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

1. Find a RR for the number of ways to climb n stairs if the allowed steps are 1 or 2 staircases. What are the initial conditions for this RR? Solve the problem. In how many ways can one the climb 50 stairs?

2. Find the fix points for the tent map. Then $g(x) = a\text{Min}(x, 1-x), 0 \leq x \leq 1, 0 \leq a \leq 2$. Plot the location of the right fix point as function of a and the derivative there. When is this fix point stable? Can you find a 2-cycle in the tent map?

3. Consider the following 1D CA: A cell is black in next generation if and only if either of it neighbours, but not both, was black on the step before. What is the rule number? Do 5 iterations using one black cell as seed.

4. Consider the rule B25/S4. B denotes birth and S survival. Game of Life is B3/S23. What is the rule number for B25/S4? Try seeds that are Still Life, Oscillators and Gliders in Game of Life (see Wikipedia article about Game of Life). Iterate only a few times if you have no computer program. How is this CA behaving compared to Game of Life?