Unit-3: Linear-time properties

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Chennai Mathematical Institute

NPTEL-course

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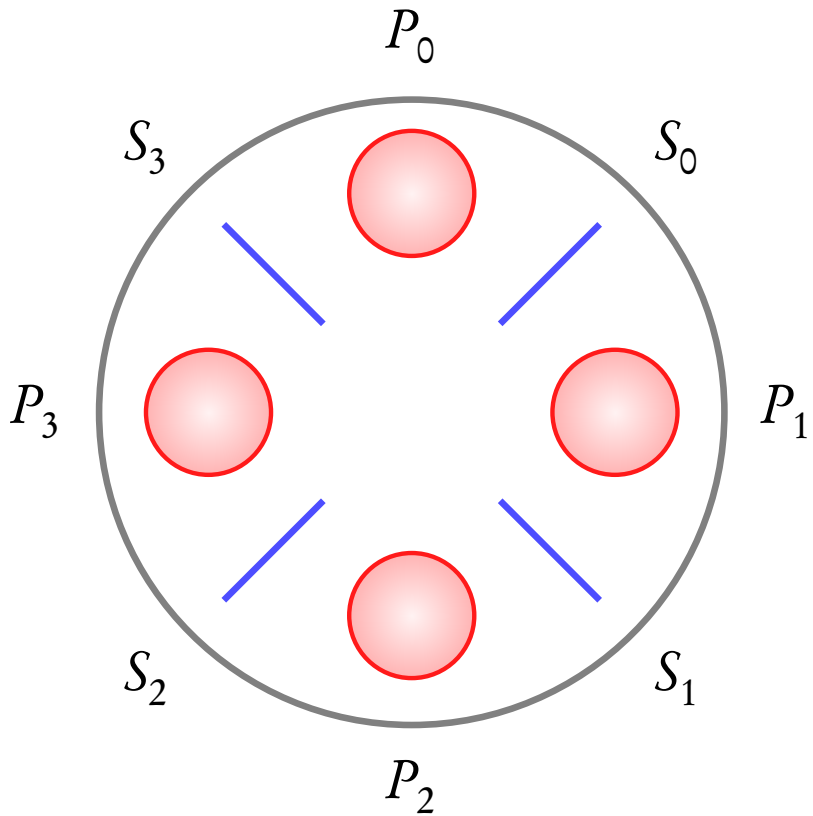
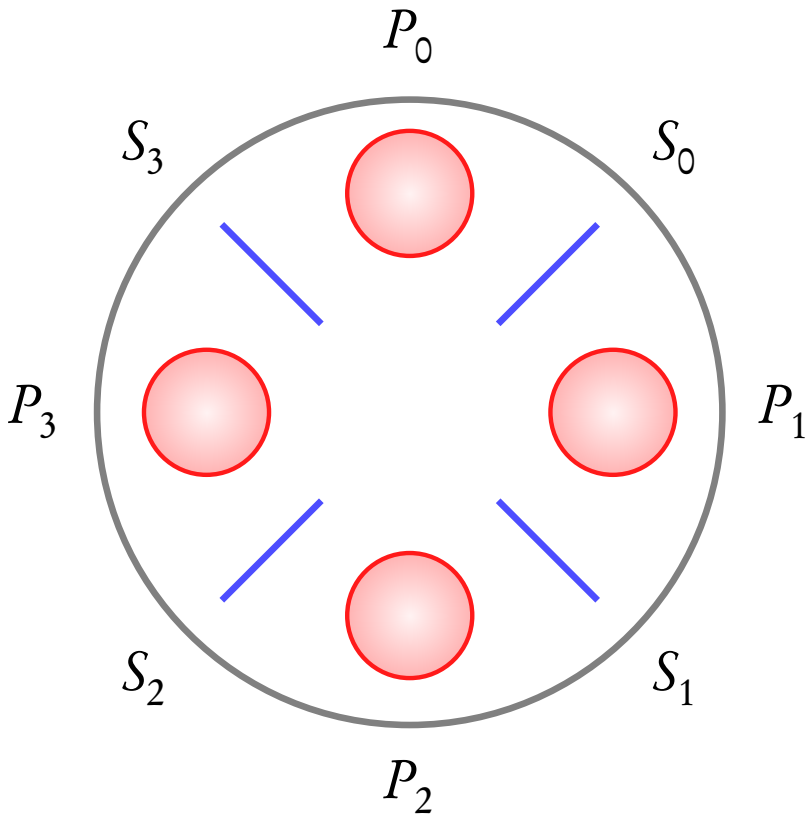
Module 1:

A problem in concurrency



$P_0 \ldots P_3$: *processes*

$S_0 \ldots S_3$: *resources*



$P_0 \ldots P_3$: *processes*

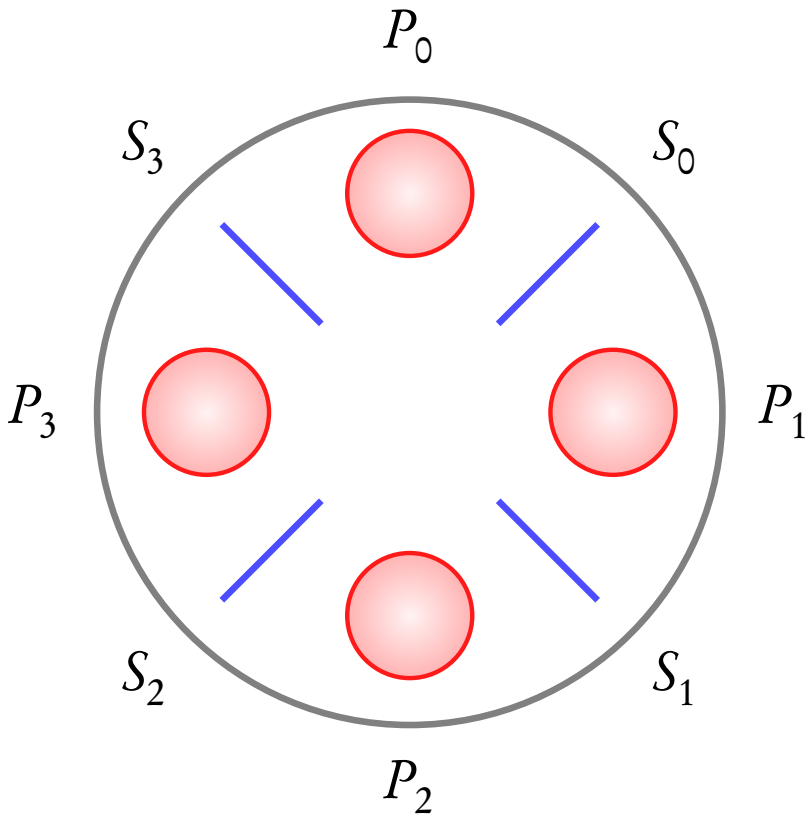
$S_0 \ldots S_3$: *resources*

Process P_i can **execute**

only if

it has access to **resources**

$S_{(i-1)}$ and S_i



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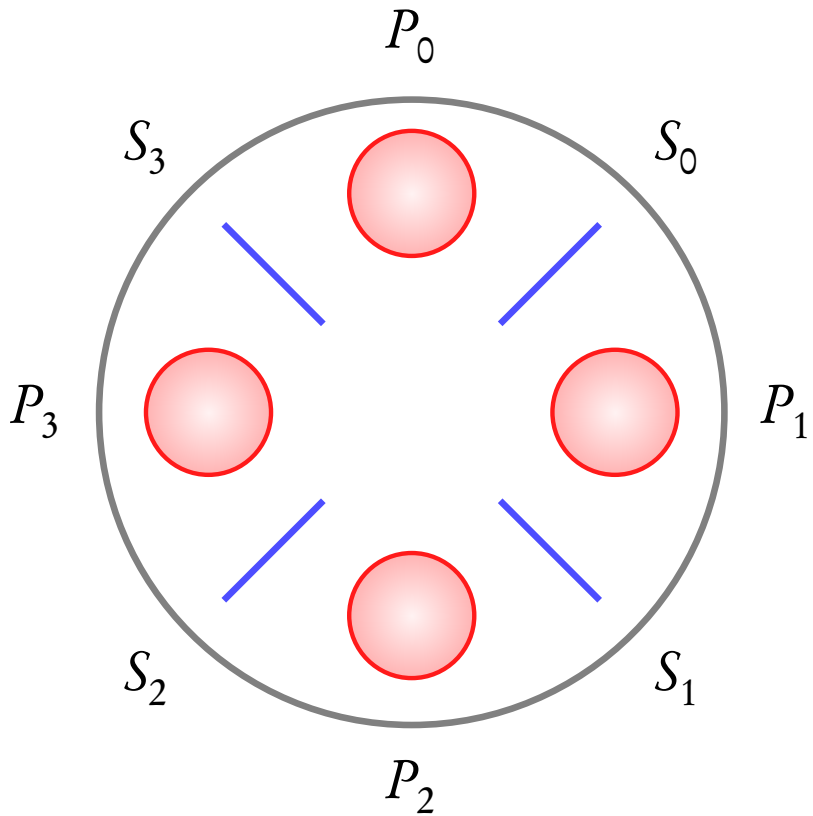
$S_{(i-1) \bmod 4}$ and $S_{i \bmod 4}$



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Process P_i can **execute**

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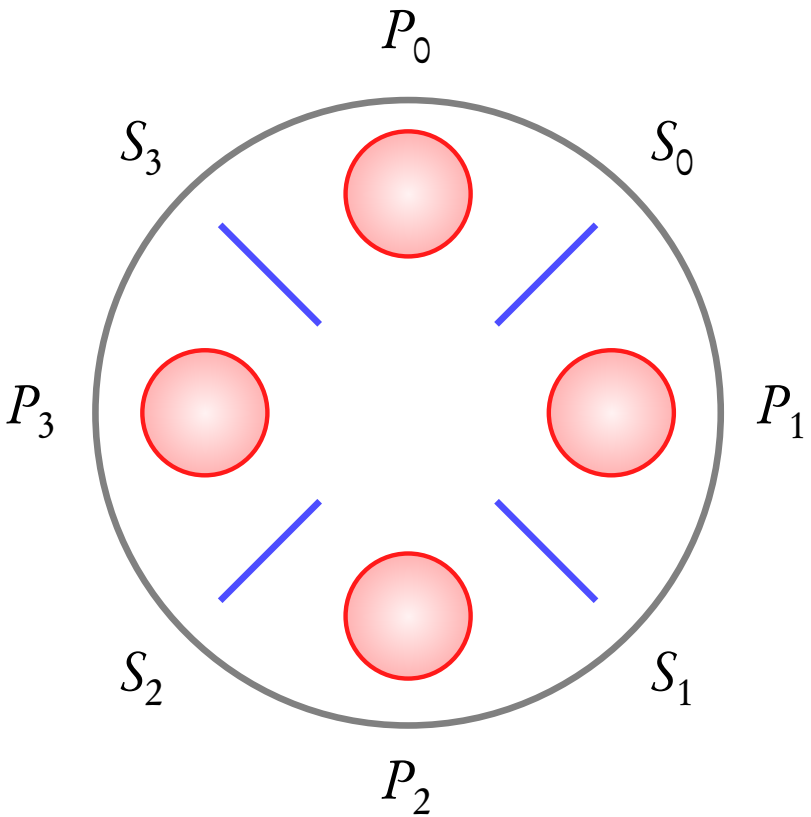
How should the processes be **scheduled** so that **every process** can execute **infinitely often?**

Dining philosophers problem (Dijkstra)



$P_0 \ldots P_3$: *philosophers*

$S_0 \ldots S_3$: *chop-sticks*

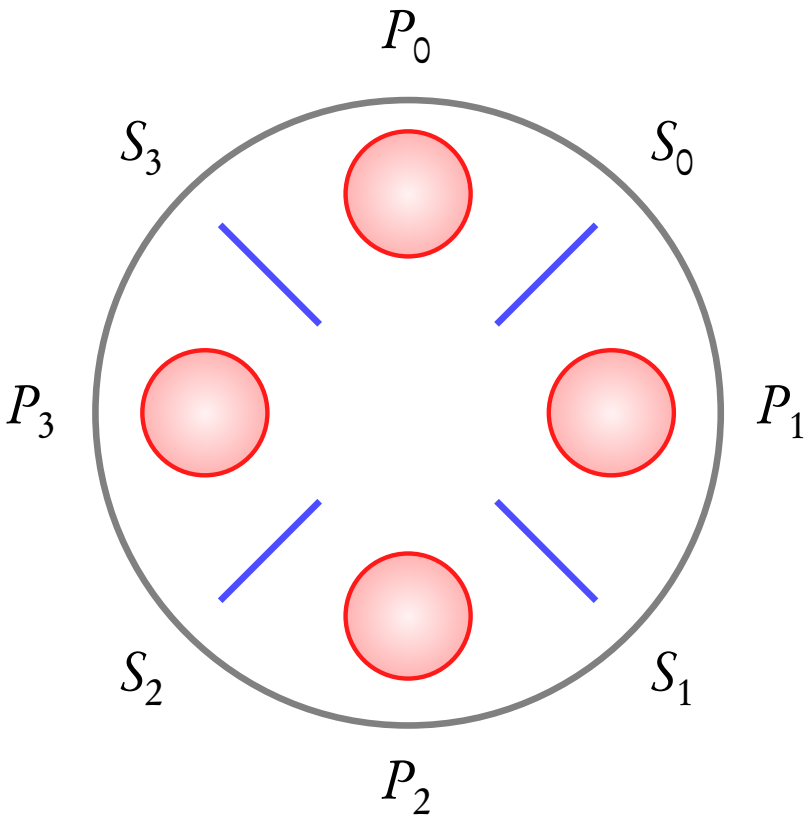
Philosopher P_i can **eat**

only if

he has access to **chop-sticks**

$S_{(i-1) \bmod 4}$ and $S_{i \bmod 4}$

Dining philosophers problem (Dijkstra)



$P_0 \ldots P_3$: *philosophers*

$S_0 \ldots S_3$: *chop-sticks*

Philosopher P_i can **eat**

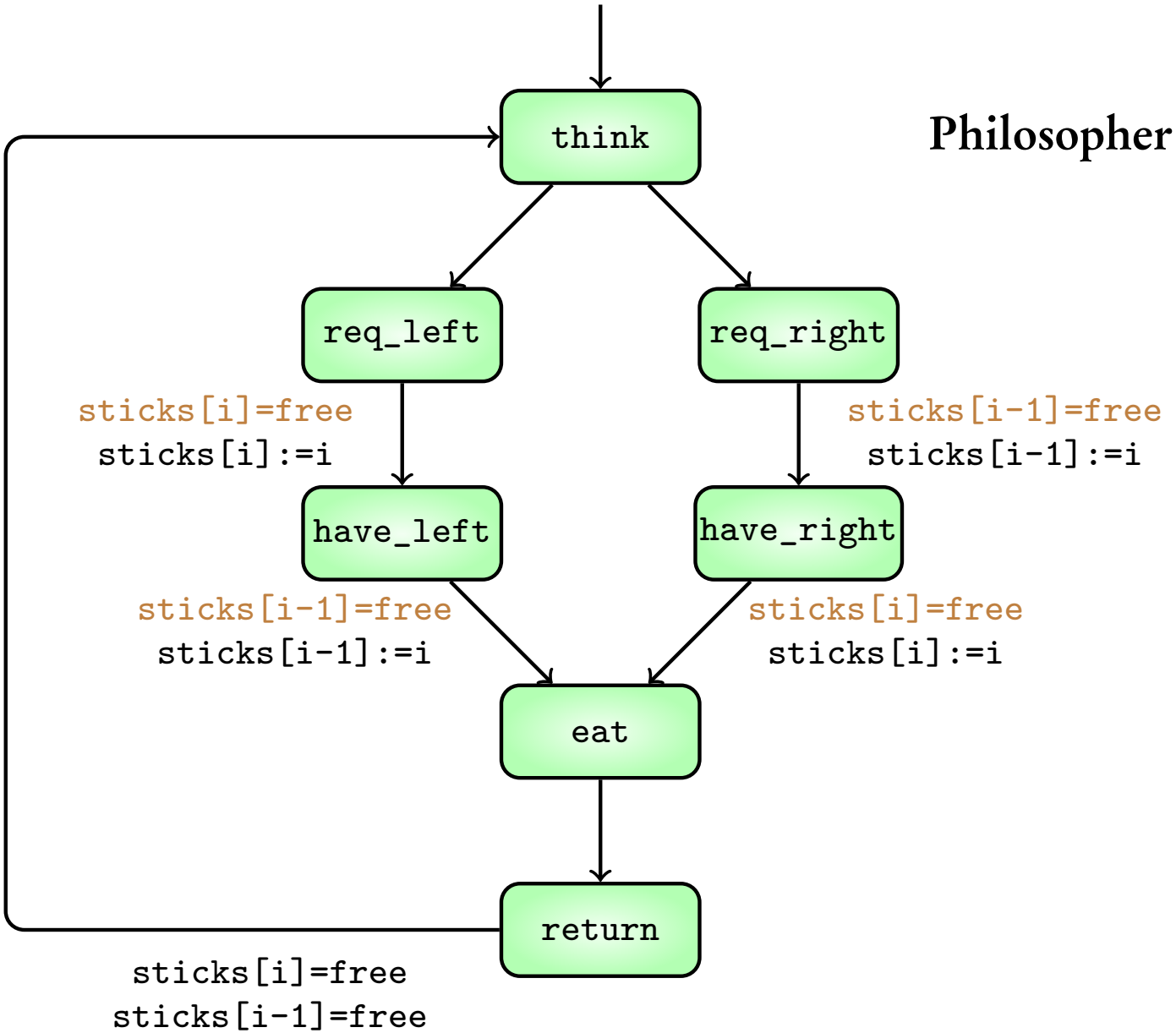
only if

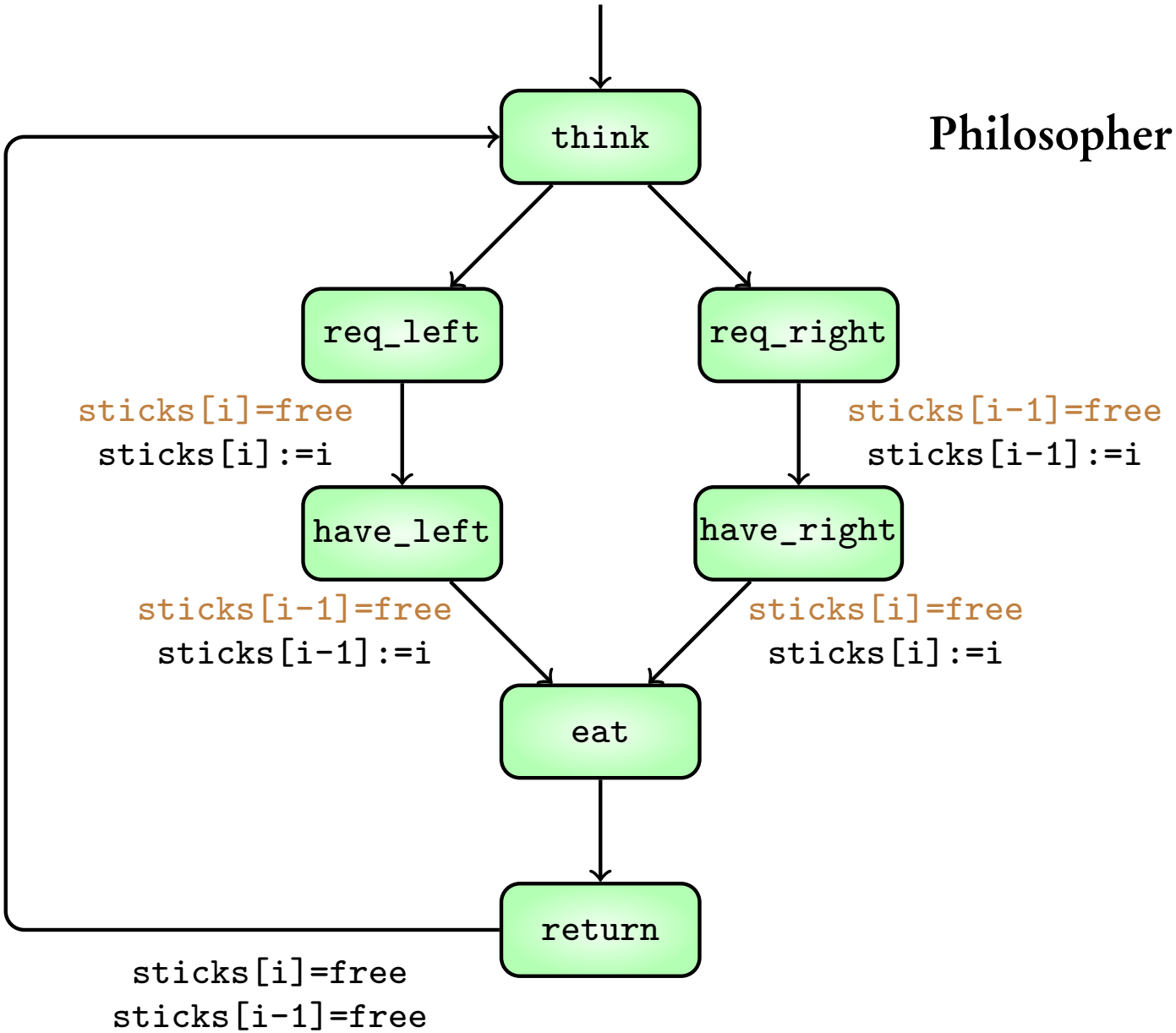
he has access to **chop-sticks**

$S_{(i-1) \bmod 4}$ and $S_{i \bmod 4}$

What should the **protocol** be so that **every philosopher** can eat **infinitely often?**

Coming next: A protocol for the dining philosophers


Philosopher i
think
req_left
req_right
sticks[i]=free
sticks[i]:=i
sticks[i-1]=free
sticks[i-1]:=i
have_left
have_right
sticks[i-1]=free
sticks[i-1]:=i
sticks[i]=free
sticks[i]:=i
eat
return
sticks[i]=free
sticks[i-1]=free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return
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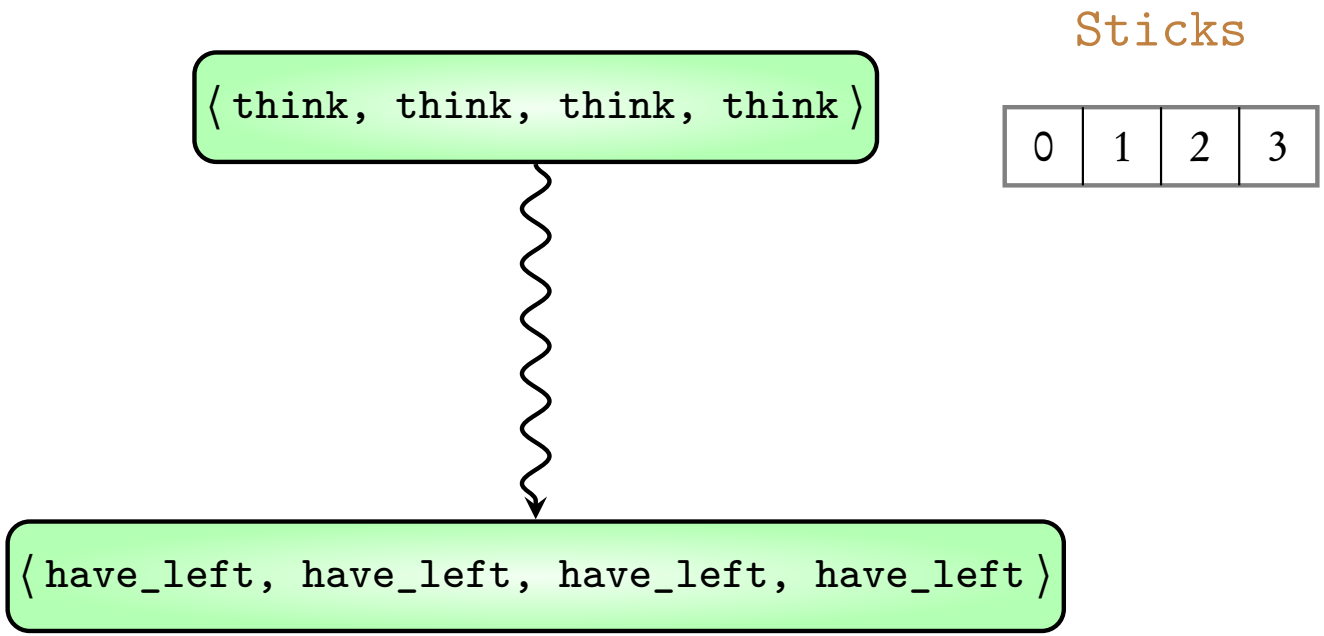
sticks[i-1]=free

NuSMV demo

A deadlock


⟨ think, think, think, think ⟩
⟨ have_left, have_left, have_left, have_left ⟩
Sticks
0
1
2
3

In this unit...

What **properties** should be checked to **detect deadlocks?**

In this unit...

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- Module 2: Attach a mathematical meaning to properties

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- Module 3, 4: Different examples of properties

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What **properties** should be checked to **detect deadlocks?**

- Module 2: Attach a mathematical meaning to properties
- Module 3, 4: Different examples of properties
- Module 5: Answer to the question