Message-Passing Thought Exercise

Traffic Modelling

Reusing this material

epcc

THE UNIVERSITY OF EDINBURGH

Traffic flow

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

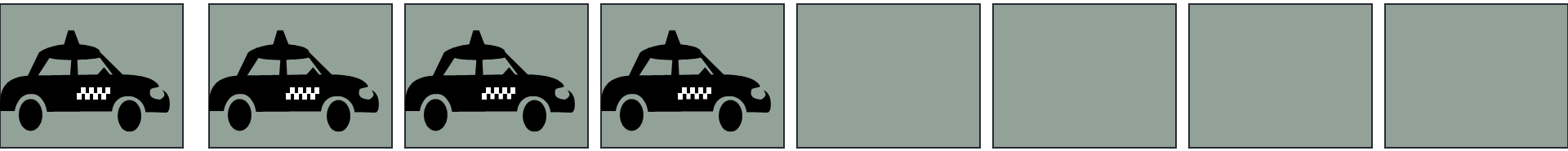
Simple traffic model

- 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

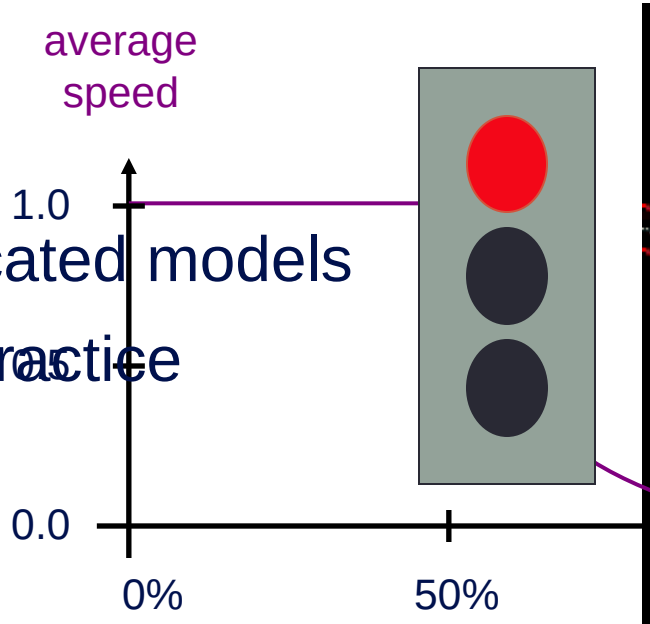
could do this by moving pawns on a chess board

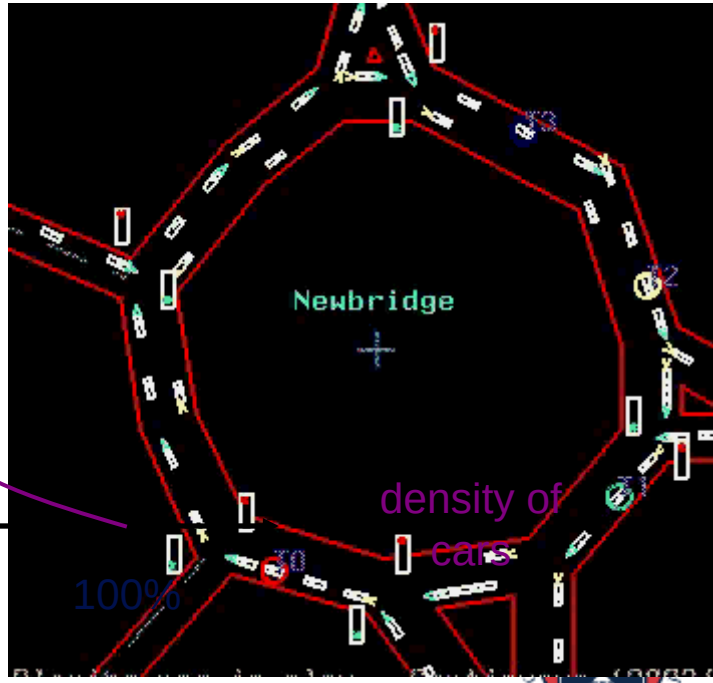
Traffic behaviour

- model predicts a number of interesting features
- traffic lights



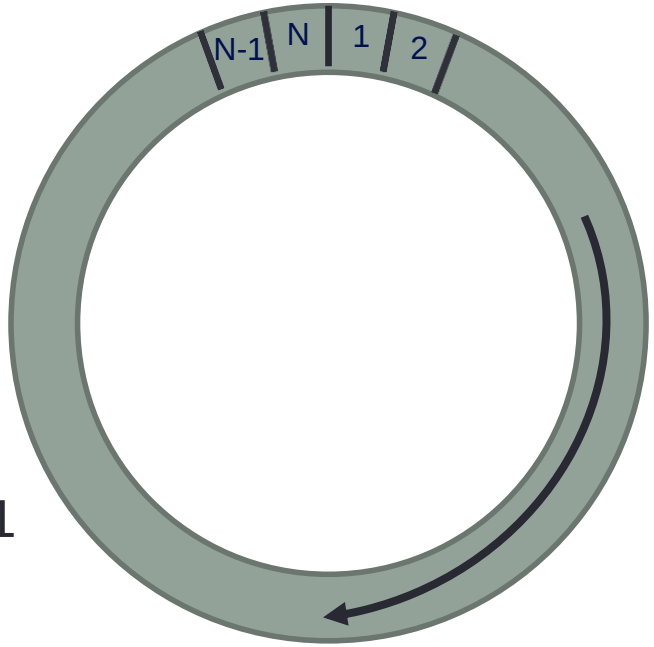
- congestion
- more complicated models are used in practice





Boundary conditions

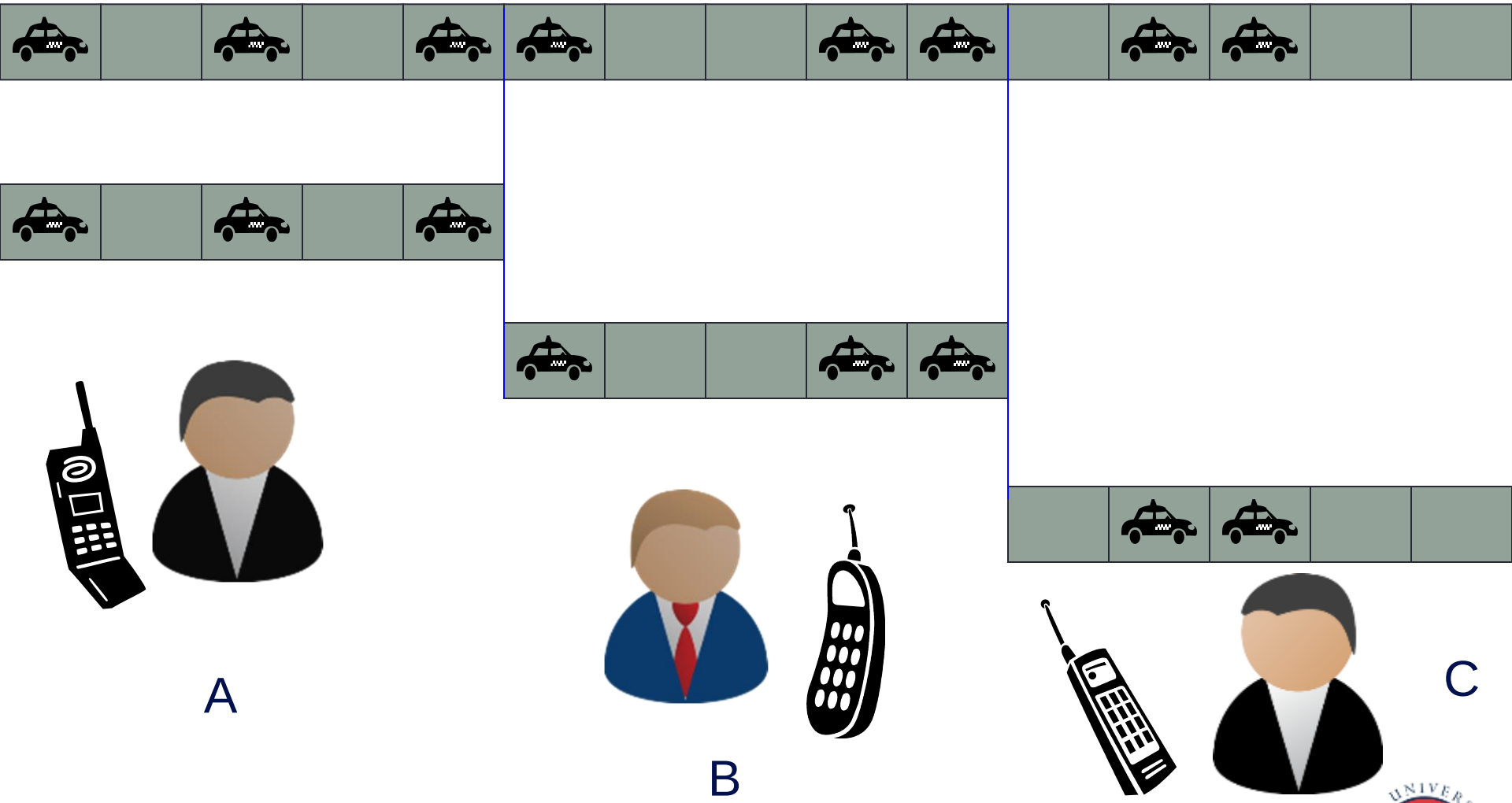
- What happens if a car falls off the end of the road?
  - when does a car appear at the start?
- Consider a roundabout
  - periodic boundary conditions:
    - up from last cell *N* is first cell 1
    - down from first cell 1 is last cell *N*
- Implement with *ghost* or *halo* cells
  - road has *N*+2 cells 0, 1, 2, ..., *N*-1, *N*, *N*+1
  - copy cell 1 to cell *N*+1 and cell *N* to cell 0
  - then update cells 1 to *N* as normal



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?

Parallel Traffic Modelling



Pseudo Code: traffic on a roundabout

```
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
```