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

1. In how many ways, a_n, can a sum of 1s and 2s sum up to n? For $n = 3$ there are 3 ways. 3=1+1+1=2+1=1+2. Find a RR for a_n and solve it on the computer. What is a_{20}? Plot with command DiscretePlot the first 10 values of a_n and its logarithm.

2. Find and plot an unstable 2-cycle in the logistic map for $a = 4$. Iterate a couple of times to illustrate the instability. You can locate the 2-cycle by the fix points of $g(g(x))$.

3. Consider the CA called Majority Action. The majority of the 3 cells (left,middle and right) decides the state of the middle cell in next generation. So 2-3 black cells gives black and 0-1 black cells gives white. What is the rule number? Run it for a random seed a couple of times. What happens? Extend to 2 neighbors on each side. Then you have to modify the program somewhat. Read about the command CellularAutomata. What is the rule number for majority action this time? Run it also for random seeds. Any difference compared to 2 neighbors?**OP**

4. Run a seed with 3 black cells in a row in Game of Life. What happens? Investigate what happens if you make the initial state longer? That is, 4, 5 and 6 black cells in a row and even longer. Include an illustrative plot. Use ;; when arrange the seed.