Parallel Programming

Thought exercise: traffic modelling

Traffic Flow

- we want to predict traffic flow
  - to look for effects such as congestion
- build a computer model

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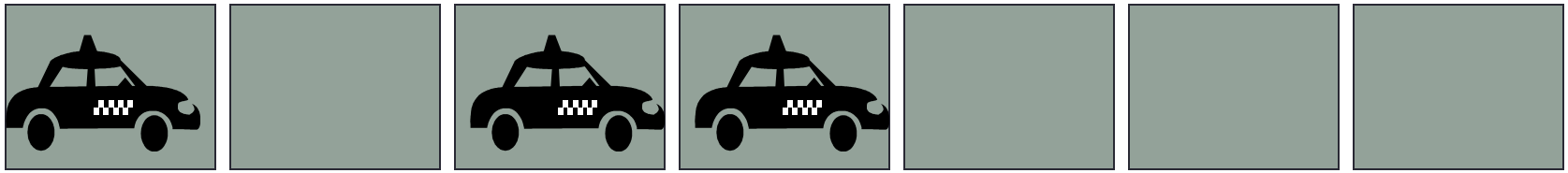
Simple Traffic Model

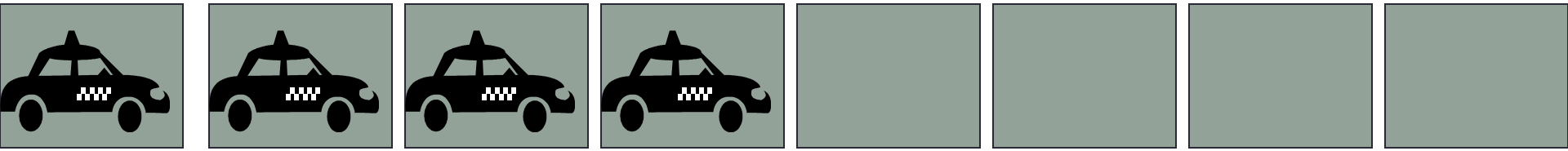
- divide road into a series of cells
  - either occupied or unoccupied
- perform a number of steps
  - each step, cars move forward if space ahead is empty



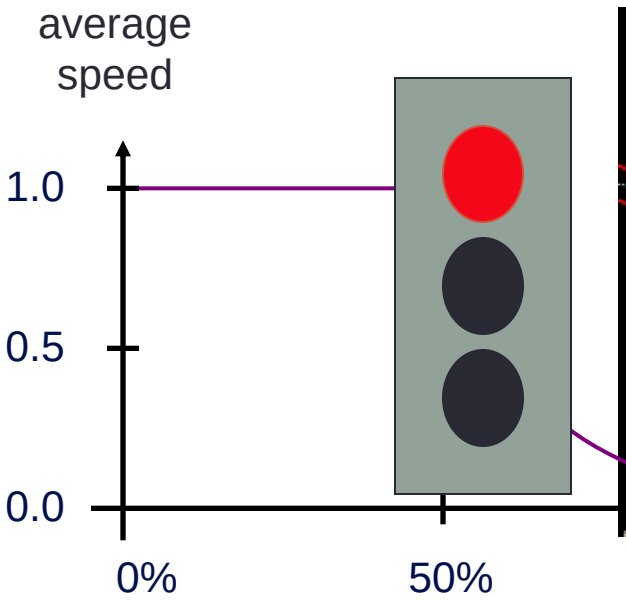
could do this by moving pawns on a chess board

traffic behaviour

- model predicts a number of interesting features
- traffic lights



- congestion
- more complicated models are used in practice



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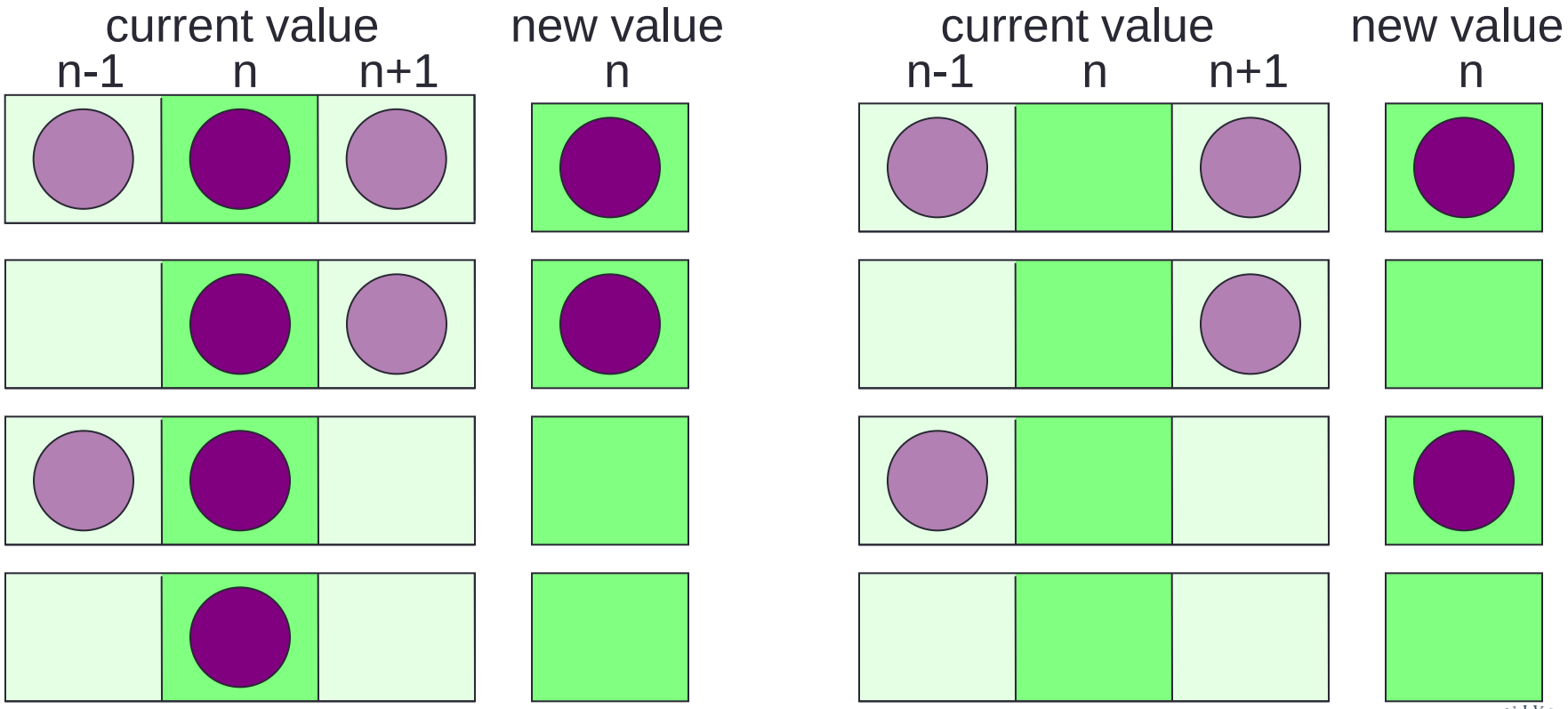
Traffic simulation

- Update rules depend on:
  - state of cell
  - state of nearest neighbours in both directions



State Table

- If $R^t(i) = 0$, then $R^{t+1}(i)$ is given by:

	$R^t(i-1) = 0$	$R^t(i-1) = 1$
$R^t(i+1) = 0$	0	1
$R^t(i+1) = 1$	0	1

- If $R^t(i) = 1$, then $R^{t+1}(i)$ is given by:

	$R^t(i-1) = 0$	$R^t(i-1) = 1$
$R^t(i+1) = 0$	0	0
$R^t(i+1) = 1$	1	1

Pseudo Code

```
declare arrays old(i) and new(i), i = 0,1,...,N,N+1
initialise old(i) for i = 1,2,...,N-1,N (eg randomly)
loop over iterations
  set old(0) = old(N) and set old(N+1) = old(1)
  loop over i = 1,...,N
    if old(i) = 1
      if old(i+1) = 1 then new(i) = 1 else new(i) = 0
    if old(i) = 0
      if old(i-1) = 1 then new(i) = 1 else new(i) = 0
  end loop over i
  set old(i) = new(i) for i = 1,2,...,N-1,N
end loop over iterations
```

how fast can we run the model?

- measure speed in Car Operations Per second
  - how many COPs?
- around 2 COPs
- but what about three people?
  - can they do six COPs?

a parallel traffic model