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 Plot the first 20 values of a_n.**OP**

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 a 1D cellular automata starting with one black cell. Produce a black triangle (90,45,45 degrees) with two corners in the middle and the third to the right. Find a possible rule number? Run it 30 times. Only black cells in the triangle.

4. Run the outer totalistic rule 258752 starting with a random state, that is each cell can be black or white with probablity 1/2. Use RandomInteger to construct the seed. Do 50,100,200 and 500 iterations. You can use a 500 times 500 grid. What happens? Repeat for a new random seed. Express 258752 in base 2 and describe in words the rule, when will birth and survival happen?**OP**