Leader Election

Leader Election in Rings

- Models
  - Synchronous or Asynchronous
  - Anonymous (no unique id) or Non-anonymous (unique ids)
  - Uniform (no knowledge of *N*, the number of processes) or non-uniform (knows *N*)

- Known Impossibility Result:
  - There is no synchronous, non-uniform leader election protocol for anonymous rings

Election in Asynchronous Rings

- LeLann's and Chang-Robert's Algorithms
  - send own id to node on left
  - if an id received from right, forward id to left node only if received id greater than own id, else ignore
  - if own id received, declares itself "leader"

- Works on unidirectional rings

- Message complexity = $O(n^2)$

Hirschberg-Sinclair Algorithm

- Operates in phases, requires bidirectional ring
- In the k^{th} phase, send own id to 2^k processes on both sides of yourself (directly send only to next processes with id and *k* in it)
- If id received, forward if received id greater than own id, else ignore
- Last process in the chain sends a reply to originator if its id less than received id
- Replies are always forwarded
- A process goes to $(k+1)^{th}$ phase only if it receives a reply from both sides in k^{th} phase
- Process receiving its own id – declare itself “leader”. At most lg*n* rounds

Features: Hirschberg-Sinclair

- Message Complexity: $O(n \lg n)$
- Lots of other algorithms exist for rings
- Lower Bound Result:
  - Any *comparison-based* leader election algorithm in a ring requires $\Omega(n \lg n)$ messages