Semantics for Concurrency

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Introduction - 5.3.19

- Intro: Concurrent data structures
  correctness and performance

Concurrent Data Structures Correctness and Relaxations

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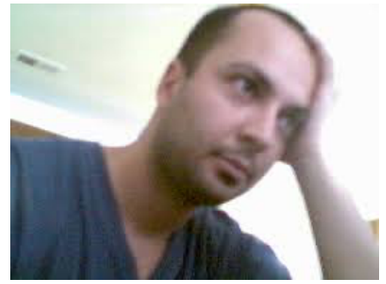

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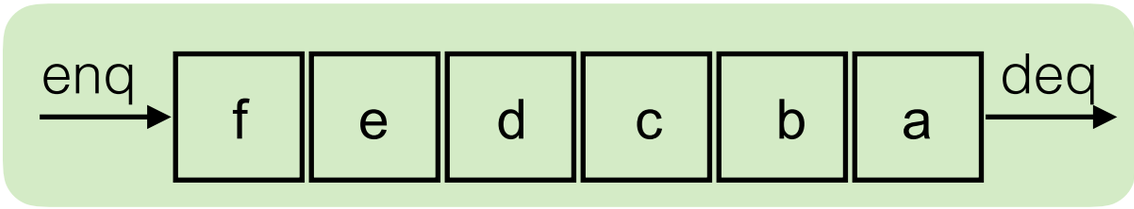
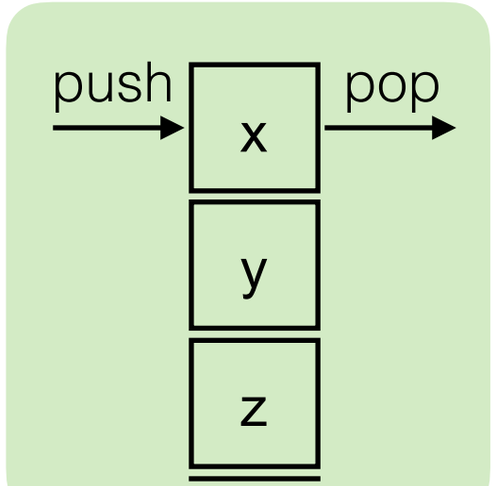
Data structures

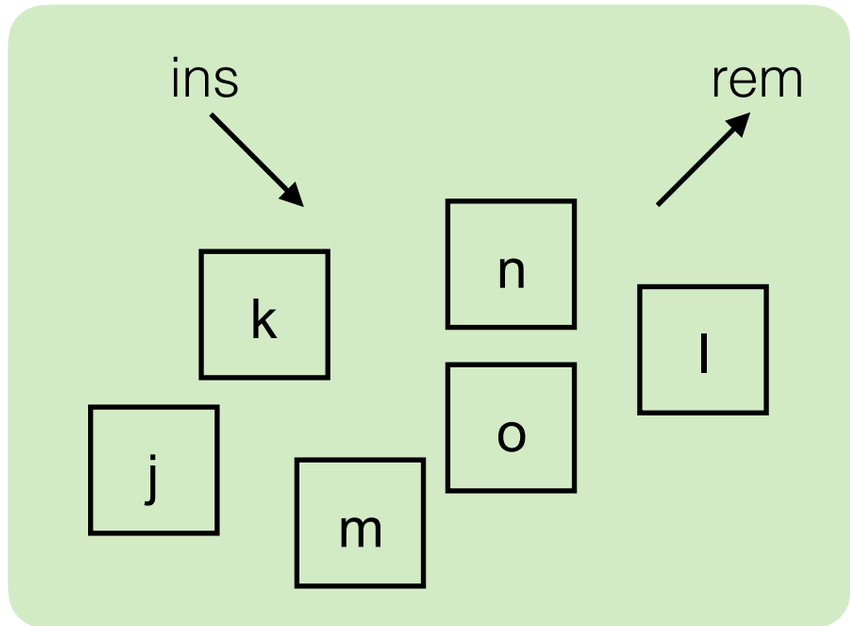
- Queue FIFO



- Stack LIFO

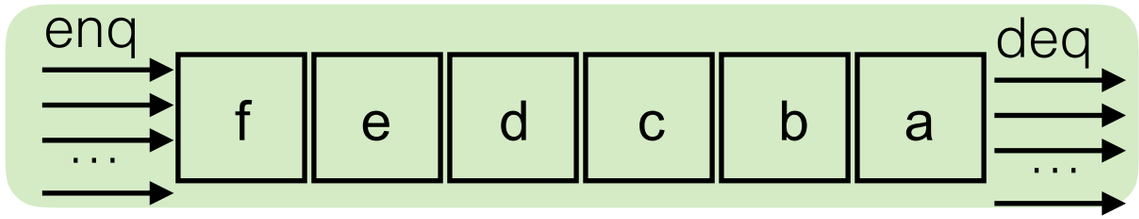


- Pool unordered

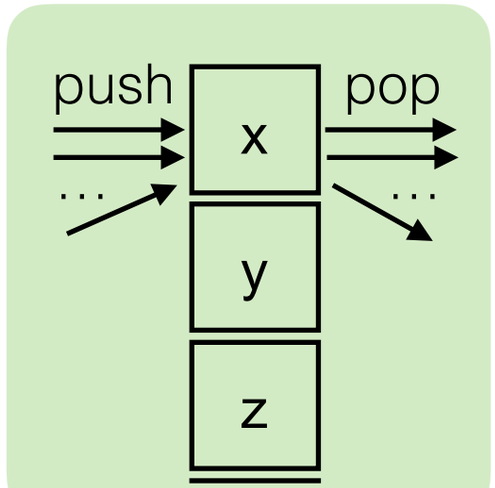


Concurrent data structures

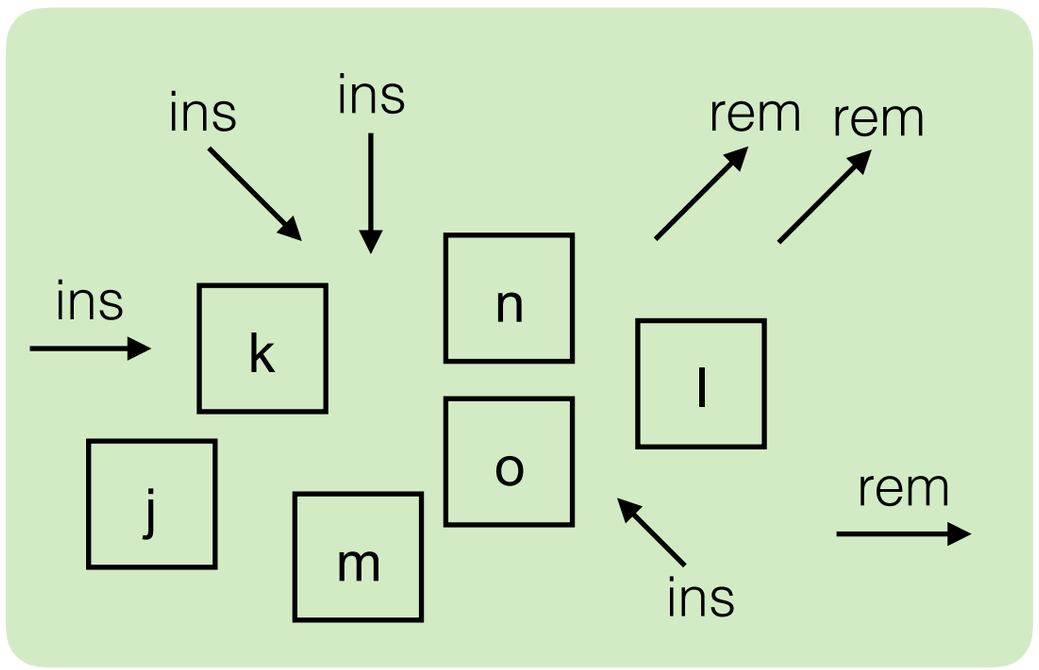
- Queue FIFO



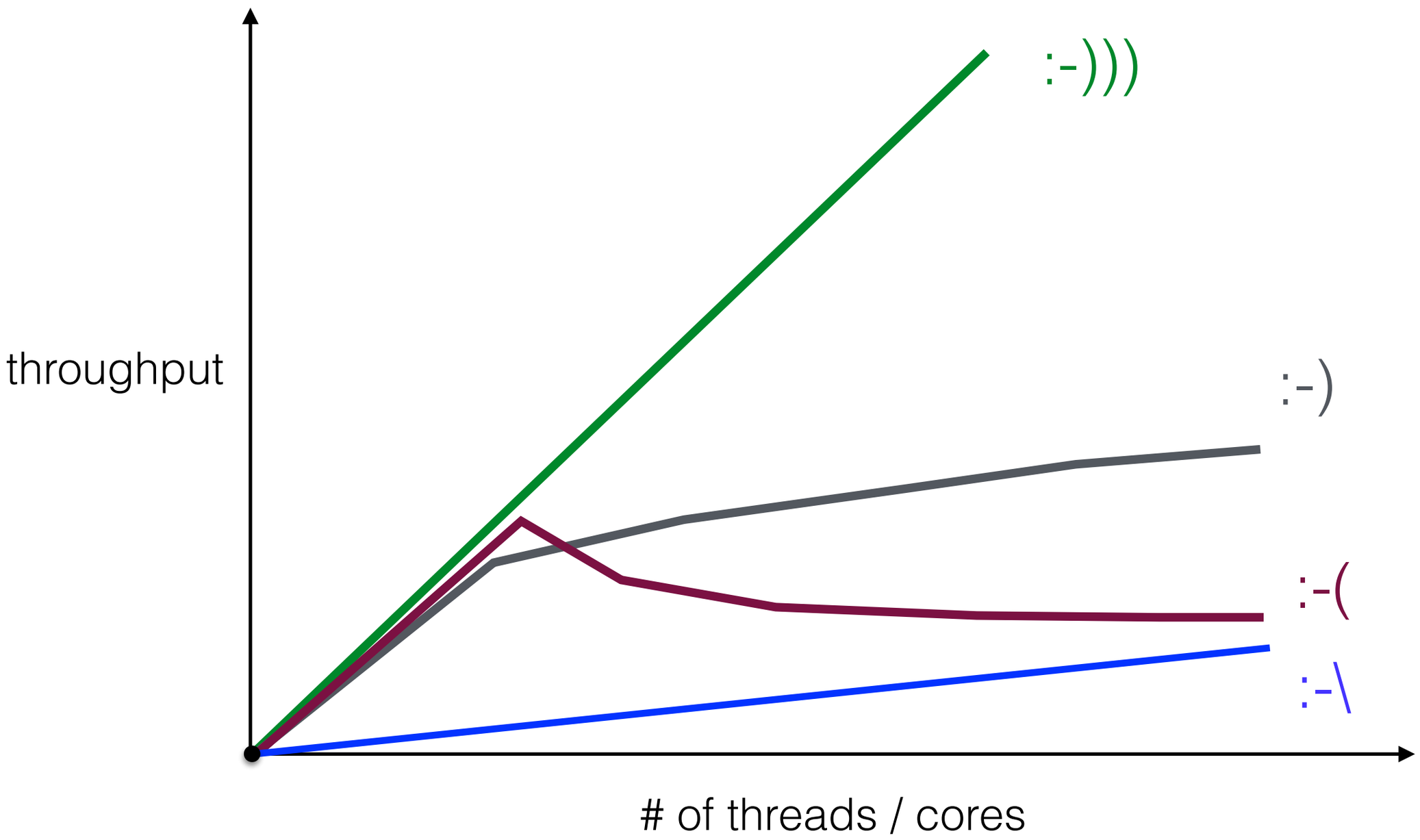
- Stack LIFO



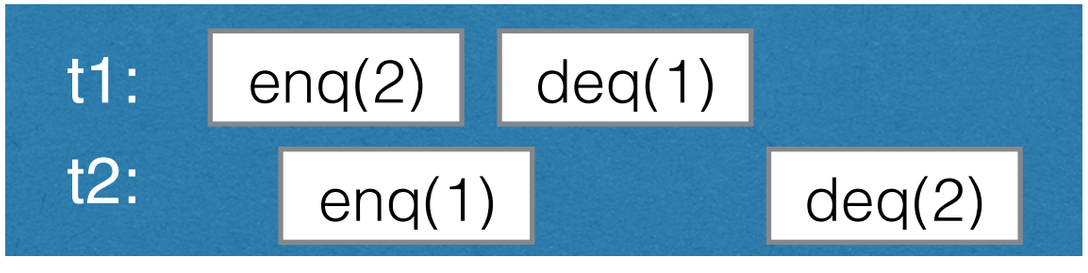
- Pool unordered



Performance and scalability



Semantics of concurrent data structures



e.g. queues

- Sequential specification = set of legal sequences

e.g. queue legal sequence
enq(1)enq(2)deq(1)deq(2)

- Consistency condition = e.g. linearizability / sequential consistency

e.g. the concurrent history above is a linearizable queue concurrent history

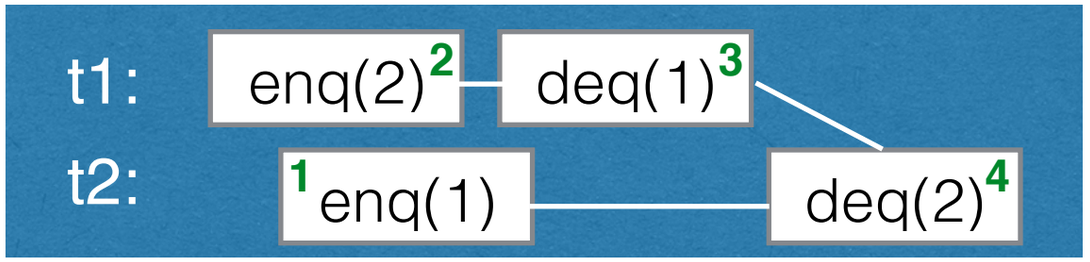
Consistency conditions

A history is … wrt a sequential specification iff

there exists a legal sequence that preserves precedence order

Linearizability [Herlihy,Wing '90]

consistency is about extending partial orders to total orders



Sequential Consistency [Lamport'79]

there exists a legal sequence that preserves per-thread precedence (program order)