Activity 10

COMPLEXITY SCIENCE (CELLULAR AUTOMATON)

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The outputs presented in the succeeding pages are created using MATLAB. Moreover, the codes are uploaded in Github. In addition, the results of are also shown in this **link**.

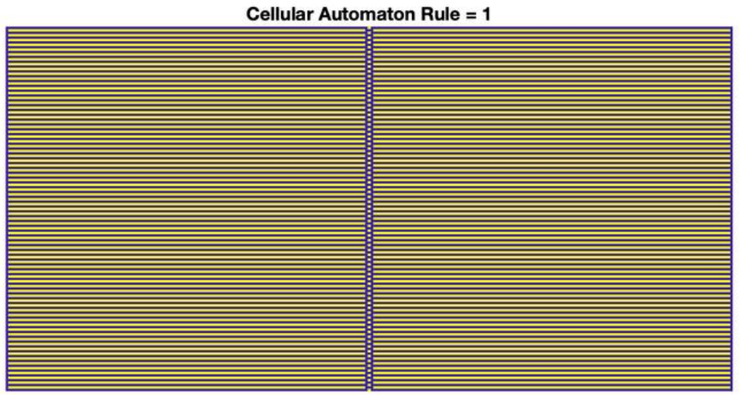
INTRODUCTION

Cellular automata are **computational models** that perform computations on a divided grid representing a simple world, where each chunk or cell evolves its state based on **local rules** and the states of its **neighboring cells**.

Most cellular automata are **deterministic**, meaning that their behavior is solely determined by the initial configuration and the specified rules without any random elements. This deterministic nature ensures that given the same initial conditions and rules, the cellular automaton will always produce the same subsequent states. It does not have any random elements since programs produce only **pseudo-random number generators (PRNGs)** and are not considered truly random.

In this experiment, the goal is to *demonstrate Wolfram's 1D Cellular automaton models* through the use of MATLAB and show some figures of specific rules.

RESULTS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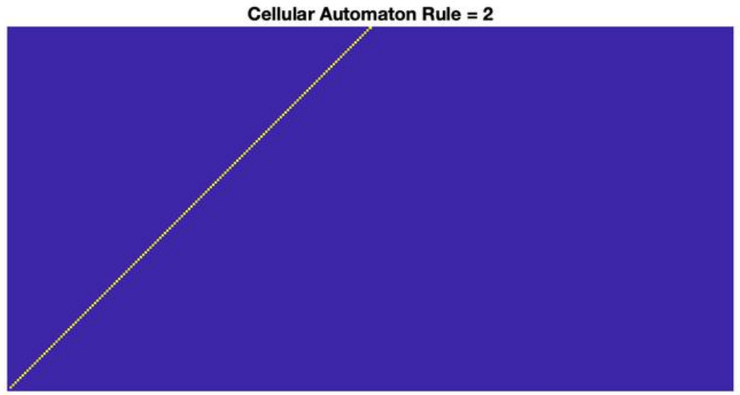
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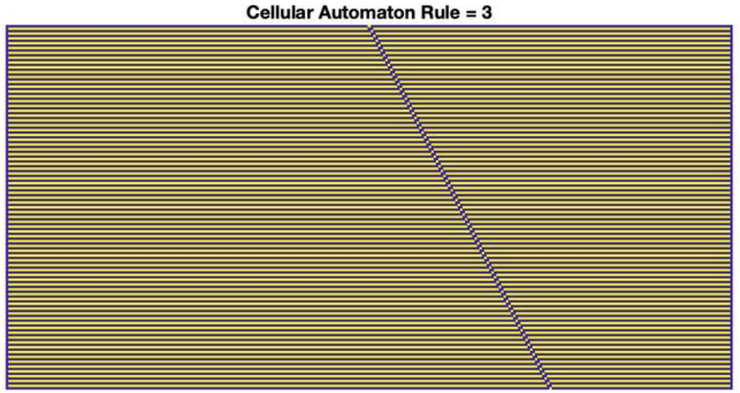
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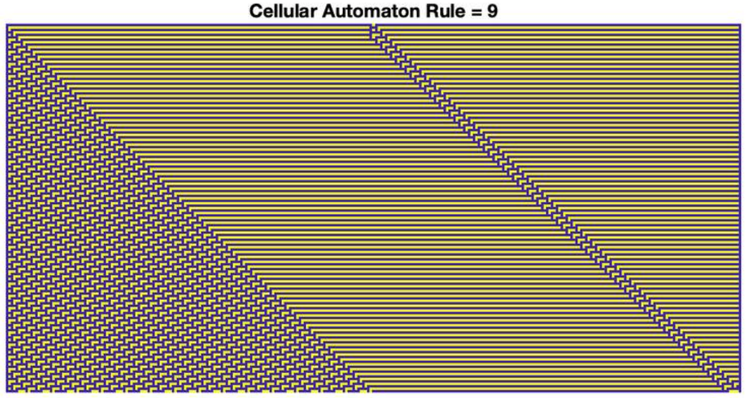
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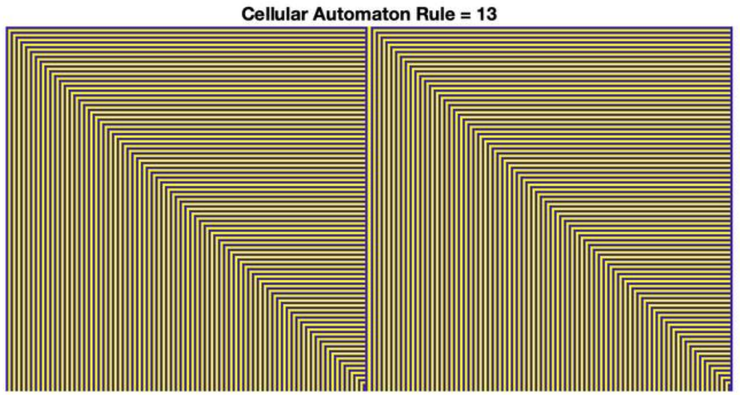
RESULTS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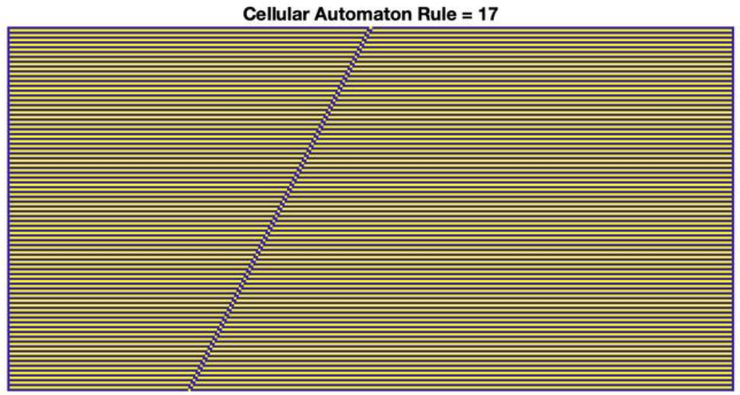
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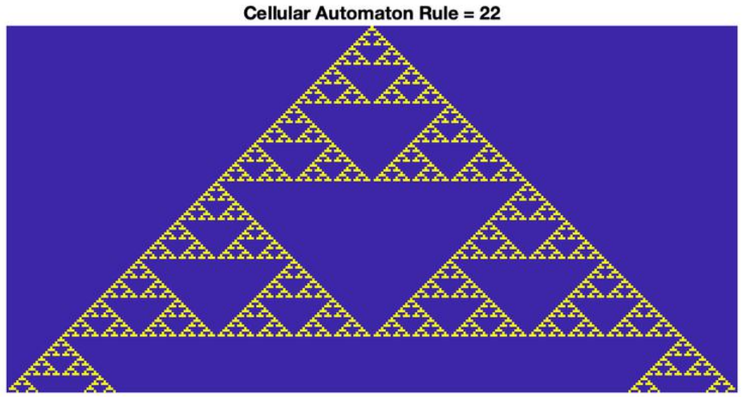
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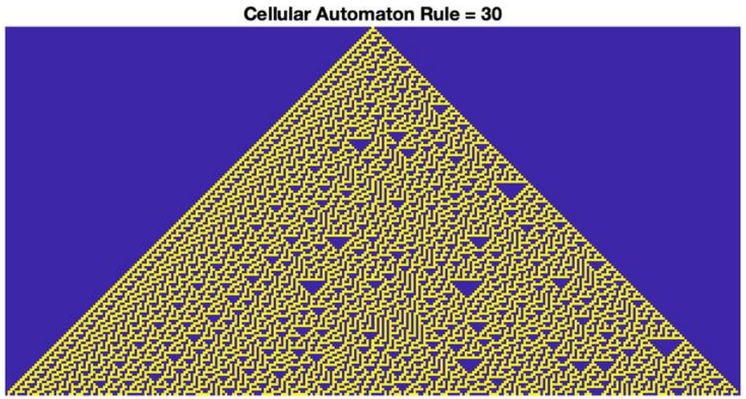
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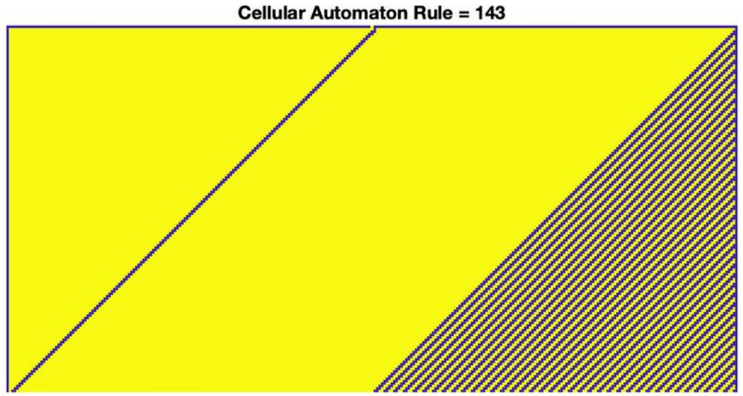
RESULTS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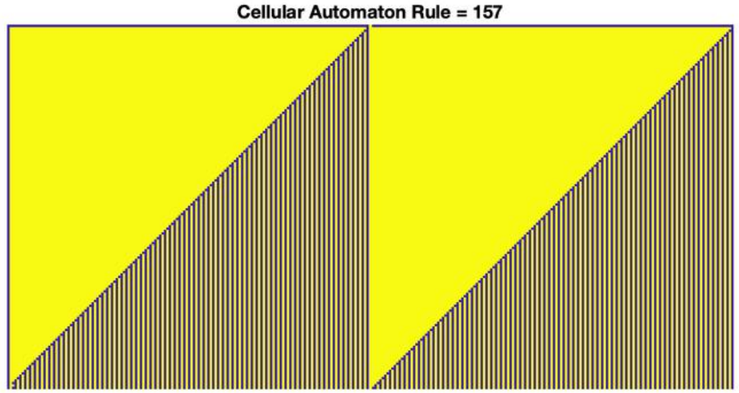
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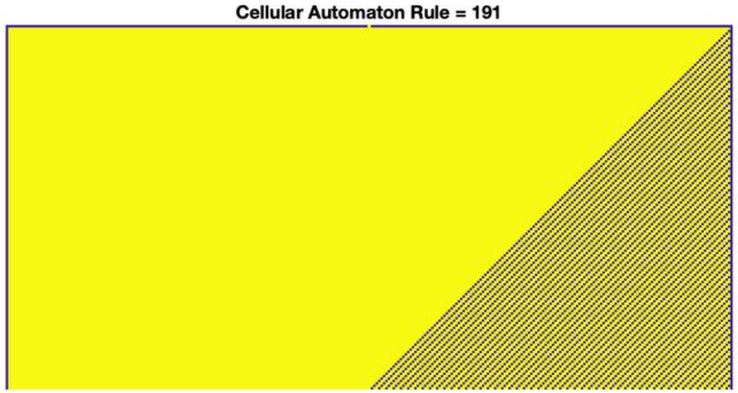
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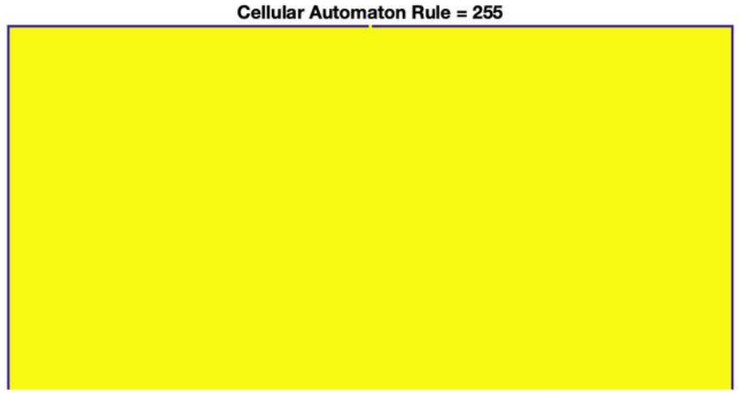
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OBSERVATIONS

- All experiments consistently yielded the expected output, demonstrating the deterministic nature of cellular automaton.
- The patterns generated by the automaton exhibited intricate and captivating structures, showcasing the complexity and richness inherent in the rules governing its behavior.

- Cellular automaton provide a practical way to model and simulate complex systems using only simple rules.
- Even small changes to the rules may lead to different outcomes, which proves the sensitivity of the system to its initial conditions and rule settings.
- Randomness in programs are not truly random at all.
- Cellular automaton offer a powerful framework for simulating and modeling dynamic systems, allowing us to study and analyze various phenomena in different fields.

REFLECTION

RATING: 90 / 100

Exploring cellular automaton has been a fascinating way to learn about Complexity Science. It's been easier to understand compared to previous topics like Machine Learning because it focuses on a different aspect of programming. I couldn't have done it without the help of my labmates (Abdel, Johnenn, Julian, Kuya Ja, and Kuya Richmond) who supported and motivated me throughout. Their presence kept me going even when I felt tired. I also would like to mention my use of chatGPT in assisting me in editing the code and saving the automaton as GIFs and PNG files.

As the semester comes to an end, this experience has reignited my excitement to complete the remaining activities.

Reference :

Downey, A. B. (n.d.). Think Complexity Version 2.6.3. Green Tea Press.

MathWorld. (n.d.). Elementary Cellular Automaton. Retrieved June 26, 2023, from https://mathworld.wolfram.com/ElementaryCellularAutomaton.html