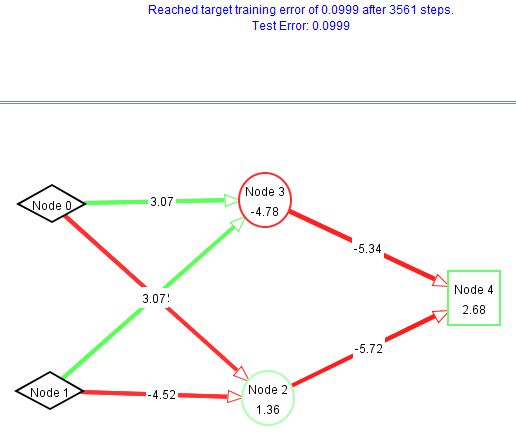
Trial 7 (error graph):



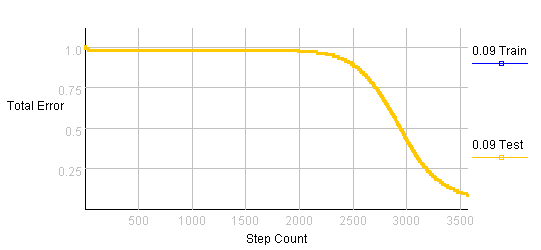
Trial 8 (weights and steps):



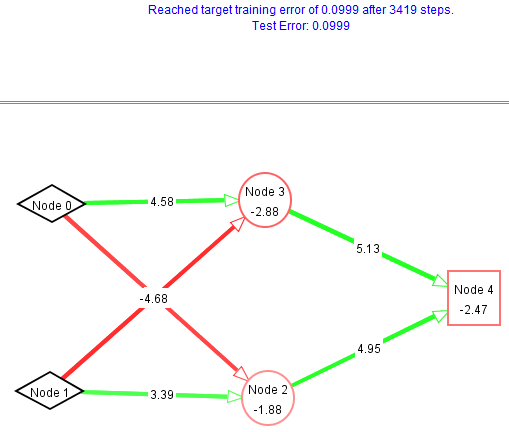
Trial 9 (weights and steps):



Trial 9 (error graph):



Trial 10 (weights and steps):



1. What do you notice about the error on different trials. Explain your observations.

Each trial stops at a different number of steps. Some trials fail to stop before 50,000 steps.