# Lecture 9.3
# Fast Mutual Exclusion

EN 600.320/420

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# Fast Mutual Exclusion

- Now let's scale this to *n* processes

## Leslie Lamport Receives Turing Award

Microsoft Research
March 18, 2014 6:00 AM PT

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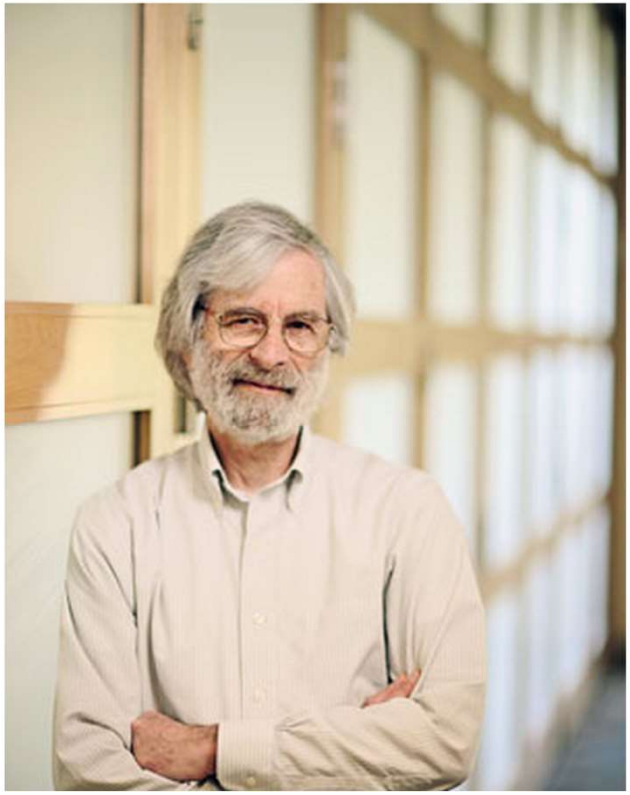


Leslie Lamport first began dabbling in computers while he was still in high school. Nothing too unusual about that—until you consider that this was in the mid-1950s. Lamport was attending the Bronx High School of Science in New York, and he and a friend used to scrounge around, looking for discarded vacuum tubes to build a digital circuit.

The path to greatness begins with baby steps, and for Lamport, a principal researcher with Microsoft Research, that teenage curiosity has yet to be quenched. Over the ensuing decades, he has become a veritable legend in computing circles. His work in the theory of distributed computing is foundational. His 1978 paper *Time, Clocks, and the Ordering of Events in a Distributed System*

Publications

- *Time, Clocks, and the Ordering of Events in a Distributed System*
- *The Maintenance of Duplicate Databases*
- *A New Solution of Dijkstra's Concurrent Programming Problem*
- *The Byzantine Generals Problem*
- *The Part-Time Parliament*
- *Paxos Made Simple*
- *Specifying Systems: The TLA+ Language and Tools for Hardware and Software Engineers*

Awards

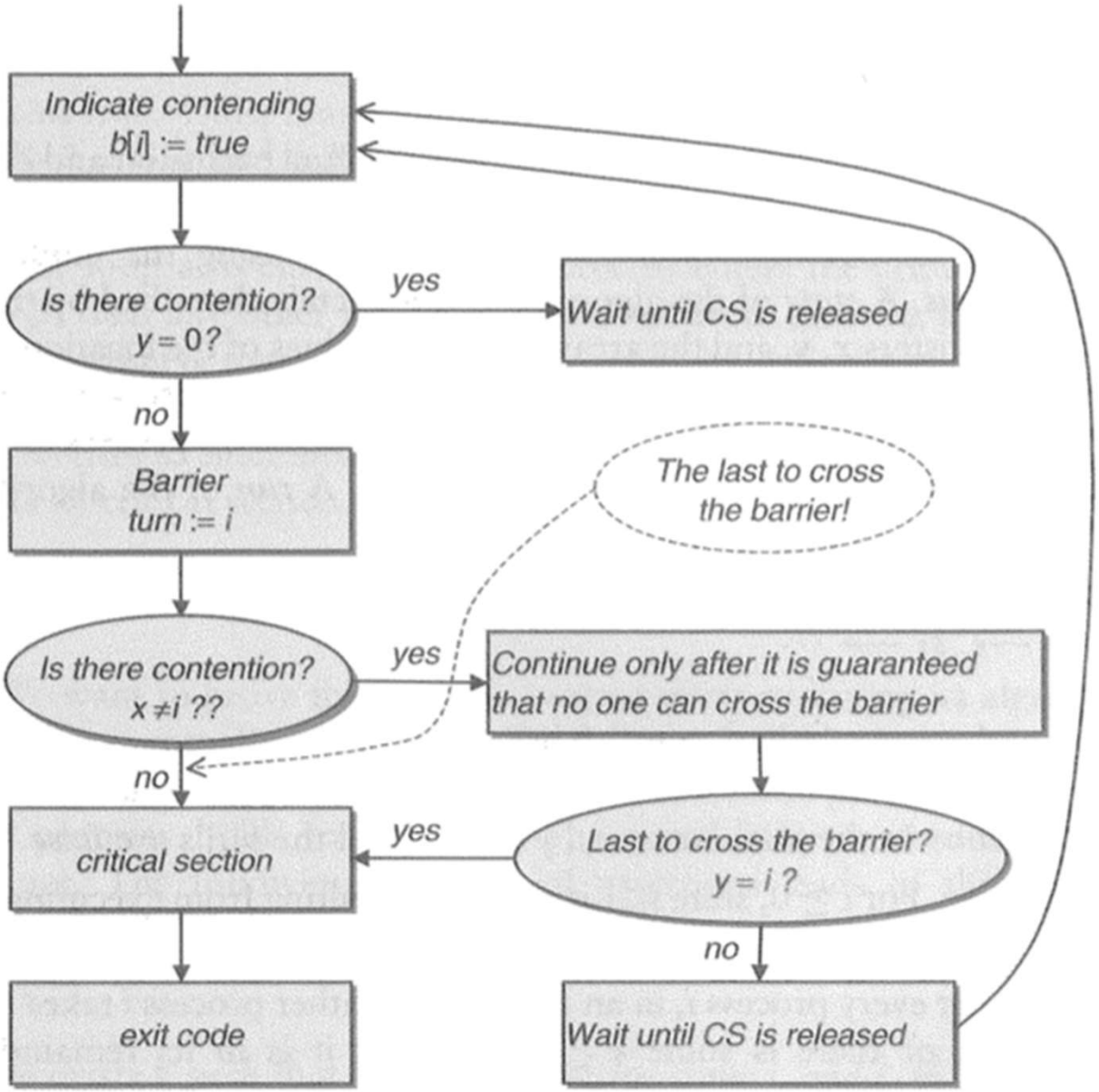
- A.M. Turing Award

# Fast Mutual Exclusion

- Lamport 1987

```
1  start:  b[i] := true;
2          x := i;
3          if y ≠ 0 then b[i] := false;
4                        await y = 0;
5                        goto start fi;
6          y := i;
7          if x ≠ i then b[i] := false;
8                        for j := 1 to n do await ¬b[j] od;
9                        if y ≠ i then await y = 0;
10                                     goto start fi fi;
11         critical section;
12         y := 0;
13         b[i] := false
```

# Fast Mutual Exclusion




# Fast MutEx Properties

- Mutual exclusion/deadlock freedom
- Contention free overhead=  7 accesses
- **Starvation is possible!** (of any process)
  - Unbounded wait times

# Practical Concerns

- None of the algorithms are used in practice
  - Too simple
  - H/W support
- But demonstrate fundamental tradeoffs
  - Space (# shared registers), speed, fairness (bounded waiting)
- All of these algorithms rely on *atomic* registers
  - Not available in distributed memory machines, which leads to whole new families of protocols