

Rules for Elementary Cellular Automata

1. Setup: Start with any number of squares in a row, each colored black or white.
2. Compute the next row by looking at each triplet of adjacent squares and using the key below to determine the color of the middle square in the row below.



3. Repeat the procedure to compute any number of additional rows.

Questions on Cellular Automata

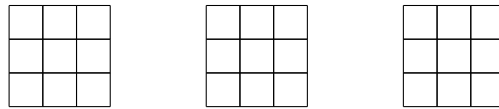
1. What happens if you start with a full row of white squares?
2. What happens if you start with a full row of black squares?
3. What happens if you alternate white, black, white, black?
4. Make up your own key using the 8 different triples above. What does the pattern look like after the first 5 generations? 10 generations? 100 generations?

Rules of the Chip Firing Game

1. Setup: Map of states, each with specified neighbors.
2. Start: Put any number of chips on each state. Chips placed on the ocean, sink to the bottom and are lost forever!
3. Chip firing moves: Choose any state S with at least as many chips as neighbors (including multiples and ocean). Then fire S by giving each neighbor of S one of its chips.
4. Repeat the chip firing moves if possible on any state until no more states can fire.

Questions on Chip Firing Games

1. Start with a 3×3 board. Put 6 chips on each square. Now fire away! How many chips are left on at the end? What symmetries does the final stable sandpile have?
2. Run the experiment again with 6 chips on a 3×3 board, but this time fire away in a different order. Was the end result the same or different? Why?
3. Take the final result of your experiments and add 6 more chips on each square. Call this sandpile M . Then, try adding M to any other pattern of chips on the same grid. After you fire away, what pattern is left in the end?



For More Information

- <https://sites.math.washington.edu/~billey/>
- <https://timeatihanyi.com>
- <https://sliprabbit.org>

References

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