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

1	1	0
1	0	0
0	0	0

X	X	X
X	1	X
X	X	X

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

Example

1	1	0
1	1	0
0	0	1

X	X	X
X	0	X
X	X	X

- 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:
  - (para_on)/(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?