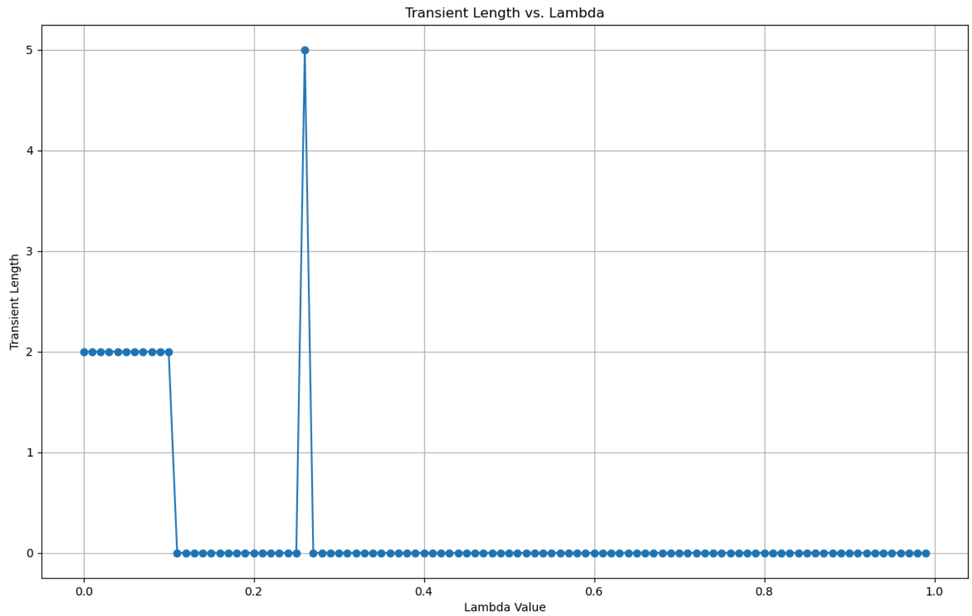
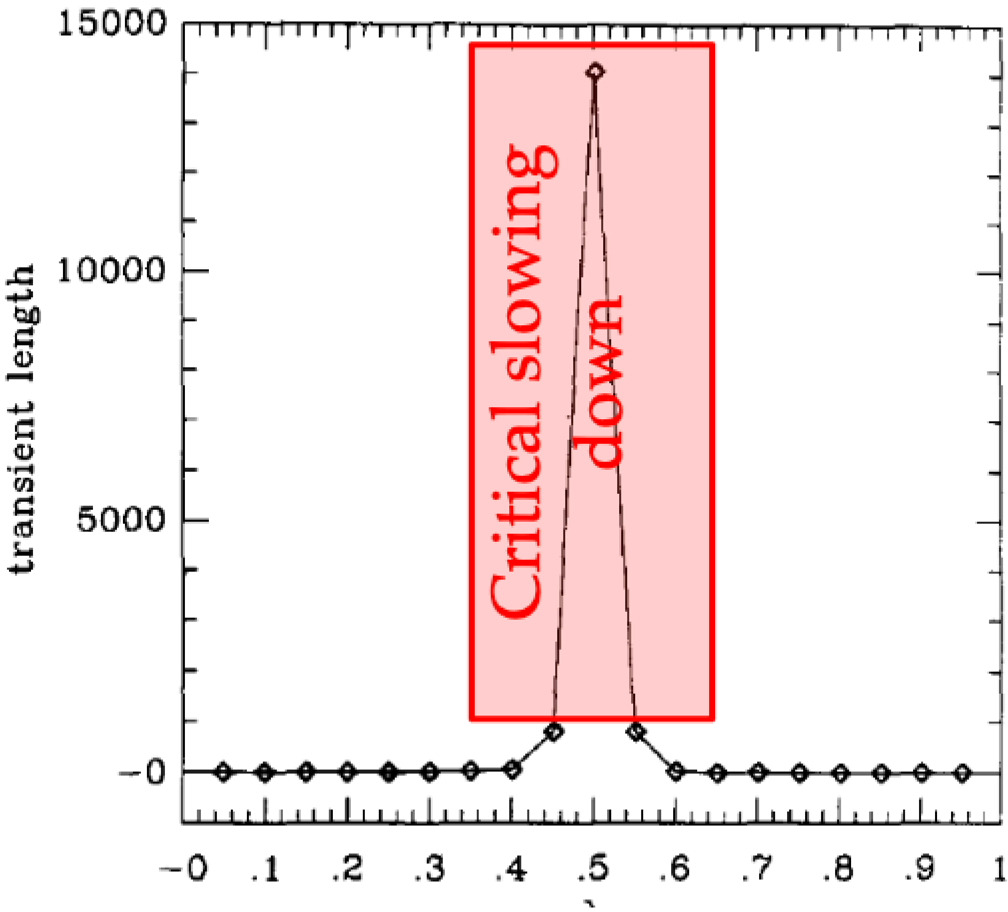
Introduction Computational Science - CA3



The figure above illustrates the transient length for all the λ values (0 - 1.0) for a cellular automata. We iterate over the λ values by steps of 0.01. The width and height are set to 200 and k = 4 and r = 2 with a random seed of 50. So this certainly took a couple minutes of runtime.

The axes are labeled to reflect the transient length along the vertical axis and the λ values along the horizontal axis. Each dot represents the average transient length for a λ value between 0 and 1. The clear visualization of the data points allows for us to see how many iterations it takes for the CA to stop exhibiting new behaviour.



Above shows a similar graph, this is the result that we expected and we would like to hold them against each other to make observations. When λ becomes 0.5 there should be a sudden peak in the transient length which goes down immediately at 0.6.

Even though the expected results and the result from the experiment aren't exactly the same, they do both show a similar and interesting pattern. In the experiment our sudden spike happened around the 0.3 λ mark.

This is the critical λ region (around 0.25-0.3) and this is where the transient lengths spike, this could mean that the automata takes much longer to settle into a stable or repeating pattern and may indicate the boundary between non-chaotic and chaotic behaviour. In this region the behaviour of the automata is complex and exhibiting chaos.

In the other regions the transient lengths are very short, this means that the automata reaches a repeating or stable state very quickly.

Besides the critical region the region where λ is below 1 seemed to return higher transient lengths, but not the highest. A transient length of 2 was displayed, while the peak was at 5. This could mean that there is chaotic behaviour in the automata for λ lower than 1.