Modeling 1D traffic with cellular automata

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Aim

The aim of the exercise is to design serial and parallel algorithms to implement a simple cellular automaton which attempts to model traffic flow.

Model

Road at time t

1	0	1	1	0	1	1	1	0	0

Road at time $t + 1$

0	1	1	0	1	1	1	0	1	0

Update rules

	$R_t(i-1) = 0$	$R_t(i-1) = 1$
$R_t(i+1) = 0$		
$R_t(i+1) = 1$		

Values of $R_{t+1}(i)$ if $R_t(i) = 0$

	$R_t(i-1) = 0$	$R_t(i-1) = 1$
$R_t(i+1) = 0$		
$R_t(i+1) = 1$		

Values of $R_{t+1}(i)$ if $R_t(i) = 1$

Solve the problem

Write a serial version of your code.

- Gives a starting point
- Solve your problem in the simplest terms
- Useful for checking the correctness of the parallel version

Parallelise

- Identify the aspects of the problem that can be executed simultaneously by, say, several people
- Which data does each person need at each step?
- If someone is missing some or all of the needed data at the beginning of each step, Who has it? How can it be transferred?
- How to integrate the data to obtain a result?
- Remember to do as little communication as possible (expensive)