Mathematics
1ma162
Linneaus University

Discrete Mathematics

spring 2017

Mathematica Problems on Recurrence Relations (RR) and Cellular Automata (CA) XX

1. A particle moves horizontally to the right. For $n \in \mathbf{Z}^+$, the distance the particle travels in the $(n+1)$st second is equal to $3/2$ the distance it travels during the nth second. If $x_n, n \geq 0$, denotes the position of the particle at the start of the $(n+1)$st second, find a recurrence relation for x_n, where $x_0 = 1$ and $x_1 = 6$. Solve it on the computer.

2. Try to find a truly chaotic orbit in the logistic map. Try to show that it spreads uniformly over the interval, for example by iterating 100 times and show that it roughly visits evey interval of length 0.1 10 times.

3. Consider rule 170. Run it for a randomly generated seed. This is an example of a reversible CA, that is, each state has a unique predecessor. Try to understand that!

4. Run Game of Life with the initial state below on next page. What do you observe? From top and down there are 4, 2, 6, 2, 2, 6, 2, 4 black cells. **OP**

Out[419]=

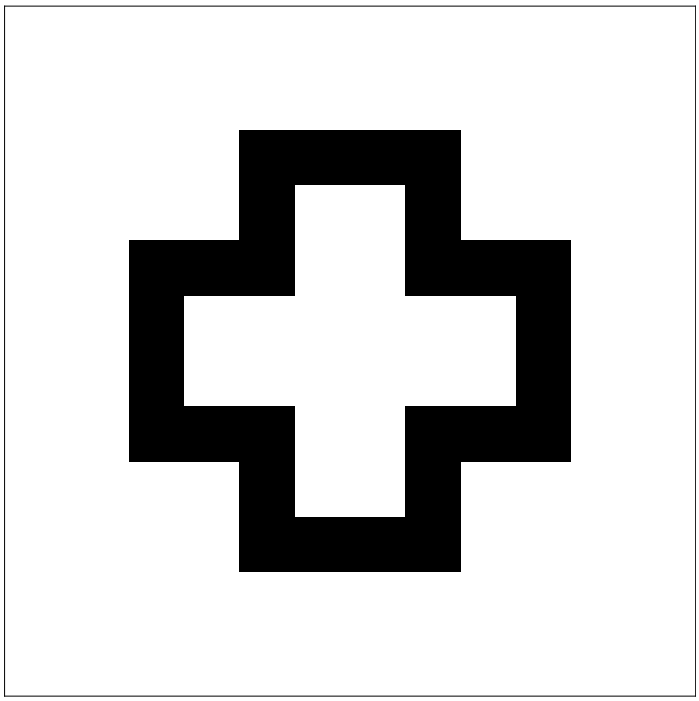

Figure 1: Your initial state to Game of Life.