

Wolfram Pyramids

Introduction

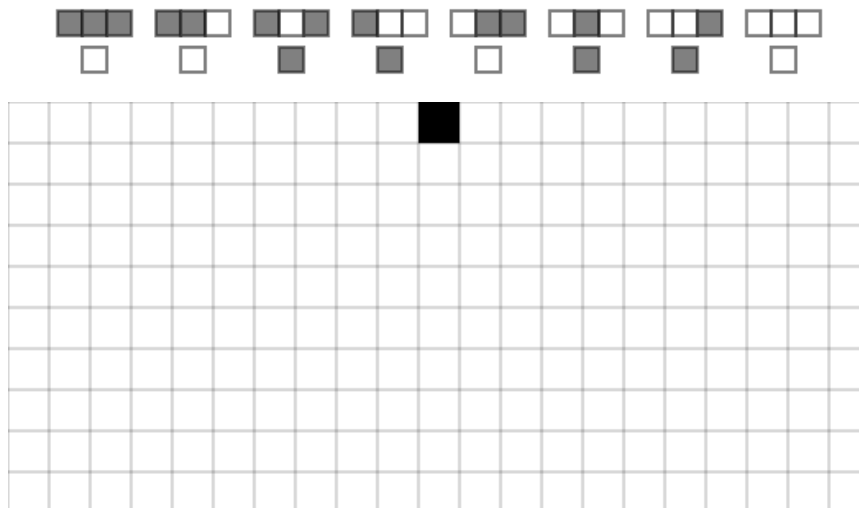
In this lab, we're going to explore a cellular automata algorithm that has been slightly adapted from Stephen Wolfram's *A New Kind of Science* (www.wolframscience.com/nks/).

Here is [a link to the accompanying video lab overview](#), which walks us through these activities.

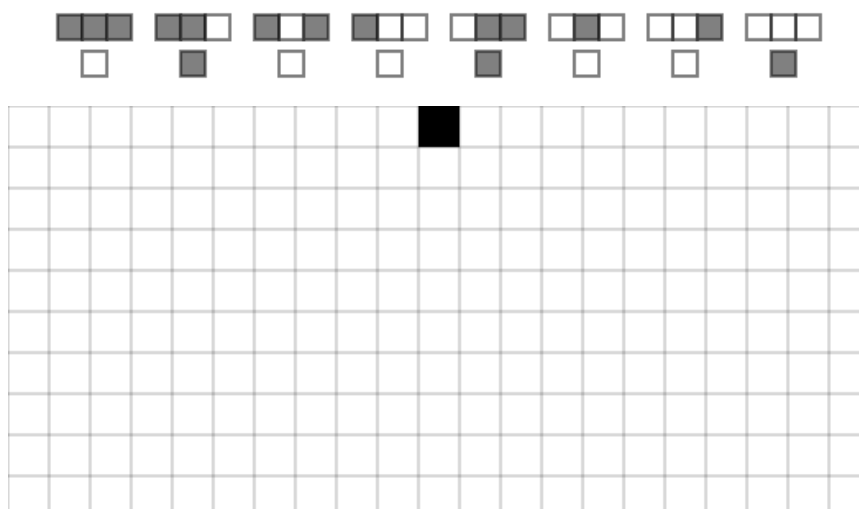
Task 1: Play

Use a pencil to draw Wolfram pyramids for each of the following rules by shading the appropriate cells.

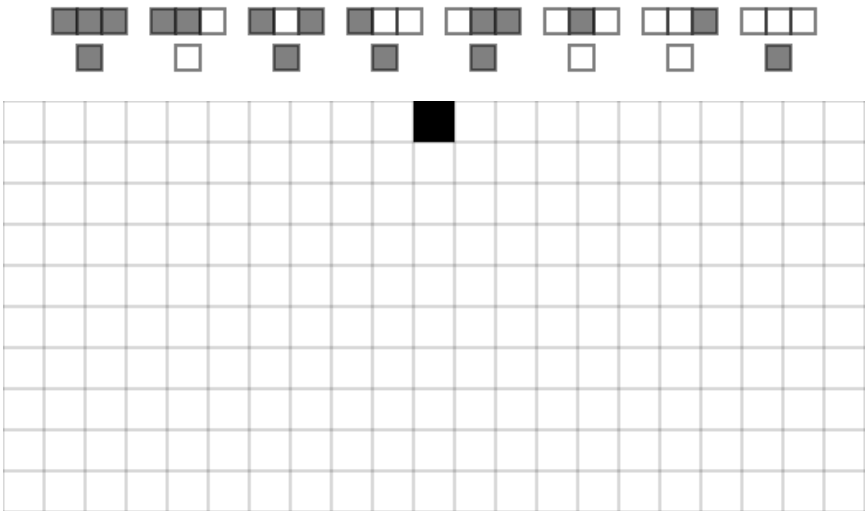
Rule 54



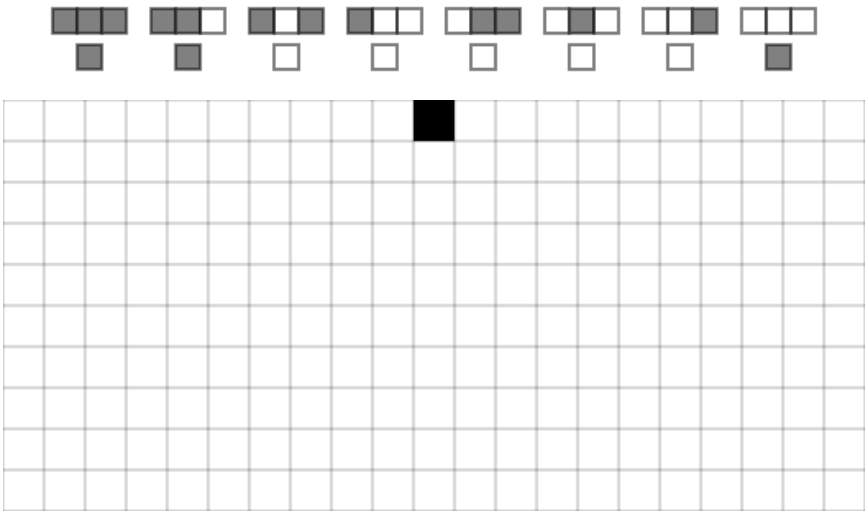
Rule 73



Rule 185



Rule 193



Task 2: Implement

Write a program that generates the corresponding Wolfram pyramid for each of the rules you covered in task 1 to at least 50 rows.

Task 3: Generalize

Write a program that accepts the number of a rule (from 0 to 255) and generates the corresponding Wolfram pyramid to at least 50 rows. Use the program to identify a rule that generates (i) nothing (only white cells), (ii) a completely black pyramid, (iii) a pyramid with a consistent pattern, (iv) a fractal pyramid, and (v) a pyramid that has self-similarity in its structure. (Find pyramids that were not covered in the video.)

Task 4: Report

When you're done, write up a report that contains:

- An appropriate heading.
- A brief explanation of the algorithm used in this lab.
- A scan of the patterns you generated by hand in task 1.
- The code you wrote for task 2 along with output generated for the patterns in task 1.
- The code you wrote for task 3 along with generated images of the pyramids you identified.

Assessment

Your report will be peer-assessed according to agreement level with the following statements.

- The report contains an appropriate heading.
- A brief explanation of the algorithm used is provided, which could be easily followed by a reader who is not familiar with the algorithm.
- The hand-generated images are clear and correct.
- The code for task 2 is well written: appropriate variable names have been assigned; the code has been well documented; the code is easily read by a human while using conventions of the language chosen.
- The images generated in task 2 are correct and match the hand-generated images.
- The code for task 3 is well written: appropriate variable names have been assigned; the code has been well documented; the code is easily read by a human while using conventions of the language chosen.
- The report successfully identifies and illustrates pyramids that match specifications (i) — (vi) in task 3.
- The structure of the report is clear: sections are easily identifiable; consistent styling choices have been implemented.