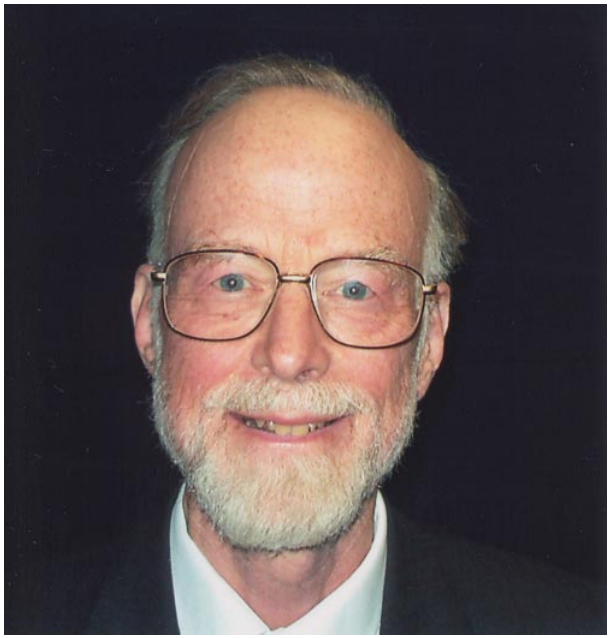
Synchronous Message Passing

CSE 6490A

February 10, 2010

Communicating Sequential Processes (CSP)

C.A.R. Hoare. Communicating sequential processes. *Communications of the ACM*, 21(8):666-677, August 1978.



sir Charles Antony Richard (Tony) Hoare

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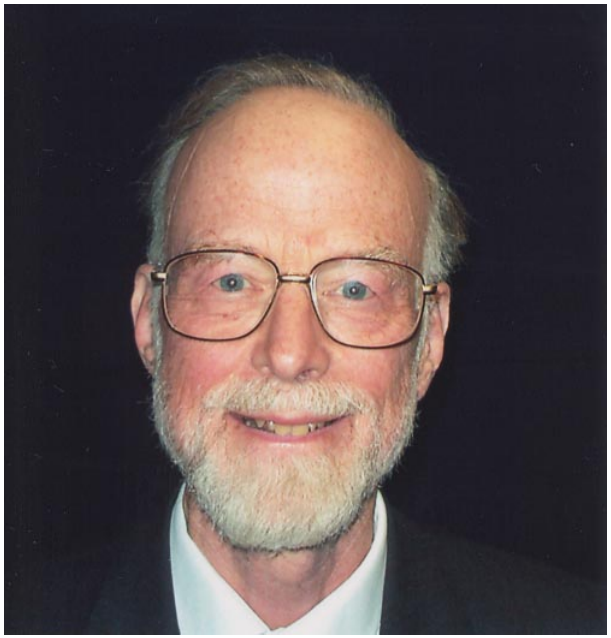

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Syntax of CSP

CSP has static process creation.

[name :: command $\|$ $\cdots$ $\|$ name :: command]

Syntax of CSP

CSP uses synchronous message passing to communicate.

- Receive command
  name?pattern
- Send command
  name!expression

Communication in CSP

[sender :: receiver!(1,2) $\|$ receiver :: sender?(1,x)]

As a result of the communication, the variable x is assigned the value 2.

Communication in CSP

[sender :: receiver!(1,2) $\|$ receiver :: sender?(3,x)]

No communication takes place since the expression (1,2) does not match the pattern (3,x).

Syntax of CSP

Conditional command

[guard $\rightarrow$ command $\Box \cdots \Box$ guard $\rightarrow$ command]

Guard

- Boolean expression
- receive command
- Boolean expression ; guard

Syntax of CSP

Iteration command

$*[\text{guard} \rightarrow \text{command} \; \square \cdots \square \; \text{guard} \rightarrow \text{command}]$

Guard

- Boolean expression
- receive command
- Boolean expression ; guard

Examples in CSP

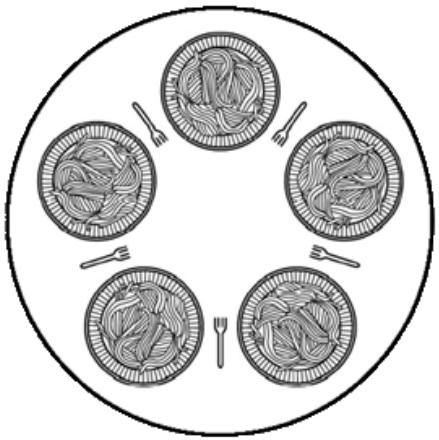
Express a semaphore and a process using that semaphore to protect its critical section.

Examples in CSP

Express the consumer-producer problem. The producer produces the integers 1, . . . , 100 and the consumer prints the integers it consumes.

Examples in CSP

Dining philosophers problem (Dijkstra, 1965): five philosophers are seated around a circular table. Each philosopher has a plate of spaghetti. The spaghetti is so slippery that a philosopher needs two forks to eat it.



The life of a philosopher consists of alternative periods of eating and thinking. When philosophers get hungry, they try to acquire the left and right fork, one at a time, in either order. If successful in acquiring both forks, the philosopher eats for a while, then puts down the forks and continues to think.

Examples in CSP

The sieve of Eratosthenes is a simple, ancient algorithm for finding all prime numbers up to a specified integer.

Eratosthenes