

Parallel Conway's Game of Life

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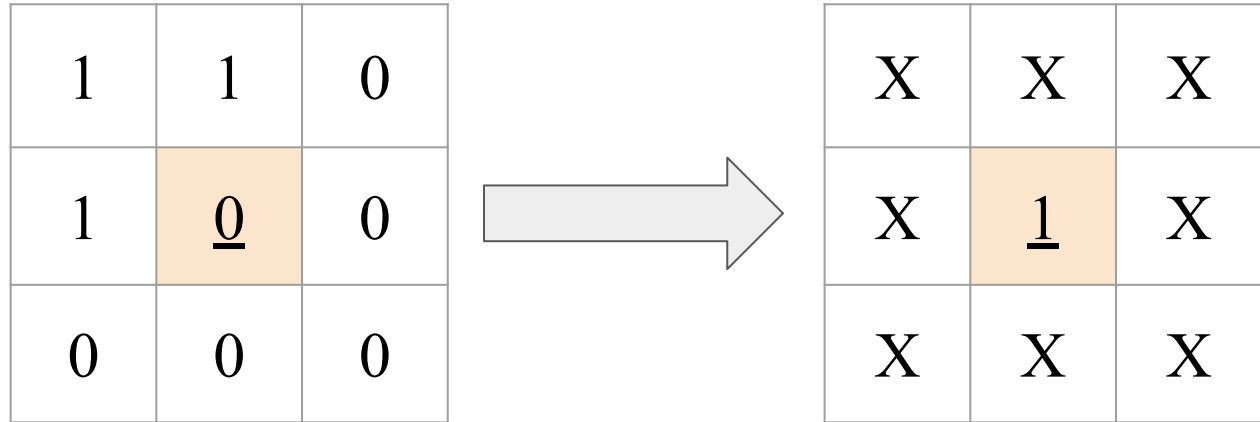
Background

- Invented by John Conway in 1970
- Cellular Automaton - system where rules are applied to cells within a grid
- Sometimes just called 'Life'
- Run over successive generations, must calculate one to calculate the next

Rules

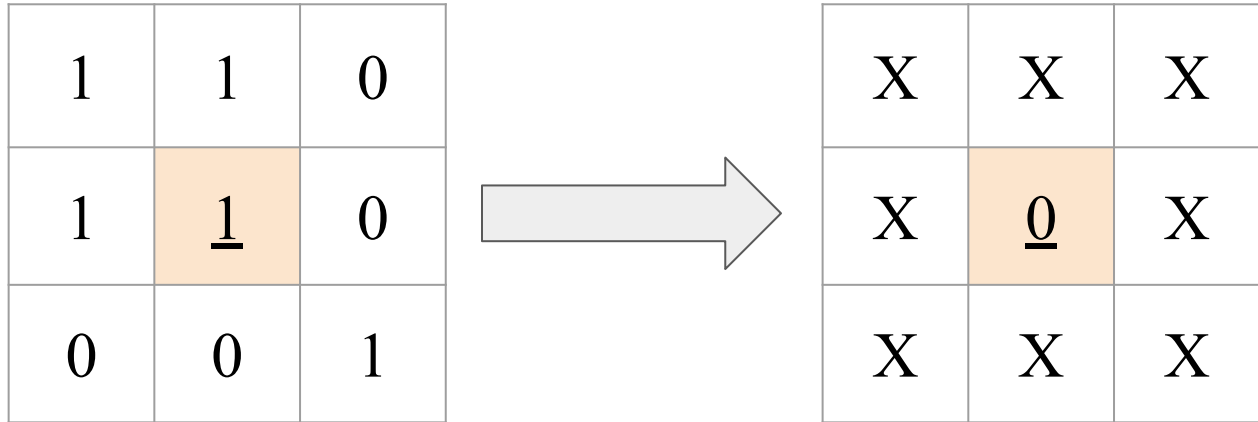
- A live cell with fewer than 2 neighbors dies
- A live cell with two or three neighbors lives
- A live cell with more than three neighbors dies
- A dead cell with three neighbors becomes a live cell

Example



- By the rule: A dead cell with three neighbors becomes a live cell

Example



- By the rule: A live cell with more than three neighbors dies

Features

- Modes: Calc and Demo
- Adjustable Board Size
- Adjustable Generations
- Percentage-based and preconfigured start states
- 3 Parallelization strategies
- Count of alive cells over generations (.txt file)

Parallelization

Parallel_for

- Calculates next generation
- Also, save “next” generation to “current” generation
- Two parallel_for uses

Parallel_reduce

- Calculate number of alive elements
- All generations recorded, output in .txt file

Parallel_invoke

- Calculate next generation and alive elements of current generation at the same time

Demonstration

Results

- Board 500x500
- Generations: 50
- Preconfig1
(glider gun)

Parallel_for	Parallel_reduce	Parallel_invoke	Results (uS)
off	off	off	112036
on	off	off	18305
off	on	off	121199
off	off	on	224865
off	on	on	218305
on	off	on	15731
on	on	off	16563
on	on	on	15658

Results Cont.

for/reduce/invoke	Generations	Results (uS)
off/off/off	50	112036
on/on/on	50	15658
off/off/off	25	54341
on/on/on	25	8469
off/off/off	10	22007
on/on/on	10	4157

- Does parallelization net more gains with a higher generation count?
- Use equation:
 - $(\text{para_on})/(\text{para_off}) * 100\%$

Generations	%
50	13.97
25	15.58
10	18.89

Results Cont.

for/reduce/invoke	Configuration	Results (uS)
off/off/off	Glider Gun	112036
on/on/on	Glider Gun	15658
off/off/off	25% random board coverage	167445
on/on/on	25% random board coverage	19987

- What about different start states?

Questions?