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

1. Find a RR for the number of ways, a_n, to climb n stairs if the allowed steps are 1,2 or 3 staircases. What are the initial conditions for this RR? Solve the problem with RSolve. If you do not like the output use N for numerical value and Re for real part. In how many ways can one climb 50 stairs? Plot with command DiscretePlot the first 20 values of a_n (or the logarithm).

2.Plot the value of the derivative of $g(x) = ax(1-x)$ at the two fix points for $0 < a < 4$. Try to formulate a criteria for the stability of a fix point.

3. Investigate the totalistic 1D CA with 2 colors and two cells on each side. $k = 2$ and $r = 2$, see the details for the command CellularAutomaton. How may rules? Try to find some interesting cases. Start both with one black cell and with random strings.**OP**

4. Run the seed Acorn for rule 224 (Game of Life). Do at least 5206 iterations. See for example the Wikipedia article about Game of Life. There you find the seed. What happens? Plot the start configuration and some nice looking iteration. Take a sufficiently large grid so you don't hit the boundary.**OP**